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CANADIAN MACHINERY
AND MANUFACTURING NEWS

Vol. XXVIII. No. 1 | Published Weekly by the MacLean Publishing Company, Limited, Toronto, Ont. | July 6, 1922 | $4.00 a Year Subscription Price

READ AND PASS TO	Check	See Page	READ AND PASS TO	Check	See Page

Tested Processes in File Making

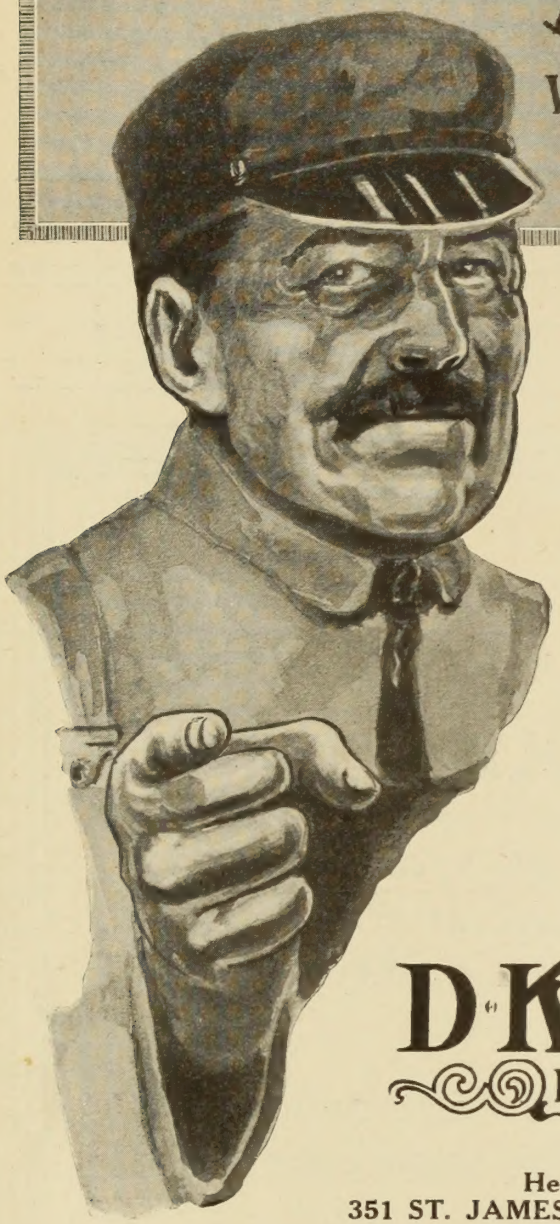
IN the course of fifty years' specialization in file making we have developed processes that ensure uniform quality in our files.

When you order one of the following brands, you get the result of fifty years' experience and perfected processes.

Kearney & Foot
Great Western
American
Arcade
Globe

Nicholson File Company
Port Hope - - Ontario

"Belting trouble ends where D.K. McLaren's Belting begins"



Do you realise—

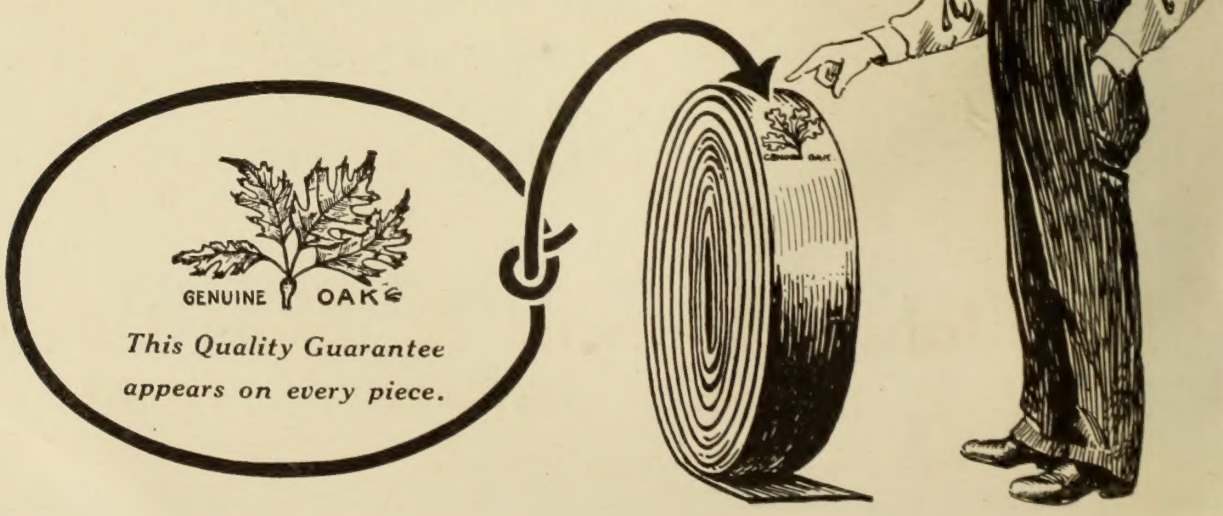
just how much you have to leave to the efficiency of your belting—just how much you depend upon it? Imagine a break-down on your main drive—you know best what it would cost you.

Every inch of D. K. McLaren Belting can be relied upon —absolutely. Manufactured only from the **backs** of hides selected by experts; the process of genuine British Oak Tanning preserves every bit of the hide's natural strength. The painstaking final inspections and tests made are final efforts on our part to maintain the reputation for reliability so long associated with our "Genuine Oak" Trade Mark.

D·K·McLAREN LIMITED

Head Office and Factory
351 ST. JAMES ST., MONTREAL, P.Q., CANADA

TORONTO, ONT., 194 King St. West.
ST. JOHN, N.B., 90 Germain St.
VANCOUVER, B.C., Gormans, Limited, 1158 Homer St.
CALGARY, Gormans, Limited.
EDMONTON, Gormans, Limited.



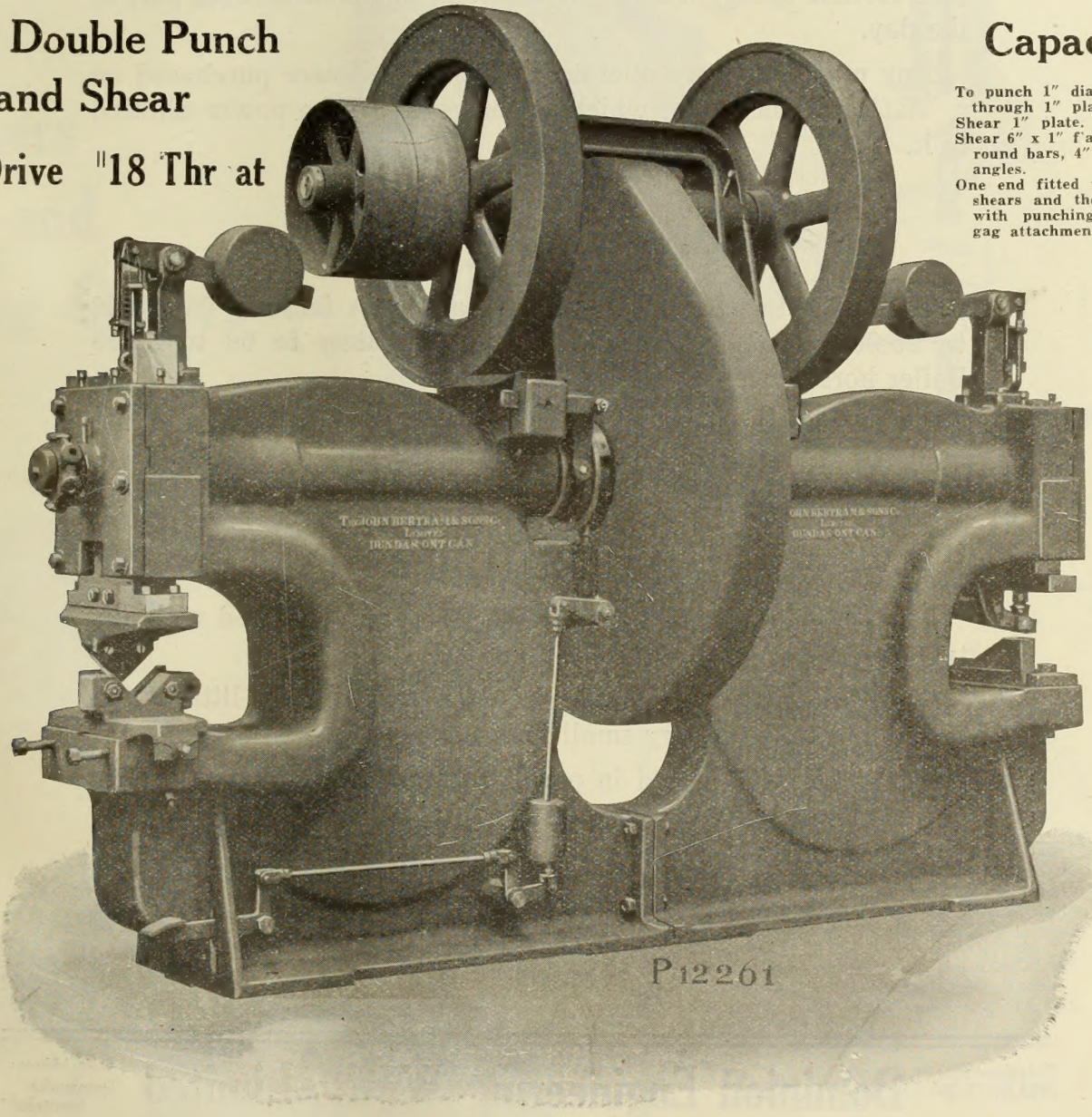
This Quality Guarantee appears on every piece.

The BERTRAM Page

MACHINE TOOLS

JB&SCo

No. 4 Double Punch and Shear Belt Drive 18" Throat



Capacity

To punch 1" diameter holes through 1" plate.
Shear 1" plate.
Shear 6" x 1" flat bars, 1¾" round bars, 4" x 4" x ⅜" angles.
One end fitted with Angle-shears and the other end with punching tools and gag attachment.

The John Bertram & Sons Co., Limited

DUNDAS ONTARIO CANADA

MONTREAL 723 Drummond Bldg. | TORONTO 32 Front St. W. | VANCOUVER 609 Bank of Ottawa Bldg. | WALKERVILLE 103 1-2 Sandwich St. | WINNIPEG 1205 McArthur Bldg. | HALIFAX Roy Bldg.

KAELIN ELECTRIC STEAM GENERATORS

Their Field

Any mill or factory developing its own power which has surplus electric energy during the whole or any considerable part of the day.

Any mill or factory operating on bought power purchased on a "flat rate" basis, but which is not using all the power allotted to it.

Capacities

These Electric Steam Generators are built in sizes from 600 to 25,000 K.W., corresponding approximately to 60 to 2,500 Boiler horsepower.

They can be operated by alternating current only, and are built for voltages varying from 550 to 12,000.

Advantages

Their first cost including installation is low compared with any type of coal or oil-fired boiler plant.

They are safe, clean, easily regulated, require but little attendance and take up very small floor space.

They can be operated in parallel with existing boilers or can be installed close to their work.

Information and prices promptly submitted on receipt of particulars as to your conditions.

Telephone: MELROSE 700

Dominion Engineering Works Limited

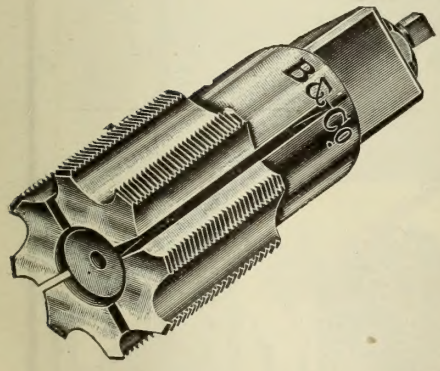
Cable Address: "Domworks Montreal"

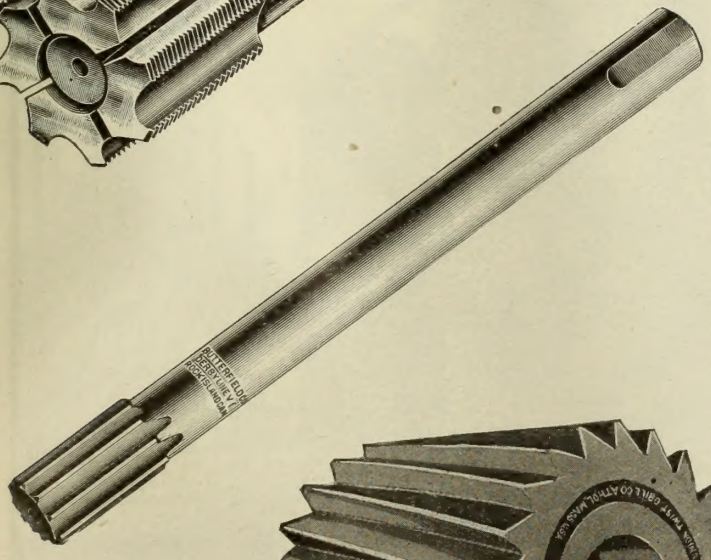
MONTREAL, CANADA

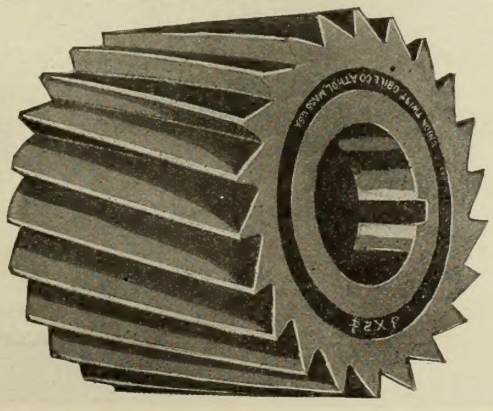
R. F. MATHER, Western Representative, London Bldg., Vancouver, B. C.

Butterfield

Drills
Taps
Reamers
Dies and
Milling Cutters







The Tools You Buy Again

Forty years' experience and close association with users, big and small, is behind the popularity of Butterfield Tools to-day.

The standard of quality set by Butterfield Tools and maintained throughout the years is due, in part, to the policy of rigid inspections and tests before leaving our works.

These are factors of the confidence users have in Butterfield Tools — reasons why they continue to use Butterfield Tools.

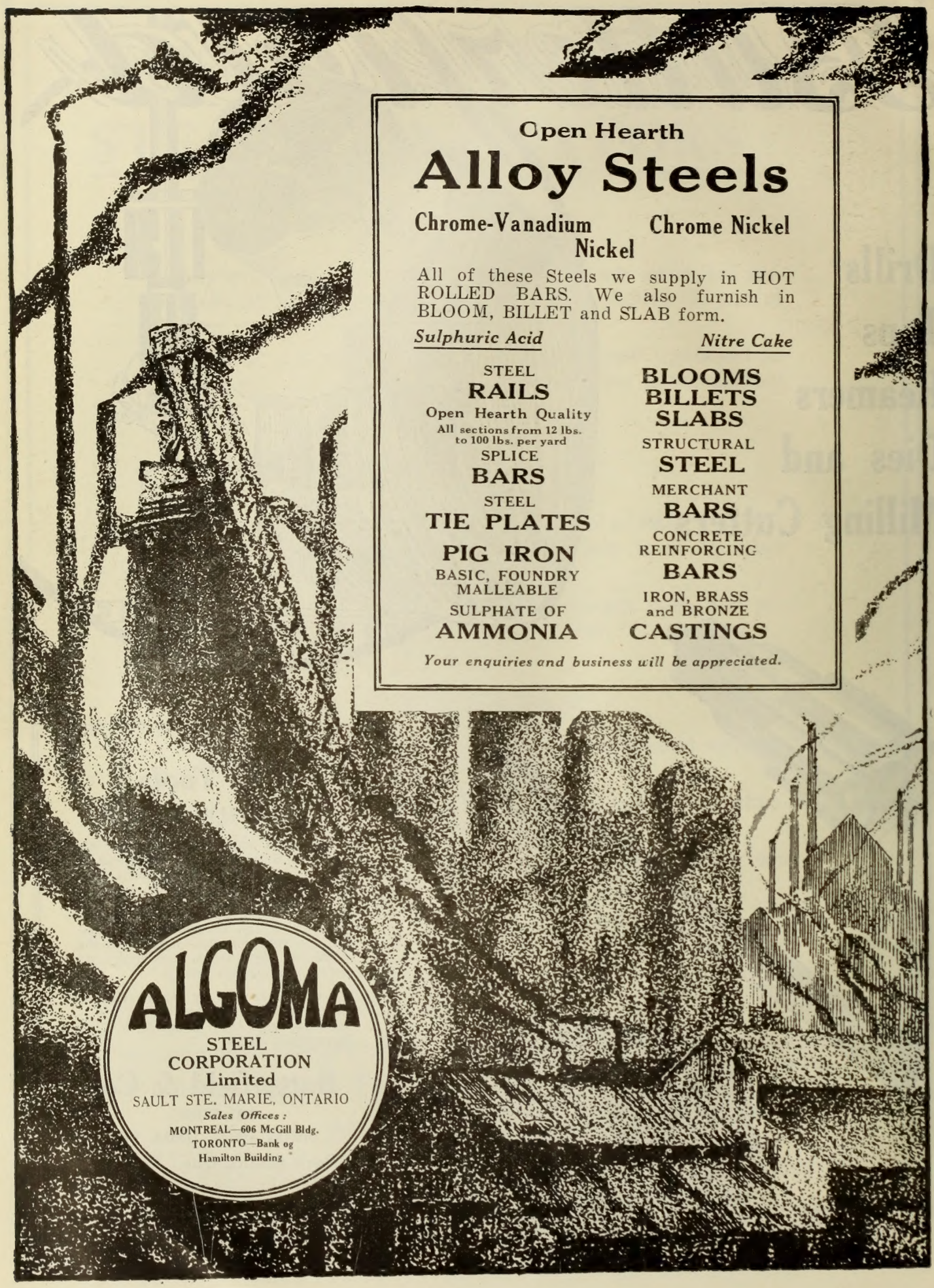
Butterfield & Co.

DIVISION

UNION TWIST DRILL CO.

Rock Island, Que., Canada

STORES: 220 King Street West, Toronto; 131 St. Paul Street West, Montreal.
AGENTS: D. Phillip, 138 Portage Ave., Winnipeg, Man.; Gorman's Limited, Dominion Bldg., Vancouver, B. C.



Open Hearth

Alloy Steels

Chrome-Vanadium Chrome Nickel
Nickel

All of these Steels we supply in HOT ROLLED BARS. We also furnish in BLOOM, BILLET and SLAB form.

Sulphuric Acid *Nitre Cake*

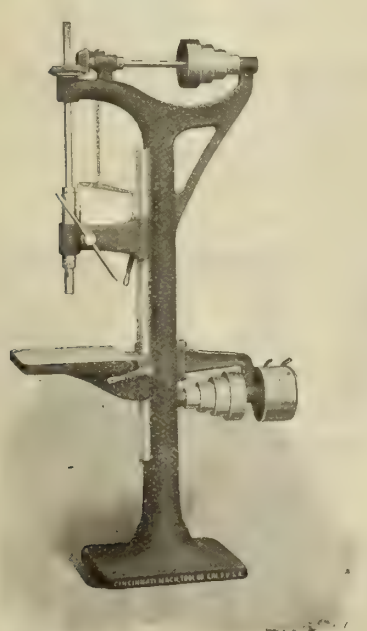
STEEL
RAILS
Open Hearth Quality
All sections from 12 lbs. to 100 lbs. per yard
SPLICE
BARS
STEEL
TIE PLATES
PIG IRON
BASIC, FOUNDRY MALLEABLE
SULPHATE OF
AMMONIA

BLOOMS
BILLETS
SLABS
STRUCTURAL
STEEL
MERCHANT
BARS
CONCRETE REINFORCING
BARS
IRON, BRASS and BRONZE
CASTINGS

Your enquiries and business will be appreciated.

ALGOMA
STEEL CORPORATION Limited
SAULT STE. MARIE, ONTARIO
Sales Offices:
MONTREAL—606 McGill Bldg.
TORONTO—Bank of Hamilton Building

More than 130,000 Sq. Ft. of Floor Space



Cincinnati Sliding Head, High Speed 20-inch Drilling Machine.

GIGANTIC stocks of the best known ironworking and woodworking **MACHINERY AND SUPPLIES** make it possible for us to fill every order intelligently and promptly. Courteous attention and prices that are within reason are other factors of general satisfaction in dealing with Petrie. Many heads of concerns "leave it to Petrie" from force of habit. Petrie's is known as "Canada's dependable Machinery and Supply House."

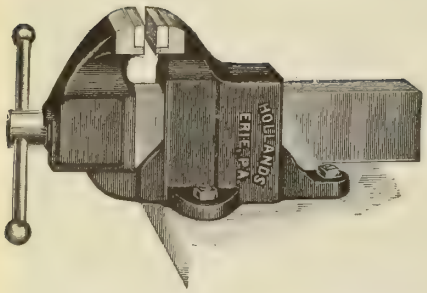
Firms We Exclusively Represent

Cincinnati Milling Machine Co., Cincinnati, Ohio.
Cincinnati Bickford Tool Co., Cincinnati, Ohio.
The Lodge & Shipley Machine Tool Co., Cincinnati, Ohio.
The Cincinnati Gear Cutter & Machine Co., Cincinnati, Ohio.
The Cincinnati Shaper Co., Cincinnati, Ohio.
The Cincinnati Grinder Co., Cincinnati, Ohio.
The G. A. Gray Company, Cincinnati, Ohio.
The Colburn Machine Tool Co., Cleveland, Ohio
The National Machinery Co., Tiffin, Ohio.
The Rivett Lathe & Grinder Co., Brighton, Boston, Mass
The Universal Boring Machine Co., Hudson, Mass

H. W. PETRIE LIMITED

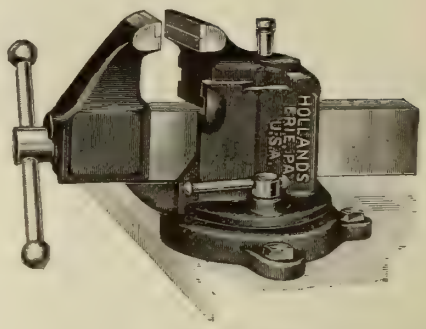
TORONTO and HAMILTON

HOLLANDS VISES



Have a record of thirty-five years of satisfactory service.

If your dealer cannot supply you, write direct for circular No. 25.

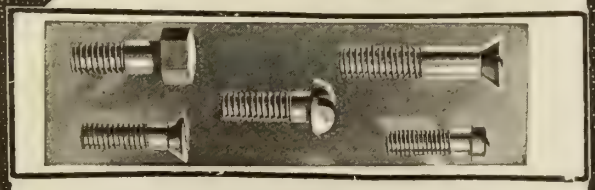


HOLLANDS MANUFACTURING CO.

Established 1887 Erie, Pa., U. S. A.

Wood Screw Making Machinery

SEND FOR CATALOGUE



For sixty years we have constantly manufactured machinery for making screws, always studying to improve and refine our product.

Write or Wire us.

Cable address: "Cook,"
Hartford, U.S.A.
Codes: Liebers
Western Union

Asa S. Cook Co.
Hartford, Conn.

GISHOLT

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TURRET LATHES
Hand Operated
For Chucking and Bar Work
AUTOMATIC TURRET LATHES
For Chucking Work
VERTICAL BORING and TURNING MILLS
UNIVERSAL TOOL GRINDERS
HORIZONTAL BORING and DRILLING MACHINES
CYLINDER GRINDERS
TOOL-POST TOOL HOLDERS
REAMERS, "SOLID ADJUSTABLE"
Shell and Chucking
BORING BARS
With Adjustable Cutters
PERIODOGRAPH
For Time Recording in Factories
Separate Catalogs on each Product
Send for the ones you want

GISHOLT MACHINE CO.
1207 E. Washington Avenue
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CUT GEARS

Theoretically Correct

PROMPT SERVICE

ROBERT GARDNER & SON
LIMITED
52 NAZARETH ST., MONTREAL, P. Q.

RAWHIDE OR METAL

THE MORSE CHAIN CO.

are the
Largest Manufacturers in the world
of
High Speed Silent Chains

The superiority of **Morse Rocker Joint Silent Chain** has never been seriously questioned.
They speed up production, cut belt expense and overtime wages.

Catalogue Free.

Jones & Glassco (Reg'd)
Canadian Agents
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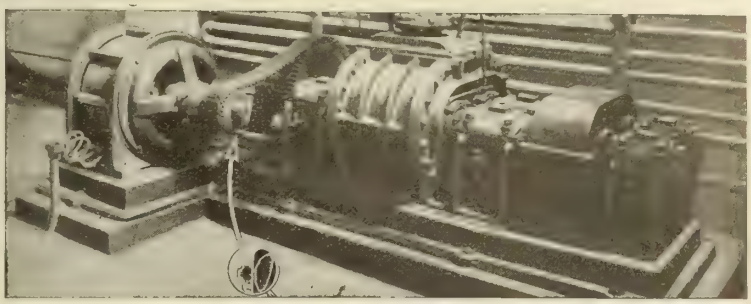


25 H.P. Morse Silent Chain to Positive Blower.

Buried in the Work and Broke!

Next time a tap breaks below the surface of a large casting, don't let some makeshift method of removing it injure the thread and waste half an hour of valuable production time. Instead—

Walton it Out in a Jiffy

And save the casting.

Special analysis steel fingers of the Walton Extractor drop into the flutes of the broken tap—and grip. Then a few turns of a wrench applied to the squared end of the Extractor backs out the buried tap.

Sixty-day trial offer proves the Walton Extractor pays for itself. Write.

The Walton Co.
Hartford, Conn.

—you can take your holidays—if—

YOUR MACHINERY

is babbitted with

Harris Heavy Pressure Babbitt

and your biggest engines with

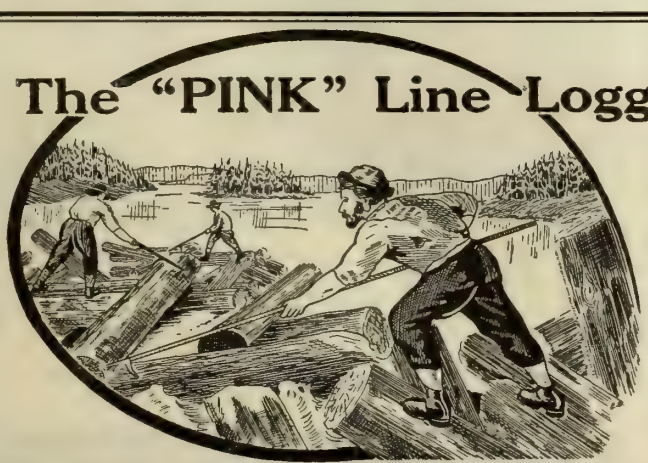
Imperial Genuine Bearing Metal

Thirty-five years on the market

British Standard Metals

THE CANADA METAL CO., LIMITED
TORONTO HAMILTON MONTREAL
WINNIPEG VANCOUVER

The "PINK" Line Logging Tools and Handles



MADE-IN-CANADA Products---Headquarters for British Empire for all Lumbering Tools

In every lumber camp in Canada you'll find PINK'S famous lumbering tools. They are the favorites there and have won the esteem of all woodsmen through their superior merit. They are world-renowned and are extensively used in Australia, New Zealand and other countries where the lumbering industry thrives.

EXPORTERS TO EUROPE

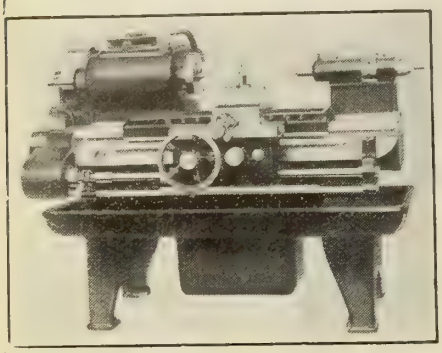
We export the same good quality of lumbering tools that have made PINK'S TOOLS a by-word in the matter of good tools in all Canadian lumber camps. Enquiries cordially solicited.

Thomas Pink Co., Limited
PEMBROKE, ONT., CANADA

THE JOHNSON FRICTION CLUTCH

AS USED ON THE

"NEW" 12 IN. SUNDSTRAND MANUFACTURING LATHE



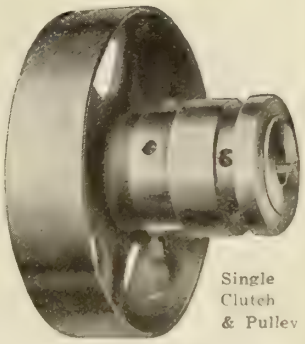
Progress in machine tool design demands a reliable and powerful friction clutch.

The Johnson Friction Clutch is proving of great value in machine tool designing.

Courtesy: The Rockford Tool Co., Rockford, Ill.

The main drive pulley is mounted on a No. 5 single clutch hub. The same movement that disengages the clutch automatically applies a brake whi h stops the spindle instantly. The sliding sleeve is machined to act as a brake.

A feature of the Johnson Friction Clutch is the ease of application to particular machine requirements.



Single Clutch & Pulley

WRITE FOR STOCK LIST AND YELLOW CATALOG

THE CARLYLE JOHNSON MACHINE CO. MANCHESTER, CONN.

STEEL CASTINGS

QUICK DELIVERIES

High Carbon Steel
Manganese Steel
Chrome Steel
Mild Steel

QUALITY GUARANTEED

Sizes—½lb. to 5,000 lbs.

THE WILLIAM KENNEDY & SONS LIMITED

OWEN SOUND, ONTARIO

ESTABLISHED 1860

CANADA FOUNDRIES & FORGINGS LIMITED

DROP FORGINGS

Automotive Industrial Railway

General and Special Forgings

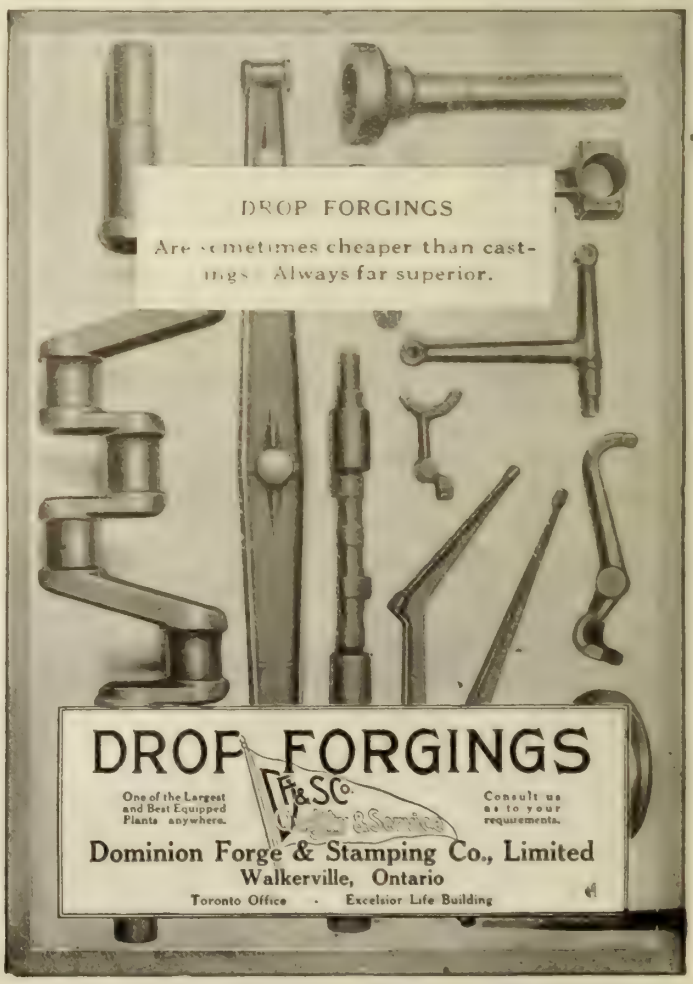
Journal Car Box Wedges

Turnbuckles

Send Blueprints for Prices

Canada Foundries & Forgings Ltd.

Welland, Ont.


DROP FORGINGS
Are sometimes cheaper than castings. Always far superior.
DROP FORGINGS
One of the Largest and Best Equipped Plants anywhere.
Consult us as to your requirements.
F&SCo.
Dominion Forge & Stamping Co., Limited
Walkerville, Ontario
Toronto Office · Excelsior Life Building

TRACKWORK

FOR STEAM AND ELECTRIC RAILWAYS OF ANY STANDARD SECTION

MANGANESE-STEEL SPECIAL WORK

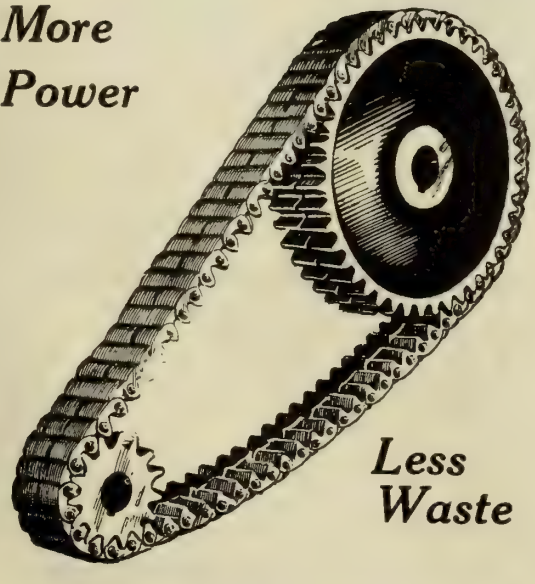
Frogs, Diamond Crossings, Crosses, Switches, Mates and Complete Intersections to meet any traffic requirements.

Makers of Balkwill Articulated Manganese-Steel Crossings

CANADIAN STEEL FOUNDRIES LIMITED

RENOLD
SILENT CHAIN DRIVE

More Power



Less Waste

The Recognized Standard for Efficient Power Transmission

Twenty-six years' highly efficient performance in the finest plants in the country has built up an enviable reputation for Renold Silent Chain Drives. Absolute reliability in service with maximum efficiency and minimum maintenance costs has made "Renold" the universal name for power transmission chains. Renold Silent Chain Drives are applicable to any powers, no matter how small or large and not only are they silent in operation, but also unaffected by heat, cold or moisture.

Let Renold Chains solve YOUR power transmission problems, and ensure YOU maximum efficiency, durability and service. Our engineering service is at your disposal without obligation. Why not write us?

Prompt Deliveries from Montreal Stocks

HANS RENOLD OF CANADA, Limited

11 St. Sacrament Street
MONTREAL

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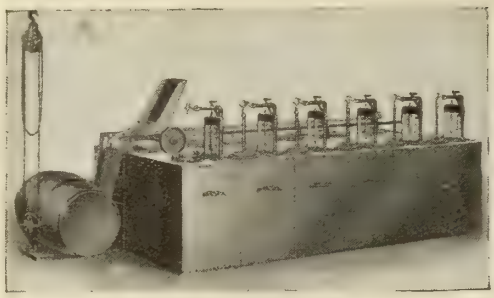
TORONTO



The Bowser Oil Bank Will Give You a Check

To be absolutely sure that you get what you pay for in lubricating oil, check incoming shipments as barrels are emptied into the tank, then check the oil as it goes out by a meter on the Bowser piston-type measuring pump.

In this way, you are absolutely sure of getting full value for your oil dollars. Thus, the Bowser bank of oil tanks gives you a check on your oil.

More than that—the use of Bowser equipment insures you against waste. The pump measures the oil accurately, and if any happens to be spilled, it runs back into the pump through the Bowser drip pan.

For specific figures as to how you, too, can save money by installing Bowser equipment, write our engineers. Ask for booklet C-13, and get the whole Bowser story of economy and efficiency.

Bowser equipment is MADE IN CANADA by

S. F. BOWSER & CO., LTD.

Toronto -- Canada

BOWSER ESTABLISHED 1885

ACCURATE MEASURING PUMPS

Bowser Products

For Handling Gasoline and Oils Wherever Sold or Used

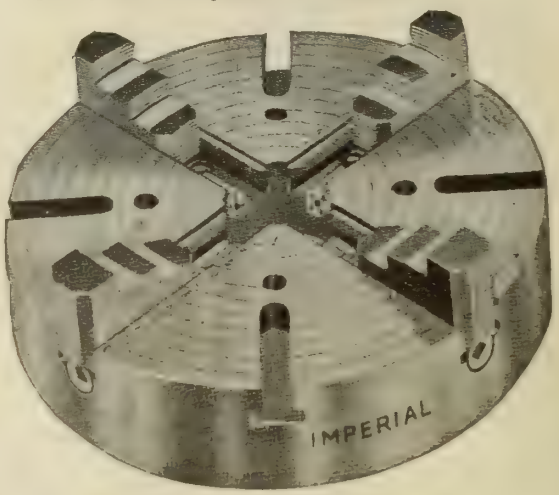
Filling Station Pumps and Tanks for Gasoline.
Portable Tanks for Oil and Gasoline.
Storage and Measuring Outfits for Paint Oils, Kerosene and Lubricat ng Oils.
Carload Oil Storage Tanks.
Power Pumps.
Dry Cleaners' Underground Naphtha Clarifying Systems.
Richardson-Phenix Oil Circulating and Filtering Systems and Force Feed Lubricators.

Write for Booklets

IMPERIAL LATHE CHUCKS

Highly Endorsed by Canada's Best Manufacturers

Sturdy long-wearing "Made-in-Canada" Chucks that are making good everywhere. Specify them in your next order.



Ker & Goodwin Machinery Co.
BRANTFORD, Ont. LIMITED

One of These Gauges is Saving a Firm $1,200 a Month !

The same combination of circumstances may never occur in relation to your own gas supply, but this situation which is vouched for by the firm's own figures, actually exists. It may serve to suggest some place in your own plant where a reliable

TRADE MARK BRISTOL'S REG.U.S.PAT.OFFICE

Pressure Gauge

can save you money. Gas, air, steam and many liquids are being accurately measured and continuously recorded by one and another of the Bristol pressure gauges.

Full details will be found in Bulletin I-1005.

THE BRISTOL CO., Waterbury, Conn.
Canadian Distributor
A. H. WINTER JOYNER
TORONTO MONTREAL

"Bristolize for '22"

BROWN-BOGGS

B B

Not Sometime—

Right Now !

"B-B" Tools Mean Bigger Opportunities

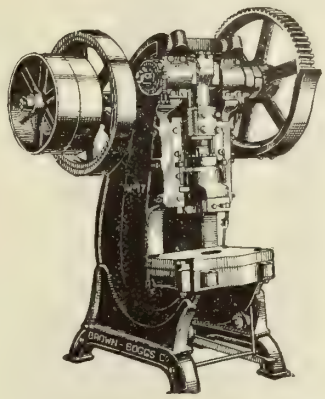
Is it really Consistent Practice in times of retrenchment to cut down your men's wages and still retain machines and methods of practice that are out-of-date, slow and costly? If economy demands adjustments a good place to start is an investment in a machine that will cut down operating expenses.

That's why we urge you at this time to investigate "B-B" Metal Working Tools.

What they will save you NOW can be approximately figured by the profits they have built up in brisker days.

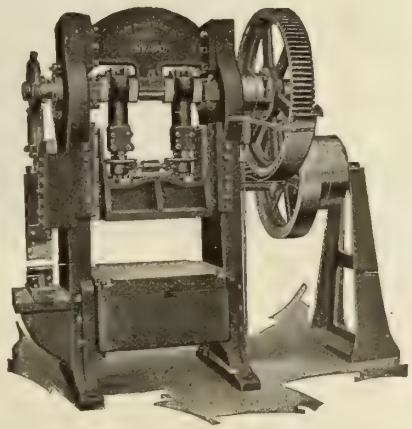
Rigidly tested and guaranteed—presses, dies, shears, punches, drop hammers, and tinsmiths' tools of every description.

What our catalogue does not explain we will be glad to.



No. 215—Power Press

Easy-Running
Long Lasting
Sturdily Built
Greater Production

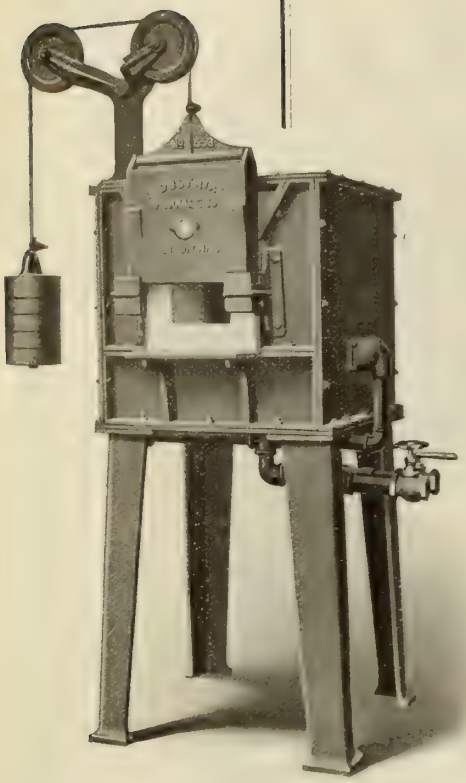


No. 140—Double Crank Trimming Press

TORONTO OFFICE:
Holbrook Building

A. B. WALKER,
Representative

THE BROWN-BOGGS CO. LIMITED
HAMILTON, CANADA.



BELLEVUE
FURNACES

Will greatly reduce your heat treating costs and increase your production.

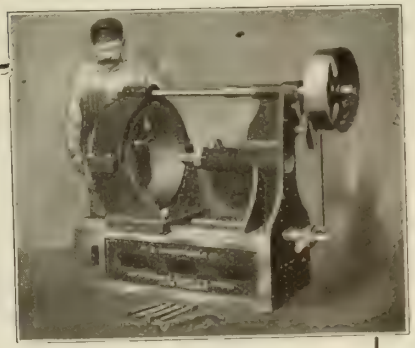
Their easy accurate control — reverberatory flame travel — quick uniform heating — and economical operation — are all great factors in producing desired heat treating results.

We build furnaces for every industrial use—oil or gas burning.

What are Your Requirements?

Bellevue Industrial Furnace Co.
2977 Bellevue Ave. - Detroit, Mich.

Representatives in Canada
CHAS. A. STRELINGER COMPANY, WINDSOR
GARLOCK MACHINERY LTD., Toronto, Montreal, Winnipeg



Crank Pins Trued to Original Accuracy

with the

UNDERWOOD
Crank-Pin Turning Machine

Crank pins (disc or bell shaped) on side crank engines can be aligned to the original true, smooth, accurate finish with this Underwood Portable Tool.

Work is always in full view of the operator—a distinct advantage. And the tool is really portable, saving time.

An oil-bathed driving mechanism running in dust-proof housing and other practical features recommend this tool.

H. B. Underwood Corporation
1025 Hamilton St., Philadelphia, Pa., U.S.A.

No. 605—$15.50 per dozen pairs.

PLAY SAFE!

DEPRIVED of his hands a workman would be of little use in your shop. You owe it to yourself to give your men the best "hand" protection. **Play safe!** Furnish them with

Steel Grip Industrial
Work Gloves and Mittens

Absolutely the longest wearing and most economical gloves and mittens that can be obtained. **They wear like iron,** yet soft and pliable. Steel-Grip reinforcement on palm, fingers and thumb. Steel-sewed seams rip-proof. In pairs or singles. Write to

Swan-Kemp-Beatty Co.
Representing Industrial Gloves Corp.
424 Wellington St., W., Toronto

A few uses of
DIAMOND FIBRE

Silent Waterproof Gears
Packings
Conduits
Washers
Parts for Automobile Ignition Systems
Combs and Novelties of all sorts
Pinions
Receptacles
Wheels
Handles
Track Insulation for Block Signals
Insulation
Bushings
Knobs
Bearings
Valves
Cleats
Machined Parts

Supplied in Sheets, Rods or Tubes or machined to your specifications

and to-day—Universal!

NOT so many years ago hard fibre was in its infancy and practically unknown as a raw material for all manufacturing purposes.

To-day, thousands of industries are using Diamond Fibre in the making of their different commodities.

Every day new uses are being found for it in the most unexpected quarters, uses that not only improve the manufacturers' products but also decrease his production costs.

Probably *you* can use it with advantage. Let our experts help you with your production problems. They are always at your service without obligation to you. Just call on us personally or by mail.

DIAMOND STATE FIBRE COMPANY OF CANADA, LTD.
Head Office and Works:
235 Carlaw Ave. Toronto, Ont.

VENUS
VENUS PENCILS

The largest selling quality pencil in the world

At Stationers and Stores throughout the World

"THE world's finest drawing pencil" is what engineers call VENUS; because VENUS has *given* to engineers a service incomparably more perfect and complete than that of any other pencil.

For sketch, plan or blueprint VENUS is the pencil of precision.

17 black degrees, 3 copying

For bold, heavy lines	6B-5B-4B-3B
For Writing, sketching	2B-B-HB-F-H
For clean, fine lines	2H-3H-4H-5H.6H
For delicate, thin lines	7H-8H-9H

Plain Ends, per doz. $1.50
Rubber Ends, per doz. $1.75

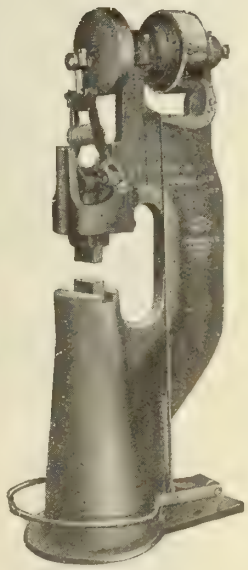
American Lead Pencil Co.
238 Fifth Avenue, New York
and London, Eng.

Ask us about our new VENUS EVERPOINTED from $1.50 to $75.

Strength in the Part that takes the Blow

Keen buyers of equipment find in

"JARDINE"
Power Hammers



much more than tools built to meet a price. Every "Jardine" Hammer is built for long service. The great strength of the anvil block explains why this is so. Built in sizes for every job —light, heavy and exacting work. Ask for Catalogue No. 18.

REGISTERED J TRADE MARK

MADE IN CANADA

A. B. JARDINE & CO., Ltd.
HESPELER, ONTARIO

For best results in welding and cutting

—DOMINION OXYGEN
—PREST-O-LITE DISSOLVED ACETYLENE

By placing within easy reach of every manufacturer an unlimited supply of fuel gas and oxygen—

By using cylinders light in weight, easy to handle, and leak-proof—

By a policy of liberal cylinder loans—

By filling all orders the day they are received—

Dominion Oxygen service will take care of your requirements efficiently and at the lowest prices. Send your orders by wire, telephone, or mail to our nearest Distributing Station.

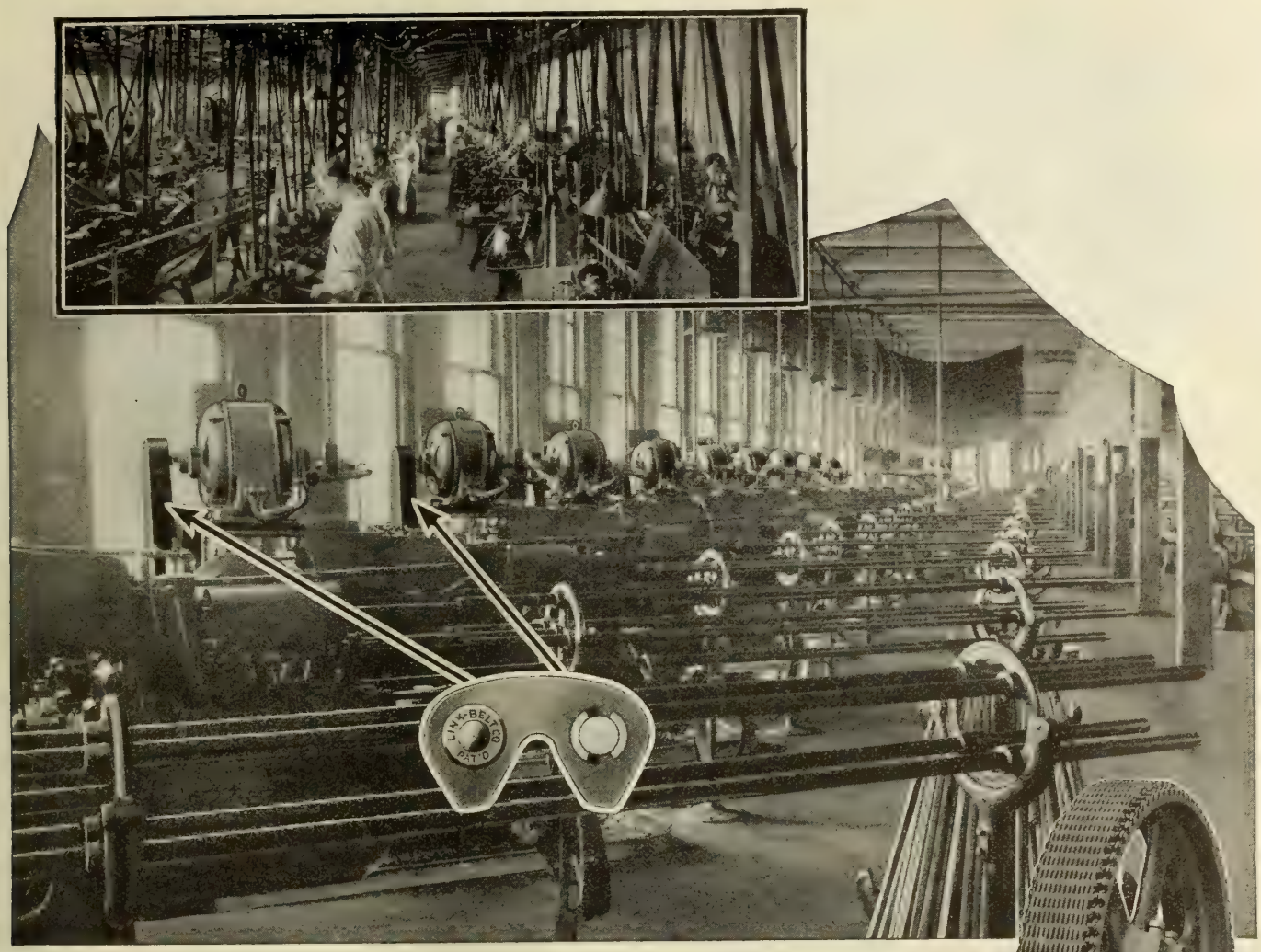
DOMINION OXYGEN COMPANY, LIMITED

Operating the Welding and Cutting Gas Division of
PREST-O-LITE COMPANY OF CANADA, LIMITED

Hillcrest Park, Toronto

Shawinigan Falls, Quebec, Montreal, Hamilton, Merritton, Welland, Windsor, Winnipeg.

D28

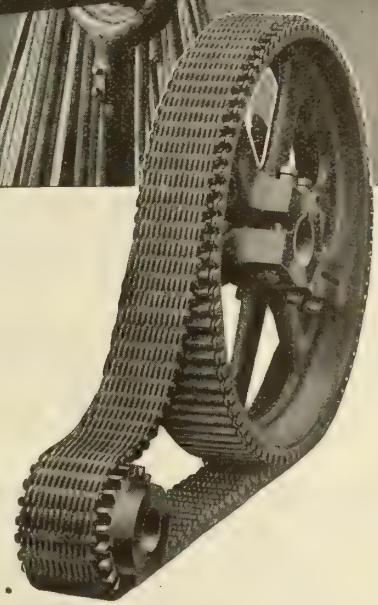


WHICH DRIVE DO YOU USE?

HERE is shown a comparison between two methods of transmitting power. Above, flat belt drives; below, Link-Belt Silent Chain Drives individually applied.

Compare the performance of flat belt drives with the 98.2% efficient Link-Belt Silent Chain Drives. Compare the menace to workers and obstruction of light of the flat belt drives with the safety and clear overhead which the Link-Belt Silent Chain Drives give. Compare the details of the two scenes pictured above.

Let our engineers help you get better results from your power transmission equipment. Send for our specialist on your industry.

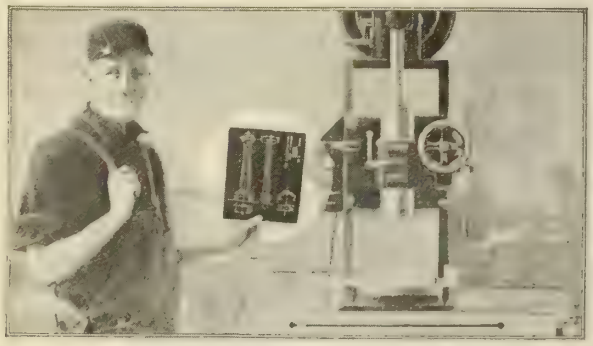


Flexible as a Belt—
Positive as a Gear—
More Efficient Than Either

CANADIAN LINK-BELT COMPANY LIMITED

TORONTO-Wellington & Peter Streets **Montreal-10 St. Michael's Lane**

LINK-BELT



His Safeguard— a PHOTOSTAT Print

Even your most conscientious machinist doesn't have to "make sure" about any figures or lines on a PHOTOSTAT print. He knows that the print was made directly from the original drawing, not from a tracing, and

The PHOTOSTAT makes no mistake. It makes photographic facsimiles.

There is always the possibility of errors in blue prints made from tracings. PHOTOSTAT prints are absolutely accurate.

It takes hours and in some cases even days to make tracings and blue prints. PHOTOSTAT prints are produced in a few minutes.

Tracing takes a skilled draftsman. The operation of a PHOTOSTAT requires only a boy or girl.

Tracings and blue prints cost dollars. PHOTOSTAT prints cost cents.

Photostat Corporation

299 State Street Rochester, N.Y.

88 Broad Street, Boston.
123 West Madison Street, Chicago.
209 Leader Building, Cleveland.
7 Dey Street, New York City.
510 North American Bldg., Philadelphia.
317 Third Avenue, Pittsburgh.
429 Monadnock Building, San Francisco.
601 McLachlen Building, Washington.

Executive Office: Providence, Rhode Island.

—and when the cutter was taken from the furnace he found—

That its cutting edges were hard and clean—no scale—and did not require to be ground. It meant much to have their edges clean and true to shape.

That's the kind of results you can get with Hoskins Electric Furnaces. The heat is clean and the temperature control is right under your thumb. The man who does the heat treating does not have to fuss around trying to get the right temperature—he takes care of the **tools,** and **not** the **furnace.** He gets greater production and better tools.

Hoskins Electric Furnace will save you money. Not just for tool rooms are they an economy but wherever metal is heat-treated.

Tell us the work you want done and ask for catalogue No. 122.

MADE IN CANADA

Hiram Walker & Sons Metal Products

LIMITED

Walkerville, Ont.

GUTTA PERCHA & RUBBER, LIMITED
TRADE P.M.S MARK
TORONTO, CANADA

"P.M.S" BELTING

Built-up Plies of Cotton Duck, woven to our own specifications, and firmly united by our Rubber Friction

We have given special study to this branch of our business with the result that we supply "P.M.S" Belting in fullest confidence that it will meet successfully even the severest tests.

For Effective Service in the Transmission Field

Our research has evolved methods that secure maximum adhesion, strength of fibre and age-resisting ability. Careful vulcanization to assure correct, uniform pressure, elimination of surplus elasticity and exactly the right temperature to properly cure the belt without burning the stock is an essential scrupulously maintained.

Our belting experts will be glad to recommend a solution of your problems in belting for all transmissions, conveying of hot or cold materials, bucket elevators, or practically any kind of belt service.

An inquiry involves no obligation.

Manufactured Exclusively By:

Gutta Percha & Rubber Limited

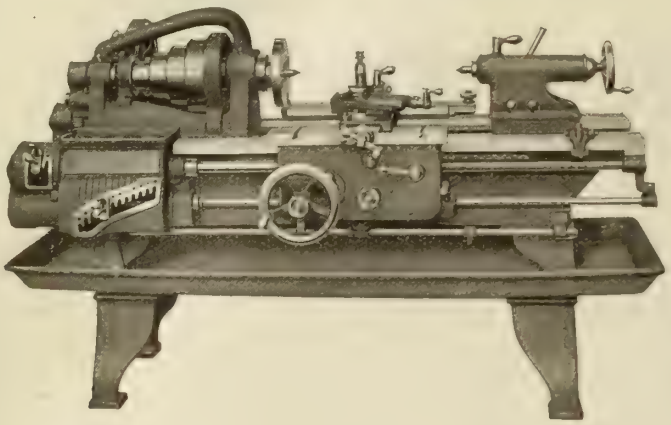
Head Offices and Factories, Toronto

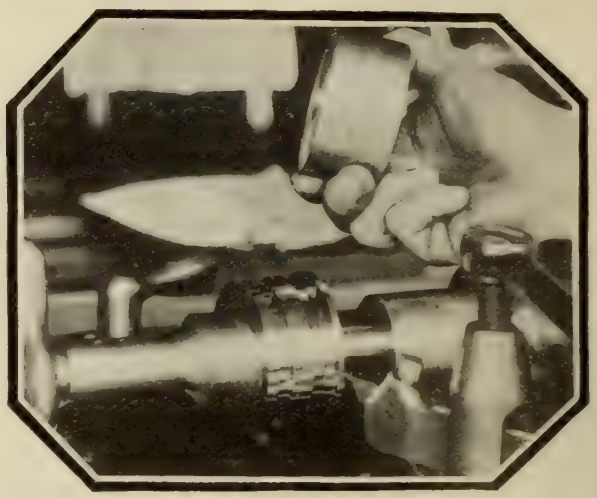
Branches in all Leading Canadian Cities

HENDEY

DEPENDABILITY

Only by actual performance can a machine be said to attain a reputation for dependability. A concrete case is this 18 in. Hendey Lathe which has earned for itself a name for reliability in an unusually large range of work. It will give speed without sacrifice of precision and is constructed for ease and convenience in operation.





Turning a form cutter in a Hendey lathe

When ordering lathes, bear in mind the Hendey reputation for dependability in speedy production at low costs. Let us send you a catalogue.

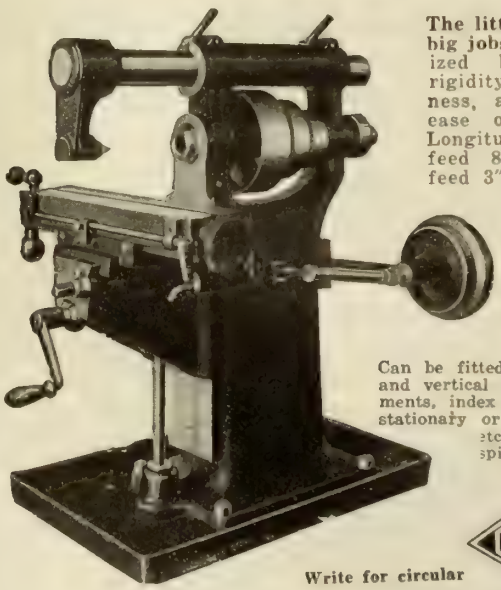
The Hendey Machine Co.

Torrington, Conn., U.S.A.

Canadian Agents:

A. R. Williams Machinery Co., Toronto, Ont.
A. R. Williams Machinery Co., Winnipeg.
A. R. Williams Machinery Co., Vancouver.
A. R. Williams Machinery Co., St. John, N. B.
Williams & Wilson, Montreal.

No. 4 BURKE



The little Miller for big jobs. Characterized by unusual rigidity, compactness, accuracy and ease of operation. Longitudinal table feed 8". Traverse feed 3".

Bench Type $220 ; with Pedestal $236.

Can be fitted with slotting and vertical milling attachments, index centres—either stationary or tilting heads, etc. 8" between spindle and table.

Write for circular

BURKE

THE BURKE MACHINE TOOL CO.

520 Sandusky St., Conneaut, Ohio, U.S.A.

Write for name of dealer located in your locality

ARMSTRONG

Bent Tail Lathe Dogs

They Stay With the Job

With Headless Screw

With Square Head Screw

The specially tough grade of open hearth steel from which these dogs are drop forged gives to them the stiffness and tensile strength so essential in a good lathe dog. They are designed to stand up to the severest work—moreover, they do so.

The screws are made of alloy steel, hardened at the point, the improved shape of which renders them less liable to "flange" or upset.

Canadian Agents:
A. R. WILLIAMS
Toronto
Williams & Wilson
Montreal.

ARMSTRONG BROS. TOOL CO.
THE TOOL HOLDER PEOPLE
305 N. FRANCISCO AVE. CHICAGO, U.S.A.

Patent Pending

LET THE

MIKRO INDICATOR

Cylinder Gauge

prove to your customers that they are wasting gas and oil, and gumming up spark plugs because of worn cylinders.

The Atlas Mikro Indicator will not only do this; it will make cylinder testing in your shop more accurate as well as speedier. And the dial element can be slipped off its carrier and used wherever a dial indicator is needed.

GEO. H. WILKINS Company, Chicago, Ill.
Would appreciate full information on the Atlas MIKRO INDICATOR, Cylinder and Piston Gauges.
Name .....
Address .....

ATLAS MIKRO INDICATOR

Cylinder Gauge

tells the customer or repair man:

1. Whether the cylinder size is correct,
2. Whether the cylinder is perfectly round,
3. Whether the bore tapers,
4. Whether the walls are smooth,
5. Whether the walls are parallel.

The Mikro Indicator measures exact diameters from 2⅝" to 5".

Write for circular "A Convincing Test."

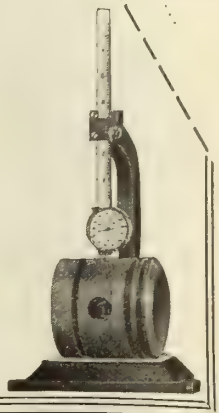
THE ATLAS MIKRO INDICATOR

Piston Gauge

is invaluable to the repairman in rapidly checking the diameter of pistons, piston pins and other cylindrical articles with diameters up to and including 6". Also measures thickness of flat pieces.

Invaluable in the repair shop.

Write for descriptive Circular.



GEO. H. WILKINS CO., 180 North Market Street
CHICAGO, ILL.

Metal Spinning Lathes

Tools and Accessories for Round and Oval Work

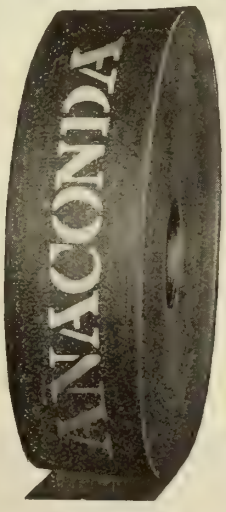
A range of sizes from 15 to 60-inch swing. Illustration is 22-inch Ball Bearing Lathe with 6-inch Oval Chuck and Compound Rest.

P. Pryibil Machine Company
New York City
Established 1859

MADE IN CANADA
FOR THIRTY YEARS

LEVIATHAN AND ANACONDA BELTING
ELEVATING TRANSMITTING CONVEYING

MUST
Earn Its Full Cost



FOR more than thirty years we have accepted the responsibility imposed by our definite guarantee to the effect that our responsibility for every Leviathan and every Anaconda continues **after** the belt is placed in service **until** it has earned its **full cost** as compared with the service under the same or similar conditions of any belt of any kind.

The widely varying kinds of service which belts must encounter in modern industry is only overcome by **individually made belting** — belting scientifically made to meet both usual and unusual conditions. Leviathan and Anaconda Belting cover all classes of work —the former is used generally for **usual** conditions, the latter for **special** ones.

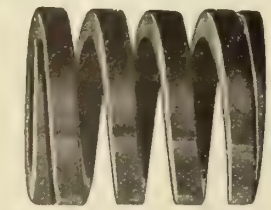
We shall be pleased to co-operate with you in overcoming your belting problems—may we?

Main Belting Company of Canada

Office: 122 St. James
Limited MONTREAL
Factory: 1112 St. Patrick

BRANCHES:

TORONTO 32 Front St. West, Phone Main 1838
WINNIPEG W. W. Hicks, 567 Banning St. Telephone Sherbrooke 3652
EDMONTON Calgary, Vancouver —Gorman's Ltd.



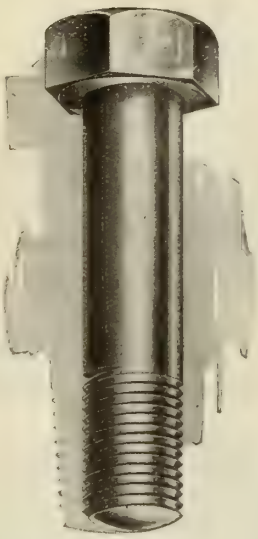
THE WALLACE BARNES CO. LIMITED
WIRE
BARNES CANADIAN SPRINGS
STEEL
HAMILTON, ONTARIO
CANADA

PRECISION SPRINGS OF HIGHEST GRADE

— FOR —

ENGINES, VALVES, DIES, AND SPECIAL MACHINERY

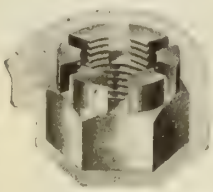
ALSO SPECIAL DESIGNS AND TYPES



ACCURACY

Just now all jobbers should have a complete stock of SAE Cap Screws, Plain and Castellated Nuts and Taper Pins to meet the automobile repair trade requirements.

Your rush orders filled promptly by

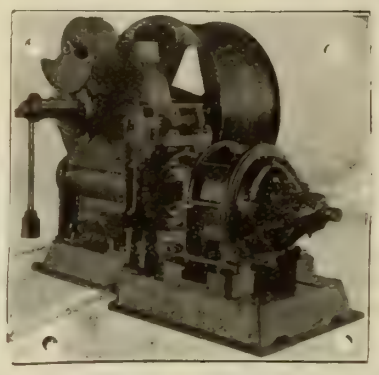


The Galt Machine Screw Co., Limited

GALT, ONTARIO

Eastern Representatives:
Messrs. F. BACON & COMPANY
131 St. Paul Street West, Montreal, Que.
Western Representative:
Mr. D. PHILIP
138 Portage Avenue, Winnipeg, Man.

Tighten Up —



On Your Freight Handling Costs

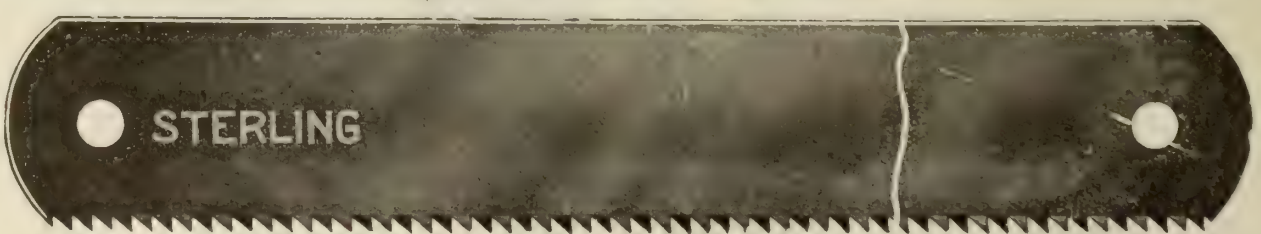
Roelofson Elevators

Once installed, the Roelofson Elevator—noiseless, smooth running, self-oiling, dust proof, and remarkably efficient—carries on its work with hardly any attention. In addition, its self-adjusting brake, phosphor bronze gears and worms cut from solid steel forging, make it absolutely safe and reliable. Enquiries solicited.

Roelofson Elevator Works

GALT, ONTARIO

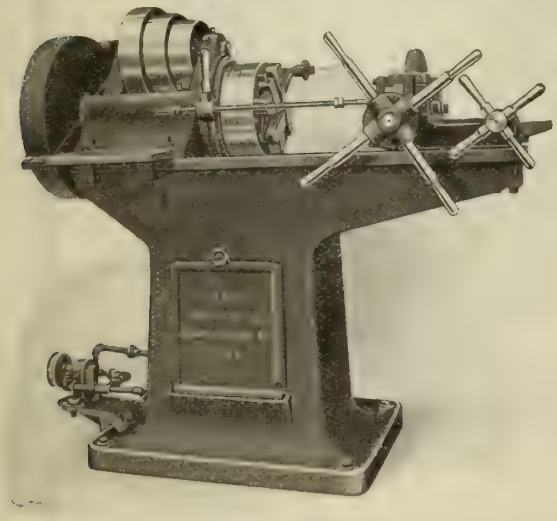
HACK "STERLING" SAWS



MANUFACTURED BY
DIAMOND SAW & STAMPING WORKS -:- BUFFALO, N.Y., U.S.A.

Women Operators Run the Landis Threading Machines in this Belgian Plant

The Belgian fighting spirit is still manifest; it is putting this nation back on its feet, speedily and positively (note the value of the Belgian franc). And the women are bearing their share of the burden. Here for example, are five of them running a battery of 1½ in. Landis Bolt Threading Machines, for the Liege Bolt Works.



The simplicity and convenience of Landis Machines make them ideal equipment where unskilled help is used. They can be run efficiently all day without unduly fatiguing the operators. They cut accurate clean threads, always.

Let us tell you more about the famous Landis line of Threading Machines, Die Heads, Pipe Threading and Cutting Machines, etc.

LANDIS MACHINE COMPANY, Inc.

Waynesboro, Pa., U.S.A.

LANDIS

DOMESTIC AGENTS: Marshall & Huschart Machinery Co., Chicago, Ill.; Marshall & Huschart Machinery Company of Indiana, Indianapolis, Ind.; Colcord-Wright Machinery & Supply Company, St. Louis, Mo.; R. B. Whitacre & Co., St. Paul, Minn.; Hamilton Machinery Co., Chattanooga, Tenn.; Seeger Machine Tool Co., Atlanta, Ga.; Young & Vann Supply Co., Birmingham Ala.; Woodward Wight & Co., New Orleans, La.; Jos. T. Ryerson & Son, Houston, Texas; Hendrie & Bolthoff Mfg. & Supply Co., Denver, Colo.; Salt Lake Hardware Co., Salt Lake City, Utah; Eccles & Smith Company, San Francisco, Calif.; Los Angeles, Calif.; Portland, Ore.; Hallidie Machinery Company, Seattle, Wash.; Hallidie Company, Spokane, Wash.

CANADIAN AGENTS: Canadian Fairbanks Morse Company, Toronto and Montreal.

FOREIGN AGENTS: Alfred Herbert, Ltd., Coventry, Eng.; Calcutta, India, and Yokohama, Japan; Allied Machinery Co., Barcelona, Spain; Turin, Italy; Zurich, Switzerland and Tientsin, China; R. S. Stokvis & Zonen, Rotterdam, Holland and Dutch East Indies; D. Drury & Co., Johannesburg, South Africa; Benson Brothers, Sydney, Australia.

Thoroughbred Springs

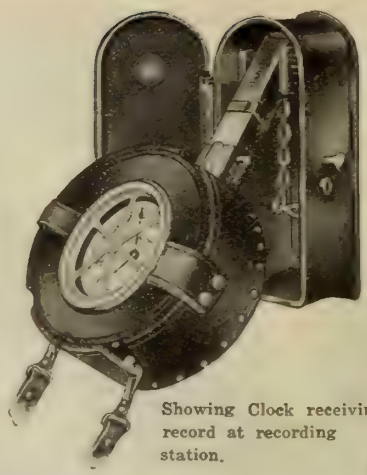
RAYMOND SPRINGS—

are in every sense "Thoroughbred Springs." They owe their superiority to careful, painstaking creation by experts, whose knowledge of spring requirements comes from an intensive study of the subject for many years. In addition to this, even smallest details of their manufacture are given the same scrupulous care as obtains during the scientific heat-treatment which imparts to RAYMOND SPRINGS that attribute which places them in the "thoroughbred" class.

There is a RAYMOND SPRING for every purpose.

Raymond Mfg. Co., Ltd.
Corry, Pa., U.S.A.

Watch Your Watchman!



Showing Clock receiving record at recording station.

WHEN you pile into your bed every night do you ever stop to realize that you are entrusting, absolutely, the source of your income to a low-salaried watchman **without proof that he is actually "on the job"?** True, you have your fire insurance, but that is merely indemnity for buildings and material destroyed. It pays you nothing for loss of production, organization and time.

The Hardinge Alert System is your Factor of Safety. It tells you, beyond argument, whether you are getting all the protection you pay for. If your watchman is "on the job," it tells you so—if he's a slacker, it tells you so. It cannot lie, the watchman makes the record himself. By his own hand he tells you whether or not he is faithful.

There's no wiring, no complicated installations to the Hardinge Alert; your workman can equip your plant in a couple of hours.

Let us send you a system for thirty days' trial.
Send for Catalogue C.M.

Hardinge Bros. of Canada, Ltd.
47 Wellington St. E. TORONTO 50 Front St. E.

BOLTS

Machine Bolts **Blank Bolts** **End Spring Bolts**
Carriage Bolts **Stud Bolts** **Cant Dog Bolts**
Plow Bolts **Bridge Bolts** **Coupling Bolts**

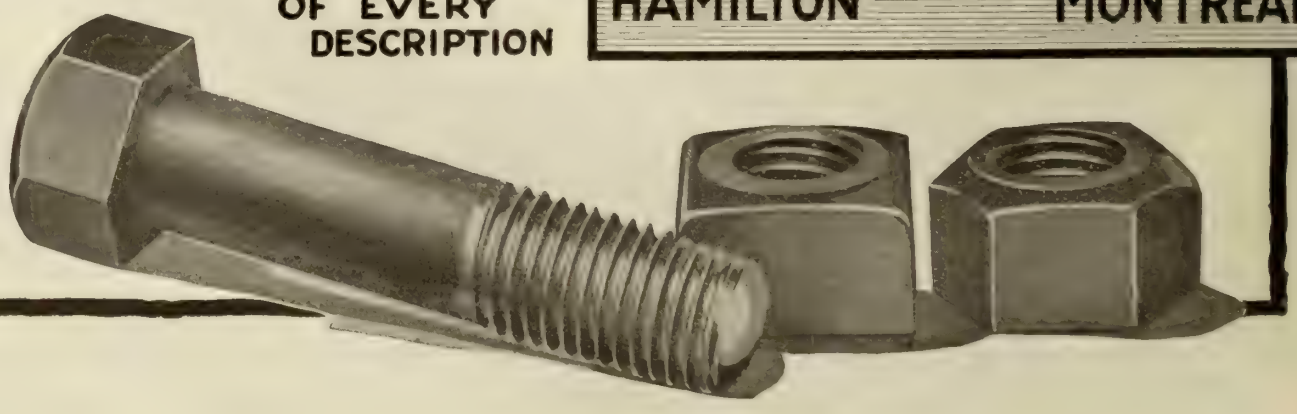
ALSO

NUTS, WASHERS AND RIVETS

OF EVERY DESCRIPTION

THE STEEL COMPANY OF CANADA LIMITED

HAMILTON MONTREAL

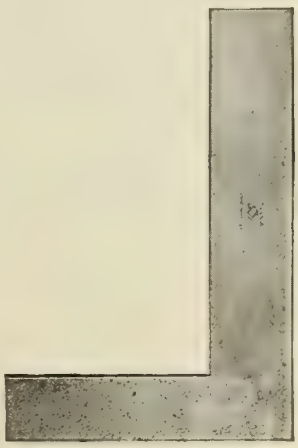


The Beveled Edged Blades of these Squares Give Practically a Line Contact

Mechanics will be quick to appreciate this advantage of the new Starrett No. 55 Hardened Beveled Edge Squares now ready. The two edges of the blades are beveled on both sides, thus furnishing practically a line contact with the work.

Made in five sizes with length of blade varying from 1½ inches to 6 inches, and length of beam varying from 1½ inches to 4 5/16 inches.

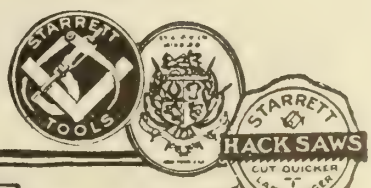
Fully described and illustrated, with other interesting new Starrett Tools, in a special Supplement to the Starrett Catalog No. 22 3 . Copies of both this Supplement and Catalog will be promptly sent free on request. Write for them.



THE L. S. STARRETT CO.

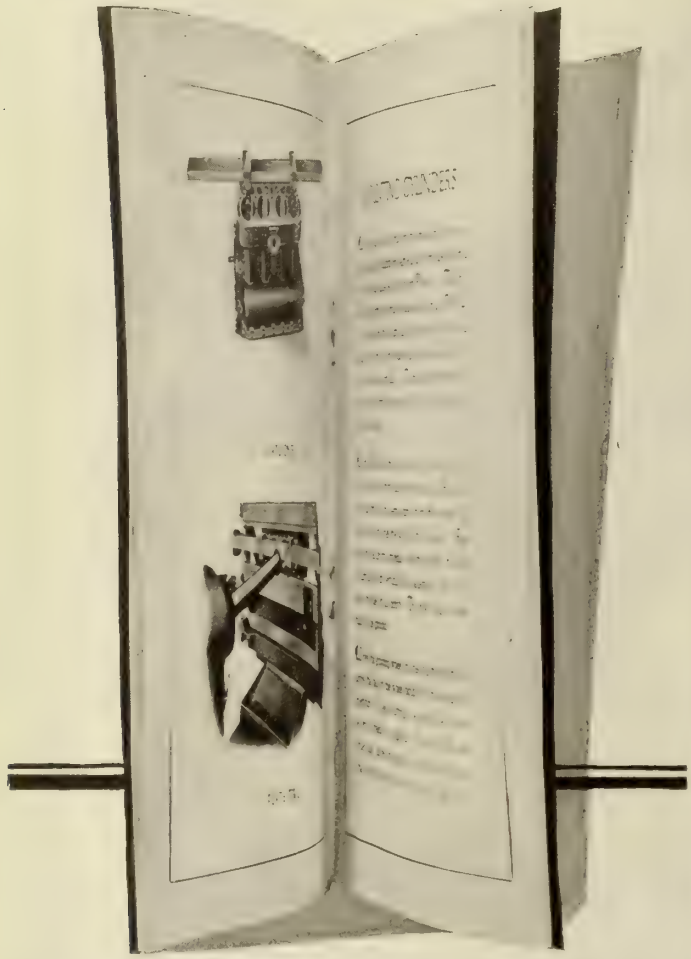
The World's Greatest Toolmakers
Manufacturers of Hacksaws Unexcelled

42—342 ATHOL, MASS.



Use Starrett Tools

LANDIS



Get this free book

Here's a new book, just off the press, on the operation of the Landis No. 5 Cylinder Grinder. It's indispensable to owners of a Landis and is just as valuable to those planning to install such a machine. It will help you to decide. Filling out and sending this coupon entails no obligation.

Fill in—Tear off—and Mail

LANDIS TOOL CO.,
Waynesboro, Penna.

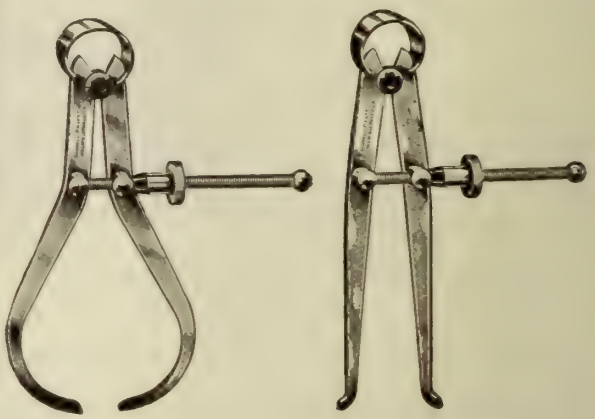
Gentlemen: Send me your new book. I have written my name and address in the marg'n of the magazine below.

.....
.....
.....

GOODELL-PRATT

1500 GOOD TOOLS

We Welcome Any Kind of Tests for Accuracy



You may be prejudiced about machinists' tools, but standards are not. If you give our precision tools the most exacting tests for accuracy in comparison with other makes, the results will be more convincing than any words of ours.

Micrometers, Rules, Squares and Gauges can all be tested for accuracy before you buy them, but Calipers can only be judged by general appearance.

Look at Goodell-Pratt Calipers, each one has well-proportioned legs of tempered steel—we don't make soft ones. The points are well shaped and come together accurately. The springs are strong and screws are smooth and even. Quick nuts work freely and do not bind.

If you are proud to own good tools write for "Tools for the Toolmaker"

Goodell-Pratt Company

Toolsmiths

Greenfield Mass., U.S.A.

Here's the Acme Upsetting and Forging Machine That Saved $398.00 on its First Run!

THESE are not our own figures, they are taken from the report of an up-to-date manufacturer in Western Pennsylvania who specializes in spokes for tractor wheels and also handles miscellaneous contract work.

In this Acme 3″ All-Steel Heading and Forging Machine, the dies are opened and closed by a powerful cam, entirely independent of the plunger slide. This gives the proper movement to "time" to the gripping slide, so necessary in forging when a large amount of stock is to be gathered or upset.

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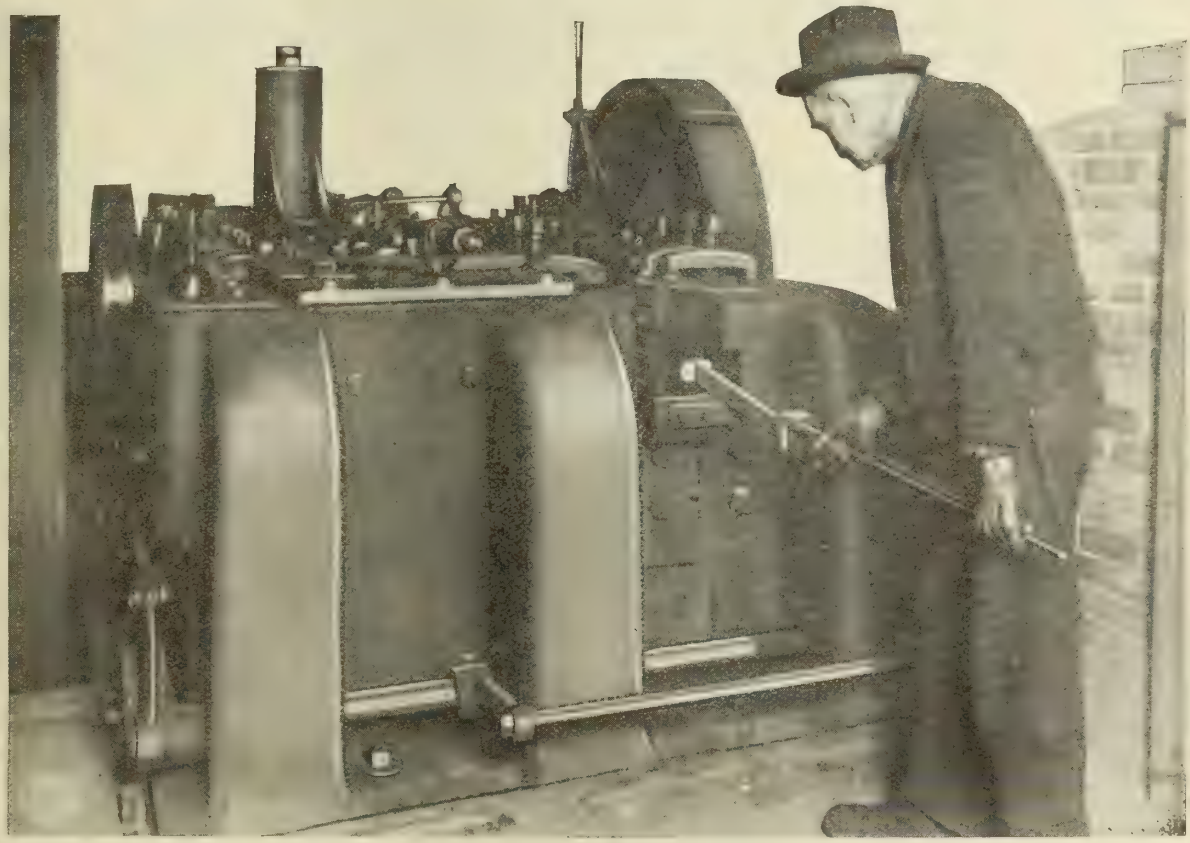

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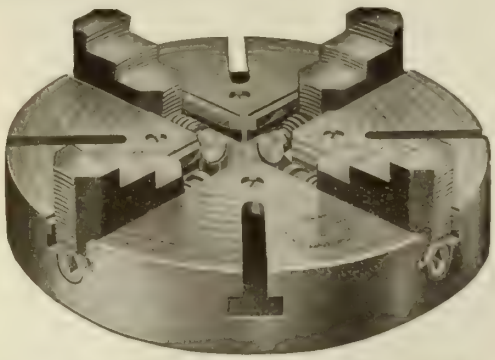

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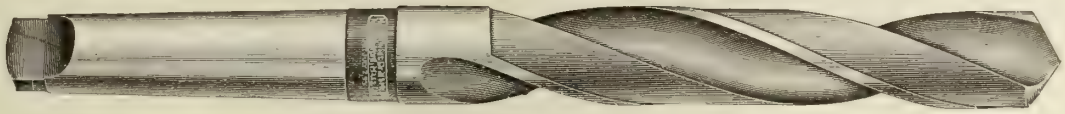

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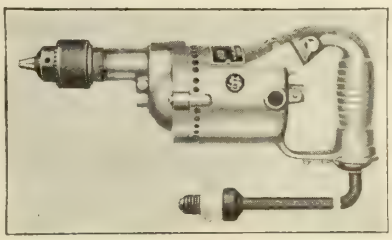

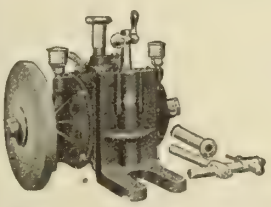

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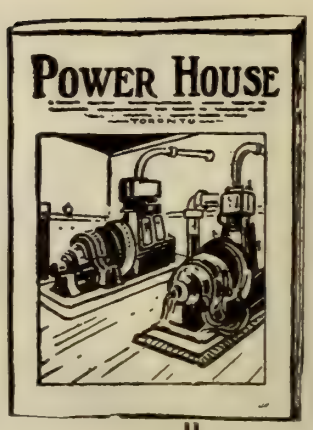

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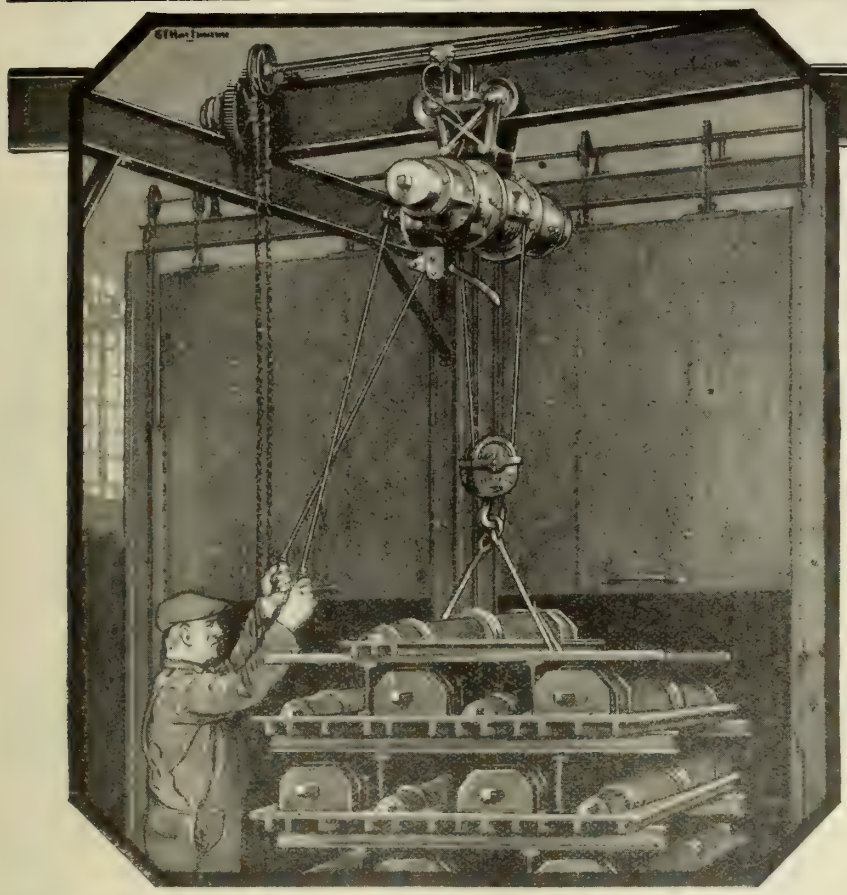

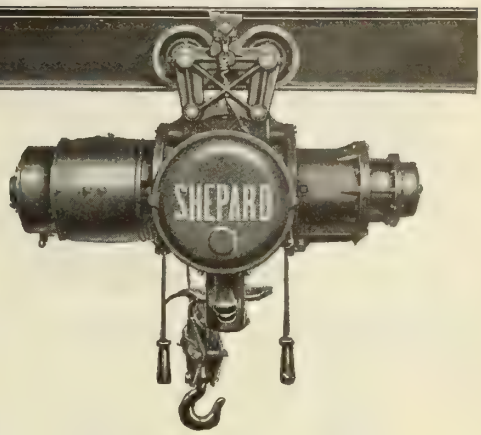

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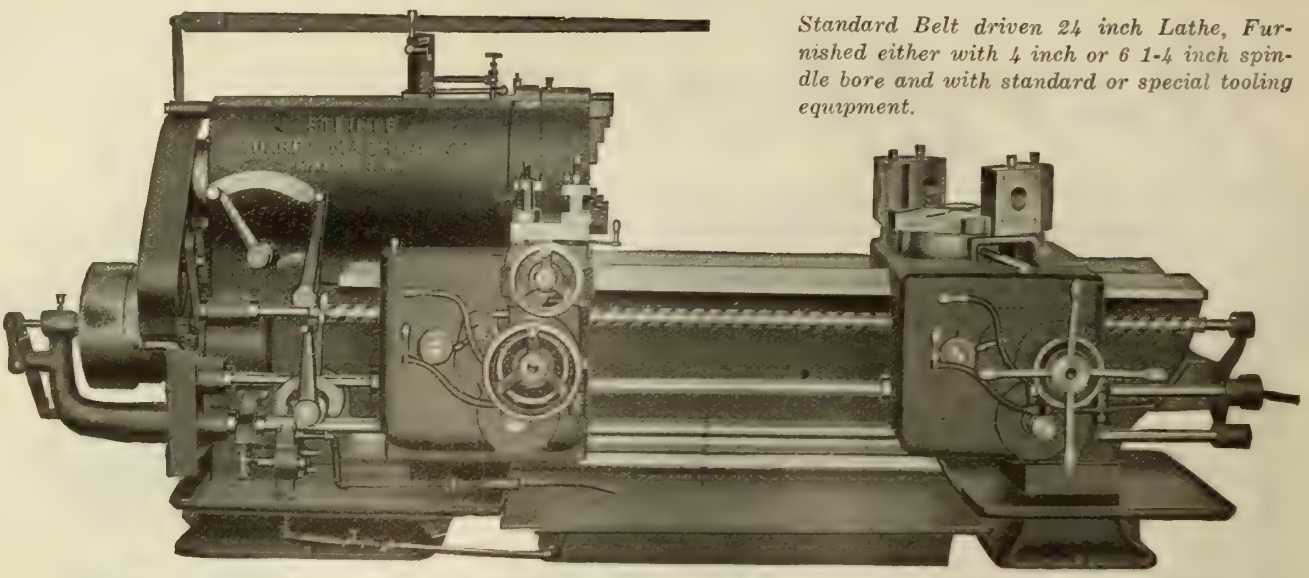

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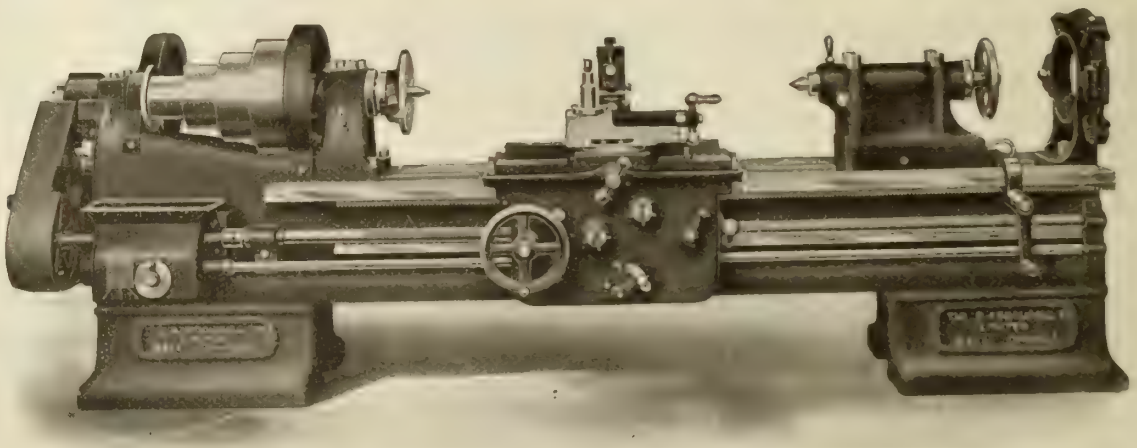

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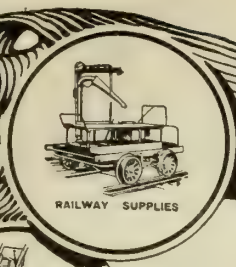

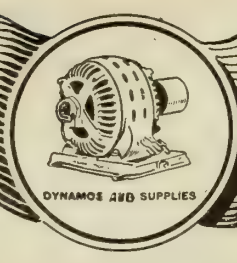

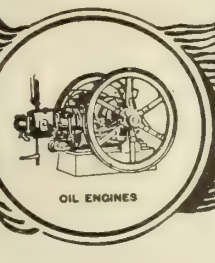

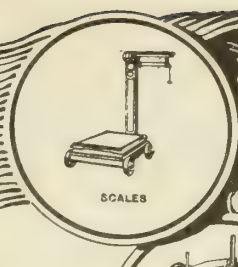

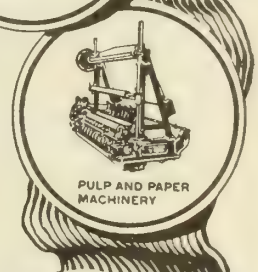

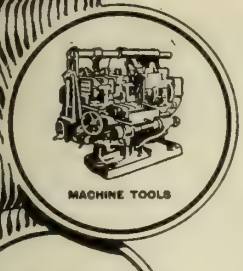

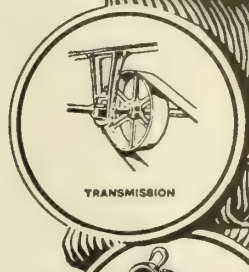

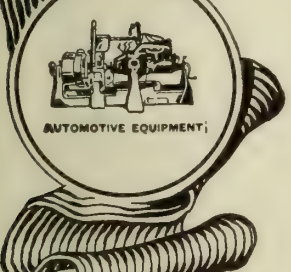

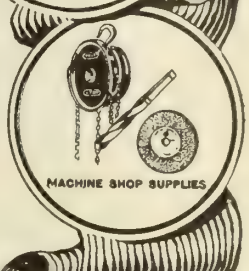

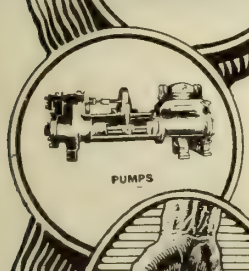

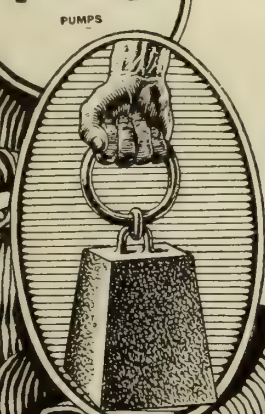

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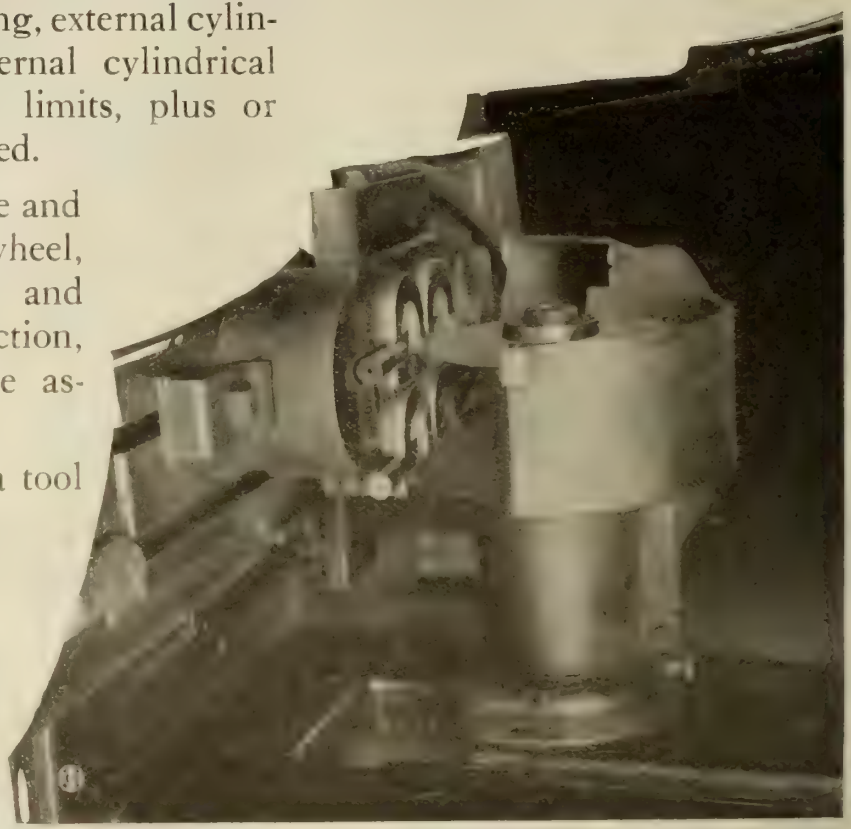

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CANADIAN MACHINERY
AND
MANUFACTURING NEWS

Vol. XXVIII. No. 1 JULY 6, 1922

Producing Gears in Quantity at High Speed

Modern Gear Cutters Very Efficient—Multiple Fixtures Reduce Non-Productive Time—Automatic Operation Practically Eliminate Possibility of Error—Special Methods for Bevel Gears

By J. H. RODGERS

TWO GENERAL methods are used for the cutting of gear teeth; milling and planing. It is common practice to use either process for cutting teeth of spur gears, bevel gears, internal gears and racks, but the planing method is not well adapted for spiral and worm gears. On the other hand perfectly cut bevel gears can only be produced by the shaping process, owing to the gradual change in size of tooth from the outer to the inner end. Bevel gears are often cut by means of milling cutters but where great accuracy is desired the form is derived by a single edged, fixed cutter having a reciprocating motion, the tool or the work holder being given the necessary movement to retain the proper tooth shape throughout its entire length.

In the early days of gear cutting the ordinary milling machine was largely used for the purpose, where one or more gear blanks were secured on a suitable arbor supported on centres bolted to the table and moved beneath the cutter which removed the metal from between the teeth. While the fundamental principle of cutting gear teeth has not changed, the design of the modern gear cutting machine has rapidly conformed to the growing demand for heavy duty equipment capable of mass production, where speed and accuracy are the two dominating features of manufacture.

When gears are not made in large quantities it is seldom that more than one cutter is used, and this is especially true when the gears are small as regards tooth pitch. However, in the cutting of gears of large diametral or circular pitch it is advisable to use two cutters, one for roughing and one for finishing. This, of course, necessitates two cycles of operations, but owing to the possibility of greater speeds and

Illustrations and production data through courtesy of Gould and Eberhardt, Newark, N.J.

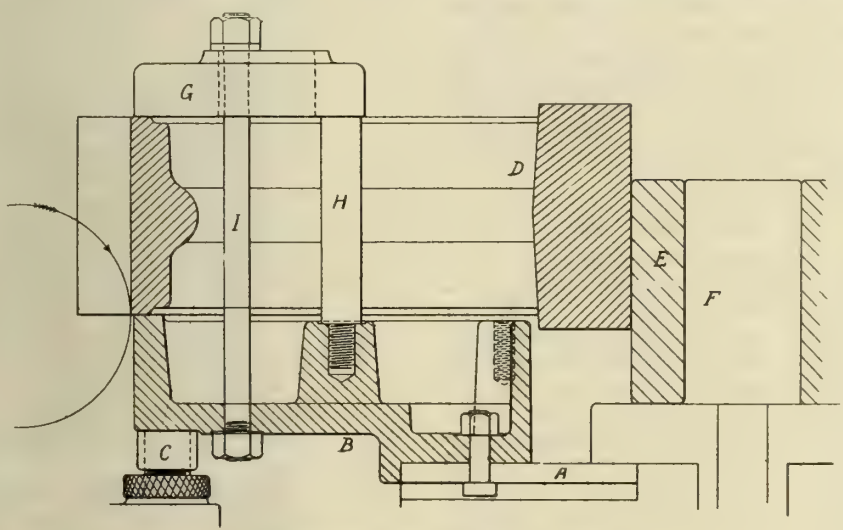


Fig. 2. Sectional View of Holding Fixture

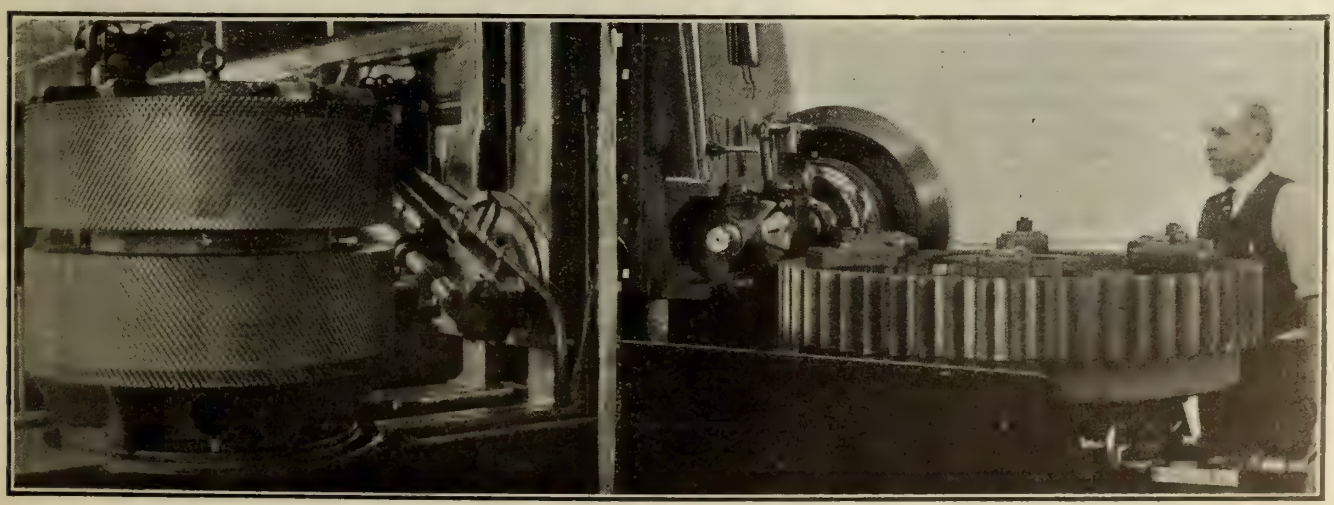


Fig. 1.—Left: cutting a large helical gear. Right: cutting large spur gear, total time 5 hours.

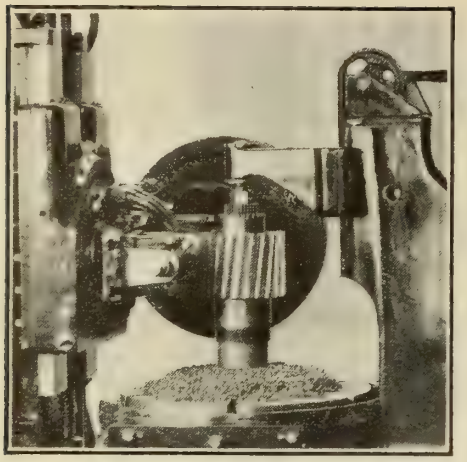


Fig. 3.—Cutting 3-pitch helical pinion, 20 teeth, 7 in. face, in twenty minutes.

feeds, and less wear on the finishing cutter the production is increased and likewise minimizes the possibility of error in the finished product.

Stepped Stocking Cutters

Where roughing or stocking cutters are used it is general practice to shape the teeth so that alternate ones cut on opposite sides, and in addition the teeth may be provided with a series of steps to break up the chips and reduce the tendency to overheat the cutter and the work. In the operation of cutters of this character it is important to see that sufficient stock is left for the finishing cut, as the action of the alternate cutting sometimes causes a weaving motion that may prevent the proper finishing of the tooth face.

Large Spur Gear

To the right of Fig. 1 is shown a 72 x 16 in. spur gear cutting machine operating on a 51-tooth, 3 in. c. p., 7½ in. face gear made of open hearth steel. This gear was finished in 5 hours from floor to floor. The roughing out was performed by a stepped stocking cutter operated at ⅛-in. feed per min. One finishing cut was taken at a feed of 2.6 in. per min.

Fig. 2 shows a line drawing of the holding device used in Fig. 1. The fixture B is fitted over the outer edge of the machine table A, which is provided with T-slots for clamping. The standard rim support C takes the thrust of the cut as the teeth are being machined. The bush E is made to suit the bore of the gear being cut and likewise the centre mandrel F. The clamp G is a steel casting slotted to take the bolt I, the stud H being screwed into the body of the fixture.

Fig. 3 shows a gear cutter at work on a helical gear such as is used in trolley cars, 20 teeth, 3 pitch and 7 in. face, made of machinery steel, finished in one cut in 20 minutes time from floor to floor.

Preparing the Blanks

While the actual cutting of the teeth is the principal factor in the gear production problem, the preparation of the blanks in large numbers is a matter of no little import. The machining is seldom performed in the engine lathe, using a single tool, but in semi-automatic or full-automatic machines, very often specially designed for the single purpose of turning out blanks of a specified size. In the automatic machines, where the blanks are made direct from bar stock or where drop forgings are fed from a magazine, multiple tooling is provided, each tool or group of tools having a specific duty to perform, operating simultaneously or in rapid succession, on different parts of the bar or blank, the actual unproductive time being reduced to the lowest degree, if not entirely eliminated On the larger gears the operations are usually divided between two machines, one taking care of the bore and hub, and the other working on the larger outside faces and diameters at reduced speeds. It is sometimes possible to mount two or three blanks on the one arbor and machine at the same time with multiple tooling arrangement.

Turret machines are particularly well adapted for the operations on the larger automotive and similar gear blanks, the work being distributed between two machines, one adapted to the chucking of the rough casting or forging and the second taking the work from the first after one side and part of the outside diameter has been faced and turned.

Bevel Gears in Quantity

In the making of bevel gears, where accuracy is essential the teeth must be produced by the generating process. This necessitates more costly equipment than the ordinary spur gear cutter, and is slower in operation—based on the amount of metal removed—but owing to the gradual change in the dimensions of the uniformed shaped tooth of bevel gears, this method of generation is necessarily imperative. How-

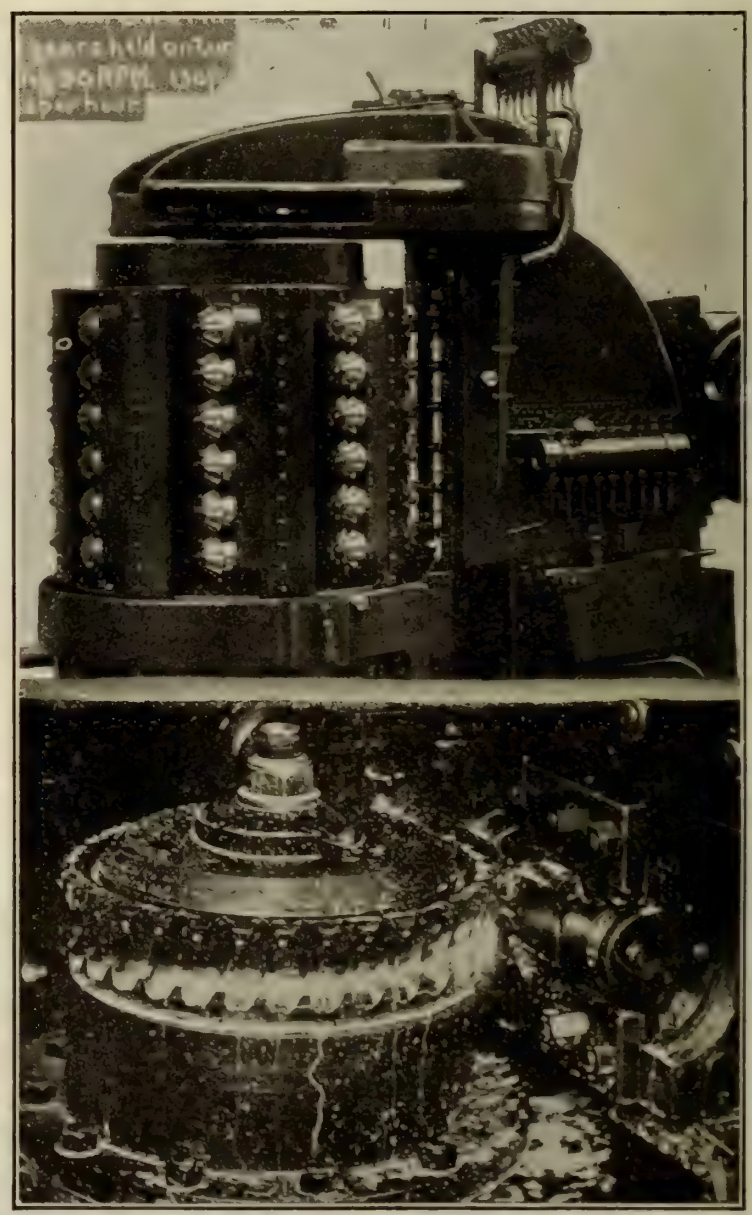


Fig. 4.—Top: special fixture for holding 48 bevel pinions, eight tiers of 6 in. each tier. Six cutters working at the same time. Bottom: hobbing a large worm wheel.

ever, this generating process is largely confined to finishing operations and the usual practice is to stock cut bevel gears by means of the ordinary spur gear method, using the forming cutter as a tool. These roughing cutters are usually made to cut as deep as the greatest depth of the tooth and no wider than the narrowest part of the tooth space.

The automobile industry has created an abnormal demand for the smaller sizes of spur and bevel gears, nearly all of which are made of alloy steel of high tensile and wearing qualities, with the maximum of strength and the minimum weight. Quality production of bevel gears has been attained largely by the adoption of mass methods of roughing out the gears before they are given the generating or finish shaping. While it is possible to group a number of spur gear blanks on the one arbor for the operation of cutting the teeth, the requirements of the bevel gear call for the mounting of each gear on its own individual arbor. For this reason quantity production resolves itself into the adoption of suitable gear holding fixtures fitted with several work arbors on which the blanks are secured, and which can be adjusted to different positions within the range of the machine. In the design of such fixtures, rigidity, compactness and convenience and speed of accurate indexing are among the important features.

Special Fixtures

An interesting and highly productive design of gear cutter fitted with a special work holding fixture is shown in top view of Fig. 4. The turret has a capacity of 48 bevel gears, six in each tier, the cutter spindle being mounted in a vertical position. This machine was constructed for the Ford Motor Co., for roughing the teeth of bevel pinions and rings which were subsequently finished by planing at another operation. The pinions in this case have 9 teeth of ¾-in. pitch. When in operation the turret revolves continuously, loading and unloading being carried on while the head is in motion. One man can look after two machines. The stocking cutters are 5 ½ in. dia. with a 2-in. hole, and run at 90 r. p. m. giving a cutting speed of about 130 ft. per min. The production is approximately 64 gears per hour

Different turrets, modified in design to suit specific requirements, can be made for other sizes of gears, the location of the arbors or turret faces being arranged to meet the needs of each individual blank. In the case of large rings the blank is held on by means of a large circular place and one clamping nut. The remounting of finished gears and the mounting of new blanks are carried on while cutting is in progress. Between cutting periods the movement of turret is speeded up seven times. At the completion of each full turn of the turret all the gears on the fixture are indexed one tooth. A machine of this type, operating on bevel gear rings mounted on an octagon turret holding 24 at one time, has roughed out vanadium steel, drip-forged gears, 40 teeth, 5 d. p., 1 in. face, at the rate of about 240 in 8 hours.

This method of multiple machining of the preliminary roughing of bevel gears is the only real economic way of aiding quantity production, as the final shaping of the teetht faces must be done individually for the reasons above stated. Even when finished with a revolving milling cutter each side of the tooth must be finished with a separate cut owing to the conical nature of bevel gear teeth.

SHOULD INDUSTRIES HEREAFTER LOCATE IN RURAL DISTRICTS?

"WHAT would you give, Mr. Manufacturer, if you could have a steady supply of labor at your busy season, out of your way in slack times, always consisting of the same contented personnel, and living happily on an income that is not entirely derived from you? Wouldn't that be a fairly satisfactory state of affairs?" asks The Industrial Digest, New York.

"But perhaps your labor problem has already been solved," the magazine continues. "Perhaps you are so much luckier than the rest of us that you can always get the right kind of hands at the right price whenever you want them. In that case you needn't bother to read this article, which is a discussion of a visionary scheme for helping to cure the labor troubles of American industry, and at the same time help solve the farm problem, the problem of city congestion and perhaps a few more of the difficulties of civilization.

"The author of the idea is Henry Ford. Mr. Ford's mind is productive of many ideas for the solution of the world's troubles. Not all of his schemes are regarded highly. But in discussing any idea of his relating to the labor problem it is worth while to remember that Mr. Ford is a highly successful manufacturer, and that his record for success with his labor is hard to beat.

"Mr. Ford's scheme is this: Let us combine factory work with farming. Let us locate our plants in country neighborhoods, and encourage our employees to own and operate farms. With the aid of modern mechanical methods they will be able to finish their agricultural duties in a short period every year, and they will have the rest of their time for factory labor.

"Is it feasible to locate industry in the country? Why not? A factory must, in most cases, be on a railroad and conveniently located in regard to its sources of raw materials and its markets; but these conditions can be, and often are, fulfilled in locations near good farm lands.

"When large corporations create towns in which their workers can live they usually encourage the men to cultivate little garden plots behind their houses. There is a great difference, of course, between a garden plot and a farm, yet to urge workers to grow their own cabbages is a step, however small, in the direction of Mr. Ford's ideal condition.

"If that condition could be made to prevail, it would be wonderfully beneficial for all hands. It would mean satisfied, cheap labor for the manufacturer and a fuller, happier existence for the combined farmer and factory worker. It is a vision for the future, and most of us have all we can do to take care of the present; yet if we are to make the most of the present we must keep the future, too, in mind. Mr. Ford's idea may not be practical. It is at least worth thinking about."

HEAT TREATMENT OF CAST IRON

Grey iron castings very seldom receive heat treatment of any kind, being used just as they leave the moulds. The benefits resulting from proper heat treatment are many. Take, for example, a lathe bed casting. Some engineering firms rough machine such castings, then leave them out in the weather for several months for "seasoning." The reason given for this is that "if a lathe bed casting is machined and finished without seasoning, it twists and goes out of shape, and the lathe is no longer accurate." Why? In a lathe bed or similar casting, where unequal thicknesses of metal are joined together, internal stresses are set up by the contraction at different times of the various thicknesses of metal, assisted to an extent by the cores. When the skin of the casting is broken these stresses begin to assert themselves, and in time pull the casting out of shape, and no period of sun and weather will ever completely take these stresses out. Heat treatment will.

Castings of unequal thickness of metal, where accuracy in the finished machine is desired, states a writer in Hardware and Machinery, ought to be heated slowly to 550 deg. Cent., held at that temperature for at least twelve hours, and then allowed to cool slowly in the furnace. This will give a casting which will not only keep its shape, but possess the maximum strength in all parts. Hard spots in medium castings and all hard light castings are very often the result of chill from water. When these faults are found the results from the machine shop are far from satisfactory, broken drills and reject castings being numerous. To stop this the castings ought to be heated to 850 deg. Cent., held at that temperature for two hours, and then allowed to cool slowly in the furnace. For both of these heating operations muffles or steel boxes, securely luted with fire clay to prevent oxidation, should be used. Not only so, but the castings should be painted over with powdered charcoal or coke and water.

Half Year's Business Retrospect and Prospect

Seasonal Work Helping Unemployment—Wage Standards Fairly Well Maintained for Skilled Work—Warning Against "Building Orgy"—Motor Industry Promising—Better Outlook for Railways—Freight Reductions Effective Aug. 1

AS a matter of history, the first six months of 1922 are not without good features, nor does the future lack cause for optimism. Unemployment in the early weeks of the year was serious. At one time the number of personal enquiries handled by the employment service of Canada in Toronto alone was something like 20,000 weekly. Many of these, of course, were repeats—that is, men who, having filled temporary jobs, necessarily made second or third applications, while in more serious periods, it was required of men seeking relief, to call daily. So that the figure is hardly so serious as it may seem. Seasonal work has brought about a marked improvement. Construction, railway and farm work has absorbed thousands of men. The opening of navigation makes its demand, and large engineering works have assisted in the easing process.

Farmers are keen to get good men and for the summer the wage rates are $35 to $40 monthly, everything found, for experienced men. Some effort is being made to have farmers hire their men by the year on a basis that will allow for the higher wage during the heavy months and for a wage considerably lower in the winter, or the so-called slack period.

Low Rates For Railway Labor

Except as regards railroad laborers, wages seem to be held at a reasonable standard, living cost levels being considered. Men for railroad contracts have been cleared through the employment service at 25 and 30 cents an hour, a ridiculous wage, and one that has called forth some protest from the service, but, contractors reply, "if you can't get us the men at that figure, we will get them elsewhere." The supply has been quite up to the demand.

On city work in Toronto, no laborer is paid less than 60 cents an hour, the Toronto Transportation Commission is paying 40 to 55 cents, while it is stated that men for lumber camp work are being contracted for at 26 to 32 cents an hour, everything found. It goes without saying that the cost of taking out lumber is going to be on a much lower scale than formerly.

Warning Against "Building Orgie"

Building trade activity has been one of the bright spots. For the most part, the trades engaged here are fairly well organized, and the wage represents a better standard of living. Wages to skilled men range from 75 cents to $1.00 an hour, with the higher figures generally ruling in the Western provinces.

Building materials have held firm. There has been strong demand for all materials, particularly in the larger centres of population. Opinion seems to differ as to whether the building activity was merely a spasmodic spurt or the forerunner of sound recovery. There are said to be 6,000 houses in course of erection in Toronto this summer. Referring to this fact, a prominent bank official expressed the opinion to Canadian Machinery, that such a number of houses would seem adequate for the immediate requirements of that city. He expressed a fear that if what he called "a building orgy" set in, and the supply outstripped the demand, stagnation in the building trades might result greatly to the detriment of healthy, stable growth. He further predicted that a decline was about due in real estate prices. This was a department, he stated, in which no deflation had occurred and he considered that such development was due.

Little Demand For Credits

"So far as industry as represented by your medium, is concerned," said this official, "about all that can be said is that the banks are meeting the requirements of industry. Generally speaking, people have not been asking for credits during the past six months, except in very few lines representing individual effort, where a good selling specialty may be concerned. People doing business with a standard line, say in the machinery field, have probably felt the falling off in demand more seriously than in the specialties. There has been an easing off in the security markets, bonds have had a slight recession, the best industrial stocks are holding up in a way that suggests an undertone of confidence, and I would say that, at heart, things are sound. The only warning that seems necessary is against overdoing anything that looks like an honest-to-goodness return to prosperity, and against the risking of money in schemes or undertakings which investigation will prove to be practically worthless. Such times as those through which we are passing seem to nourish that kind of speculation. It seems to be good advice, that people should consider their hard earned money as something that should still be handled carefully. They may need it."

Manufacturers of machine tools do not report much improvement in the situation, except in the woodworking section. Here, the activity in furniture and lumber industries has helped to keep industry on its feet. The demand here is regarded as largely an outcropping of the improvement in building operations. In the employment service, the information is given out that in the meantime, machinists and other skilled men in that class, have been taking employment in other lines.

Buying By Railroads

The appearance of the railroads in the market for material is regarded as an encouraging sign. In the United States, the railroads have been heavy buyers for the past three months, and the demand from this quarter has been a great factor in maintaining a most active market. The coal strike has also contributed to a firming tendency in steel and iron prices. While reports indicate the Canadian lines to be in good condition, so far as rolling stock is concerned, road requirements seem to be receiving attention. The Algoma Steel Corporation, for example, has received an order from the C. P. R. for 48,000 tons of rails. The rail mill there had not been operating for the past six weeks. Reports from Sault Ste Marie state that "as general steel business is now improving, it is expected that enough business will be secured to keep the plant running steadily. Beginning Sunday night, it is expected that the whole plant will go on double shift with a full force." The Nova Scotia Steel Co. also reports activity as the result of railway buying.

The foundry industry seems to have survived a bad three months at the beginning of the year, although it is still evident that most business is being done where there is contract with thriving conditions in the building trades. Builders' hardware, plumbing and drainage supplies have been in great demand and this has helped foundry business. On the other hand, up to one month ago, there had been little doing in the agricultural implement industry. Foundries that have always depended on this source of business, have been disappointed and have been going after general work to tide them over. However, there is a change for the better here, owing to good crop outlook, and the prospect of a better Autumn business in implements. The motor car industry has also been a helping factor here.

Increased Production in Motor Cars

Whether or not it may be considered a seasonal industry, the manufacture of motor cars in Canada would seem to be measuring up to the prediction that the year 1922 would be just what it should have been had there been no war and no post-war inflation, and that in 1923 the normal increase in demand should fully require the enlarged production capacity planned in more propitious times.

In fact, the motor car industry will figure largely in the extensive building operations of the near future, and some

plants have already been announced. The large, potential export market for cars, represented by the British Empire, is in large measure responsible for the growth of the industry in Canada. Preferential tariffs have been an advantageous factor.

Freight Rate Reduction

The most that can be said about railway business during the past six months is that reports reflect general conditions. The month of May was in some respects exceptional. One road reports an increase in carload lots in the east. Crop prospects are good, and the feeling in railroad circles is that reports from now on should show improvement. Some impetus is looked for as the result of the reductions in freight rates ordered for August by the Dominion Board of Railway Commissioners. The reduction is on basic commodities—forest products, including pulpwood west of Port Arthur, building material, brick, cement, lime and plaster, potatoes, fertilizers (other than chemicals) ores, pig iron, booms, billets, wire rod, and scrap iron—and amounts to 7½ per cent. from existing freight rates. The decrease reduces the increase of September, 1920 to 12½ per cent. in Western Canada and 17½ per cent. in Eastern Canada. Grain and flour rates were fixed in accordance with the rates prevailing under the Crows Nest Pass agreement, and the order rescinds all increases provided for in September, 1920, on coal, other than anthracite and coal from the head of the lakes westward. Important decisions affecting the railroads have also been made in the United States. A horizontal cut of 10 per cent. has been made in freight rates, a reduction to 5¾ per cent. of the "fair return" basis for purposes of fixing rates, and a series of wage reductions affecting 800,000 men.

Delicate adjustment is required in the fixing of freight rates, the problem in Canada being accentuated by varying conditions as between East and West in the matter of business possibility and upkeep. Time seems to be the only satisfactory test of freight rate changes, for in fixing relief to the shipper there has also to be consideration of earnings of the railroads in order that investment may have reasonable protection. The announced reductions mean a loss in revenue of about eleven millions each to C. P. R. and Canadian National. The new rates are in any event, a step toward normal, and hence not unwelcome to shippers, however divergent outside views may be.

On the whole, it may be said of industry, that the advent of the year's second half, is marked, at least, by greater degree of stability than has been evident for some time. Caution is advisable, but at the same time, the view seems somewhat clarified and not without its encouragement for well-directed effort. Summer months will see an easing off in manufacturing and in general demand, but there seems in many quarters a feeling that some confidence may be reposed in the prediction that from the mid-year onward the general industrial trend would be upward.

ENGINEERING FIRM IN GROUP LIFE PLAN

FROM time to time Canadian Machinery is asked for information with reference to the operation of group life insurance. One of the most recent contracts entered into in a large way is that of Dwight P. Robinson & Co., engineers and constructors, New York, with branch office in Montreal. By arrangement with an insurance company, life policies are provided without expense to individuals for all employees reporting to the central group office under a group insurance plan. This insurance is without cost to the employees and its benefits are in addition to those provided by law under compensation acts.

All employees included in the plan are insured regardless of their age and condition of health and no medical or physical examination is required. The amount of insurance is increased $100 for each additional year of continuous employment and this plan of regular increase is thus a recognition of length of service. Each employee has the privilege of naming his or her beneficiary which may be changed if necessary, and individual policies are issued to each insured employee as evidence of the coverage. Not only life insurance but provision for total and permanent disability before the age of sixty is included in the contract. In case of disability the amount of insurance stated on the certificate is paid to the insured in monthly or annual instalments. If death occur during this period of disability, the remaining amount is paid to the beneficiary.

The Insurance Company maintains a plan, which includes the furnishing of professional graduate nurses to the homes of employees covered under group policies in case of illness. The nurse's duties are to assist in carrying out the instructions of the physician in charge, advising members of the household in the proper care of patients and visiting the homes as often as may be needed. It also maintains a complete course of literature and lectures dealing with matters of health, hygiene and disease prevention.

CANADA'S PETROLEUM FIELDS MAY BECOME WORLD'S GREATEST

"SIXTY per cent. of the world's total supply of oil is now produced in this country, but U. S. fields are becoming exhausted, and geologists expect their early decline. When our petroleum is used up where will the bulk of the world's oil come from?" asks The Industrial Digest, New York. "A large part will undoubtedly come from Canada, whose oil fields have enormous potentialities. In western Canada are petroleum territories which have scarcely been tapped, but which, when they are developed, may make our northern neighbor one of the foremost oil-producing countries of the world. "According to latest government statistics, Canada's annual oil production up to date stops short of 310,000 barrels (90 per cent. from the Ontario fields) in comparison with more than 330,000,000 barrels produced by the United States.

"If we take a map of Canada and very roughly draw a line from east of the Great Slave Lake, passing through Lake Athabasca down to the north end of Lake Winnipeg, along the east shore of that lake to its southerly end, thence to and along the north shore of Lake Superior to the Soo, and thence along the northerly shore of the Georgian Bay to Parry Sound, thence due east to the St. Lawrence River, and along the northerly bank of that river to its mouth, we shall have divided the Dominion into two vast areas, that lying to the northward of our line being regarded as generally hopeless for oil prospecting, that lying westward and southward being from its geological formation rich in promise for the finding of productive oil fields within the economical range of practical drilling.

"If we further examine the geological map of this latter area, we find that the great oil-bearing strata of the North American continent, which in the United States have been productive of the richest and most prolific oil reservoirs of the world, contributing in fact in excess of 60 per cent. of the world's total oil supply, constitute the principal geological formations and out-crops of this vast Canadian territory. All of these geological formations contribute in the various oil fields of the United States to the vast total production of the country.

"It requires, therefore, no more than an average share of optimism to predict that Canada's future as a world oil producer is certain, and only awaits the assured results of time and capital expended on the scientific location of favorable structures of these formations and their subsequent exploration by the drill."

REMOVING RUST FROM TOOLS

Tools that have become very rusty should be treated with a chemical solution, instead of trying to scour the rust off by means of emery cloth. A good solution for removing rust may be mad as follows: Into one quart of distilled water dissolve, little by little, sufficient chloride of tin to obtain a saturated solution, that is, until the water will not dissolve any more of the salts. Put the tool into a receptacle containing the solution and let it stand over night. In the morning rinse the solution off in running water and dry thoroughly with a piece of chamois or cloth.

Hints on Setting Up and Clamping Work on Planer

Planing Machines Require Good Foundation—Keep Wearing Surfaces Free From Chips and Dirt—Protecting Tool on Return Stroke—Multiple Tooling and Production

By H. ALTON

THE problem of getting the most work in a given time from a planing machine is one largely up to the shop foreman or superintendent. As the planer does not lend itself to varied settings and multiple tool setups to the same extent as some designs of lathes, many foremen pay little attention to planer work, allowing the operator of planer to take care of the work largely as his fancy dictates. Such a policy does not produce the best results, and there are but few shops operating planers to-day that cannot increase not only the efficiency of such machines but range of usefulness.

Setting and Aligning Planer

The bed of a planer should always be placed on a concrete foundation in order that perfect alignment of the Vees may be maintained. Work can never be accurate unless the Vees are in perfect alignment.

A common mistake, that is often made in setting a planer, is to place the machine on a level concrete foundation, wedge it up until the platen is level, then group it in. It is common knowledge that planer Vees tend to wear low in the middle, and for that reason it is always advisable to set the centre of the Vees of a new machine one or two thousandths of an inch higher than the ends. Thus until the Vees wear one or two thousandths low in the centre, work can be very accurately planed. If this point is not taken into consideration a machine will much sooner tend to produce "hollow" work.

A very good type of planer bed wedge is shown at "A" Fig. 1. These wedges are set into pockets in the concrete foundation and are spaced as shown at B and C for large and small planers of the legless type. When the adjustable wedges are set, it is not a difficult job to level a planer bed. It is necessary to have two accurately sized cylinder plugs like those shown at A in Fig. 2, a test bar similar to that shown at B, and a precision level. In the case of planers having end legs it is only necessary to level crosswise, at one end, while the other end is levelled both ways. With the legless variety, levels are tested both ways, as shown in Fig. 2 and 3 proceeding as indicated by the dotted lines in Fig. 4, working to both ends from the centre.

In some small shops a precision level is not available, but such a contingency need not keep the small shop man from leveling his planer bed. A gallon or two of kerosene and a few odd lengths of pipe will give extremely accurate results. The Vees are dammed at each end as shown in Fig. 5, and connected together with a pipe at one end to maintain the level. A surface gauge on a block which fits the Vees is moved along, and carried from one side to the other while the wedges are adjusted until the liquid surface is at the same distance from the gauge point at all places.

Capillary attraction makes the liquid surface rise to meet the needle, as seen under the magnifying glass. This occurs when the point is about two one-thousandths of an inch above the surface, and this fact can be used as a guide when levelling.

It is often the case that even new planers will refuse to plane square on the down feed when the saddle swivel scale is set at zero. When a competent planer-hand tackles a new machine, his first idea, after oiling up, is to find its errors, and he goes after a new zero line for the saddle-scale, as shown in Fig. 6, using an accurate square and a test indicator held in the tool block.

When one considers the backlash of the elevating screw gears, lost motion in the elevating nuts, wear on the threads of the screws, the short bearing that the cross rail has on the housings, and the weight of the cross rail itself, it is surprising how any planer can plane square with the table, after the cross rail has once been moved. The alignment of rail is maintained principally by the elevating screws, and to get best results it is always common practice after lowering the head to raise it a little again, to take out all backlash. It is very necessary to keep the elevating screws free from dirt and grit, and well oiled, if ordinary accuracy is to be maintained. When exceptionally close work is required it is best to test each setting of the cross rail as shown in Fig. 7.

A planer is a bulky and heavy machine, this fact ensuring long life. When figuring depreciation it is usually estimated over a much longer period than other machines such as lathes. On large planers it is common practice to assume they will be used for a period of twenty-five years or more.

The Accurate Planer Considered as a Precision Machine

To gauge and measure a flat surface is more difficult than to gauge a round one. For that reason many planers are finishing work to-day that is not as accurate as it is assumed to be. Therefore, one of the possible explanations for the longer life of a planing machine lies in the fact that it is very difficult to test accurately the flatness of a surface, and inaccurate and worn machines are thus permitted to operate.

In spite of this, when carefully looked after and properly operated, a planer not only can, but does, form the basis for the accuracy of all other machine tools. Upon it is produced the final shape of nearly all flat sliding surfaces, which, while they may be further smoothed and rectified by hand scraping or grinding, must owe their initial and a great part of their final measure of accuracy to the planer.

Some machines are subject to more or less hard usage and abuse owing to the fact that they are supposed to have a long life. Some mechanics regard a planer as a heavy chunk of metal capable of withstanding almost anything, while in reality an accurate planer is a delicate

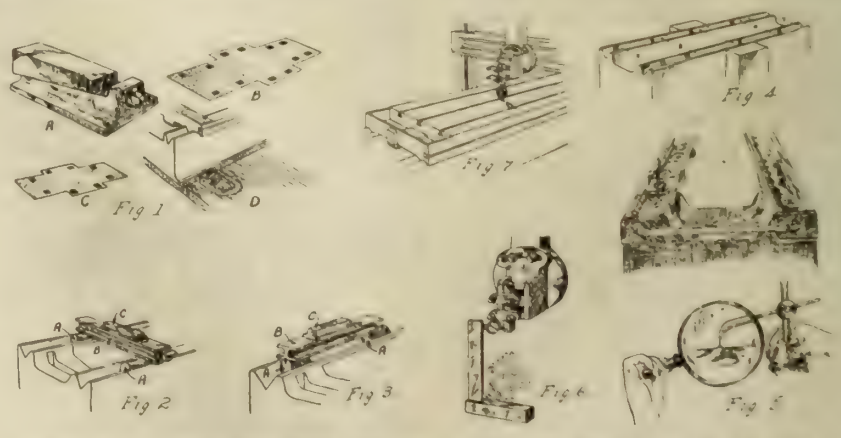


Fig. 1.—Planer wedges and their correct setting. Fig. 2—Cross leveling with round plugs and test bar. Fig. 3—Leveling planer longitudinally. Fig. 4—Sequence of leveling operations on planer. Fig. 5—Liquid level for setting up planer bed. Fig. 6—Testing saddle for graduations. Fig. 7—Testing alignment of planer cross rail.

Illustrations shown in Fig 16 by courtesy of Niles-Bement-Pond Co. Those in Figs. 17 and 18 through courtesy of Bett's Machine Co. Line drawings prepared by the author.

machine. It is a rare thing to find planer Vees that have been used for any length of time, that are not scratched, or more or less corrugated with deep gauges and crevices. The Vees, which are the vital parts of the planer, often get less consideration than the top of the platen.

Many planers get old fashioned and out of date long before they wear out. Planers designed and sold a few years before the advent of high speed steel are, so to speak, still in their prime. They are geared to run between 15 and 20 feet per minute on the cutting stroke and between 40 and 50 feet per minute on the return. Most of these machines in service to-day are completing work at a somewhat faster rate and it remains to be seen if the length of their days will be shortened. Many difficulties are met with in re-speeding old planers. The inertia of the moving parts is great, and at higher speeds the belts give an endless amount of trouble.

A common idea is that the great amount of power required to reverse a planer is due to the weight of its heavy table. It has been shown however, that the thing which makes a planer hard to reverse is the inertia of the fast revolving driving and overhead pulleys, which have to be brought to a dead stop and reversed within a short period of time. Some mathematical genius has figured out that it takes from eight to twelve times as much energy to bring these rotating parts to a stop and reverse them, as it does to reverse the planer tabe. This same mathematician figured out that in the course of a day of ten hours a pair of planer belts slip, on an average, five miles. Planer belts always should be endless, as the constant shifting from tight to loose pulleys is destructive to all forms of laced joints. Double belting is best, because it will not stretch as quickly as single belting, therefore requires less cutting and shortening.

Planers are all subject to belt troubles and as this is a necessary problem it must be accepted. Therefore, it is essential to inspect the belts periodically, cutting them and making the necessary

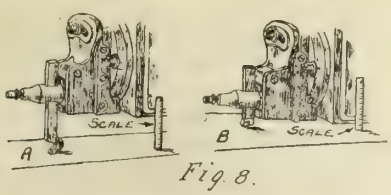


Fig. 8.

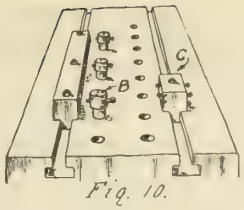


Fig. 10.

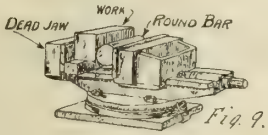


Fig. 9.

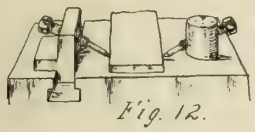


Fig. 12.

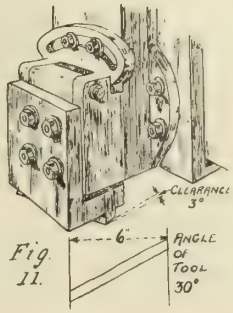


Fig. 11.

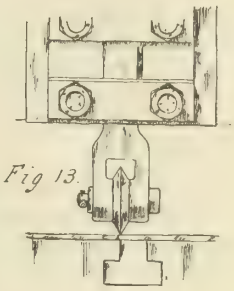


Fig 13.

Fig. 8.—Simple way of measuring planer dividends. Fig. 9.—Getting true work from planer or shaper chuck. Fig. 10—Screw stops and square stop bar for rapid chucking of flat work. Fig. 11—Tool for 6-in. finishing cut. Fig. 12—Pin clamps for thin work. Fig. 13—Splitting sheets on a planer.

glued joints. The older designs did not experience the same belt troubles as they moved more slowly, in some cases it has been found that belt troubles on re-speeded planer caused so much idle time that less work was actually accomplished. The best solution of the old planer problem is not to speed it up too much, but to increase the feed, in this way bringing its capacity for removing metal, up in the neighborhood of the modern machine. The latest style of planers are geared to take care of most of these troubles. They are designed to rough cut cast iron at from 40 to 50 feet per minute, and to handle steel castings and machinery steel at from 30 to 35 feet per minute. Return speeds as high as 100 feet per minute are not considered excessive.

Use and Abuse of a Planer

Before considering the intensive idea of planing by the use of several heads, electric drive, and other distinctly modern applications, we will look into some of the things that can be done with the single head on the cross slide. A planer must be kept well oiled at all times, and the Vees must be kept not only well oiled but scrupulously clean and free from all dirt, grit and foreign matter. Chips should be kept out of the gears.

When planing short jobs it is always good practice to place the work near the end of the table. This distributes the wear on the Vees and does not tend to wear them low in the centre, as much as if the work were placed on the centre of the table. When planing long work, and the tool is directly over the Vees, there is every probability that some chips from the overflowing pockets at the end of table will fall in the Vees. This should be anticipated and provision made to prevent its occurrence by never allowing the pockets to get full to the point of overflowing. In fact each reversal is quite apt to dislodge a few chips. When rough sandy castings are being machined, means should be taken to protect the surface of platen. Castings should never be moved with a crow-bar inserted in the holes of platen, and if it is necessary to slide castings, put old strips of belt leather or pieces of thin wood under them. All holes and slots in platen should be plugged with wood, and these plugs can be easily removed from any holes or slots it is necessary to use. Should any burrs be raised on the table they should be immediately removed.

In all forms of clamps get the bolt as close to the work as possible, and as far from the clamp block as conditions will permit. Hard maple with the grain on ends makes the best blocks. It is not good practice to pull the nuts down too tight.

In planing unannealed castings, or castings that have not been seasoned, particularly on work where large areas of scale are removed, it is always a good precaution to release the clamps before the finishing cut is taken to allow possible internal strains to become equalized. Then, only lightly clamp the work for the finishing cut. Work should always be well supported by

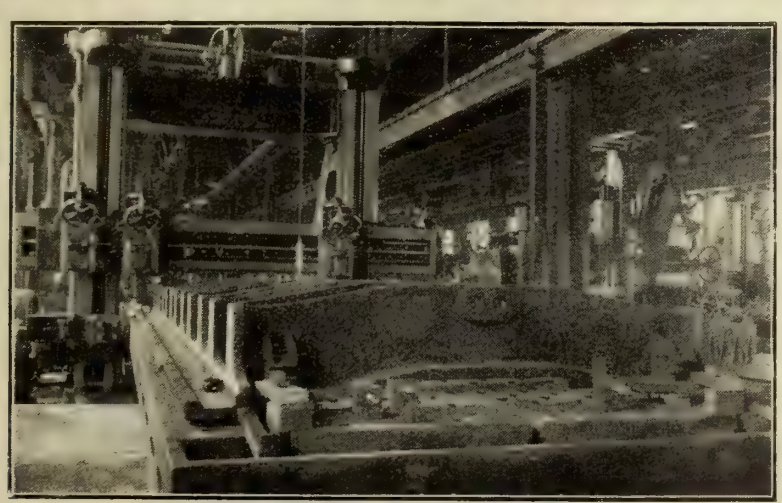


Fig. 16—Large modern electric driven planer with five heads.

blocks so that the tool pressure will not distort. All overhanging pieces that have to be finished should also be well supported.

The practice of pulling nuts down very tightly is the source of a good many troubles. Castings are often strained and sometimes broken from this cause. Clamping nuts and bolts often have their threads ruined. With a properly ground tool there is not much tendency for work to "lift" when it is being planed. Provide good substantial stops and get the work located positively against the stops, and then only a nominal amount of clamping will be sufficient.

One point that only a few planer hands seem to appreciate is that it is extremely bad practice to allow a planer to take its feed at the end of the cutting stroke. It is even more disastrous if rough castings are being machined. When this practice is resorted to, the cutting edge drags on the work all the way on the back stroke, and if sand and scale are encountered, the fine cutting edge of the tool is ground off after the first few strokes.

A goose-neck tool such as shown in Fig. 8 at "A" will scrape a casting fairly smooth. A finishing tool such as shown at "B" in Fig. 8, ground with not over 5 degrees clearance on the bottom, gripped close to the tool block, and with the rail as near the work as it can be placed, will never dig in, and will give as smooth a surface as the goose-neck tool, and in addition, one that is as true as the planer Vees. An old superintendent the writer had the pleasure of working under used to say, "You can pretty nearly figure planer accuracy and planer profits by measuring the distance between the top of the work and the bottom of the cross rail, the greater the distance the less accuracy and profits." Experience goes to show he was pretty nearly correct in his reasoning. Fig. 9 shows a kink that is overlooked in many shops. When work is being held in a planer, shaper, or miller chuck, the solid, or dead jaw must always be reckoned with for the alignment of the piece that has to be planed. By placing a round bar between the live jaw and the work, the latter is forced against the true surface of the dead jaw and materially assists in producing square work.

Time is lost on many planer jobs by putting on too many clamps, and using too little judgment. As stated previously a properly ground planer tool will tend to lift the work, but will rather tend to thrust downward and against the motion of the platen. Work properly stopped endwise does not need much clamping and can be held sideways by means of stops as shown in Fig. 10, any one of which may be applied in much less time than the ordinary U-clamps. The square side bars, in connection with the smaller screw stops "B" and "C" in reality take the place of a planer chuck and usually pay for themselves in a short time.

There is plenty of room for discussion of finishing cuts on planers, especially in cases where extreme accuracy is not required. The tool shown in Fig. 11 is one capable of taking a six inch cut, and of being fed at a rate of four inches per stroke. The cast iron block which holds the cutting tool is bolted solidly to the clapper block and is very rigidly supported. A tool of this kind if given a shearing cut will do excellent work without any tendency to dig in, but it must be carefully set in its holder, to have the cutting edge dead level with the platen. This is accomplished by using two accurate squares, and adjusting the tool till no daylight is seen between the edge of the square and the cutting edge of the tool.

Fig. 12 shows the use of pin clamps where thin work is being planed, while Fig. 13 illustrates how sheets can be split on a planer.

Jobbing Work on Planer

In shops where repair, jobbing and contract work is the rule, rather than manufacturing, a number of angle plates for the planer are good revenue producers. Where a keyseating apparatus does not exist the planer can be used for keyseating purposes. Fig. 14 diagrammatically represents how this is accomplished. Bar tool "A" is clamped in the clapper block. A wooden block with a stiff coil spring is placed as shown at "B." The bar "C" is fastened in the bar "A" and the two set screws are tightened against the bar "C" which has a small flat on its side to receive these screws. The keyseating tool "D" is tightened in bar "C." This tool is squared up with planer platen by means of two squares. The bar "C" should only extend from the bar "A" far enough to permit the tool to pass completely through the bore without interference. An angle plate is then placed on planer against two square headed stops as shown at E. Next the strip "F" is placed under the angle plate as shown. This gives taper to the keyway to be cut, and the thickness of the strip should be calculated to give the standard taper. If in keyseating pulleys with extended hubs, bevel gears, or pieces that have been faced on one side only, it is found more advantageous to clamp them on one side than on the other, it may be found the key will drive from the wrong side if the strip "F" is placed where shown. In order to correct this, the strip is placed next to the stops at "E." Then the pulley or part to be keyseated is clamped to the angle plate. A hole is located in the angle plate at "G." Straight edge strips are used to hold the work away from the angle plate and to allow the operator to see the tool as it comes through the hub. In cases where large pieces are to be keyseated, long straight-edges, extending above angle plate can be used. If the keyseat is too wide for a single tool, a narrow tool can be used to hog out the metal, and the full sized tool run through to finish and and size the keyseat. Care must be taken in centering the tool when starting. Work of this nature can be quickly and accurately completed.

The cutting of keyseats in shafts is a rather simple matter on the planer. Perhaps the average mechanic does not realize that a large number of spur gears are being cut on planers every week. Special dividing heads are used for this purpose. The indexing is through the medium of a worm and worm gear and a set of change gears, mounted in a suitable frame so as to operate an arbor. The arbor is fitted with a number of removable pins which are tapered and fit into the main arbor, for different bores as shown in Fig. 15. The method of clamping gear is shown. For special bores, collars are placed on the pins as indicated in Fig. 15, and if a blank is to be cut, a roughing tool gouges out the metal, then a finishing tool the proper shape of the tooth space is run down.

(To be Continued)

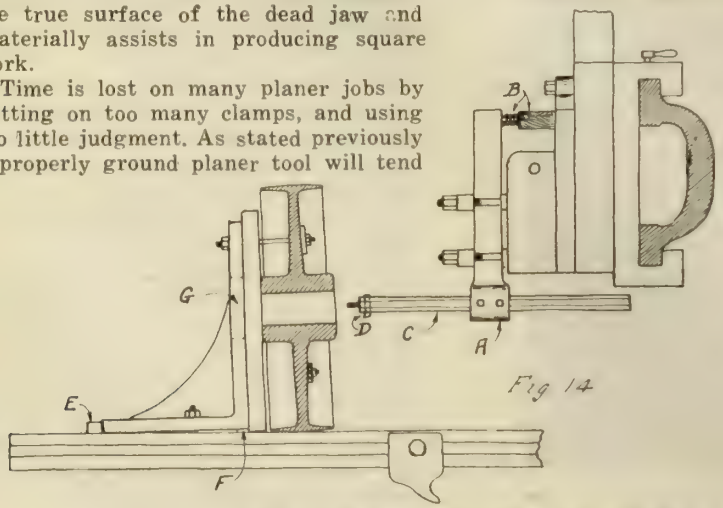


Fig 14

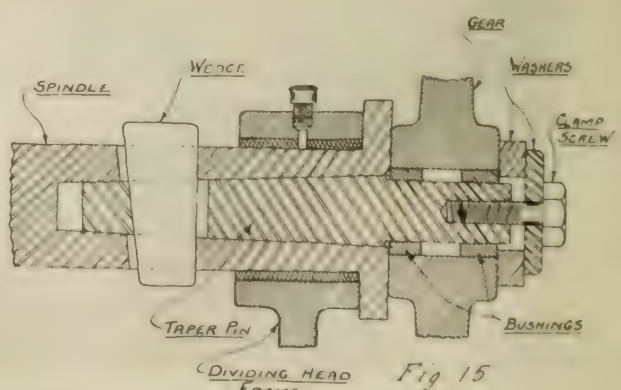


Fig 15

Fig. 14.—Keyseating on a planer. Fig. 15.—Method of holding gears in a dividing head on a planer.

Important Points in Joining Ends of Belting

Leather Lacing Still a Favorite—Lace Holes Reduce Ultimate Strength of Belt—Joint Should Run Smoothly Over the Pulley—Making An Endless Joint

By LOUIS W. ARNY

PROBABLY the greatest source of annoyance in the use of any kind of power transmission belt is that arising from the difficulty of properly joining the two ends. This is often done with lace leather, and a laced joint is a good one, if well made, and it still is a favorite. There is too, a wide variety of metal fastenings for this purpose, and some of them are not so bad as some others. In the various fabric belts resort must be had to lace leather or to the metal devices, for though it is possible that rubber belts, and some other varieties of fabric belts, may be made endless in the process of manufacture, they are very troublesome to install on their pulleys, necessitating often the taking down of shafting, etc., and they will run but a short time when they have stretched enough to make it necessary to cut the belt to shorten it, and then resource to lace leather or metal fastenings becomes necessary. Where these belts run with a tightener, which will take up all the stretch of service, this endless joint will make no trouble, but where there is no provision for taking up the stretch, or where the swing of the tightener is not large enough to provide for all the stretch, there is frequent trouble with the lace holes cutting out, or the metal fastenings breaking, or the ends of the belts tearing. The joining of the two ends, therefore, is the weakest and most troublesome point in any belt.

Method of Fastening

The requirements of a good method of fastening the ends of belts are, first, that it shall be strong. The tensile strength of leather belts is from 3,500 to 5,000 lbs. per. sq. in., and of the fabric belts even higher, and the strength of the fastening should be approximately as much, even though the strains of operation are much less, for the belt is no stronger than its weakest point. It is true that no belt ever operates under any such load. Mr. Jones, research director of The Leather Belting Exchange Foundation, at Cornell University, reports that the greatest load he has ever been able to place on a belt and keep it upon the pulleys, is about 1,000 lbs. per eq. in. on a lether belt, and the difference between the figure and ultimate tensile strength of the belt seems an ample margin of safety, indeed much greater than it is customary to provide in other materials, but the high tensile strength requirements of leather and other kinds of belting are considered necessary to insure the presence of other qualities which are requisite to a good belt. It seems foolish, however, to spend good money for a belt to stand a tensile strain of 2,500 to 3,500 lbs. and then to fasten the ends with devices that will break or pull out at 1,500 to 2,000 lbs.

Author is secretary of the Leather Belting Exchange.

Strength of Joint

Second, the joining device must not only be strong itself, but it must not weaken the ends of the belt. Lace leather, even when skilfully applied, makes necessary holes of a size that reduces the cross section of the belt, and when bungingly applied cut into the belt very seriously. The various wire lacings do not cut anything from the belt, but they result in a series of perforations which make it easy for the end to be torn off, just as the bank checkbook makers perforate the checks, so that they may be readily detached. The various plate hooks distribute their load better over a larger area of belt, and are not so likely to tear out the belt.

Third, the joint must be smooth and even in its operation over the pulley, more especially at high speeds. A badly laced joint, or a plate hook, strikes the pulley with a hammer blow, and even a well laced joint makes itself heard and felt, all to the injury of the belt and its fastening, and to the machine of which it is a part. The wire lacings and fasteners are comparatively smooth in their operation, but the testing machine of The Leather Belting Exchange Foundation shows that there is a momentary slippage on the pulley as such a joint passes over it, and a consequent momentary reduction in power transmission.

Fourth, any successful method of fastening must be durable. Some changes are required while the belt is new and stretching to its place, but when once run-in the fastening should serve for a long time. Probably nothing is so annoying as to have to stop production to repair a belt joint. Lace leather, though long lived, wears out, and the metal fastenings crystallize and break, so that none of them have the same permanency as the belt.

The Endless Belt

The happy resources for all these difficulties is the readiness with which a leather belt may be made endless, and the operation is so simple as to bring it within the ability of every shop. Where the plant is large enough, some good mechanic, or some handy man with the mechanical instinct, should be placed in charge of the belts, or where the plant is not large enough for this, the foreman or engineer should take them in charge, and they soon will learn to do the work expeditiously and well. It is only necessary that the belt shall be properly fitted to its pulleys for length, and there shall be cut on each end the necessary bevel for the lap, and that it shall be cemented properly, and the cement permitted to dry. In the case of small belts, these usually may be cemented and thrown on the pulleys while they are moving slowly. With larger belts, it is necessary to use belt clamps, but these need add but little complication.

The tools required are as follows; a square, an ordinary spoke-shave, with a good edge for doing the rough cutting in shaping for bevel. A scraper for finishing this bevel to a smooth surface, and to make a fine point. Possibly some sandpaper to compensate for a poor scraper. A double-jacketted glue pot, with a brush. A couple of hard-wood blocks, with bolts and nuts, between which the joint may be placed and pressure applied, or a set of bench screws may be used for this purpose. A set of belt clamps of suitable size. Most all of these can be found in the plant, or a complete set of tools may be bought at small cost from one of the belting manufacturers, and most of them specify them in their catalogues, and they will supply also the necessary cement, at a small cost.

Joint Must Be Smooth

The requisites are that the two ends must be brought together perfectly square with each other, and that the faces of the joints must be perfectly smooth, and an even bevel from heel to point. If they are bumpy, and do not lay flat together, the cement will not stick properly. The latter must be applied hot, and well worked into the fibre of the leather, and pressure should be applied before the cement sets. In the absence of pressure, it will answer if the joint is well rubbed with a tool handle, or a smooth substance during the process of setting, though pressure is more desirable.

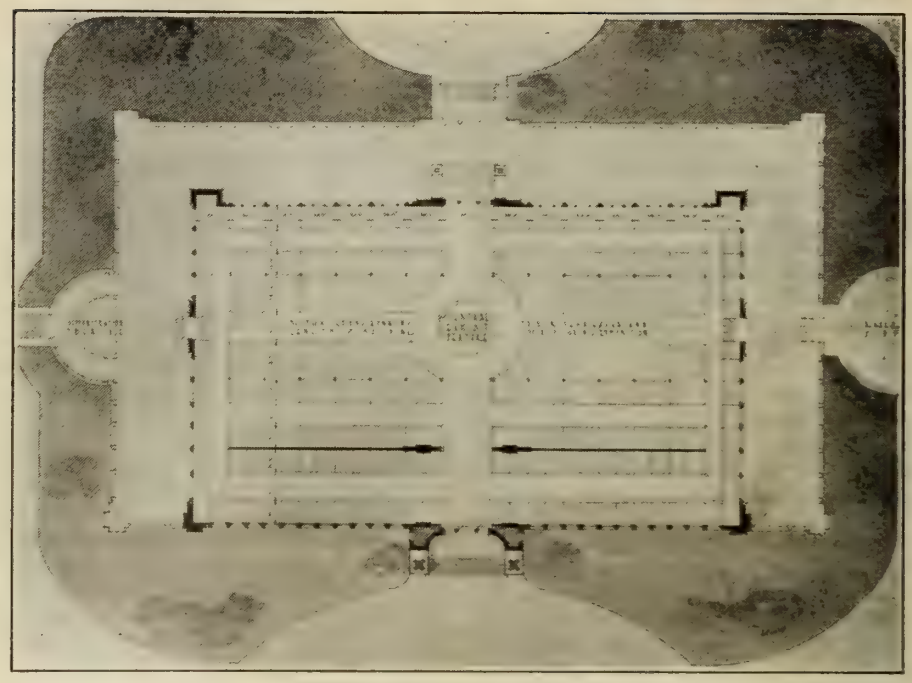
If it is desired to make a joint that will not be affected by dampness, it is necessary to use the waterproof belting cement, which can be obtained from any leather belting manufacturer. With this cement, it is necessary to size the learther before cementing. Give each part of the lap one, or better, two good coats of the cement, allowing each to dry before applying the next, then to cement these sized joints and bring the two faces of the joint together, and to apply pressure or rubbing as above described.

The leather belt, sufficiently run-in, and fitted to its job, and made endless in this manner, makes a permanent in-

(Continued on Page 45)

New Engineering Building For Exhibition

Machinery Displays to be Adequately Housed—To Be Self-Supporting on Space Lease Plan—Requirements of Industry Consulted



General Plan of New Engineering Building

AT LAST, plans are taking definite shape for the erection of an engineering building to take the place of old Machinery Hall at the Canadian National Exhibition in Toronto.

The movement looking to so desirable an object had its beginning in 1912, and gained headway until in 1914, the proposition was submitted to Toronto ratepayers, but owing to uncertainty of conditions, due largely to the outbreak of the war, it was voted down.

Buildings Self-Supporting

As in the case of all of the modern buildings at the Exhibition grounds, the funds are provided by the city, and the exhibitors of the industry represented are required to pay for display space at a rate that will provide revenue sufficient to ultimately cover the cost. The style of building is determined by the directors of the exhibition in consultation with the representatives of the industry concerned. Space rates will likely be in the neighbourhood of 90 cents per square foot.

In connection with the proposal to erect an engineering or machinery building that will do justice to Canadian industry, a representative committee of which T. A. Hollenrake of the A. R. Williams Co. is chairman, has not only had plans prepared for consideration, but has done much toward feeling out manufacturers in the matter of leasing spaces for a term of 10 years, which for all practical purposes is the limit generally proposed by Toronto City Council Already something like 20,000 ft. has been guaranteed, and this is regarded as a very satisfactory start.

It is proposed that the new building be located directly opposite the new eastern entrance to the Exhibition grounds. The illustration herewith shows it to be a most imposing structure and well in keeping with the general scheme

Architect's drawing of the new engineering building at The National Exhibition grounds, Toronto.

being worked out by the directorate to have buildings that will be creditable in every way to the reputation of the exhibition. It is hoped to have it ready for occupancy in 1923.

Adequate Floor Area

Of course, plans as prepared may be said to be tentative, but as proposed the building's dimensions will be 200 ft. by 400 ft. with a floor area of 121,000 sq. ft. The main display spaces as shown on the plan have a width of twenty-four ft., but it is understood that these are arranged in such a way that they may either be sub-divided or enlarged to meet requirements. The sketch shows provisions for a fifty-ton crane running the length of the building, a railroad track for unloading which will be depressed within the building so that it may be covered over while the exhibition is in progress. There is a large central space for special display, representative, say, of enterprise, such as electricity, and special areas are also provided for demonstration purposes. In short, every effort is being put firth to have the building so planned that it will meet the requirements of a strong industry.

Will Encourage Educative Displays

The old building has been most inadequate. The light was poor, spaces ill-arranged, and the areas insufficient for effective display. Its general appearance, moreover, was uninviting, and of recent years, representative firms, though admitting the advertising value of the exhibition, have remained away. In fact there are many such firms in the machinery industry who could use the entire building in a display of their own particular products.

Manufacturers will undoubtedly welcome the new proposal as one that will enable them to show to advantage the products of their industry. Such displays fall short of the mark if not highly educative, but it has been long felt that in old Machinery Hall this purpose has been sadly handicapped.

The plans of the exhibition directorate have in view the addition of 84 acres to their ground by 1945. The present area is 264 acres, so that these ambitions point to an ultimate layout of something like 350 acres, in which all important industries will have a distinctive segregation.

It is a thoroughly representative committee that has been chosen to co-operate with the Exhibition Board in working out details in connection with the proposed building. The members are: T. A. Hollindrake, chairman, A. R. Williams Co., Toronto; J. H. L. Patterson, Miller & Richards, Toronto; Wm. Robinson, P. B. Yates Machinery Co., Hamilton; C. A. Waterous, Waterous Engine Works, Brantford; C. F. Wheaton, Dodge Mfg. Co., Toronto; W. S. Hamilton, D. K. McLaren, Limited, Toronto; Alex. Goldie, Goldie & McCulloch Co., Galt; S. Gaskill, Lancashire Dynamo and Motor Co., Toronto; Wm. Inglis, John Inglis Co., Toronto; W. P. Dobson, Hydro-Electric Station, Toronto; John Crowley, Davis Bournonville, Toronto; F. M. Bawden, Bawden Machine Co., Toronto; W. S. Braden, Canadian Westinghouse Co., Toronto; J. . Blair, Alfred Herbert, Limited, Toronto; C. B. Hamilton, Hamilton Gear and Machine Co., Toronto; J. A. Ferguson, John Bertram & Sons Co., Limited, Toronto; J. P. Murray, Associate Director Canadian National Exhibition.

Direct Reading and Limit Snap Gauge Micrometer Calipers

A NEW departure in the design of micrometers has recently been introduced in the form of a micrometer that gives measurements directly in figures. This arrangement will no doubt appeal to many users, as there is always present the possibility of making an error in reading. As will be seen in Fig. 1, the readings are taken off directly and thus all chances of error are eliminated. Of course in the case of the skilled mechanic, tool maker, or inspector, who has had years of training in the use of the micrometer, rarely does a mistake occur in reading an instrument. There does exist, however, the fact that a certain mental calculation is necessary to transform the reading into a decimal expression. Now a first-class man who uses micrometers a great deal in his daily work will often find it necessary to use the instruments at times when his mind is centred on one or two matters of major importance. This pre-occupation would tend to distract him and make the actual interpretation of the reading occur under conditions not exactly ideal. In just such times as this, mistakes occur which may or may not have far reaching effect. In order to eliminate to the greatest possible extent the chance of human error, these micrometers were produced. The design is a simple compact combination of well-tested counting device with the micrometer. This counting device is so compactly designed and so centrally placed as to balance the micrometer nicely. To gain additional accuracy graduations are placed on the handle and barrel which enable extremely accurate readings to be taken, which serve as a check on the direct reading.

Limit Snap Gauge Micrometer

Probably the only real problem, and objection to the adoption of the limit snap gauge, was in cases where the production was limited and there was evidenced a thought that the expense was not warranted. In cases of small production it is readily admitted that the product is more readily and more economically controlled by standard measuring instruments than through the medium of gauges. There always arrives a point in an increasing production problem where standard measuring instruments become a more expensive method of control than that of gauges. As stated in our previous references to gauges the snap gauge was one of the commonest and most useful of gauges in general work. To meet the demand of an adjustable limit snap gauge for varying work produced in small quantities, and for the thousand and one other emergency demands for a gauge, the limit snap gauge micrometer has been developed. Fig. 2 shows a cut of this instrument. The field of application of the instrument is very large and it be used in many shops and on various operations where heretofore the expenses of limit snap gauges were considered too great to be borne by the job. The wide range of adjustment and the efficient lock all tend to make the application very wide. Thus it is not possible to attempt to describe the uses of this snap gauge micrometer, as one would run into very interesting applications at every turn. The uses of the instrument are almost self evident as simplicity is the keynote of the design.

Information and cuts supplied through the courtesy of the J. T. Slocmb Co., Providence, R. I.

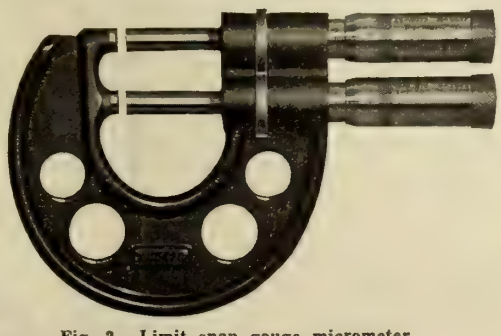


Fig. 2.—Limit snap gauge micrometer.

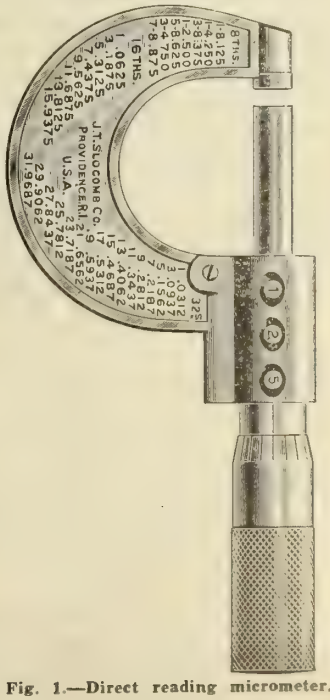


Fig. 1.—Direct reading micrometer.

Air Transformer Shows Remarkable Efficiency

New Meaning to the Term "Free Air"—Low Consumption of Compressed Air—Big Saving Effected—Strainer Retains All Dust and Dirt

By D. M. McLEAN, E.I.C.

REMARKABLE savings are being shown by a new device for blowing forge fires and similar purposes recently introduced in Canada. A tiny jet of high pressure air discharges into a bell mouth nozzle leading to the forge and induces a flow of air from the atmosphere into the nozzle where it mingles with the expanding jet and is propelled into the pipe leading to the forge, providing the proper volume of air at a suitable pressure for the purpose.

In present practice, in boiler shops, blacksmith shops, steel erection, ship yards and certain chemical and other processess, it is customary totake compressed air from the general supply line and throttlte it down to a pressure of a few ounces before it reaches the forge fire. In rivet heating, for example, the ordinary small portable forge will require about 45 cubic feet of free air per minute to blow the fire. To compress this to the initial pressure of 100 lbs. will take the expenditure of approximately 7½ horespower. In constant daily use, this may mean a yearly cost for air from one forge of at least $300.

With the new blower or air transformer, made by the Ingersoll-Rand, and described below, the consumption of compressed air from the supply line is less than 2 cubic feet of free air per minute, requiring practically one-third of a horespower, because the other 43 cubic feet required for the fire is drawn from the atmosphere. This represents a saving in dollars and cents per year per forge, other conditions being equal, of not less than $275 per forge. The tterm "free air," therefore, takes on a new and very important meaning.

The chart, Fig. 1, shows graphically the results of three tests of forges operating with and without the blower. The space between the upper and the lower curves indicates the greatly lessened drain upon the compressed air supply, and the consequent savings are expressed in percentages at the top of the cut.

Test No. 1 was taken with a slow fire, No. 2 with a fairly hot fire and No. 3 with an intense fire. These percentages may also be considered as expressing the efficiency of the blower under the varying conditions, and they emphasize unmistakably the futility of the common practice of compressing the required quantity of air to a pressure of 80 to 100 lbs. and then throttling it down for use at a pressure of a few ounces.

These tests were taken with partial needle valve openings and consequent reduced pressure on the jet nozzle. The results of tests with the blower connected to an orifice tank with low pressure nozzle on the outlet to furnish resistance to draft and measure the output are shown in Figs. 3 and 4.

Fig. 2 shows the general arrangement of the device. V is an ordinary needle valve regulating the flow of compressed air. In ordinary operation, one quarter of a turn usually provides sufficient air for the work. After passing through the strainer S which retains all dust and dirt which might clog the device, the air reaches the special nozzle N and is discharged into the bell mouth B which is connected to the forge.

The bell mouth is cast solid with the strainer chamber, and ample space is provided for access of atmosphere air as it is drawn into the bell mouth. The strainer may be easily blown out by removing the plug at the bottom of the chamber. Home-made blowers resembling this device have often been made up from pipe fittings, but cannot attain anything like the results reached by this

Working Pressure on Jet Nozzle lbs. per sq. inch	High Pressure Air Used C.F.F.A. per minute	Low Pressure in Inches of Water	Free Air Delivered C.F.M.	Per Cent. of Air Induced
5	.96	.29	18.3	94.8
10	1.36	.48	23.6	94.5
15	1.67	.67	28.0	94.0
20	1.93	.88	31.9	94.0
30	2.52	1.29	38.6	93.5
40	3.07	1.64	43.5	93.0
50	3.64	1.95	47.5	92.4
60	4.20	2.18	50.5	91.7
70	4.75	2.50	54.0	91.4
80	5.3	2.80	57.0	90.6
90	5.85	2.95	58.5	90.0
100	6.45	3.25	61.4	89.5

The resistance to flow or draft pressure required in an ordinary forge is somewhat less than for a nozzle of this size. With less resistance the flow is greater in volume. The working pressure on the jet is controlled by the needle valve and can be anything up to the full line pressure. In forge blowing the working pressure required is usually from 15 to 40 pounds and draft pressures of ½ in. to 1 in.

Working Pressure on Jet Nozzle lbs. per sq. inch	High Pressure Air Used C.F.F.A. per minute	Low Pressure in Inches of Water	Free Air Delivered C.F.M.	Per Cent. of Air Induced
5	.96	.31	12.15	92
10	1.36	.72	18.5	92.8
15	1.67	1.00	21.8	92.3
20	1.93	1.25	24.4	92.2
30	2.52	1.84	29.6	91.5
40	3.07	2.38	33.6	90.8
50	3.64	2.87	36.9	90.2
60	4.20	3.14	38.6	89.2
70	4.75	3.61	41.4	88.7
80	5.3	4.12	44.2	88
90	5.85	4.57	46.5	87.5
100	6.45	5.05	49.0	87

With a 1 in. orifice the New Jersey Blower develops pressure or draft in excess of ordinary requirements for blowing forges. When pressure or resistance against which the Blower delivers is increased, this is at the expense of volume and also reduces the percentage of free air induced. The normal outlet of the Blower is 1¼ inches, giving a greater volume at a little lower draft pressure.

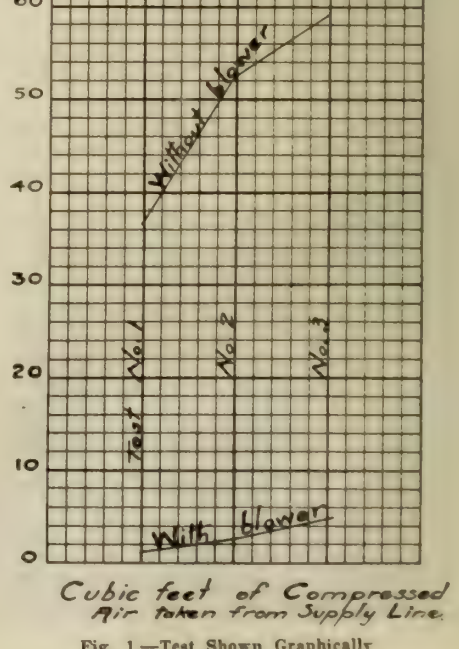


Fig. 1.—Test Shown Graphically

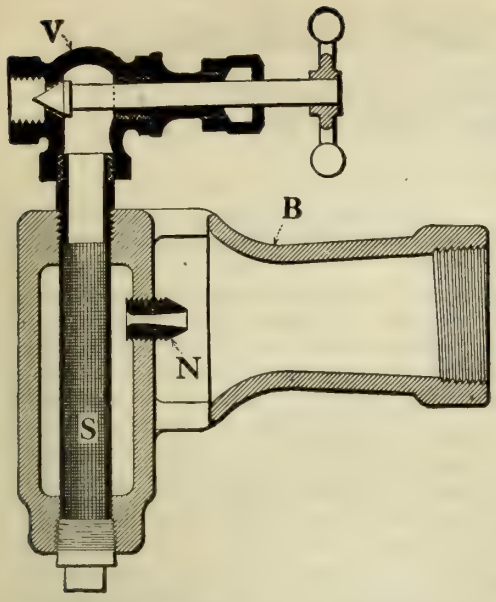


Fig. 2.—Cross section of new forge blower or "Air Transformer," showing arrangement of various parts.

specially designed appliance, proportioned and adjusted for the best possible work. The standard blower of this type is designed to deliver the air at a pressure of 4 inches of water, but higher pressures may be reached by the use of specially designed jet nozzles.

In the tests mentioned above the actual air pressure in the screen chamber below the needle valve was taken. This is the same as the working pressure on the jet nozzle. The cost of this device is such a small fraction of the saving it secures, it may be expected to have quite a wide application in its particular field.

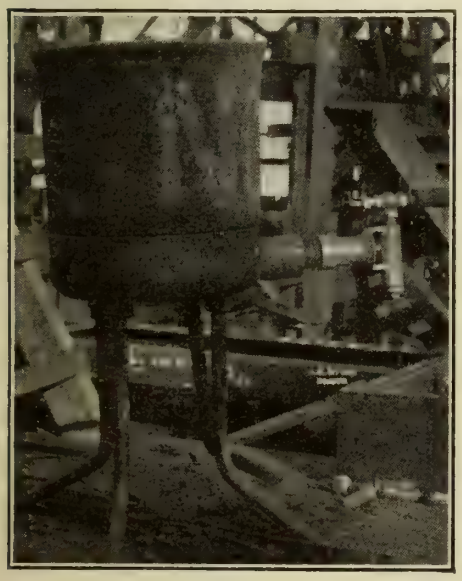


Fig. 5.—Installation of Blower

The great value of high speed steel is due to its quality of holding its hardness when cutting at a rate of speed and feed which heats the point of the tools to a red or higher heat, and also the greater length of time the tools will stand up to the work without regrinding.

CANADA'S EXPORT TRADE

The graph opposite shows the growth in Canada's foreign trade per head of population in comparison with that of the United Kingdom and the United States. Canada was in 1902 exporting products to the value of $28 per capita, as compared with $40 per capita for the United Kingdom and $15 per head for the United States. At the beginning of 1914, Canada had increased her ratio to $58 per head, an increase of 130 per cent. as compared with $70 per head in the United Kingdom, an increase of 75 per cent. and $24 per head in the United States, or 60 per cent. increase. The figures for 1921 show that Canada has not only held this increase but has passed the United Kingdom and now leads the world in value of exports per head of population, with $150 per capita as compared with $98 per head for the United Kingdom and $65 per head for the United States.

IRON AND STEEL FOR INDIA

That India is shaping up as a potential iron and steel market is evident from reports on recent British business in that part of the Empire. The Middlesborough correspondent of the Empire Mail makes the significant statement that British iron and steel is on the road to recovery. "We have shipped from Middlesborough alone nearly 100,000 tons of steel to India this year, and that is but a tithe of what she needs," said the principal of one big concern with world-wide connections. "Enormous quantities of railway material are wanted in India and the Far East. Big bridge works are contemplated and huge grain silos. Here there is work for our iron and steel works, and it only remains for our government to cast off the fetters from trade, and our workmen to sink their differences and make up their minds to give a fair day's work for a fair day's pay."

STEAM TURBINE LOCOMOTIVE

Ever since the steam turbine—which was invented by Sir Charles Parsons in Great Britain—proved its wonderful advantage on board ship and for electric power generation, railway engineers have been looking forward to the possibility of applying it to locomotives. A bold experiment was recently made by a leading British locomotive factory, which constructed a turbo-electric locomotive, now being tested on the rail. The main turbine on this locomotive drives an electric generator which supplies power to four motors arranged in two groups on the front and the rear respectively of the locomotive. Each of these motors is capable of developing 275 horse power. One of the novel features of this locomotive is the condenser, in which the steam tubes revolve in water at a slow speed. The makers claim that this locomotive gives considerable saving in both fuel and water compared with the existing types.

IMPORTANT POINTS

(Continued from Page 41)

stallation, requiring no further attention for a long time, when it may be necessary to "take it up" a little. When this must be done, open the old joint with a screw-driver point, make a new lap on one end, scrape the old cement off the other to get down to the fibre, and make the joint as before.

An endless joint on a leather belt meets all the requirements above mentioned. It is stronger than any lacing or metallic fastening, and as strong as any other part of the belt. It does not weaken the ends of the belt. It is smooth and even, and it will travel over the pulleys, even small pulleys, at high speeds without a jar, and it is durable, for, unless necessary to open the joint to shorten the belt, it will last as long as the belt itself. There is no loss of power, even momentarily, as the belt passes over the pulley.

With the same outfit, it is always possible to keep all the leather belts of the plant in perfect condition. The cementing down of a corner of a lap, or the insertion of a small new piece of leather, will indefinitely prolong the life of the belt. Or the belt can be lengthened by cementing a piece to one end, or if not heavy enough for its work, an additional ply can be cemented on it, or it can be cut down to narrower sizes.

BOOK REVIEW

The McGraw-Hill Book Co. has just issued a book entitled "Metal Cutting Tools," by A.L. DeLee, M. S., M. E. The purpose of the book is to bring before the reader the principles underlying the selection, design, maintenance, and the proper application of cutting tools, rather than a treatise on a variety of existing equipment. The book is prepared for the practical man as well as the student of science, and where mathematics are used they are applied in such a form as to be easily understood by the workman in the shop. Every class of metal cutting tool is given consideration and the construction and action of different shapes, together with the resultant strain and stresses are dealt with in detail, giving to the reader a thorough knowledge of the elements of design in the development of cutting tools. The book is 6 x 9, and contains 330 pages.

Edgar Allen & Co., Ltd., have recently published a most interesting handbook on the application and heat-treatment of their high-speed steels for milling cutters, reamers, bits, form and other cutting tools. It gives much information to users of high-speed steel in general and to machine tool users in particular.

Accidents never happen—they are caused.

Sit in judgment on yourself—are you as careful as you could be?

Important Developments in British Industries

New Combine of Large Engineering Firms—Business Secured From South America—Bridge Building in China—Labor Conditions Generally Improved

SPEAKING on the general outlook in the machinery and engineering trades in England, F. W. Field, H. M. trade commissioner at Toronto, says that the most promising feature of the past few weeks has been the settlement of the labor dispute in the shipbuilding trades.

"This settlement will undoubtedly have a beneficial effect on trade generally," remarks Mr. Field, "as it must lead to a reduction of labor costs. Certain work which has been diverted to continental yards on account of the dispute will henceforth be dealt with in that country and any new ships laid down will be completed at a lower cost.

"The engineering lock-out is still in effect, but conditions appear to be more favorable to an early settlement. This is emphasized by the fact that orders are still coming in with fair regularity for new construction as though the purchasers anticipate that the duration of the dispute would be short. In the meantime the suppliers of raw materials, such as iron and steel and non-ferrous metals, are in a position to supply all the requirements of the home and export trade.

The market in engineering goods and raw materials is inclined to be sensitive owing to the fact that it is dangerous to lay in large stocks of materials in case there should be a fall in prices. In these conditions overseas buyers are well advised to purchase through channels which are well placed to take advantage of these repeated variations in price. It will be understood that buying at advantageous prices cannot very well be undertaken by inexperienced or distant purchasers.

"The market in engineering goods and establishing economic relations between countries which have been separated by political and economic barriers for a long time. The degree of success achieved will doubtless lead to a general revival in the engineering trades, particularly and more especially in such trades as agricultural machinery and general development works. This will undoubtedly steady prices, in some cases perhaps on a higher level than at present, but generally at a lower level in view of the fact that large scale production usually leads to economy. The gradual readjustment of prices downwards based on cheaper raw material and lower wages costs appears to be continuing, and is the most promising side in connection with the future trade in export markets.

A New Combination

"An important development in the engineering industry is the formation of the British Power and Transport Finance Co., with an initial capital of a quarter of a million pounds. This company has been established for the purpose of combining the technical resources of several of the best known firms in order to investigate overseas engineering schemes and to provide the necessary finance where possible. The firms involved in the new combine are the following:—

Cammell Laird and Co.
Sir William Arrol and Co.
The English Electric Co.
The North British Locomotive Co.
John Brown and Co., and the Prudential Assurance Co.

The following constitute the board of directors of the new combine:—

Mr. W. L. Hichens, chairman of Cammell Laird and Co.

Sir John Hunter, managing director of Sir Wm. Arrol and Co.

Sir George May, Prudential Assurance Co.

Lord Meston, director of the English Electric Co.

Mr. P. J. Pybus, managing director of the English Electric Co.

Sir Hugh Reid, managing director of the North British Locomotive Co., and Mr. John Sampson, director of John Brown and Co.

"This formation has been prompted by the signs of trade revival and by the experience gained during the past two years, in which it was clearly demonstrated that individual British firms, while able to carry out work of the highest order on the lines in which they are interested, were definitely excluded from larger openings because of (1) lack of the necessary finance, (2) absence of arrangements for doing work other than that in which they were directly interested, and (3) the magnitude of some of the schemes.

"The new company have already got to work and it is known that they are interesting themselves in a number of contracts now open, particularly dock and harbor, and railway development schemes in South America. Confidence is felt in engineering circles that they will be able to secure a sufficient number of contracts to justify their existence.

Bridge, Dock and Harbor

"In these engineering lines firms have, since the end of last year, been doing very good business, and the more important concerns have now a number of useful contracts in hand. The Cleveland Bridge and Engineering Co., is, perhaps, the outstanding example, having secured a fair share of the world's business. Particularly might be mentioned the construction of the Menam Bridge in Siam and a number of railway bridges in the same country, while it is understood that the negotiations for the construction of the bridge across the Santa Lucia and that across the Magdalena River in Colombia are well advanced.

"S. Pearson and Sons are now at work on the bridge across the Yellow River in China, whilst they have also in hand the construction of bridges, the repair of canals, and the extension of docks and harbors in Belgium. They have, further, concluded a contract amounting to about two million pounds for the extension of the water supply of Belfast. The contract is expected to extend over seven years.

"Sir William Arrol & Co., have in hand a number of contracts in Argentine and Chile and are in negotiations with regard to the extensive scheme of dock and harbor construction on the Chilean Coast. They are competing strongly for the erection of the bridge across Sydney Harbor.

"The smaller firms are also well equipped with a number of bridges and similar classes of works, both at home and abroad.

Railway Rolling Stock

"Builders of locomotives, carriages, and wagons have been doing fairly well during the past two months. The North British Locomotive Co., William Beardmore and Co., Sir W. G. Armstrong Whitworth and Co., The Vulcan Foundry Co., and others have, it is understood, secured considerable contracts for the supply of locomotives to Roumania, whilst Kitson and Co., Airedale Foundry, Leeds, are engaged on eight new locomotives for the Palestine Railways. Colonial orders have helped considerably to make up the numbers required and the shops may be said to be assuming something like normal conditions.

"The Birmingham Railway Carriage and Wagon Co., are quite busy on stock both for home and foreign railways. The Metropolitan Carriage, Wagon and Finance Co., are supplying to the Palestine Railways four first and second class combined, six second-class, and nine third-class coaches together with four third-class and brake composite, two tri-composite and brake, and three luggage and postal brake carriages. The Birmingham company referred to above has its share of the Palestine orders in the form of 10 bogie first-class carriages.

"The Metropolitan Carriage, Wagon and Finance Co. is understood to have secured considerable orders for Russia, while the Leeds Forge Co. is engaged on 1,000 tank wagons for that country. Firms manufacturing permanent way material are well placed with their orders, having secured fairly large contracts in the face of foreign competition."

Practical Ideas From Practical Men

MAKING AUTO WHEELS

By Geo. Barrett

The automobile wheel to receive the most general application on all types of cars is that constructed with wooden spokes and known as the artillery wheel from the fact that it was originally designed for use on gun carriages.

The spokes are turned from a wooden billet A, the operation being performed on a special lathe and called club turning on account of the shape of the stock after it leaves the machine. The elliptical spokes are obtained by movable centres and a cam action, which moves the lathe heads in and out with respect to the cutters, to get the shape desired, shown at B.

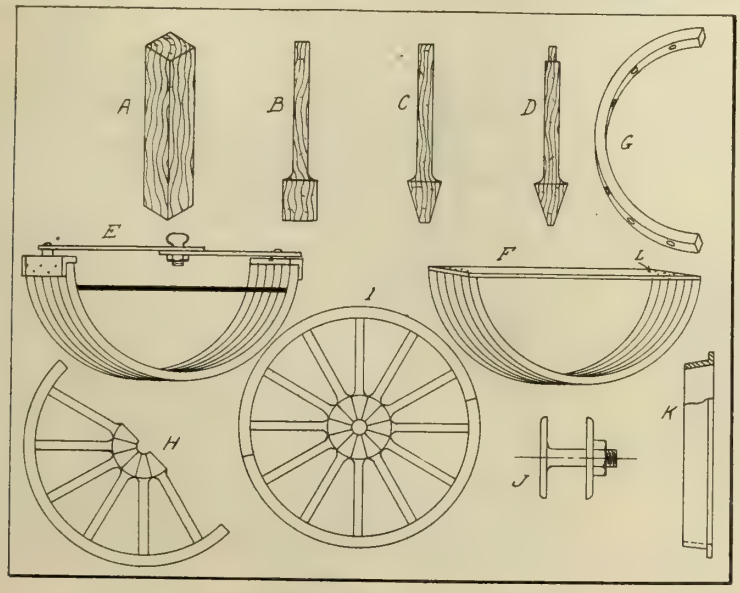
The next operation is mitering the large end as shown at C, which is performed by two saws set at the required angle, and afterwards finished correctly by two knives. The next step is to turn spokes tenon at upper end D to fit the wooden fellow or rim of wheel. This is done with a revolving hollow cutter set to correct diameter so as to have a pressed fit in rim after boring for spokes.

The fellows are made by bending wooden stock, previously cut to the desired length and thickness, and steamed for several hours, the bending being done on special machines. The stock is placed —6 in number—on a flat piece of sheet steel, and has two clamps which hold the bent wood against the spacer at E in order to secure the desired curvature. They are then placed in drying kilns for a considerable time. After removal the steel clamp is removed and pieces held by strips shown at F, and sawn and planed to correct form.

The next operation is drilling the fellows for the tenon of the spoke; this is done on a single purpose machine. A sanding machine is then used for chamfering inside between spokes, and afterwards the holes are spot faced for spoke bearing.

The first stage in assembling the wheels is shown at H. The spokes are driven into the fellows and after combining the two halves the wheel is placed in a hydraulic press which clamps the spokes and rim tightly together. The spokes are supported by a dummy hub as shown at G. The wheels are now ready for the steel rim and are laid on a special table where they are heated by gas flames sufficient to expand them so the wooden centre can be inserted and placed under a press to force the steel rim to its proper position on the fellow. The dummy hub is then removed.

Next operation is boring and facing for the hub. After holes are drilled and bolts put in, the assembled wheel is twisted for correct balance. The final operation is drilling and inserting dismountable rim bolts and clips.



Making Artillery Type of Auto Wheel

PUNCH AND DIE DIMENSIONS

G. L.

The question sometimes arises: "What is the relation between minimum punch diameter, clearance and thickness of stock?" One firm has found the following by experiment.

"Our usual practice is to make the clearance between punch and die about one-fifth the thickness of stock. If the stock is high carbon steel or thicker than the diameter of the punch, greater clearance is necessary. For light work such as sheet metal, a clearance between .002 in. and .005 in. is satisfactory. We find that for ordinary machine steel the minimum diameter of hole punched may equal the thickness of stock, on the average.

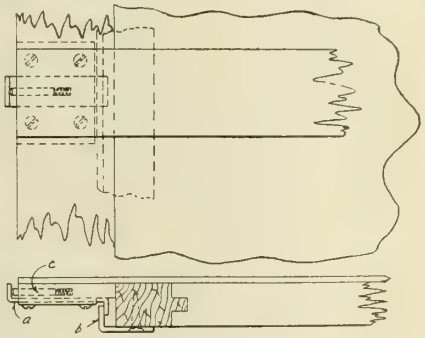
"In soft machine steel of about 10 per cent. carbon, we have cases where we regularly punch 9/32, 13/32 and 15/32 in. holes in ⅜, ½ or ⅝ in. stock respectively. This gives a ratio, hole to stock, of about 75 to 1.

"In hard spring steel of .60 to .70 per cent. carbon and .90 to 1.10 per cent. Manganese, we punch a 9-16 in. hole in 7/16 in. stock as received from the mills, the average life of the punch being about 100 holes. On attempting to punch a ½ in. hole in the same piece, the usual result was a broken punch. Our experience also shows that 13/32 in. is a safe minimum diameter for holes in 5/16 in. stock of this steel, as it allows a good life to the punches. This gives a ratio, hole to stock, of about 1.25 to 1."

SELF ALIGNING T-SQUARE

By N. F. P.

The accompanying sketch shows a T-square with an attachment for maintaining alignment at all times when in use. The slide (a) being kept out by the spring plunger (c) against the angle



Self aligning T-square

strip (b) holds the T-square in position which is easily released by a slight pressure of the hand. The slide is retained by a small plate as shown.

HOW TO WEIGH ATTACHED IRREGULAR PARTS

By W. F. Schaphorst

Occasionally it is desired to know the weight of some part on a machine, but which cannot be detached easily for weighing and it is too irregular to compute with ease. In such case the weight can be found indirectly by weighing the water displaced by the part, if the part projects in such a way that it can be made to displace water. For example, the writer once had to determine the weight of a flywheel governor weight, which was made of cast iron, and which could not be detached without removing the governor from the engine.

We turned the flywheel to such a

position that the weight was at its extreme low point. We then procured a rectangular sheet metal vessel and filled it with water. We weighed the vessel when it contained as much water as could be held in it. Then the vessel of water was carried over to the engine and raised so as to envelop the weighted end. Water was displaced, of course, but that is what was wanted. The vessel was raised until the water level cut the governor arm.

The vessel was again weighed; this time with the remaining water. The weight of the governor end was then computed in this manner: the first weight was 45.5 lbs. and the second was 39.5 lbs. The weight of the water displaced was therefore:

45.5—39.25=6.25 lbs.

Now to compute the weight of the cast iron that displaced the water all that is necessary is to multiply by the specific gravity of cast iron which is 7.207 or:

6.25 x 7.207=45 lbs.

The remainder of the arm was of rectangular cross-section whose weight was very easy to compute on this basis of 0.26 lbs. per cubic inch, which is the weight of cast iron. In case other metal parts are to be weighed in this manner here are the specific gravities of metals most commonly used in mechanical constructions:

Cast iron	7.07
Wrought iron	7.78
Soft steel	7.833
Steel castings	7.917
Cast aluminum	2.60

Should it be desired to know the volume of the piece of metal in cubic inches divide the difference in weight (which is equal to the weight of the displaced water) by .0362. The result is the volume of the part in cubic inches. The latter test will come in handy for finding the volume of any irregular substance that can be submerged in water without harm or without any absorption of water. Or, should one wish to find the specific gravity of coal, brick, rock, etc., this method reversed, will serve the purpose. Weigh the rock, say, and then weigh the displaced water (which can be done by subtraction as already explained). Divide the former by the latter and the quotient is the specific gravity of the rock or other substance.

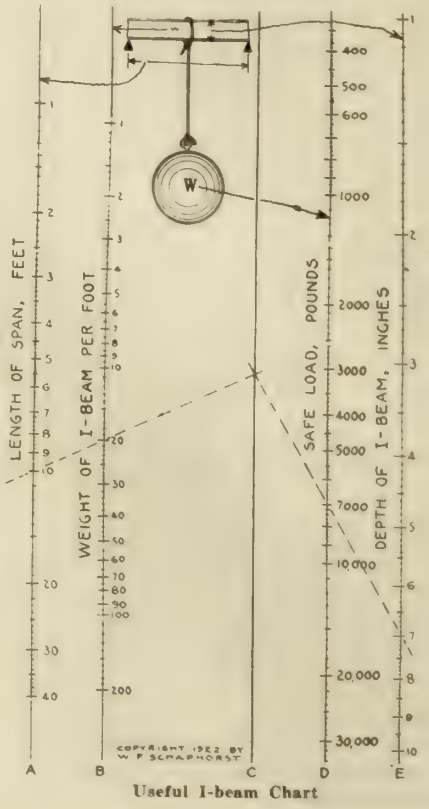
A USEFUL I-BEAM CHART

By W. F. Schaphorst

Here is an I-beam chart that tells all about I-beams almost at a glance. It is much quicker than a table for solving many problems such as are met frequently. The I-beam is the lightest and most economical steel beam for most purposes. Inasmuch as a concentrated load, as shown in the sketch, represents the very worst conditions, requiring the largest beam for the given load, this chart is based upon such loads for the sake of safety. The wavy arrow lines running from the sketch to the vertical chart lines show at a glance just what each chart column means. Thus, column A gives the length of the span in feet and includes all lengths from 1 ft. to 4 ft. Column B gives the weight of the I-beam in lb. per ft. and includes all weights from 1 lb. to 200 lb. Column D gives the safe load of the I-beam and varies from 400 to 30,000 pounds. Column E gives depths of beams in inches from 1 to 10 inches.

For example, to show how the chart is used, let us suppose that a weight of 4,000 pounds must be lifted. A 7-in. I-beam weighing 240 pounds is available. It is 12 ft. long and therefore weighs 20 lb. per ft. The minimum distance between supports that can be obtained for the lifting operation is 10 ft. Is the I-beam strong enough to lift the 4 000 lb. load?

The dotted lines drawn across the chart show how the problem is solved by means of the chart. Run a straight line through the 10 ft. (Column A) and the 20 lb. (Column B) and locate the intersection in Column C. Then from the intersection in Column C run over to the 7-in. (Column E.) The intersection through Column D shows that the I-beam will support 7,000 pounds. Since the load to be lifted is only 4,000 pounds the beam is amply strong. In fact, the reader can easily find by applying the chart that a 4-in. I-beam, all other conditions being the same, would safely support the load of 4,000 pounds. Similarly, it is easy to ascertain the maximum allowable span when the factors in Columns B, D and E are known. Or, the necessary weight per ft. of I-beam may be determined when the factors in Colums A, D and E are known. Lastly, the depth of beam can be determined when the factors in Columns A, B and D are known. For loads that are "uniformly distributed"—not concentrated—the safe loads in Column D may be multiplied by two. Thus, the above described beam will support a uniformly distributed load of 14,000 lbs. or 1,400 lbs. per running foot.



Useful I-beam Chart

HINTS TO CHECKERS

I. N. B.

Before turning finished drawings over to the production department, it is very important to make certain of the accuracy of the different dimensions and the general information included on the prints. The following list of questions has been compiled to aid checkers in eliminating the possibility of error in the making of the product:

1.—Is the size of the sheet correct?
2.—Is the layout of the model correct?
3.—Can fixture be loaded and unloaded without interference?
4.—Can the fixture be assembled?
5.—Do figures "tie-up?"
6.—Are there enough dimensions on each piece?
7.—Are the dimensions to scale?
8.—Are dimensions not to scale underlined?
9.—Are finish marks on drawing?
10.—Have grind notes and other necessary notes been included?
11.—Does fixture fit the machine, and have bolt holes been provided?
12.—Is stock list and bill of materials on the drawing?
13.—Spot for marking?
14.—Have Title No., Part No., Pattern No., Order No. and Sheet No. been en?
15.—Has provision been made for gauging on milling fixture?
16.—Is pattern constructed in the simplest manner?
17.—If a chucking ficture, is it counterweighted?
18.—Don't be in a hurry—the time spent in checking may prevent loss of time in the tool room if hurriedly done. (Remember—the onus rests on you.)
19.—When you have checked a drawing always feel that there can be no come-back.

TAPPING CAST IRON

In answering a query as to whether a lubricant should be used when tapping cast iron with 1½ in. to 3½ in. collapsing taps, Threads recommends the following solution: 40 gal. of water, 10 gal. of mineral lard oil, 2½ pounds of soda ash (exactly), and 10 ounces of borax.

Take a barrel of about 50 gal. capacity. Tap at the bottom for spigot. Weigh the 2½ pounds of soda ash (caustic soda or caustic potash will not do). Thoroughly dissolve this with ten ounces of borax in a bucket of hot water. Place in the mixing barrel and add water until barrel is three-quarters full. After agitating this mixture of water and alkali, allow it to stand at least 30 minutes. Then add the ten gallons of mineral lard oil.

New Things in Shop Equipment

BALL BEARING TOOL GRINDER

A ball bearing tool grinder has recently been developed and placed on the market. The grinder is furnished with a floor stand but may be provided with the necessary offset if it is desired to bolt the machine to a post, or a plate can be furnished when being fastened to a bench. Fafnir ball bearings are used in mounting the spindle. The spindle can be driven direct by a belt attached to the line shaft, so that it is not necessary to start and stop it each time the grinder is used. All necessary tool rests, water pots, etc., are furnished with the machine. This grinder is manufactured by the Fafnir Bearing Co., of New Britain, Conn.

NEW DESIGN DIFFERENTIAL CHUCK

A wrenchless chuck for turret and engine lathes has recently been developed and placed on the market. The scroll-plate is made heavier and thicker to allow of cutting air internal gear on the face instead of the usual practice of bevel gears. The scroll-plate has its bearing on the outer edge of chuck body and not on the smaller bore diameter, giving added rigidity.

Directly back of the scroll-plate in the assembled chuck is an annular steel ring, attached to the body of the chuck as described later. Upon the inner circumference of the ring are cut the teeth of an internal gear similar to the one in the scroll-plate but slightly larger in pitch diameter. This ring is called the "backing gear." Turning freely upon a large ball bearing mounted on the hub of the chuck is a ring, known as the "handwheel," of the same outer diameter as the chuck body. This wheel may be seen in Fig. 1, where it appears as the knurled portion of body, and separately in Fig. 2 with the backing gear and differential pinions in the respective places. Five pairs of pinions are mounted on studs shouldered into the inner face of the web of the handwheel. Of each pair, one pinion is slightly smaller in pitch diameter than its mate and meshes with the internal gear of the scroll-plate, while the larger one meshes with the backing gear. The two pinions of each pair are pinned together as one piece, the entire mechanism thus forming in effect an epicyclic train.

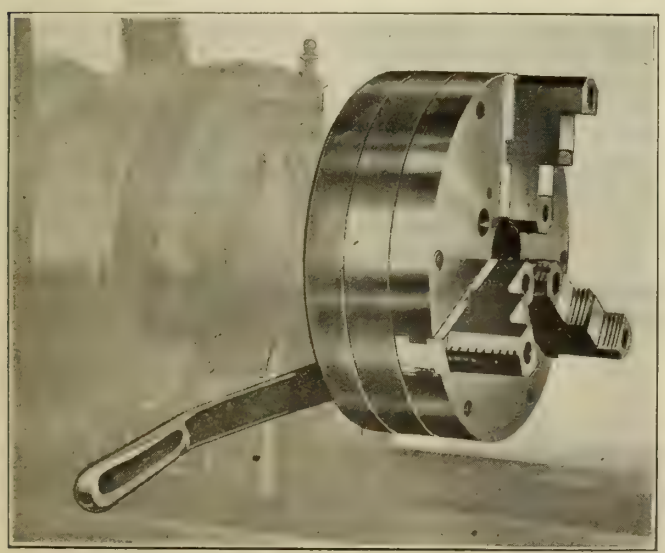
Because of the differential ratio, the internal gear that is part of the scroll-plate will turn slowly backward with relation to the stationary chuck body. Similarly, when the chuck is running forward with the lathe, if the hand is pressed upon the knurled part of the handwheel and its rotative movement stopped, the differential action of the epicyclic train will cause the scroll-plate to creep slowly ahead of the revolving chuck and thus close the jaws. This differential action may be made in any desired ratio. In practice, it has been found desirable to make it about 9 to 1, causing the chuck jaws to move radially 1-32 in. for each full revolution of the handwheel upon the chuck body. When mounted upon a machine, as a lathe, turret, or screw machine, a lever and brake are supplied to be attached to the headstock, thus providing means by which the pressure may be applied to hold the handwheel stationary while the rotation of the chuck automatically closes the jaws upon the work.

The backing gear is held to the chuck body by studs entering short curved slots upon its periphery in such manner as to permit a certain amount of lost motion or "backlash" in the mechanism. Thus a quick forward movement of the handwheel will deliver a hammer blow upon the train, and will effectively release the most obstinate grip. This rocking movement of the handwheel may be repeated, if necessary, until the chuck releases, when the wheel will spin rapidly forward without material resistance. Except for the manner of operating it, the chuck is the same as the standard steel-bodied Horton chucks the jaws being interchangeable.

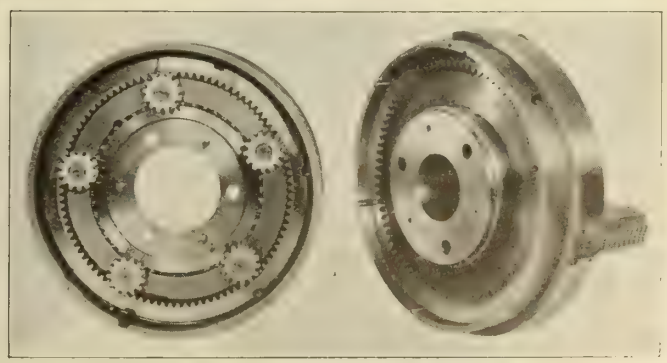
All moving parts are mounted on ball bearings, permitting of easy operation and rapid adjustment of the jaws to any desired position. The chucks are made in the 13 in. size and will also be manufactured in 9 in. and 16½ in. They are made by the E. Horton and Son Co., Windsor Locks, Conn.

SELF-ALIGNING BALL-BEARING PILLOW BLOCK

The essential features of a pillow block that has just been placed on the market are the double ball bearing hanger box and the self aligning pillow block. Both the end and radial thrust is taken by the balls. The bearing automatically aligns to compensate for any variation between the bed on which it rests and the position of the shaft. The inner ring is made very wide, in order to give the bearing a firm seat on the shaft and to afford a greater support to it. Special provision is made for preventing the escape of lubricant or the entrance of dirt. The block has no bolts, screws, or adjustments. It is secured endwise on the shaft by the means of two collars fitted with set screws. These collars have lugs which engage corresponding slots cut in the wide inner ring of the ball bearing. These pillow blocks may be easily installed. The spherical seat in the pillow block and the ball on the box permits the whole unit to align with the shaft. These pillow blocks are manufactured by the Fafnir Bearing Co. of New Britain, Conn.



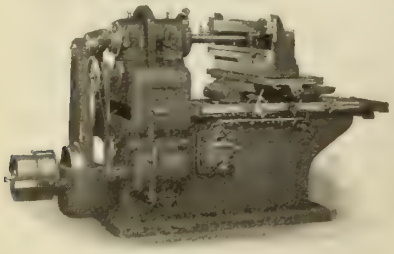
New design wrenchless chuck.



Internal view of differential gearing.

CYLINDER GRINDING MACHINE

A new design of cylinder grinding machine has just been placed on the market. A special feature of construction is the hydraulic drive for the main table, oil being used as the operating medium. The operator can reverse the table at any desired point without shock or noise. In addition to the vertical adjustment that it is possible to get with the universal locating jig the cross-slide table can be raised and lowered sufficient to take care of any vertical adjustment that may be desired by the operator after the block is strapped to



Heald Cylinder Grinder.

the jig. This is obtained by two inclined slides between the main table and the cross slide. The base of the machine is of ample dimensions to permit of undue overhand on either side, when castings with four or six cylinders are being ground. The main drive shaft is mounted on ball bearings and driven direct from the main line. The cross slide table has an adjustment of 28 in. Hole to hole setting is obtained by means of micrometer stops. The cross slide table has a vertical adjustment of 5/16 in. obtained by means of two inclined slides.

The grinding head and feeding arrangement for the eccentric are of similar design to which has been used so successfully for over 17 years, the locating head being made up of two eccentrics, one within the other, giving the grinding spindle a sort of planetary adjustment for accurately feeding the wheel to the work. There are three speeds to the eccentric, controlled by a conveniently located lever.

The grinding spindle is driven from the main drive shaft through a flexible idler which maintains uniform belt tension at all times and gives a very satisfactory driving arrangement. The spindle is hardened, ground, and runs in a solid taper bronze bearing at the wheel end, with a self-aligning ball-bearing at the pulley end. It is fitted with interchangeable pulleys, to give different speeds to the grinding wheels, so the operator can always obtain exactly the right speed, whether using large or small wheels for the work in hand.

For regrinding shops and for those who desire it, we are in a position to furnish a universal quick locating jig having a capacity of 38 in. which will take care of all styles and sizes of blocs used with standard makes of cars. It is made up of two extra heavy bars bolted to the face of the angle iron. These can be adjusted for various size blocs so that when in position the center of the holes will be the correct height for the wheel to enter. It is a great time-saver where there is a large variety of sizes and styles of blocks, each requiring a different set-up. A bulletin fully explaining this jig will be sent upon request. This grinder is made by the Heald Machine Co., Worcester, Mass.

INDUSTRIAL LOCOMOTIVE

A gasoline driven industrial locomotive has recently been placed on the market. This unit is intended for general hauling around industrial plants and for road construction. The frame and running gear are similar to other locomotives constructed by the same company. The motor is of 18 h.p. and has four cylinders. All parts of the mechanism are readily accessible but are entirely enclosed to give protection. The axles are driven from a jack shaft by means of roller chains, and the clutch is located in the fly wheel of the motor. The locomotive is constructed either with steel or cast iron wheels. The locomotive operates on a gauge of 24 in. or wider, and has a wheel base of 34 in. It operates at a maximum speed of 8 miles per hour and the track weight is about 4,000 lbs. These locomotives are manufactured by the Atlas Car and Manufacturing Co., of Cleveland, O.

NEW REX MICROMETER

Of particular interest to mechanics, tool makers, manufacturers and every user of measuring instruments, is the new line of Rex Micrometers, which afford a high grade precision tool at a low price. This tool is furnished for either English or Metric measure and includes 24 different sizes of micrometers to take measurements up to 24 inches, or 600 mm. These micrometers are regularly furnished with a clamp ring which clamps the spindle and preserves the setting. A feature of these micrometers is the rectangular shape of the frames which can be seen from the illustration. These frames give greater measuring capacity than frames of the circular type. Holes are used in the larger sizes to lighten the frames. The anvil, spindle, and other parts of this Rex line are similar to the parts of the regular Brown and Sharpe micrometers and means are provided for adjustment for wear of measuring surfaces and screw. The cut shows the Rex No. 11, 1 inch micrometer caliper without clamp ring which lists at $6.25 In the larger sizes, Rex micrometers are furnished in finished wooden cases. These cases are substantially made, and afford a good place to keep the tool as well as to protect it. While the price of these micrometers is low, their accuracy is carefully held to the highest standard. This Rex line makes available highly accurate measuring instruments at a low price either singly or in sets. These micrometers are made by the Brown and Sharpe Mfg. Co., Providence, R. I. (see cut).

REAMER HOLDER FOR LATHES AND SCREW MACHINES

An appliance for holding reamers in lathes and screw machines has recently been placed on the market. The holder is not of the floating type but a bushing or adapter is provided and suitably applied on the part of the lathe on which the holder is employed. When used on a turret the hole is first bored and then chamfered a short distance and reamed to provide the proper bearing for the centre plug, the cone-faced entering plug is advanced to the work and while held firmly in position the face plate which holds the adapter is firmly secured by means of screws. When the face plate is properly aligned the turret is taken away and the folding leaf inserted in its place. This assures that the reamer will be properly held in alignment with the work being reamed. The shanks of the reamer are so designed that they may be passed completely through the holder if desired. The various sizes of adapters are interchangeable. The holes in the adapters are interchangeable. The holes in the adapter may be made to suit the reamers that are being used. This device is manufactured by the Marvin and Casler Co., Canastota, N. Y.

ARE RUNNING CLOSE TO NORMAL

The Eclipse Machine Co., Elmira, New York, have a Canadian plant at Walkerville, Ont. Their line consists of the manufacture of Eclipse Bendix Drives, which are used as standard equipment and starting means on internal combustion of gasoline engines taking in the various lines of automobiles, both pleasure and commercial lines, aviation motors, marine engines, and motors for pumping or other power needed applications.

New Rex Micrometer.

CANADIAN MACHINERY
AND MANUFACTURING NEWS

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Industry Demands the Best

DO MANUFACTURERS sometimes overlook the dividend possibilities of their own enterprises? Profitable operation is, above all, the definite object of industrial effort, but it frequently occurs that, for want of better equipment, an otherwise efficient organization may be short of success. Instances are known where business men, disregarding an element that made for weakness, have shown preference for investment in channels that seemed to promise a better return than that from which they may be obtaining their bread and butter. In other words, they are willing that other men should handle their capital for them, and in an enterprise on which they may have the most meagre knowledge. To make money is desirable, but the best concentration and the best equipment is first essential for the success of the undertaking in which a manufacturer is engaged. If an organization is functioning properly in the scheme of things, it should be the most dependable source of profit. Old and dilapidated equipment and antiquated methods will hardly do under modern conditions.

In his day and generation, Andrew Carnegie said many wise things, and misdirected investment by business men must have come under his observation. In his autobiography he says:

"It is surprising how few men appreciate the enormous dividends derivable from investment in their own business. There is scarcely a manufacturer in the world who has not in his works some machinery that should be thrown out and replaced by improved appliances; or who does not for the want of additional machinery or new methods lose more than sufficient to pay the largest dividend obtainable by investment beyond his own domain. And yet most business men whom I have known invest in bank shares and in far-away enterprises, while the true gold mine lies right in their own factories."

Germany Under Economic Pressure

ACCORDING to reports coming from Germany, the fear that competition from that country would become more or less of a menace to profitable operation in certain branches of industrial activity, seems to have been hardly worth while. The trend of economic law seems to point to troublous times ahead. The boom is still on, but the rise in prices of basic materials and the increasing scarcity of money for industrial investments are among the factors that point to difficulty for the not far distant future. Moreover the cost of living for Germany has reached a point many times higher than that of pre-war levels, and at the same time the standard of living is said to be lower. Nor does it require a close observer to note the development of the strike fever. In fact in South Germany, the home of the metal industry, there were many weeks of inactivity while capital and labor fought over a difference of two hours in the working day. A more or less unsatisfactory compromise was the result. Further, it now becomes evident that until Russia has solved her internal problems, business cannot be developed with any degree of confidence in that quarter, and this in spite of any agreement entered into between the two countries during the Genoa conference. In short, that day seems to be fast approaching when inevitable economic pressure will bring German products to the level of world markets and hence more and more within the direct influence of international competitive conditions.

The Freight Rate Reduction

ANOTHER STEP in the somewhat delicate but necessary process of reducing freight rates on basic commodities, has been announced by the Board of Railway Commissioners. The change, effective Aug. 1, means a further decrease of 7½% on the original increase ordered in 1920 of 40% in the East and 35% in the West. What will now remain of this increase will amount to 12½% in Western Canada and 17½% in Eastern Canada. The Crow's Nest Pass agreement on grain and flour has been reinstated, certain arbitraries adjusted, and all increases on coal, other than anthracite and coal from the head of the lakes Westward have been rescinded. Thus the order of the Board seems to make freight rate reduction a matter of unanimity in U. S. and Canada. The Interstate Commerce Commission ordered a reduction of 10 per cent. on all commodities. This became effective July 1.

The decreases announced by the Board represent a loss in revenue to the two chief carriers of eleven millions each. Whatever the general opinion may be as to the extent to which the reduction will meet the requirements of brisker business, or in what form the twenty-two millions will eventually help the pockets of the consumer, the Railway Board seems to have given serious consideration to reports of traffic earnings of Canadian carriers. For the first five months of the year, these have shown serious declines as compared with last year.

In the steel industry, the reduction in freight rates seems to be regarded as an item that can be applied by way of relief in operation costs, rather than one that can be passed on, at once, to the consumer. As regards import business, there are those who feel that there is also a danger of the decrease being offset by the exchange rate. As a straight decrease, however, it represents a saving of $22.80 on a car of steel say from Pittsburgh. The rate at present is $7.60 per ton or $304 on a 40-ton carload. The saving will, of course, benefit the large purchaser most. The opinion among jobbers and manufacturers' agents is, therefore, that the decrease will hardly benefit the ultimate consumer as largely or as quickly as he has been led to suppose. The absorption of such an item in the different processes from raw material to its final consumption is an easy matter especially in a market that seems to be struggling upward through a very cautious industrial revival.

Increased Production in Steel Industry

Mills Are Well Sold Up—Prospect of Continued Activity During Autumn—Consumption Increased 27 Per Cent.—Prices Continue Firm—Some Advances Predicted—Railroads Appear in Market

MILLS MAY ADOPT CONSERVATIVE POLICY

STEEL markets are developing interesting features. A spirit of cautious selling is developing. Reports from Fittsburg indicate that mills could dispose of large tonnages if they were willing to accept on late year contracts. Mills are well sold up for the next two months, and although there is no change in prices to speak of, it is predicted that they are on the way. This is not altogether due to the coal strike. The demand will undoubtedly continue in strength during the latter part of the year, and it is inevitable that there should be a movement in the direction of more profitable operation than has been the case for the past six months.

To date production of steel ingots shows, for the first six months of 1922, an increase of six million tons over the same period last year. It is assumed that there has been some movement toward the replenishing of stocks that were liquidated last year, and that consumption has had a very material increase, say 27 per cent. If these factors are taking care of the enormous increase in production then there can be no weakness in the fundamental situation. If, on the other hand, consumption does not measure up to the increases in production trouble may ensue, such as a buyers' panic, next Autumn. It is not improbable therefore that some attempt will be made to hold prices at levels, at least, that cannot be criticized.

It is doubtful, after all, if the ending of the coal strike will bring a heavier demand for steel. Experience has pretty well established the fact that buying is keenest in lines of threatened scarcity and inclined to lethargy when supply is readily available.

Demand for building materials seems to be well maintained. Reports indicate that some very large tonnages are going forward to the mills for steel and plate.

Pig iron markets, though active, remain unchanged so far as prices are concerned. There are good supplies on hand, and the improvement in the foundry business will account for some increases in consumption. The decrease in freight rates of 7½ per cent. will be welcomed more as a factor tending to ease the load of operation, rather than one that can at present be passed on at once to the consumer.

An upward movement continues in steel and iron bars. In fact in some quarters, this advance is considered long over due and it is predicted that within the week there will be an advance to 3.15.

Non-ferrous metal markets show little marked activity. Some easing developed in electrolytic copper and castings copper, but this is considered more in the light of a fluctuation than indicating a decided tendency.

Machine tools are inactive though there seems to be an undertone of optimism that general conditions cannot continue an improvement, without a kindred showing in the matter of equipment. It is regarded by some, as probable, that if industry displayed a tendency toward a strong recovery and inquiry for machinery developed, a temporary easing of prices might be made by way of encouragement.

Small tools and supplies are in continued better demand, and the movement seems a general one, and not due to marked requirements in any one department of industry, although activities in agricultural implement and motor car manufactures are showing a much better tone.

Toronto

GENERAL firmness marks the Toronto metal market this week, the tendency in this direction being more pronounced in some quarters than was the case one week ago. If one will take, as an exampie, the situation in steel and iron bars, a decided upturn is regarded as inevitable. In fact an announcement of increases from the mills is momentarily expected. "It has to come," was the comment of one jobber. "Prices have been too low. There must be a normal spread as between mill and distribution prices. Our minimum price to-day is $3.00; next week we will probably have to say to you that it is $3.15. Mills can no longer be expected to operate below cost." In other quarters the comment was of a similar character. Price tendencies are upwards. General conditions are steadily improving. "The situation is immeasurably better than it was four months ago," remarked a jobber who generally inclines to a conservative view. "To-day, I would repeat what they used to say prior to the war, 'there is no crisis.' We seem to have come through the worst of it. Given a settlement of the coal strike and I will say that the outlook would be exceptionally encouraging."

Freight rate reductions effective Aug. 1 are regarded as a help toward stability. While the decrease may not seem important, it is a case where every little bit helps. For example, the rate between Pittsburg and Toronto is 38 cents or $7.60 per net ton. The rate on a forty-ton car would therefore be $304. As applied to this, the 7½% reduction would amount to $22.80 the car, not much in itself, but important enough to the large shipper. Immediate effect on prices, however, seems out of the question. Exchange rates have shown a tendency to move upward. Steel mills carry at least six months' supply of basic materials, and would appear to have been operating at such figures as would make the freight rate reduction welcome to them as a particular measure of relief in a more or less unprofitable situation.

It is regarded as a good sign that the railways are again making their appearance as buyers. The Algoma Steel Corporation and Nova Scotia Steel Co. are reported to have received large orders for rails and other track supplies. Favorable crop reports are being received from the West and this will undoubtedly account in considerable degree for slightly improved activity among agricultural implement plants.

Iron and Steel Bars:—The prices given herewith indicate the tendency toward stiffer prices in iron and steel bars. Even for small shapes prices are stiffening, and it is here that some dealers declare there should be a more marked boost than for regular sizes, as they represent an accommodation and one that is not altogether beyond the factor of additional expense. In some quarters there is a determined undertone indicating that the boost is somewhat overdue:

Iron bars	2 90 to 3 15
Steel bars	2 90 to 3 15
Reinforcing bars	2.90 to 3 15
Steel hoops	4 00
Tire steel	3 15
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in base	3 50
Small shapes	3 15
Sheets, black, No. 28	5 00
Sheets, blue ann., No. 10	4 00
Canada plates, dull, 52 sheets	6 00
Canada plates, all bright	6 00
Galvanized Sheets, No. 28	6 00

Scrap metal markets report no change so far as prices are concerned, but the feeling is better, as reflecting the general improvement in business. There is still a great deal of what is called "gun metal" copper and brass coming in from the Old Country. This is, as a rule, very carefully graded, and percentages are good.

Copper, light per 100 lbs.	8 50
Copper, crucible	11 00
Copper, heavy	11 00
Copper Wire	11 00
No. 1 composition	9 00
New brass cuttings	6 00
Red brass turnings	6 50
Yellow brass turnings	4 85
Light brass	3 50
Medium brass	4 50
Scrap zinc	4 00
Heavy lead	4 50
Tea lead	3 00
Aluminum	11 00
Boiler plate, per gross ton	9 00
Heavy melting steel	11 00
Axles (wrought iron)	16 00
Rails (scrap)	11 00
Malleable	11 00
No. 1 machine cast iron	16 00
Pipe, wrought	6 00
Car wheel	16 00
Steel axles	15 00

In the non-ferrous department, copper and brass products are reported as showing strength. An authority ascribes this tendency to several causes. The heavy tonnages left over from the war have been about absorbed, production has improved and Europe is said to be doing a little buying. In the basic non-ferrous metals, there was a little weakness apparent during the week-end. New York prices eased slightly. Electrolytic copper at $16.75 and castings copper at $16.50, are the more important items. Here, too, railways are buying more, and doing it direct, rather than through the large jobbers, thus saving one tax item.

Lake Copper	17 00
Electric Copper	16 75
Castings, copper	16 50
Tin	34 00
Spelter	7 25
Lead	6 75
Antimony	6 75
Aluminum	26 00

Machine tools are reported as being the one black spot in the rising sun of industrial improvement. Dealers and manufacturers declare there is practically no demand for new equipment, except in the woodworking machinery line. This shows an improvement, explained by activity in the lumbering and furniture industries. The feeling is optimistic however. An upturn in business, it is felt, should create a demand for the best that the market has and there are those who say that such a development would be met, temporarily, at least, by reduction in prices.

Small tools and supplies are figuring in a better demand. The manufacture of radio equipment, the motor car and agricultural implement industries are regarded as three important factors in this section.

There seems to be an undertone in the machinery market that conditions are going to move slowly, but steadily, in the right direction during the next six months. It may be difficult to explain by facts and figures, but the feeling is there.

Due to a rise in the price of crude oil, an increase is announced of one cent in Royalite and Polarine, and of 1½ cents in premier gasoline.

Castor Machine oil, per lb.	34½
Royalite, per gal., bulk	0 20
Palacine	0 23
Machine oil, per gal.	33 00
Black oil, per gal	17 50
Cylinder oil, Capital	61 50
Petroleum fuel oil bbls., net	10 80
Pure turp., single bbls. gal.	1 40
Linseed oil, raw, single bbls.	1 15
Premier gasoline	35½

WASTE

XXX Extra	16	Atlas	13
Peerless	21	X Empire	13
XX Grand	15	Ideal	18
Superior	20	X Press	11½
X L C R	14		

Colored

Lion	12	Fancy	13½
Standard	10½	Popular	9
No. 1	13	Keen	7½

Wool Packing

Arrow	30	Anvil	20
Axle	25		

Washed Wipers

Select White	13	Dark colored	13
Mixed colored	14		

Montreal

July 5

A DISTINCT improvement in many of the lines of iron and steel has been noted during the week. The outstanding feature is the placing of a large order for rails and attachments by the Canadian Pacific Raliway. The demand for general lines has improved to such an extent that an upward revision in prices has been predicted. The railways are showing a tendency toward coming into the market to a greater extent than they have done heretofore this year. Supplies of various kinds are in demand. Pig iron sales are improving, with the sales of Scotch iron featuring the market. Machine tool conditions remain unchanged. The non-ferrous metals show a little more strength which is only about what was required to offset the weakness developed last week. The scrap metal market is quiet.

Iron and Steel.—A decidedly better tone prevails in all lines of the steel business locally. The pressure of orders for the smaller steel products and the occasional order for larger material, has caused the stiff quotations of last week to be revised upward. Base prices of iron and steel are now from $3.15 to $3.25 according to the size of the order. During the week the Canadian Pacific Railway has placed orders with the Algoma Steel Corporation for 48,000 tons of 100 lb. Type R. E. rails, together with the necessary tie plates and rail joints. This will keep the mills at the Sault occupied for about two months, operating one shift. Orders have been placed elsewhere for the spikes, bolts and other accessories.

The demand for black, blue annealed and galvanized sheets is still greater than the supply. The Montreal jobbers claim that they are unable to keep in stock any standard sizes and gauges of galvanized sheets. Prices on sheets are unchanged in spite of the above conditions. The demand comes from the building operations and the sheet metal working industries.

Stocks of structural steel are getting very low locally. Little of this material has been rolled in Canada for some time past. Poor deliveries from the United States mills have kept the business in Canada. This condition has resulted in depleting the local supplies. Up to the present no plans for rolling structural sections have been made. If the demand keeps up at the present rate it will not be long before steps will have to be taken to avert a shortage.

Merchant bars are moving fairly well, but the number of orders are not tending to embarrass dealers. The products mentioned above are much more active. Small steel products such as nuts, bolts, screws, etc., are moving very well indeed.

June has been the best month so far this year. With the exception of plates all products are moving well. Local quotations are as follows:—

Iron bars	3 15 to 3 25
Steel bars	3 15 to 3 25
Reinforcing bars	3 15 to 3 25
Steel hoops	4 00
Tire steel	3 00
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	3 25
Small shapes	3 00

Pig Iron.—Some large sales of Scotch Summerlee iron have been made during the week. Two local firms have each purchased five hundred ton lots, while one firm in Quebec placed an order for two hundred and fifty tons. This iron is being delivered on the docks at the St. St. Lawrence ports for $29.75 and to this amount must be added cartage and wharfage charges. The local quotation on No. 1 iron of the Canadian product is $31.80, which is the figure that has been asked for some weeks. The ocean freight on the Scotch iron is understood to be $3.40 from Glasgow. Rails rates from Central Ontario points exceed this figure, while from the Sault to Montreal the rate is about $6.50 per ton. Thus where all water shipment can be effected the Scotch iron can be obtained at a figure which averages about one dollar per ton less than the figure quoted on Canadian iron. In spite of the large sales of Scotch iron the sales of Canadian iron have also increased, particularly in the inland districts. Thus the condition of the market is greatly improved.

Machine Tools.—The machine tool market continues to be rather discouraging. The demand for some months past has been next to nothing. Only occasionally a sale is reported, and then it is usually for one small sized machine. In common with other parts of the country the demand for small screw machines for radio work has been the result of a few sales. There is a limited demand for used equipment of the better kind. A large number of sales in the past few months have been to garages. This class of prospect is also interested in the many developments of the portable tool. Present indications are that there will not be any great improvement in this market for some time yet. All business is keenly sought and the prices have been pared to the smallest margins.

Shop Supplies.—This business still continues to be very satisfactory. The demand comes from the small shops largely and is pretty well scattered over the country. Local contract shops are busier than the manufacturing shops, and thus they create the larger portion of the demand locally. No important price changes have been made during the week.

Non-Ferrous Metals.—The weakening tendency of the non-ferrous metal market that was present last week has been checked but the condition at this time could not be described as being strong. Local sales are about the same as last week and, with the exception of tin, no changes in quotations have been made. The quotations are as follows:—

Lake Copper	17 50
Electric Copper	17 25
Castings, Copper	17 00
Tin	34 50
Lead	6 75
Spelter	7 75
Antimony	6 50
Aluminum	23 00

Scrap Metals.—The scrap metal market remains unchanged. With the advance in prices of steel there is a tendency toward stiffening in certain lines but no change has been made in quotations. Local holdings are rather small in most cases. The foundries have come into the market for pig in the last week and it is expected that the demand for scrap iron will improve somewhat. The volume of business offering is about the same as last week.

Copper, light ..... per 100 lbs.	8 50
Copper, crucible	11 00
Copper, heavy	11 00
Copper Wire	11 00
No. 1 compositon	9 00
New brass cuttings	6 00
Red brass turnings	6 50
Yellow brass turnings	5 00
Light brass	4 00
Medium brass	5 50
Scrap zinc	3 50
Heavy lead	4 50
Tea lead	3 00
Aluminum	11 00
Boiler plate, per gross ton.	9 00
Heavy melting steel	10 00
Axles (wrought iron)	20 00
Rails (scrap)	11 00
Malleable	10 00
No. 1 machine cast iron	20 00
Pipe, wrought	7 00

Pittsburg

THE turnover in the steel market, in point of tonnage, has decreased farther in the past week, there having been indeed a more or less steady decrease for several weeks, the most active market having been in April. While the tonnage turnover is relatively light it would hardly be entirely accurate to describe the market as "quiet" for the reason that there is considerable pressure for early deliveries. The tonnage thus bought is not large, but the market is kept from appearing actually dull.

The mills say that the lighter turnover at present is due to their indisposition to sell, and assert that they could dispose of large tonnages if they were willing to accept the business offered them by customers. This, however, would be chiefly in the form of contracts for delivery late in the year, and the mills are no doubt just as well off without such business, as the buyers would specify freely if the market should prove strong late in the year, and otherwise would be indisposed to specify.

July and August are almost invariably very dull months in the steel market and this year will furnish no exception, as the stage has practically been reached already. This does not make the market any less strong, for the mills are well sold up through the two months, and in some lines, particularly in merchant bars, they are sold for a longer time. Whether all buyers are covered to an equal extent is a question, the present buying for prompt delivery indicating that they are not.

The market is quotable unchanged as follows: Bars, shapes and plates, 1.60c to 1.70c; hoops and bands, 2.40c to 2.50c; blue annealed sheets, 2.40c to 2.50c; black sheets, 3.15c to 3.30c; galvanized sheets, 4.15c to 4.30c; automobile sheets, 4.50c to 4.75c; tin plate, $4.75; merchant steel pipe, 71 per cent. basing discount; wire nails, $2.40 to $2.50. When a range is given the higher price is usually for early delivery.

Production and Prospects:—Now that the usual quiescent midsummer period is entered upon, the great question is how the market will shape itself up afterwards, say in September, when regular buying for the early Autumn should begin.

This question does not hinge to as great an extent as usual upon the prospects for consumption, relative to present consumption, for the reason that it is fairly well established that consumption is likely to continue increasing, at least for a time. Apart from the regular consumption of manufacturing consumers, there are freight cars and structural steel jobs, contracts for which have been made while most of the steel involved is still to be consumed. In the first half of the year about 92,000 freight cars were ordered, while only a small fraction of the number have actually been made.

The more important question hinges upon the relation between production and consumption in the past three or four months. It might be that buyers had gone too far, buying more steel than currently needed, but laying in stocks in fear of the coal strike making trouble. If consumption of late has been much under production, then a good sized increase in consumption might still make a tonnage less than the current production, which accordingly could not be maintained indefinitely.

While the question cannot be answered specifically, some figures bearing on it can now be cited. Production of steel ingots in the half year just ended has been about 16,000,000 gross tons, against 9,000,000 tons in the second half of last year and 10,000,000 tons in the first half. Production at present is at 39,000,000 tons or possibly even 40,000,000 tons a year. Can these figures be harmonized? There is an enormous increase in production, and it is plain that there has not been an equally enormous increase in consumption.

Stocks Liquidated in 1921:—Allowance must be made for stocks. Last year there was drastic liquidation of stocks, both of steel in the hands of buyers and of manufactured wares of various descriptions, including machinery, tools, hardware, agricultural implements, etc. The end of the year found the country quite bare of stocks, perhaps unprecedentedly bare. There was not enough material in the hands of manufacturing consumers and distributors for the convenient and economical transaction of business. Probably it would be conservative to guess that the liquidation in 1921 was equal to at least 3,000,000 tons of ingots, which would mean that consumption in 1921 represented fully 22,000,000 tons of ingots instead of the 19,000,000 tons produced. Again it would probably be conservative to estimate that replenishment of stocks in the first half of this year to an amount equal to 2,000,000 tons of ingots would not represent undue stocking and might not even represent a reasonable restoration of stocks. If so, the 16,000,000 tons production in the half year would mean consumption equivalent to 14,000,000 tons, which would compare with 22,000,000 tons last year, representing an increase of 27 per cent. in the rate of consumption. Anyone can believe that there has been an increase of this amount. If this line of argument be accepted, it follows that there are no undue stocks now, in other words no weakness in the fundamental situation in that respect.

Careful About Advancing Prices:—This, however, does not fully defend the market, for we have steel production now at 39,000,000 to 40,000,000 tons, representing a much greater tonnage than the average consumption of the past six months. Consumption has been increasing, but perhaps not enough. In other words, the steel situation has not thus far laid up any trouble for itself, but it may in the next few months. With reasonable confidence on the part of consumers, things would move along rather smoothly. In some quarters it is said that there is danger of a "buyers' panic" next Autumn, buyers becoming afraid of prices and proceeding to liquidate thoroughly again. The advice to sellers from these quarters is to be very careful about advancing prices and endeavor to hold the market at a level that cannot be criticized. In the past few weeks the Steel Corporation has been notably indisposed to make advances in its prices in cases where independents have paved the way by advancing their prices, and of late some of the independents could be observed adopting a policy of reserve, not trying to push prices up as far as they could be pushed just at the moment.

Here and there statements are made that the ending of the coal strike may bring a heavier demand for steel. The mills know better, the universal experience being that consumers buy when they are afraid steel will become scarce and do not buy when it looks as if they could get steel whenever they want it. It would be rash to conclude, moreover, that a settlement of the coal strike would increase the production of steel. At best it will take time to settle the coal strike and then more time will be required to get the mines actually operating, while finally if an attempt were made to ship much more coal the limit of capacity of the railroads would be reached.

Pig iron remains quiet, prices being quotable unchanged at $25 for Bessemer and basic and $24 for foundry, f.o.b. valley furnaces. Freight to Pittsburgh came down from $1.96 to $1.76 on July 1. The market has been remarkably inactive.

New Equipment for the Hamilton Technical School recently, included six 14-inch lathes, three of which were placed with the D. McKenzie Machinery Co., Guelph, and three with the Perfect Machine Co., Guelph.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Toronto price:—

Silicon, 2.25% to 2.75%	29 15
Grey forge, Pittsburgh	$25 46
Lake Superior, charcoal, Chicago	30 00
Standard low phos., Philadelphia	31 50
Bessemer, Pittsburgh	25 00
Basic, Valley furnace	24 00

IRON AND STEEL

Per 100 lbs. to Large Buyers	Cents
Iron bars, base, Toronto	$2 90 — 3 00
Steel bars, base, Toronto	2 90 — 3 00
Iron bars, base, Montreal	3 15 — 3 25
Steel bars, base, Montreal	3 15 — 3 25
Reinforcing bars, base	3 15 — 3 25
Steel hoops	4 00
Tire steel	3 15
Spring steel	7 00
Band steel, No. 10 gauge and 3-16 in. base	3 40 — 3 50
Chequered floor plate ¼" and heavier	5 00
Bessemer rails, heavy, at mill	2 35
Steel bars, Pittsburgh mill prices	1 70
Tank plates, Pittsburgh mill price	1 70
Structural shapes, Pittsburgh mill prices	1 70
Steel hoops, Pittsburg	3 07
F.O.B., Toronto Warehouse	
Small shapes	3 00
F.O.B. Chicago Warehouse	
Steel bars	2 48
Structural shapes	2 58
Plates	2 58
Small shapes under 3-in	2 48

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points

	C.L.	L.C.L.
Montreal	58	73
St. John, N.B.	84½	106½
Halifax	86	108
Toronto	38	54
Guelph	38	54
London	38	54
Windsor	35	50½

Current surcharge 1 per cent.

METALS

	Montreal	Toronto
Lake copper	$17 50	$17 00
Electrolytic copper	17 25	16 75
Castings, copper	17 00	16 50
Tin	34 50	34 00
Spelter	7 75	7 25
Lead	6 75	7 00
Antimony	6 50	7 40
Aluminum	23 00	21 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$3 75	$3 50
Plates, ¼ up	3 40	3 25

PIPE—WROUGHT

Standard Buttweld Pipe S/C

Per 100 feet

	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
⅛ inch	$ 6.00	$ 8.00	$	$ ....
¼ inch	3.84	5.94	7.20	9.30
⅜ inch	3.84	5.94	7.20	9.30
½ inch	4.85	6.46	7.31	8.93
¾ inch	5.87	7.71	8.86	10.70
1 inch	8.16	11.05	12.58	15.30
1¼ inch	11.04	14.95	17.02	20.70
1½ inch	13.20	17.88	20.35	24.75
2 inch	17.76	24.05	27.38	30.30
2½ inch	28.08	38.03	.....	.....
3 inch	36.72	49.73	.....	.....
3½ inch	47.84	63.48	.....	.....
4 inch	56.68	75.21	.....	.....

Standard Lapweld Pipe S/C
Per 100 feet.

Below Dividing Line—Price Per Foot.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk	Gen. Wrot Iron Galv.
2 inch	$21.46	$27.38	$31.08	$37.00
2½ inch	31.50	40.95	46.80	56.16
3 inch	41.31	53.55	61.20	73.44
3½ inch	48.76	65.32	72.68	89.24
4 inch	57.77	77.39	86.11	105.73
4½ inch	66.04	86.36	1.04	1.24
5 inch	76.96	100.64	1.21	1.45
6 inch	1.00	1.31	1.57	1.88
7 inch	1.27	1.76	2.02	2.45
8L inch	1.40	1.85	2.13	2.58
8 inch	1.61	2.13	2.45	2.97
9 inch	1.97	2.59	2.97	3.59
10L inch	1.82	2.40	2.75	3.33
10 inch	2.35	3.09	3.54	4.28

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4-in. and under 60 per cent.
4½-in. and larger, 50 per cent.
4-in. and under, running thread, 40%.
Standard couplings, 4-in. and under, 30%
Do., 4½-in. and larger, 10%.

OLD MATERIAL

Dealers' Average Buying Prices

	Per 100 Pounds. Montreal	Toronto
Copper, light	$ 8 50	$ 8 50
Copper, crucible	11 00	11 00
Copper, heavy	11 00	11 00
Copper, wire	11 00	11 00
No. 1 machine composition	9 00	9 00
New brass cuttings	6 00	6 00
Red brass turnings	6 50	6 50
Yellow brass turnings	5 00	4 85
Light brass	4 00	3 50
Medium brass	5 50	4 50
Scrap zinc	3 50	4 00
Heavy lead	4 50	4 50
Tea lead	3 00	3 00
Aluminum	11 00	11 00

	Per Ton	Gross
Boiler plate	$9 00	$ 7 00
Heavy melting steel	10 00	10 00
Axles (wrought iron)	20 00	16 00
Rails (scrap)	11 00	11 00
Malleable scrap	10 00	11 00
No. 1 machine cast iron	20 00	16 00
Pipe, wrought	7 00	6 00
Car wheel	17 00	16 00
Steel axles	15 50	15 00
Mach. shop turnings	4 00	6 00
Stove plate	16 00	14 00
Cast boring	4 00	5 00

BOLTS, NUTS AND SCREWS

	Per Cent
Carriage bolts, 7-16 and up	40
Carriage bolts, ⅜ in. and smaller 6 in. and shorter	47½
Coach and lag screws	55
Stove bolts	72½
Wrought Washers	60
Do., corru. head	60
Machine bolts, 7-16 and over	42½
Machine bolts, ⅜-in. and less	42½
Blank bolts	42½
Bolt ends	42½
Machine Screws, fl. and rd hd., steel cut thread	37½ & 10
Machine screws, o. and fil. hd., steel cut thread	30
Machine Screws, fl. and rd hd., brass cut thread	15
Machine screws, o. and fil. hd., brass cut thread	30
Nuts, square, blank off net list	$1.25
Nuts, square, tapped off net list	75c.
Nuts, hex., blank off net list	75c.
Nuts, hex., tapped off net list	25c.
Copper rivets and burrs, list less	32½
Burrs only, list plus	10%
Iron rivets and burrs	52½
Boiler rivets, base ¾ in and larger	$5.50
Structural rivets, as above	5 40
Wood screws, O. & R., bright	80
Wood screws, flat, bright	82½
Wood screws, flat, brass	77½
Wood screws, O. & R., brass	75
Wood screws, flat, bronze	72½
Wood screws, O. & R., bronze	70

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	Less 55%
Square and hexagon head cap screws	Less 50%
Round head cap screws	Plus 10%
Fillister head cap screws	Less 10%
Flat head screws	Net list
Button head cap screws	Plus 10%
Studs	Less 35%
Semi-finished nuts up to and including 1-in.	Less 60%
Semi-finished nuts 1⅛ to 1¼ in.	Less 55%
Semi-finished nuts 1⅜ to 2 in.	Less 25%
Coupling bolts	Less 10%
Taper pins, No. 2 to No. 5	Less 60%
Planer bolts without fillet.	Plus 20%
Patch bolts	Plus 50%
Hollow set screws	Plus 10%
Thumb screws	Less 85%
Thumb nuts	Less 60%

BILLETS

F.O.B. Pittsburgh

	Per gross ton
Bessemer billets, 4 in. x 4 in. and larger	$35 00
Open hearth billets	35 00
O. H. sheet bars	35 00
Forging billets	40 00
Bessemer rods	40 00

NAILS AND SPIKES

Wire nails, base	$3 65
Cut nails, base	4 35
Miscellaneous wire nails	72½ %

ROPE AND PACKING

Plumbers' oakum, per cwt.	6 30
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 23
British Manila rope	0 20
New Zealand hemp	0 20

POLISHED DRILL ROD

Discount off list, Montreal and Toronto ..... Net

Solder, strictly	$0 22½
Solder, guaranteed	0 24
Soldering coppers, lb.	0 62½
White lead, pure, cwt.	13 20
Red dry lead, 100-lb. kegs, per cwt.	10 75
Wood alcohol, per gal.	1.75
Whiting, plain, per 100 lbs.	3 00

CARBON DRILLS AND REAMERS

S. S. drills, wire size	55
Can. carbon cutters,	10
Standard drills, all sizes	60
3-fluted drills, plus	10
Jobbers and letter sizes	55
Bit stock	60
Ratchet drills	10
S.S. drills for wood	10
Wood boring brace drills	55
Electricians' bits	30
Sockets	60
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	Net
Bridge reamers, carbon	50
Centre reamers	5
Taps, machine screw	less 50-60
Taps, hand, under 1"	less 40-50
Chucking reamers	30 off
Hand reamers	25
High speed drills, list	30 to 40 off
Can. high speed cutters, less	10
American	plus 40

COLD ROLLED STEEL

[At Warehouse]

Rounds and squares	$4.50 base
Hexagons and flats	$5.00 base

MALLEABLE FITTING LIST

1 in. elbow	.32	.53
2 in. elbow	1.05	1.70
1 in. tee	.43	.70
2 in. tee	1.45	2.40
1 in. coupling	.33	.53
1 in. locknut	.15	.23

Discount to dealers 70/5 off list.

SHEET

	Montreal	Toronto
Sheets, black, No. 28	$4 40	$5 00
Sheets, blue ann., No. 10	4 05	4 00
Canada plates, dull, 52 sheets	5 50	6 00
Can. plates all bright	7 00	....
Galvanized sheets, No. 28		6 00
Queen's Head, 28 B.W.G.	7 25	
Fleur de Lis, 28 B.W.G.	7 00	
Gorbal's Best, No 28...	....	....
Colbornes Crown, No. 28.	....	...
Premier, No. 28, U. S.	6 45	6 00
Premier 10¾ oz.	6 00	6 40
Zinc sheets	9 00	10 00

PROOF COIL CHAIN

(Warehouse Price)

B. B. B. CHAIN

⅜ in., $16.45; 7-16 in. $14.00; ½ in. $12.95; 5-8 in., $13.15; ¾ in. $12.75; 7-8 in. $12.25; 1 in. $11.85; 1⅛ and 1¼ in. $10.50. Fire weld chain same sizes respectively are $14.00; $11.50; $10.40; $10.55; $10.15; $9.75; $9.35; and $8.25.

ELECTRIC WELD COIL CHAIN B.B.B.

⅛ in. $20.00; 3-16 in. $16.50; ¼ in. $15.50; 5-16 in. $12.70.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	60/5
Vulcan	50
P.H. and Imperial	60/5
Nicholson	40
Black Diamond	40
J. Barton Smith, Eagle	50
McClennand, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	'60
Great Western-American	50
Kearney & Foot, Arcade	60/5

BOILER TUBES

Size	Seamless	Lapweld
1 in.	18.00	$
1¼ in.	20.00	
1½ in.	19.00	
1¾ in.	20.00	
2 in.	19.00	16.00
2¼ in.	22.00	19.00
2½ in.	25.00	19.00
3 in.	29 00	24 50
3½ in.	34 00	25 00
4 in.	43 00	36 00

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS

Castor Machine Oil, per lb.	34½
Royalite, per gal., bulk	21
Palacine	24
Machine oil, per gal.	33
Black oil, per gal. (Summer)	19
Cylinder oil, Capital	61½
Petroleum fuel oil bbls., net	10.80
Pure turp., single bbls., gal	1 65
Linseed oil, raw, single bbls.	1 10
Premier Gasoline	35½

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	30%
Standard	30 and 10%
Cut leather lacing, No. 1	1 80
Leather in side, (Lacing)	1 60

TAPES

Chesterman Metallic, 50 ft.	$5 00
Lufkin Metallic, 603, 50 ft	3 17
Admiral Steel Tape, 50 ft.	3 00
Admiral Steel Tape, 100 ft.	4 50
Major Jun. Steel Tape, 50 ft.	3 75
Rival Steel Tape, 50 ft.	4 40
Rival Steel Tape, 100 ft.	8 75
Reliable Jun. Steel Tape, 50 ft.	5 25

PLATING SUPPLIES

Polishing wheels, felt	$3 80
Polishing wheels, bull-neck	1.50
Emery in kegs, Turkish	08
Pumice, ground	05
Emery glue	25
Tripoli composition	08
Crocus composition	12
Emery composition	11
Rouge, silver	64
Rouge, powder, nickel	38

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	19
Brass sheets, 24 gauge and heavier, base	21
Brass tubing, seamless	23

WASTE

XXX Extra	16	Atlas	18
Peerless	21	X Empire	13
XX Grand	15	Ideal	18
Superior	20	X Press	11½
X L C R	14		

Colored

Lion	12	Fancy	13½
Standard	10½	Popular	9
No. 1	13	Keen	7½

Wool Packing

Arrow	24	Anvil	16
Axle	20		

Washed Wipers

Select White 18 Dark colored.13
Mixed colored.14
This list subject to trade discount

RUBBER BELTING

Standard 36 .. 28% Best grades 28%

ANODES

Nickel	.55 to .60
Copper	.38 to .40
Tin	.70 to .70
Zinc	.16 to .17

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Copper Bars, ½ to 2 in	$29 00	$28 00
Brass Tube		25
Plain sheets, 16 oz., in. 30 x 72	30 00	29 00
Copper sheet, tinned, 16 oz.	37 00	41 00
Copper sheet, planished, 16 oz. base	42 00	41 00
Braziers', in sheets, 6 x 4 base	30 00	29 00
Copper tubing, seamless		29

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$ 8 75	$ 9 00
Sheets, 3 1-2 lbs sq. ft.	8 50	8 75
Sheets, 4 to 6 lbs. sq. ft.	8 25	9 00

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	.23
Acid, hydrochloric	.03¾
Acid, nitric	.10¼
Acid, sulphuric	.03¾
Ammonia, aqua	.20
Ammonium, carbonate	.15
Ammonium, chloride	.18
Ammonium, hydrosulphuret	.75
Ammonium sulphate	.10
Arsenic, white	.18
Copper, carbonate, anhy.	.32
Copper, sulphate	.08
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.14
Nickel carbonate	.32
Nickel sulphate	.14
Potassium sulphide (substitute)	.40
Silver chloride (per oz.)	.85
Silver nitrate (per oz.)	.65
Sodium bisulphate	.18
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.35
Sodium hyposulphite per 100 lb.	6.50
Sodium phosphate	.15
Tin chloride	.80
Zinc chloride, C.P.	.30
Zinc sulphate	.06

Prices per lb. unless otherwise stated

News From the Industrial Field

64. **Hardware and tools.**—An East London firm request catalogues and prices from Canadian manufacturers of hardware and tools of all kinds.

Montreal.—Cook and Leitch have been given the general contract for the building of warehouse for Masson and Sons of Montreal. Cost will be about $24,000.

63. **Iron and steel.**—An East London firm just starting in business is prepared to consider agency arrangements for shippers in Canada of iron and steel, all kinds.

The general contract for the construction of a factory for the Dominion Wadding Co., on Vinet St., Montreal, has been awarded to B. M. Shaw, 151 Metcalfe St, Montreal.

The Preston Woodworking Machinery Co., Preston, Ont., have secured the contract for the woodworking equipment to be installed in the new technical school, Sarnia. The list includes five lathes, one grinder, band saw, buzz planes, variety saw, surfacer, and mortiser.

Owing to a rule existing at Ottawa that names of firms interested in Canadian goods cannot be divulged except through the Department of Trade and Commerce, we publish below only the key numbers. Those interested can write the Commercial Intelligence branch at Ottawa for further particulars.

A paper tape measure is being rolled into German bolts of cloth arriving at Montevideo, Uruguay. This innovation permits the salesman to tell at a glance the quantity of cloth remaining in the bolt, thus economizing time and labor and preserving the cloth in better condition than when unrolled and re-rolled as required in the usual method of measuring. The tape is about half an inch in width and is marked off in yards and meters.

There is a distinct and steady demand in Belgium for Canadian hand tools of a great variety of types, says A. S. Bleakney, trade commissioner at Brussels. If Canadian firms can lay these tools down at prices which will compete with the United States tools on the market, says Mr. Bleakney, they can undoubtedly do business. Certain Canadian tools, including saws, hoes, rakes and forks, are already on the market, a fact which should encourage other Canadian manufacturers of tools to endeavor to supply a share of the hand tool requirements of this country.

According to a report received from H. M. Trade Commissioner at Wellington, the demand for lorries, particularly petrol-driven, has been considerable since the war. The number of motor trucks in use is much larger than in prewar days, and there is no doubt that their use is capable of still greater increase. At present financial restrictions interfere with purchasing. An extended field for the sale of heavy lorries is opening up amongst the co-operative creameries as the roads improve, and even at present they are fairly important purchasers. The smaller vehicles are being increasingly used by shops and stores for delivery purposes.

74. **Wood pulp.**—A large and responsible English firm in Buenos Aires, at present importing mechanical and sulphite pulp from Scandinavia, desires to establish connections with Canadian mills in a position to supply these products in large quantities, and able to export direct to the Argentine. Correspondence with manufacturers only is desired, and full details of present prices, of capacity for export, terms of payment and proposed conditions of agency should be provided in first letter, together with samples of products. Quotations must be given c. i. f. Buenos Aires. First-class references will be given and required. Also interested in newsprint.

CORRECTION

In a news item appearing in June 22nd issue of Canadian Machinery, an error was made in reporting as members of the directorate of the Parker Motor Car Co., Montreal, Sir Wm. Price, Col. Scott, Frank W. Ross and Thos. Craig. These gentlemen are not directors nor are K. F. Dewar and James Vernon connected with the Company as the article intimated.

P. H. Falter, the new vice-president and treasurer of the Electric Furnace Construction Co., of Philadelphia, Pa., is a graduate of the engineering department of the University of Michigan, and until recently has been vice-president and general manager of the Canadian Electro Products Co., at Shawinigan Falls, Quebec, a subsidiary of the Shawinigan Water & Power Co. Prior to his connection with the Canadian Electro Products Co., he had been general manager of the Baltimore Electric Alloys Co., in the manufacture of ferro-silicon and other electric furnace alloys, and for 13 years with the Aluminum Co., of America, in various capacities, including design, construction and operation of a number of its plants. Mr. Falter was also general manager of the Shawinigan Electro Metals Co., Montreal, manufacturers of metallic magnesium, and he has also had considerable experience on hydro electric power plant work at Sault Ste. Marie and Shawinigan Falls, Canada.

OTTAWA

Carleton County Council has decided to go ahead with the erection of an addition to the Court House to cost around $50,000.

The municipality of Eastview, Ont., requests tenders for the supply of hydrants, cast iron pipe, brass work, pig lead, special pipe casting and service posts up to noon July 10.

The Vimy Realty Co., of Ottawa, has awarded a contract to the Gilmour Construction Co. for a two-storey addition to their premises, 370-374 Sparks Street, Ottawa, to cost $30,000. The present building has been used for garage purposes. The new addition will be used for offices.

Plans for the new Bible House to be erected on Lisgar Street, Ottawa, have been accepted. The building will have a frontage of 22 feet and a depth of 40 feet and will cost $25,000. Work will be put in hand as soon as tenders have been called and the contract awarded. It is hoped to have the building ready for occupation by November 1.

General tenders are asked for the excavation, masonry brick work, reinforced concrete work, hollow tile, structural steel, stone work, carpentry, joiner work, steel casement ornamental iron, painting and glazing, roofing and sheet metal work, electrical conduit and wiring, plumbing, heating and ventilating of the new Collegiate Institute and Vocational school at Renfrew, Ont. Tenders must be in the hands of the chairman of the Board of Education, Renfrew, by 3 p.m., July 18.

A company known as Salvors Ltd. has been formed by Ottawa men to undertake marine salvage work, especially the raising of sunken merchant vessels, by an entirely new method, the invention of Capt. A. G. Midford, of Ottawa. The new method calls for the use of caissons, one for each 250 tons displacement of the vessel to be raised, which are placed on either side of the work with connecting chains that pass under the vessel. Air is then pumped into the caissons while a tug tows the vessel as it is raised, in order to keep it on even keel, until it is awash.

At a meeting of shareholders of Red Arrow Tires, Limited, June 28, it was decided to make an assignment. It was pointed out at the meeting that the only known assets of the company are a partly completed plant, some office fixtures and whatever money belonging to the company may be held by the stock underwriters.

It is expected that nearly $90,000 will be spent by the Hydro-Electric Commission in acquiring new rolling stock for the Guelph street railway.

The Campbell Steel and Iron Works will be awarded the contract for lighting posts on Cummings Bridge, this city, both the city and county having approved this firm's tender.

Anything can be sold in China by personal representation and display of samples, declares a recent trade report. There is a certain demand for large and small engines and electrical equipment of all kinds.

James W. Watson, of the Kitchener Pattern Works, and Albert Wendling, formerly foundry foreman of the Forwell Foundry Co., Kitchener, have launched the Aluminum Last and Metal Company. They will make shoe lasts of aluminum and do general jobbing.

Messrs. Richards and Abra, architects, of Ottawa, have submitted revised plans to the Carleton Place school board for the new high school to be erected there. These call for the erection of a structure, fire proof, to cost in the neighborhood of $90,000. Following acceptance by the board the plans will be sent to Toronto for approval of the provincial Board of Education. As soon as this is given tenders will be called for and it is expected the building work will be put in hand at the earliest possible moment.

Business generally is beginning to feel the effect of the good crop prospects. Lines such as dry goods and groceries are said to be moving better, and merchants state that they find a much better spirit prevailing among the retailers throughout the province. Firmer price tendencies in several lines of cotton and woollen goods, moreover, have tended to stimulate sales of these lines, while the advances recently noted in teas and sugar have caused better buying at the grocery houses. The active building program which is now in progress, moreover, together with railroad and highway work, are giving more employment to the workers, which means more money in circulation and a larger buying power on the part of the general public. Altogether, the outlook appears to be considerably more favorable.

The E. S. Bryant Pattern Works, Windsor, Ont., is a branch of the company of the same name in Detroit, Mich. The Canadian branch was established eighteen months ago, and from the very start have grown until they are now handling a considerable amount of automotive work. They are familiar with all classes of machine molding for production, also match plate work. Patterns that enter into the manufacture of automobiles are made, covering everything, where patterns for castings are required, from cylinder and other large patterns for machine molding, to the smaller patterns which are usually made up in aluminum match plates of several patterns of the same part for snap flask molding. The value of plant equipment is $17,000 and there is a total floor space of 6,000 sq. ft.

Fort William, Ont.—Col. Thomas Gibson, president of the Fort William Paper Co., who are operating night and day a 120 ton capacity pulp mill at the Mission, announces that plans have been prepared for the erection in connection with the pulp mill, of a paper mill with a minimum capacity of 100 tons of newsprint daily. Colonel Gibson stated that material would be assembled for the new industry immediately and they expected to have it in operation by August, 1923. The construction will mean an expenditure of over one million dollars, and the completion and operation of the mill will add approximately one hundred and twenty-five permanent employees to the Fort William company payroll. "We have also in mind plans for the extension of both our ground wood mill and the paper mill," added Colonel Gibson, "and if we have the support of the people of this district, it is our intention to make the Fort William plant a second Spanish River. More than that it is needless to say." The Fort William city council have ratified an agreement with the company meeting their wishes in connection with the proposed new mill.

BELIEVES BIG MARKET EXISTS IN WEST INDIES

"AN IMMENSE market for Canadian goods lies in the West Indies." This was the predominant thought expressed the other day at the C. M. A. convention held at St. Andrews-by-the-sea. Several speakers expressed their opinions, and here are a few excerpts from their statements.

"Canada is the logical supply source of the West Indies in preference to other countries," said Geddes Grant, Trinidad, because there is a subsidized steamship line between the two. Canadian banks are established there and have the highest reputation, and most of the islands have established preferential tariffs with the Dominion. With a population of 2,500,000. West Indies' imports totalled $24,000,000 per year." Mr. Grant emphasized the value of courtesy when buyer and purchaser were so far apart, particularly advising immediate acknowledgment of inquiries or orders.

W. H. Shapley mentioned that if Canada did not pay more attention to the West Indies they would be lost altogether. He remarked that Canada must buy more from the West Indies if the islands were to take Canadian products. Canada now consumed 2 259,000 bunches of bananas a year, but most of these while of West Indian growth, were brought through the United States. Oranges valued at $9,000,000 were bought each year, chiefly from California, to the neglect of the West Indies growth. The bananas alone, if imported directly into Canada, would give 7,000 carloads of traffic to the country's railroads.

BETTER BUYING IN WEST CONDITIONS FAVORABLE

OPTIMISM throughout the West as the result of very encouraging crop prospects is reported by A. S. Capwell, manager Buffalo Forge Co., Kitchener, who has just returned from a trip to the coast. In Winnipeg there is considerable building going on, and at Edmonton, Calgary, and Vancouver there is similar improvement in this industry. On the outward trip the outlook in some sections was not the best, owing to lack of rain, but on returning eastward he found that two or three days' downpour had improved the general spirit.

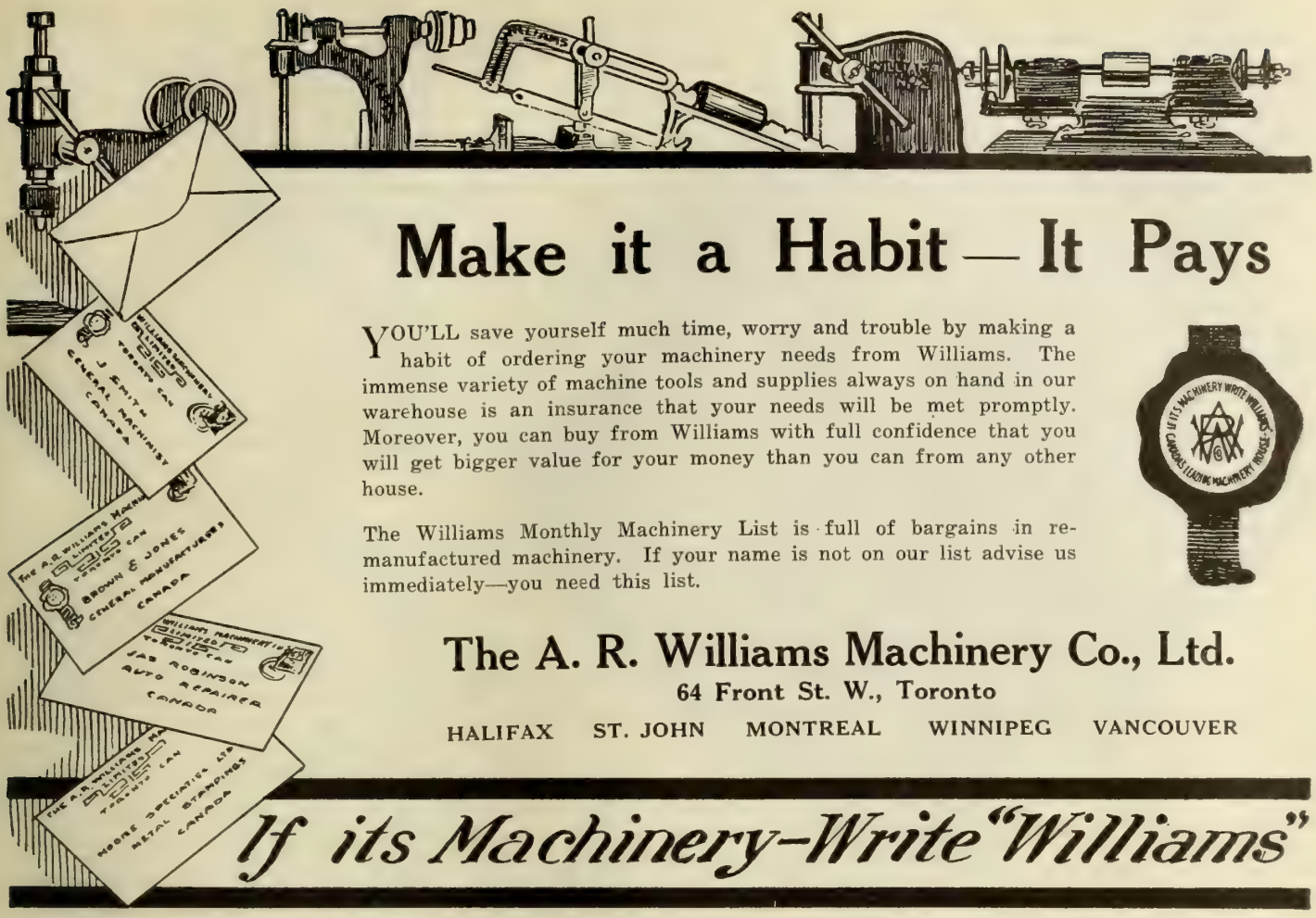
As an instance of the buoyancy caused by a timely rain, Mr. Capwell states that he was able to close business on the return trip which had looked doubtful two weeks before. The rain seemed a blessing to business generally, as well as a boost to crop prospects. At the present time, it appears, the West will bank on favorable weather, and buying improves accordingly.

At Trail, B. C., and also at Britannia, B. C., the copper mines are installing much new equipment. The lumber industry on the coast appears to be developing a boom. The domestic and export demand has improved, and a recent advance of $4 a thousand is reported. A thriving condition in the prairie provinces, brought about by bumper crops, will be welcomed by the B. C. lumber industry. It means the re-opening of a market that has been indifferent for some time.

On his return from the West Mr., Capwell was called to the general sales conference held at the head office of his company in Buffalo. Here the entire sales staff of the Buffalo Forge Co., Buffalo Steam Pump Co., and the Squier Co., the latter manufacturers of sugar-working machinery, was assembled, thoroughly representing United States fields, and it is significant that all reports pointed to greatly improved conditions.

SUBMARINE ENGINES FOR ELECTRIC POWER STATIONS

War, it is a comfort to reflect, has its uses for times of peace, especially when it involves the capture of valuable engineering plant. When Germany surrendered its submarines, six of the engines thus provided were installed in a British electric power station, the total cost being about half the ruling cost of ordinary engines of a similar capacity. The engines were thoroughly overhauled and reconditioned by a British engineering firm before being put into action again; and as they were oil-driven they proved of great value during the coal strike last year. They have also proved much more economical than the steam-driven sets which previously did the work in that station.



Make it a Habit — It Pays

YOU'LL save yourself much time, worry and trouble by making a habit of ordering your machinery needs from Williams. The immense variety of machine tools and supplies always on hand in our warehouse is an insurance that your needs will be met promptly. Moreover, you can buy from Williams with full confidence that you will get bigger value for your money than you can from any other house.

The Williams Monthly Machinery List is full of bargains in re-manufactured machinery. If your name is not on our list advise us immediately—you need this list.

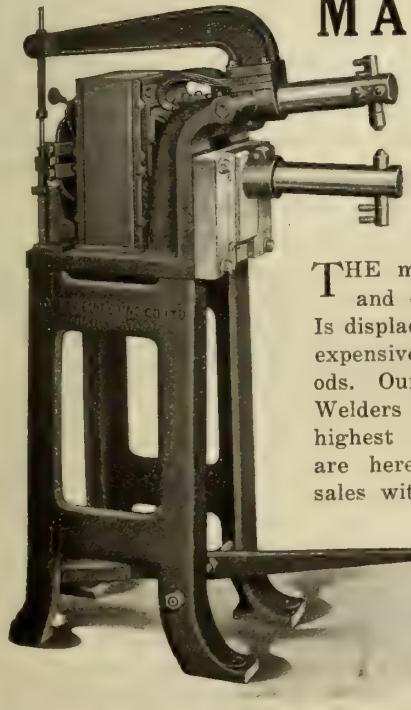
The A. R. Williams Machinery Co., Ltd.

64 Front St. W., Toronto

HALIFAX ST. JOHN MONTREAL WINNIPEG VANCOUVER

If its Machinery—Write "Williams"

ELECTRIC WELDING MACHINES



The Cost-Reducing Method

THE most economical and effective method. Is displacing the slow and expensive riveting methods. Our Canadian-made Welders will give you the highest service, for we are here to follow our sales with Service.

Illustration Shows our standard Spot Welder, adaptable for all classes of Spot and Lap welding up to ⅛ in. thick.

GLOBE ENGINEERING CO., LTD.

125 MARY ST. - HAMILTON, ONT.

MACHINERY FOR SALE

Lathes

1—26″x12′ Pond Lathe, S.B.G., C.R., P.C.F.
1—24″x12′ New Haven Lathe, D.B.G., S-Q.C.G., C.R.
1—24″x12′ Can. Mach. Lathe, S.B.G., C.R., P.C.F.
1—21″x10′ London Lathe, S.B.G., C.R., P.C.F.
4—20″x 8′ C.M.C. Lathes, D.B.G., S-Q.C.G., C.R.
1—18″x 8′ C.M.C. Lathe, D.B.G., Q.C.G., C.R.
1—21″x10′ Butler Lathe, D.B.G., Q.C.G., C.R.
1—16″x 6′ McDougall Lathe, S.B.G., S-Q.C.G., C.R.
1—18″x 8′ C.M.C. Lathe, D.B.G., Q.C.G., C.R.

Shapers

1—24″ Rockford Shaper.
1—12″ Port Hope Shaper.
1—16″ Hendey Friction Geared Shaper.

Drills

1—No. D-1 H.D. Colburn Drill.
2—No. 24 H.D. Foote Burt Drills.
1—28″ Barnes Drill, B.G., P.F.
1—22″ Barnes Drill, B.G., P.F.
16″—Back-geared Drill, lever feed only.

Miscellaneous

2—2″x26″ Pratt & Whitney Turrets.
1—No. 2 Gardner Disc Grinder.
1—3″ Acme Bolt Cutter.
1—No. 54 Perkins Sprue Cur.
1—No. 320 Brown-Boggs Press.
1—10″x24″ Plain Landis Grinder, self-contained.
Union Triplex Hydraulic Pump, 1¼″x4″.

YEATES MACHINERY

HALE STREET
LONDON, ONT.

Brig. Gen. T. L. Tremblay, C. M. G., D. S. O., has been appointed general manager and chief engineer of the Quebec Harbor Commission, and will continue to perform his duties as Harbor Commissioner.

The extension now being constructed to the factory of the Steel Trough and Machine Co., at Tweed, Ont., will give an additional 5,000 sq. ft. of floor space. This firm specializes in the manufacture of heavy sheet metal products.

The Volta Mfg. Co. of Welland, Ont., has just received an order for a standard three-ton capacity electric steel furnace, with transformer and switchboard equipment complete, from Renton & Fisher of the Hopetown Steel Works, Bathgate, Scotland.

Several changes among the C.P.R. officials are announced. Alfred Price after 40 years service latterly as general manager of Eastern lines, is succeeded by John F. Scully. Geo. Hodge, assistant to Vice-President McTier, becomes assistant general manager Eastern lines.

Contracts for machine tools for Sarnia Technical School have received departmental approval. An order has been placed with Canadian Fairbanks Morse for one milling machine, one shaper and one tool and cutter grinder. The Chas. A. Strelinger Co., Windsor, received an order for lathes, and heat treating furnaces. The woodworking machinery was placed with Preston Woodworking Machinery Co., Preston, Ont.

The Herbert Morris Crane and Hoist Co., Niagara Falls, Ont., announce in connection with their organization in United States (Herbert Morris, Inc.) the opening of offices and warehouses in Boston, New York, Chicago, Detroit and Buffalo. In the latter city a manufacturing plant has been established. The company's representatives in these cities are: Boston, R. Gillespie; New York, D. E. Hamilton; Chicago, A. C. Perrin; Detroit, J. B. Candlish; Buffalo, W. C. Kuebrick.

While being hoisted into a second story window, a heavy iron lathe fell to the pavement, 25 feet below. The six men of the cartage crew, having the job in hand, had a narrow escape. In hoisting the machine they had rigged a block and tackle attaching one end of the rope to the lathe and the other to a truck, which was hauling the lathe into the air, when a delivery car drove into the rope and snapped it. The men jumped aside. The driver of the delivery car, who failed to see the rope, declares that it was unguarded, and it is stated that the charge of obstructing traffic will be preferred against the cartage company for obstructing traffic.

Employment service officials state that, recently, some very fine young men have come out from England under the auspices of an organization known as the Church Army. These youths have had some agricultural training, the system embodying three months with horses, three with cattle, three in dairying and three in carpentry. It is told of one of these youths, who sported spats, a cane, a stiff hat and other evidences of superiority, that, on being asked if he could milk cows, replied with some traces of timidity. "Well, I have milked an English cow, but I may not know your Canadian animal." The farmer who was negotiating the matter pointed out that the Canadian cow had nothing on the English breed, and a deal was closed. These boys are picked up rapidly at a wage of about $18 monthly.

John McPherson Taylor, eldest son of John M. Taylor, president and general manager of the Taylor-Forbes Co., Guelph, died June 30, after a brief illness Mr. Taylor was born in Toronto in 1889. At the time of his death he was assistant to the general manager of the Taylor-Forbes Co. He is survived by is wife, four sons, two sisters and two brothers.

Building permits issued during the first half of 1922, ending June 30 in Ottawa totalled $2,385,241 as compared with $1,165,570 in the corresponding period of 1921, or an increase of $1,219,671. For the month of June alone the amount of new construction authorized was $421,600 and the number of permits issued 101 compared with 70 permits with a valuation of $163,585 in June 1921.

EXPANDING THE MARKET FOR RAW MATERIAL

(Continued from page 64)

economies of construction, more highly fire resistive construction, consequent reduction of national fire losses—a distinct service to the public, an establishment of a certain amount of resultant good will, and an extension of the market for cement.

We distributed several million educational-informational booklets last year. These discussed the advantages of the use of cement in the form of concrete construction in many fields. Concrete on the Dairy Farm, and around the home, are typical titles and we have a series of booklets devoted strictly to concrete construction in specialized structural fields. These are continually revised by incorporation of the latest information disclosed by study, research or experience and are in that way kept up to date.

We use miles of motion picture films. We have a film showing the numerous processes involved in the manufacture of portland cement. It does not require a high order of intelligence after having seen this film to realize a sack of cement represents the combined expense or cost of many operations, one of which, for example, is the use of 50 pounds of coal.

The advantages of paved barnyards are displayed through the medium of animated cartoon films circulated in rural communities. We have many reports showing that after a local cement dealer had displayed one of our animated cartoon films in his community, he sold within a week or ten days cement for several concrete feeding floors. Of course, we have no connection with cement dealers other than placing at their disposal motion picture films or other educational matter which they may wish to use in the immediate furtherance of cement sales. Occupying this unique position with relation to the industry, we can devote our whole time and such talent as we have to further expansion or extension of our educational methods and to the development of new ones.

BOOK REVIEW

The June issue of The Empire Mail is a special number commemorative of Empire Day, and contains a remarkable series of messages from eminent men in many spheres of Imperial thought and activity. The Marquess Curzon, Foreign Secretary, writing on the present depressing symptoms, says these will not endure, and calls upon the Commonwealth of free British nations to solve its own problems and thus set an example for other countries.

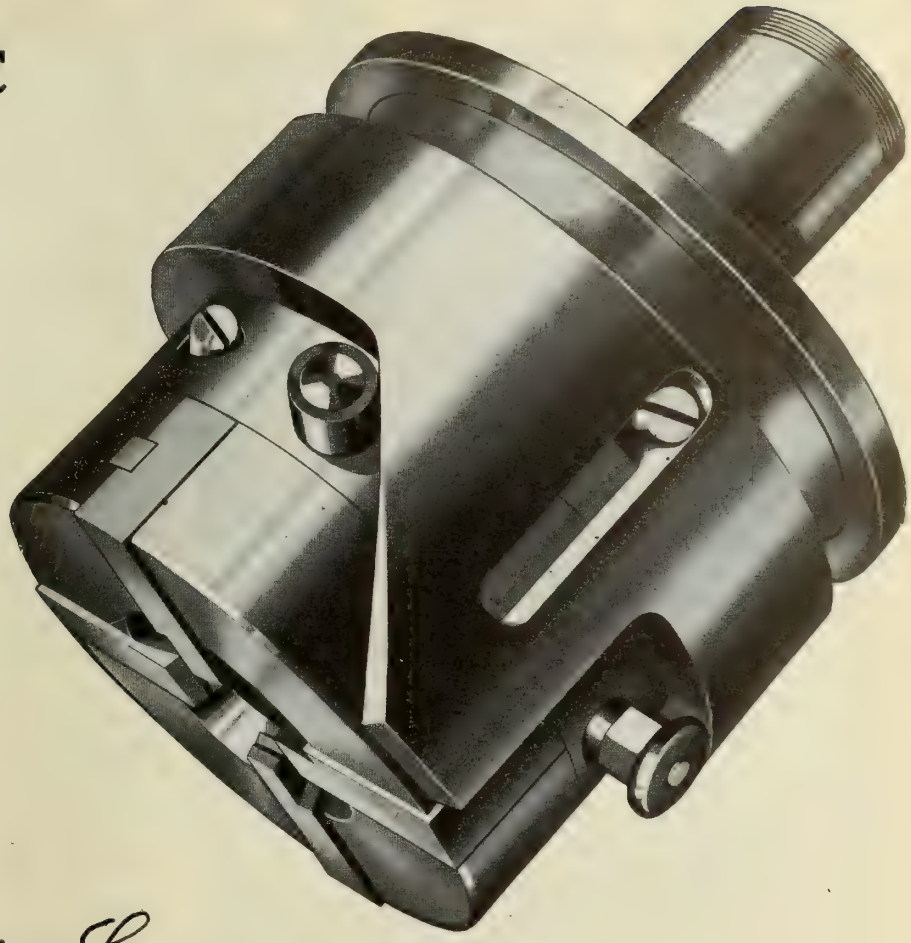
Mr. Winston Churchill, Colonial Secretary, urges firmness, coolness and patience upon all loyal and faithful subjects of the King. Other contributors to the Number include Lord Lee, First Lord of the Admiralty; Mr. Edward Shortt, Home Secretary; Sir Hamar Greenwood, Chief Secretary for Ireland: Sir A. Griffith-Boscawen, Minister of Agriculture; Mr. F. G. Kellaway, Postmaster-General; Lieut.-Col. Amery, M. P.; Lord Burnham; Sir Eric Geddes; Mr. Walter Runciman; Field Marshall Sir Henry Wilson, M. P.; General Bramwell Booth, and many others. Taken in all, it is a splendid issue and well worthy of notice. We have not space to comment on even a small percentage of the features.

MACHINE TOOL MERGER

It is stated that negotiations have been completed for the amalgamation of a number of machine tool firms having an aggregate capitalization of $30,000,000. The new enterprise will be known as The Consolidated Machine Tool Corp. of America. Among the firms mentioned in the report are the Betts Machine Co. of Rochester; Colburn Machine Tool Co., of Rochester; Colburn and Jones Co., of Wilmington; the Modern Tool Co. of Erie; and the Newton Machine Tool Works of Philadelphia. The offices of the new corporation are at 17 East Forty-second St., New York.

The Hunter Bridge and Boiler Co., of Kincardine, Ont., has been awarded the contract for the steel work in connection with the new bridge over the Sangeen River in Brant Township.

GEOMETRIC ROTARY DIE-HEAD



Right in the Lead

One of the Die Heads that has put production on the increase and costs on the decrease.

This Rotary Die Head, which made itself famous on the Geometric Threading Machines, is adaptable for rotating on other types of machines, such as Drill Presses, Bolt Cutters, etc.

Let us know the machine on which you desire to use the Geometric Rotary Die Head, and a suitable shank will be applied.

To Get Quick Production of Screw Threads Without Waste, Try a Geometric. They are sent on trial to Reliable Concerns.

THE GEOMETRIC TOOL COMPANY

NEW HAVEN **CONNECTICUT**

CANADIAN AGENTS:

Williams & Wilson Ltd., Montreal.

The A. R. Williams Machinery Co., Ltd., Toronto, St. John, N.B., Halifax, N.S., Vancouver, B.C.

Expanding The Market For Raw Materials

Each Branch of Industry Is Related More or Less to the Other, and a Cessation of Activity in One Is Sure to React on the Others —Educational Methods Have Brought Results

By H. COLIN CAMPBELL

PROBABLY no one will ever complete a list of all ways and means to expand markets for raw materials. Certainly a dominating method is to know as much as seems possible about the adaptability of such materials. This known, it is evident that one can then direct his attention toward seeing that they are used so that the best results possible will be realized. The ways of using any given raw materials may be numerous. Steel intended for horseshoes does not pass through the same processes as steel converted into watch springs.

Many people if asked to give the dictionary definition of raw materials might be unable to do so. They would, however, be able to make clear their understanding of the term by mentioning wool, cotton, iron, clay, and a great variety of other materials which in their basic form are of little or no use to mankind. These materials acquire real value to mankind only after having been put through one or several manufacturing processes which convert them into what is commonly called finished products.

To the man who needs a suit of clothes, its equivalent weight of unspun wool or unwoven yarn is worthless. The man who needs mortar to lay cut stone, brick, or concrete sees nothing that will satisfy his need in the mountain of rock, which after being put through a multiplicity of processes becomes portland cement. Yet the mountain of rock has a distinct value because a market has been made for it through the discovery that when put through certain processes it will become one of the strongest binding or bonding materials known.

However, portland cement even after having reached the dignity of a manufactured product is still a raw material until those who are to use it know and supply the way and means necessary to most efficient and effective use. Likewise, a suit of clothes remains raw materials so far as the individual purchaser is concerned if it is so small that he cannot get into it or due to any other fault he cannot obtain in satisfaction or service the equivalent of its price.

I believe the unqualified statement may be made that no manufacturing concern and no producer of any raw material, as first defined, can separate or isolate himslf from the many and varied enterprises going on about him if he expects success. A careful study will disclose a lead which shows his relation to, and interdependence upon many other enterprises, seemingly remote from his commonplace individual interests, and of vital concern to the ultimate and continued success of his business.

If I happen to refer frequently to, or dwell at some length upon the manner in which the Portland Cement Association endeavors to expand the logical market for cement, I hope you will accept as the reason the fact that in our methods are found as striking examples as can be to illustrate ways and means of expanding markets.

Inter-Relation of Operations

The discovery that a mountain of raw materials could be converted into a product known as portland cement is in itself an illustration of the expansion of markets. There are not far from 100 distinct operations that must be performed before a sack of cement can be turned over to a prospective purchaser as a product ready for use. Each one of these operations requires some related operation, manipulation, or process, the use of some device, the carrying out of some method that calls for machinery, fuel to drive it, laboratory work of a high order to determine quality. In other words, the seemingly simple process of tearing down a mountain and putting it through a sieve makes, sustains, and expands markets for a variety of other raw materials in direct ratio to the demand developed for the finished product.

If cement mills were to be shut down because there were no longer any demand for their output, there would immediately follow a reduced market for iron and steel, a great variety of tools, machines, dynamite, and other things necessary to equip and operate such plants. As a result there would naturally follow the loss of a field for the sales efforts formerly directed toward securing purchasers for the product normal to the abandoned industry. In other words, the far reaching effect of continuance or suspension of cement manufacture would soon become evident.

The development of the automotive industry has caused a great deal of latent talent and inventive genius to become productive, which has created wealth by expanding established markets not only for well known materials but has created markets for new ones. An automobile requires grades of steel and other products that were unknown or not in special demand before the motor vehicle became established. Inventive and research genius were directed toward making the discoveries that would produce the necessary steel with the required chemical and physical properties. As a result raw or basic materials that before had never entered into commerce found a market had been established for them.

A luxurious car requires special upholstery, many trappings and trimmings that add to utility as well as convenience. All of these are regarded as necessities to the car owner and for that reason are recognized articles of commerce. The demand for them, created by taste, pride, avarice or what not, has been reflected in new demands on the textile, steel, and related industries which you can readily enumerate for yourself.

The Portland Cement Association is purely a voluntary organization. In popular conception, it is classed with other organizations referred to as "trade associations." While there are other associations operating as we do, I think it safe to say that our method of operation is unique in that it has greater ramifications than any other organization with which we may be compared.

Practically all of the cement manufacturers in the United States and Canada belong to the Portland Cement Association. We have members even in Cuba, Mexico, and South America. The fact that we have these foreign members may seem strange to you when I tell you that the association is not in any way concerned in the commercial aspects of the cement industry. The reason for this foreign membership is undoubtedly due to the far reaching effect of our educational work and the inestimable value which cement manufacturers place upon it as an aid to stabilizing and expanding the market for their product.

We have twenty-four offices conveniently located in different parts of the country. The underlying idea of the association is expressed in that often used, much abused and sometimes meaningless word "service." Our headquarters in Chicago are the executive center for all of the activities in which we engage. Each district office is a service organization like our headquarters office but on a smaller scale, although sufficiently comprehensive to quickly and efficiently serve the territory of which it is local headquarters. Depending upon the number and intensity of various campaigns we may be engaged in, our staff averages around 300. Most of our men are technically trained—usually civil engineers. Also most of them are, or soon become peculiar engineers

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Author is manager of advertising and publications bureau Portland Cement Association, Chicago, and this material is a portion of some facts he presented before the First National Industrial Advertising Conference at Milwaukee, Wis.

ATKINS
METAL CUTTING SAWS

Solve your Metal Cutting problems, easily, quickly and economically, by adopting the products made by

ATKINS

We make Kwik-Kut Power Hack Saw Machines which use practically the full cutting edge of the Hack Saw Blade at each stroke; Metal Cutting Band Saw Machines for general shop work, cutting all classes of metal up to 12 x 14 inches.

Your requirements for Metal Cutting Circular Saws can be supplied promptly and we solicit a trial of our "AAA" Non-Breakable and Power Hack Saw Blades and Frames.

"A Better Saw for Every Use"

E. C. Atkins & Co.

Established 1857

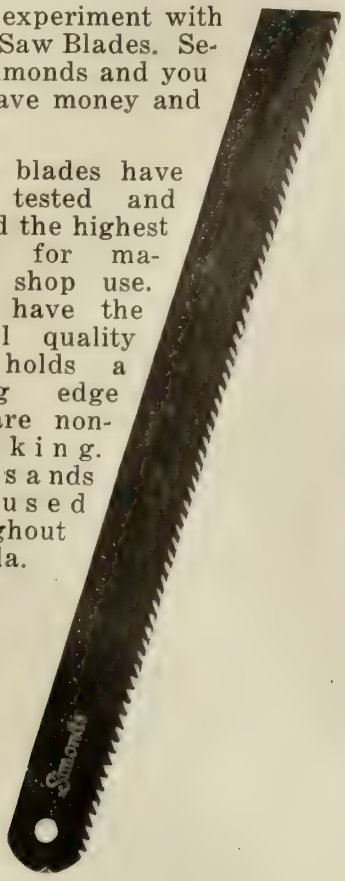
"The Sterling Quality Saw People"

Factory: HAMILTON, ONT. *Branch:* VANCOUVER, B. C.

SIMONDS
Hack Saws

Don't experiment with Hack Saw Blades. Select Simonds and you will save money and time.

These blades have been tested and proved the highest grade for machine shop use. They have the steel quality that holds a cutting edge and are non-breaking. Thousands are used throughout Canada.



Simonds
Canada Saw Co., Ltd.
"The Saw Makers"
Montreal, Que.
St. John, N.B. Vancouver, B.C.

in that they are able to keep their technical or professional training from interfering with the ability to put their ideas and aid in such form as to make popular consumption easy. They are trained in promotion. They are salesmen who have nothing to sell but an idea, which is "Concrete for Permanence."

Our headquarters, as well as various district offices are departmentized. Specialists are delegated to various classes are best suited. Agriculture, building construction in its broadest sense, sanitation, highway engineering, from the simplest to the most stupendous structures required in any given field, are all reduced to terms of concrete.

Probably the backbone of our whole educational scheme is in our structural materials research laboratory, operated jointly and in co-operation with the Lewis Institute, Chicago. Here a large corps of practically trained technical men are engaging in research work on the various uses of cement and concrete. Since 1916 considerably more than 100 000 chemical and physical tests have been made in this laboratory solely to determine how best to use concrete, as well as how not to use it—in other words, discovering and establishing the possibilities of cement as expressed in concrete construction.

Learning All the Time

In spite of the fact that the Association is twenty years old, and during all that time has been attempting to further knowledge on the use of concrete, it may startle you to know that within the last seven or eight years we have learned more about how, and how not to use it than was known in all the years before.

The evident advantages of concrete construction were early recognized and tempted many to write their own specifications, so to speak, for using the material, with the natural result that cement—the principal ingredient—was discredited because of faulty use. It was evident, therefore, that practical guidance, based on scientific knowledge and established facts, was necessary to prevent abuse of a worthy material.

Until within comparatively recent times, nothing was known as to the effect which clay and other impurities as an admixture with the sand and pebbles used in concrete might have on the strength of a finished structure. Studies have been made in our laboratory on the effect, size and grading that aggregates have on concrete, the effect of using different types of aggregates, the effect of various impurities in aggregates, the effect of various powdered admixtures in portland cement such as coloring matter and hydrated lime used for a definite purpose, the effect of impure mixing water such as impurities caused by industrial waste, etc.

At first glance these studies might seem as having but remote connection to expansion of the market for cement.. However, as an example, our studies on the effect of size and grading of aggregates as related to a concrete mixture have been most forcibly illustrated on a piece of concrete highway construction now in process in the Imperial Valley, California. At the quarry where aggregates were being obtained for the concrete used in this pavement, methods employed in screening the crushed stone for the concrete mixture caused a waste of 35 per cent of the materials taken from the quarry. One of our field engineers, who was interested in watching the progress of this work and was rendering the usual co-operative service to those in charge, suggested that a change in the methods of screening materials, based on our laboratory tests, would considerably reduce this waste of materials. His suggestion was adopted with the result that a waste of only 15 per cent. followed changed methods in screening. Instead of costing $1 a ton to prepare, the stone then cost 42 cents, or expressed in dollars, $30,000 were saved, which made it possible for the community concerned to build an extra mile of concrete road. This of course is not the only example of its kind. It is, however, the most recent one of such magnitude.

Among the various classes of educational work that we carry on are lectures before agricultural colleges, farmers' institutes, engineering colleges and universities, co-operation with county agents, architects, engineers, contractors, building commissioners, having to do with revision or writing of building codes, vocational schools in which we endeavor to establish simple courses in manual training through the use of concrete, etc. You will also find our field engineers on many a piece of concrete construction serving in an advisory, consulting or inspecting capacity in co-operation with the engineers, contractor or architect under whose immediate supervision the project is going on. We also have a motor truck with complete concreting equipment and gang giving demonstrations in the actual "how," travelling throughout various parts of the country.

A rather amusing controversy took place not long ago among our district engineers. The question was being argued just how far the functions of an association fieldman should go in rendering the service for which the Portland Cement Association stands. It finally sifted down to an agreement that if there was a job going anywhere these days and one of our men was found on the job without concrete on his shoes, he was certainly not running true to form.

We have assisted a great many aspiring men to go into the contracting field, specializing in concrete construction. We have promoted through educational work a higher standard for building codes in many cities and are continuing this work everywhere that our aid is asked. The result of this is certain to be expressed ultimately in

(Continued on page 60)

Making Fine Tools

An Interesting Operation, Economically Performed by Means of a DUMORE Grinder

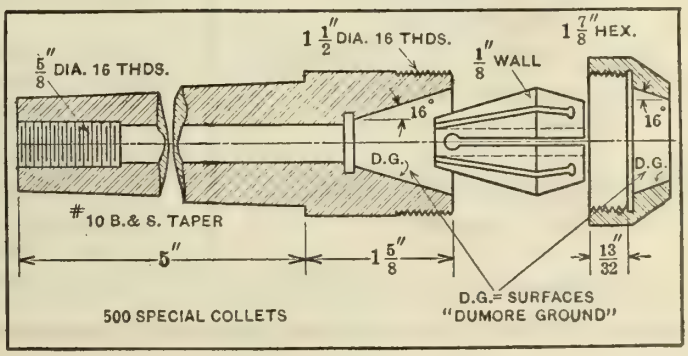
This photograph — taken at the City Engineering Company's (Dayton, Ohio) plant shows a Dumore Grinder finishing the main shank and head of a special draw-in collet. There were 500 put through in this special lot and the time for the operation shown averaged 8 minutes per piece.

The second operation; grinding the internal face of the collet nut, was also performed by this convenient precision tool.

Dumore Grinders are popular here as in every plant where fine tools are made. Their accuracy makes them useful for the finest finishing work; their simplicity and convenience make them practical for many difficult, almost inaccessible jobs.

Dumore Grinders transform any lathe into a precision grinder; they make fine finishing possible in every machine shop.

May we tell you more about them?



WISCONSIN ELECTRIC COMPANY

2947 SIXTEENTH STREET - - RACINE, WISCONSIN

DUMORE HIGH SPEED GRINDERS

Classified Opportunities

Two cents a word, including "Canadian Machinery" box numbers; minimum charge is $1.00 per insertion for 50 words or less, set in 6-pt. type. Each figure counts as a word. Display ads., or ads. set in border, are at the card rates.

PATENTS

The old established firm. Patents everywhere. Head Office, Royal Bank Bldg., Toronto. Ottawa Office, 5 Elgin St. Offices throughout Canada.—Booklet free.
FETHERSTONHAUGH & CO.

PATTERNS

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CLOSING TIME

Advertisements for this section must be in our composing room Tuesday morning prior to day of issue.

In order that the announcements of your wants, machinery for sale, etc., etc., shall not be delayed, please try to have them in our office with the Tuesday morning mail.

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See Advertisement Page 8

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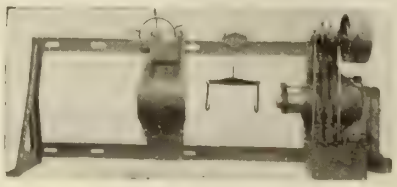

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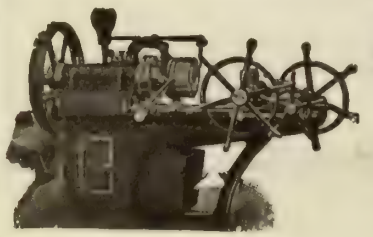

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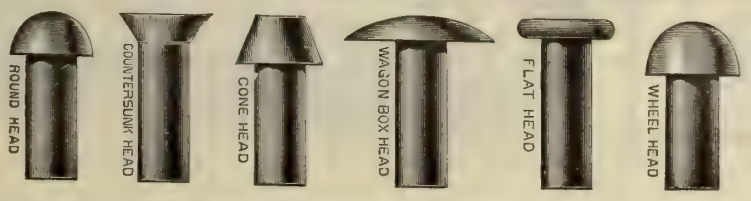

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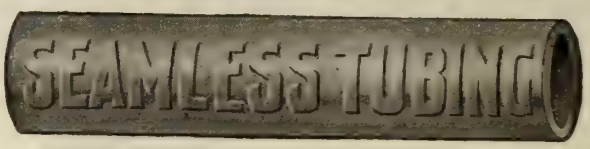

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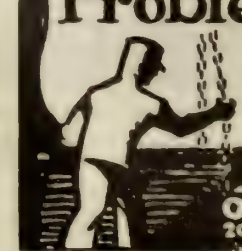

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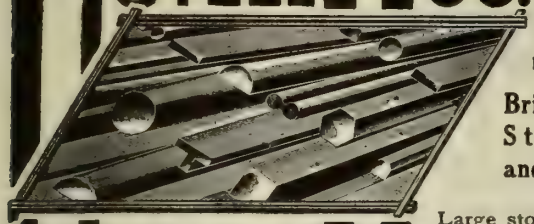

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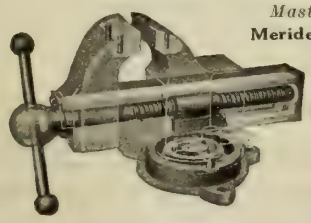

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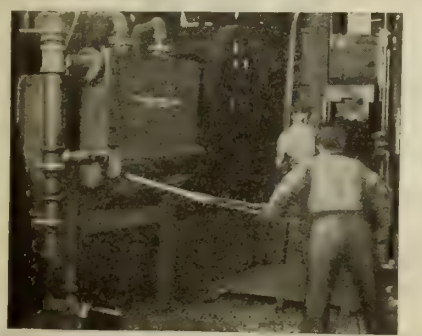

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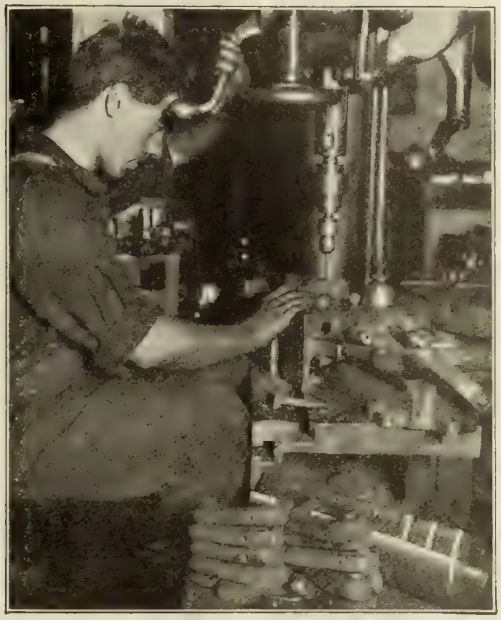

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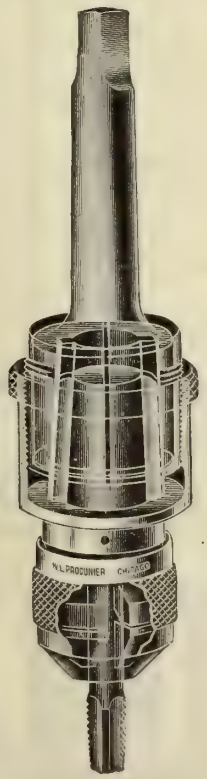

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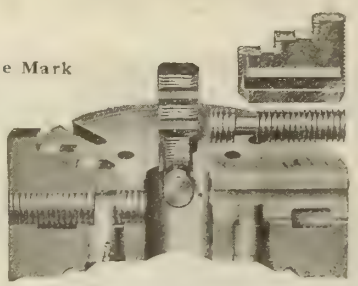

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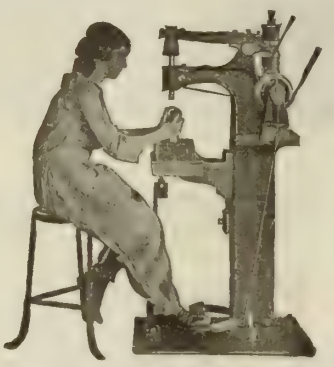

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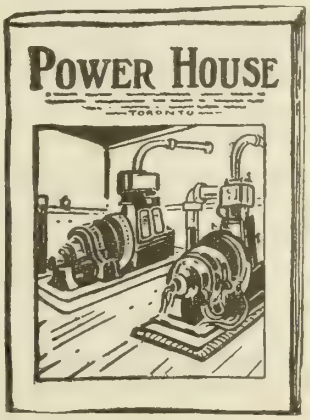

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Canadian Machinery BUYERS DIRECTORY

If what you want is not here, write us, and we will tell you where to get it. Let us suggest that you consult also the advertisers' index— last page of book, after having secured advertisers' names from this directory. The information you desire may be found in the advertising pages. This department is maintained for the benefit and convenience of our readers. The insertion of our advertisers' names undr proper headings is gladly undertaken, but does not become part of an advertising contract.

ABRASIVE DISCS
J. R. Baxter & Co., Ltd., Montreal, Que.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John, London, S.E., Eng.

ABRASIVE MATERIALS
J. R. Baxter & Co., Ltd., Montreal, Que.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John, London, S.E., Eng.

ACETYLENE, DISSOLVED
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Toronto.
Liquide Air Company, Toronto.

ANCHOR BELTS
Steel Co. of Can. Ltd., Hamilton, Ont

ANGLE BARS
Steel Co. of Can. Ltd., Hamilton, Ont.

ANVILS
Atkins & Co., Inc., E.C., Indianapolis, I.
Petrie, Ltd., H. W., Toronto, Ont.

ANCHOR BOLTS
Steel Co of Can., Ltd., Hamilton, Ont.

ANGULAR HOLE DRILLING TOOL
Globe Engineering Co., Ltd., Hamilton, Ont.

ARBORS
Atkins & Co., Inc., E. C., Indianapolis,
Brown & Sharrpe Mfg.Co., Providence,R.I
Jacobs Mfg. Co., Hartford, Con.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.

BELLS, BRASS, BRONZE and STEEL
Canada Foundries & Forgings Co., Welland, Ont.
Canadian SKF Co., Toronto, Ont.

BARRELS, TUMBLING
McDougall Co., Ltd., R., Galt, Ont.

BARS, BORING
Armstrong Bros. Tool Co., Chicago, Ill.
Bertram & Son Co., td., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

BARS, BORING, PORTABLE
Underwood Corp., H. B., Philadelphia.

BARS, STEEL
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
British Empire Steel Corporation, Montreal, Que.

BEARINGS, BALL
Canadian SKF Co., Toronto, Ont.

BEARINGS, ROLLER
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

BELT CEMENT
McLaren Belting Co., J. C., Montreal, Que.

BELT DRESSINGS AND FILLERS
Dom. Belting Co., Ltd., Hamilton, Ont.

BELT FASTENERS
Bristol Company, Waterbury, Conn.
McLaren Belting Co., J.C., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

BELT HOOKS
Bristol Co., Waterbury, Conn.

BELT LACING
Bristol Company, Waterbury, Conn.
McLaren Belting Co., J. C., Montreal,

BELT LACING, STEEL
Bristol Company, Waterbury, Conn.

BELT LACING MACHINES
McLaren Belting Co., J. C., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

BELTING, CHAIN
Can. Link-Belt Co., Toronto, Ont.
Fittings, Limited, Oshawa, Ont.
Jones & Glassco, Montreal, Que.
Renold (Hans) of Canada, Ltd., Montreal, Que.

BELTING, FABRIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Dom. Belting Co., Ltd., Hamilton, Ont
McLaren Belting Co., J. C., Montreal, Que.

BELTING, LEATHER
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Can. Fairbanks-Morse Ltd., Montreal, Q.
McLaren Belting Co., J. C., Montreal, Que.
Smith Belting Co., Toronto, Ont.

BOLTS AND NUTS
British Empire Steel Corporation, Montreal, Que.
Fittings, Limited, Oshawa, Ont.
National Acme Co., Montreal, Que
Petrie, Ltd., H. W., Toronto, Ont

BOLT THREADING DIE HEADS
Landis Machine Co., Inc., Waynesboro Pa.

BOLTS, TRACK
Steel Co. of Canada, Ltd., Hamilton, Ont.

BORING and TURNING MILLS, Vertical
Bertram & Sons Co., Ltd., The John Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

BORING, DRILLING and MILLING MACHINES, Horizontal.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
Landis Tool Co., Waynesboro, Pa

Vertical
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
McDougall Co., Ltd., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont
Rockford Drilling Machine Co., Rockford,

BORING TOOLS
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.

For list of Dealers see the last page of This Buyers Directory

BELTS, ABRASIVE
Oakey & Sons, Ltd., John, London, S.E., Eng.

BENDING MACHINES, POWER
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bertrams Ltd., Edinburgh, Scotland.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

BILLETS, BLOOMS and SLABS
Steel Co., of Can. Ltd.,- Hamilton, Ont.

BLOCKS
Wright Mfg. Co., Lisbon, Ohio.

BLOCKS, CHAIN (See Hoists, Hand)
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

BLOCKS, DIE
Canada Foundries & Forgings Co., Welland, Ont.

BLOCKS, PILLOW
Can. Link-Belt Co., Toronto, Ont.

BLOWERS
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

BOILERS, LOCOMOTIVE
Goldie & McCulloch Co., Ltd., Galt,

BOLT AND NUT MACHINERY
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Montreal, Que.

BOLT AND NUT MACHINERY, Automatic
National Acme Co., Cleveland, Ohio.

BUCKET CARRIERS, Pivoted
Can. Link-Belt Co., Toronto, Ont.

BUFFERS
Pryibil Machine Co., New York, N.Y.

BUFFING OR POLISHING MACHINES
(See Polishing and Buffing Machines)
Blount Co., J. G., Everett, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Pryibil Machine Co., New York, N.Y.
U. S. Electrical Tool Co., Cincinnati, O.

BUILDING MATERIALS
Bertram & Son Co., Ltd., The John Dundas, Ont.

BURNERS, OIL AND GAS
Rockwell Co., W.S., New York City.

BURRS
Steel Co of Can. Ltd., Hamilton, Ont

CABINETS, OIL
S. F. Bowser & Co., Ltd., Toronto, Ont

CALIPERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Starrett Co., L. S., Athol, Mass.

CAMS
Canada Foundries & Forgings Co., Welland, Ont.

CAN-MAKING MACHINERY
(See Sheet Metal Working Machinery)
Brown, Boggs & Co., Ltd., Hamilton, Ont
Bliss Co., E. W., Brooklyn, N. Y.
Smooth Mfg. Co., Jersey City, N. J.

CARBONIZING
Chapman Double Ball Bearing Co., Toronto.

CEMENTS, IRON CENTERING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont
Garlock Machinery, Ltd., Toronto, Ont

CHAINS (See Sprockets and Chains)
Reynold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg Co., Lisbon, Ohio

CHUCKS, DRILL
Jacobs Mfg. Co., Hartford, Conn.

CASTINGS, ALUMINUM, BRASS, BRONZE, COPPER, DIE-MOLDED, FERRO-ALLOY, IRON, SEMI-STEEL, STEEL.
See "Where to buy your castings" Section. Page number may be found by turning to Advertisers' Index.

CHAINS, DRIVING
Can. Link-Belt Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Glassco, Montreal, Que.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

CHASERS
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, a.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CHUCKING MACHINES
Acme Machine Tool Co., Cincinnati, O.
Brown & Sharpe Mfg. Co., Providence, R. I
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

CHUCKS, DRILL AND TAP
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canadian SKF Co., Toronto, Ont.
Cushman Chuck Co., Hartford, Conn.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg., New Britain, Conn.

CHUCKS, LATHE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Cushman Chuck Co., Hartford, Conn.
Geometric Tool Co., New Haven, Conn.
Gisholt Machine Co., Madison, Wis.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pryibil Machine Co., New York, N.Y.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

CHUCKS, MAGNETIC
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CHUCKS, PLANER
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cushman Chuck Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn
Union Mfg. Co., New Britain, Conn.

CHUCKS, TAPPING
William L. Procunier, Chicago, Ill

CHUCKS, VERTICAL BORING MILL
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis
Skinner Chuck Co., New Britain, Conn
Union Mfg. Co., New Britain, Conn.

CLAMPS, MACHINISTS'
Brown & Sharpe Mfg. Co., Providence.
Starrett Co., L. S., Athol, Mass.

CLEANERS, METAL, WASTE, GENERAL
Oakley Chemical Co., New York, N. Y.

CLOCKS
Chicago Watchman's Clock Co., Chicago.
Hardinge Bros., Limited, Toronto, Ont.

CLOCKS, TIME
Gisholt Machine Co., Madison, Wis

CLOCKS, WATCHMEN'S
Chicago Watchman's Clock Co., Chicago, Ill.
Hardinge Bros., Limited, Toronto, Ont

BUYERS' DIRECTORY

CLUTCHES, FRICTION
Can.-Link-Belt Co., Toronto, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.

COAL AND ASH HANDLING MACHINERY
Can.-Link Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

COAL-STORAGE SYSTEMS
Can. Link-Belt Co., Toronto, Ont.

COLLARS, SHAFT OR SET
Canada Foundries & Forgings Co., Welland, Ont.
Can. Link-Belt Co., Toronto, Ont.

COLLETS
Butterfield & Co.. Inc., Rock Island, Que.
Hardinge Bros., Inc., Chicago, Ill.
Hendley Machine Co., Torrington Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

COMPOUNDS, CLEANING
Oakley Chemical Co., New York, N.Y.

COMPOUNDS—CUTTING, DRILLING, GRINDING, SCREW CUTTING
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Oakley Chemical Co., New York, N.Y.

COMPRESSORS, AIR AND GAS
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.

CONES, FRICTION
Norton Co., of Can. Ltd., Hamilton, Ont.

CONNECTING RODS AND STRAPS
Canada Foundries & Forgings Co., Welland, Ont.

CONTRACT WORK
Victoria Foundry Co., Ltd., Ottawa, Ont.

CONVEYORS AND ELEVATORS (SEE ELEVATORS)
Jones & Glassco, Montreal, Que.

COTTERS
Steel Co. of Canada, Ltd., Hamilton, Ont.

COUNTERBORES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

COUNTERS, REVOLUTION
Starrett Co., L. S., Athol, Mass.

COUNTERSHAFTS
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Johnson Machine Co., Carlyle, Man-
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

COUNTERSINKS
Butterfield & Co., Inc., Rock Island Que.
Pratt &Whitney Co., of Canada, Ltd., Dundas, Ont.

COUPLERS, CAR AND LOCOMOTIVE
Can. Steel Foundries, Montreal, Que.

COUPLINGS
Steel Co. of Canada, Ltd., Hamilton, Ont.

COUPLINGS, PIPE
Fittings, Limited, Oshawa, Ont.

COUPLINGS, SHAFT
Can. Link-Belt Co., Toronto, Ont.

CRANES, ELECTRIC
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can.-Link-Belt Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls Ont.
Northern Crane Works, Walkerville, Ont.

CRANES, LOCOMOTIVE
Can. Link-Belt Co., Toronto, Ont.

Bertram & Son Co., td., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

CRANK PIN TURNING MACHINE
Underwood Corp., H.B., Philadelphia, Pa.

CUTTERS, GEAR
Brown & Sharpe Mfg. Co., Providence. R. I.
Butterfield & Co., Inc., Rock Island, Q. Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CUTTERS, HIGH SPEED
Atkins & Co., Inc., E. C., Indianapolis.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CUTTERS, MILLING
Brown & Sharpe Mfg. Co., Providence, R. I.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.

CUTTERS, STAY BOLT
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.

CUTTING-OFF MACHINE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S , Athol, Mass.

CUTTING OFF MACHINES, PIPE (SEE PIPE-CUTTING AND THREADING MACHINES)
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.

CUTTING-OFF TOOLS
Armstrong Bros. Tool Co., Chicago, Ill.

CUTTING OIL FILTERS (SEE OIL FILTERING SYSTEMS
Bowser, S. F. & Co., Ltd., Toronto.

CUTTING, OXY-HYDROGEN
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Ltd., Toronto, Ont.

DEALERS, MACHINERY (SEE SEARCHLIGHT SECTION)
Petrie, Ltd., H. W., Toronto, Ont.

DETACHABLE CHAIN
International Malleable Iron Co., Guelph, Ont.

DIAMONDS, BLACK AND ROUGH
Can. Desmond-Stephan Mfg Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

DIAMOND TOOLS
Can. Desmend-Stephan Co., Hamilton,
Wheel Trueing Tool Co., Windsor, Ont.

DIAMOND CROSSINGS
Can. Steel Foundries, Montreal, Que.

DIAMONDS, IMPORTERS
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Co., Windsor, Ont.

DIES, SCREW AND THREAD CUTTING
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.

DIES, SHEET-METAL AND SUB-PRESS (See Tool Work)
Brown, Boggs & Co, Ltd., Hamilton, Ont.

DIES, FORGING
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

DIES, SELF-OPENING, ADJUSTABLE
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Landis Machine Co., Inc., Waynesboro,
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DIES, THREADING-OPENING
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DIVIDING HEADS
Burke Machine Tool Co., Conneaut, Ohio.
Hendey Machine Co., Torrington, Conn.
Kearney & Treacker Co., Milwaukee, Wis.
Petrie, Ltd., H. W. Toronto, Ont.

DOGS, LATHE AND MILLING MACHINE
Armstrong Bros. Tool Co., Chicago, Ill.

DRAFTING MATERIALS
American Lead Pencil Co., New York City, N.Y.

DRESSERS, GRINDING WHEEL
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ont.
Norton Co., of Can., Ltd., Hamilton.
Wheel Trueing Co., Windsor, Ont.

DRESSING TOOLS
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Co., Windsor, Ont.

DRILL HOLDERS
Armstrong Bros. Tool Co., Chicago, Ill.

DRILLING MACHINES, BENCH
Burke Machine Tool Co., Conneaut,, Ohio.
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Hardinge Bros., Inc., Chicago, Ill.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
U. S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, ELECTRIC AND HAND
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, GANG
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

DRILLING MACHINES, HEAVY DUTY
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
Rockford Drilling Machine Co., Rockford, Ill.

BORING, DRILLING AND MILLING MACHINES, (HORIZONTAL.)
Gisholt Machine Co., Madison, Wis.

DRILLING MACHINES, Multiple Spindle
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
National Acme Co., Cleveland, Ohio.

DRILLING MACHINES, Pneumatic
Cleveland Pneumatic Tool Co., Toronto. Ont.

DRILLING MACHINES, PORTABLE
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, RADIAL
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto,

DRILLING MACHINES, SENSITIVE
Burke Machine Tool Co., Conneaut, O.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Williams Machinery Co., A. R., Toronto.
Wisconsin Electric Co., Racine, Wis

DRILLING MACHINES, TURRET
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wisconsin.
Williams Machinery Co., A. R., Toronto.

DRILLING MACHINES, VERTICAL
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

DRILLS, CENTRE
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DRILLS, HIGH SPEED TWIST
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Cleveland Twist Drill Co., Cleveland, O.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DRILLS, RATCHET
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

DRILLS, TWIST AND FLAT
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt. Ont.

DROP FORGINGS
Steel Co. of Canada, Ltd., Hamilton.

DUST HANDLING EQUIPMENT
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

ELECTRICAL INSTRUMENTS
Bristol Co., Waterbury, Conn.

ELECTRICAL SUPPLIES
Atkins & Co., Inc., E. C., Indianapolis.
Diamond State Fibre Co., Toronto, Ont.
U.S. Electrical Tool Co., Cincinnati, O.

ELEVATING TRUCKS (See Trucks)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

ELEVATORS AND CONVEYORS
Can. Link-Belt C., Toronto, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.

EQUIPMENT, ELEVATOR SAFETY
Jones & Glassco, Montreal, Que.

EMERY WHEELS (See Grinding Wheels)
J. R. Baxter & Co., Ltd., Montreal, Que.
Atkins & Co., E. C., Indianapolis, I.
Norton Co., of Canada., Ltd., Hamilton.

ENGINES, CAPSTAN
Kennedy & Sons, Wm., Owen Sound, Ont.

ENGINE LATHE MANUFACTURERS
Oliver Machinery Co., Grand Rapids, Michigan.

ENGINEERS, MECHANICAL
Dominion Engineering Works, Limited, Montreal, Que.
Gisholt Machine Co., Madison, Wis.
Hamilton Gear & Machine Co., Toronto,

EXPANDERS, TUBE
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

FANS, ELECTRIC
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

FANS, EXHAUST
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Petrie Ltd., H. W., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass.

FANS, VENTILATING
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

FIBRE
Diamond State Fibre Co., of Can. Ltd., Toronto, Ont.

FILES AND RASPS
Nicholson File Co., Port Hope, Ont.
Simmons Canada Saw Co., Montreal, Que.

FILLER, IRON (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J.

FIRE ESCAPES
Roelofson Elevator Co.. Galt, Ont.

FITTINGS, PIPE
International Malleable Iron Co., Guelph.
Fittings, Limited, Oshawa, Ont.

FLEXIBLE SHAFTS
Strand & Co., N. A., Chicago, Ill

FLUXES, WELDING
Carter Welding Co., Ltd , Toronto, Ont.
Dominion Oxygen Co., Ltd, Toronto
Liquide Air Company, Toronto, Ont.

FORGING MACHINERY
Acme Machinery Co., Cleveland, Ohio
Bertram & Son Co., Ltd., The John. Dundas, Ont.
Brown Boggs & Co., Ltd., Montreal.
National Machinery Co., Tiffin, Ohio.
Steel Co. of Canada, Ltd., Hamilton,

BUYERS' DIRECTORY

FORGINGS, DROP
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Ltd., Toronto, Ont.

FORGINGS, HAMMER
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Hepburn Ltd., John T., Toronto, Ont.

FOUNDRY EQUIPMENT
McDougall Co., Ltd., R. Galt, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

FOUNDRY SUPPLIES
Rice Lewis & Son, Ltd., Toronto, Ont.

FROGS, SPRING OR RIGID
Can. Steel Foundries, Montreal, Que.

FURNACES, ELECTRIC
Rockwell Co., W. S. New York City.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

FURNACES, HEAT TREATING COAL
Rockwell Co., W. S., New York City.

FURNACES, HEAT TREATING OIL AND GAS
Bellevue Industrial Furnace Co., Detroit, Michigan.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Rockwell Co., W. R., New York City.

FURNACES TEMPERING AND ANNEALING
Bellevue Industrial Furnace Co., Detriot, Mich.
Brown & Sharpe Mfg., Co., Providence R. I.
Rockwell Co., W. S., New York City.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

FURNACES AND OVENS, ELECTRIC
Petrie, Ltd., H. W., Toronto, Ont.
Rockwell & Co., W. S., New York city.
Starrett Co., L. S., Athol, Mass.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

GAGES, MEASURING (See Tool Work)
Brown & Sharpe Mfg. Co., Providence, R. I.
Greenfield Tap & Die Corp., Galt, Ont
Lufkin Rule Co., Windsor, Ont.
Starrett Co., L. S., Athol, Mass.

GAGES, RECORDING
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GAGES, SPECIAL MEASURING (See Tool Work)
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GAGES, THREAD
Brown & Sharpe Mfg. Co., Providence R. I.
Starrett Co., L. S., Athol, Mass

GALVANIZING
Fittings, Limited. Oshawa, Ont

GAS, COAL COMPRESSED
L'Air Liquid Society, Toronto, Ont

GAS, COMPRESSED
Carter Welding Co., Ltd., Toronto
Dominion Oxygen Co., Ltd., Toronto
Liquide Air Company, Toronto.

GASKETS
Diamond State Fibre Co. of Ca., Ltd., Toronto, Ont.
Smooth Mfg. Co., Jersey City, N. J.

GAUGES VACUUM AND PRESSURE
Taylor Instrument Co., Toronto, Ont

GEAR BLANKS
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.
Dominion Engineering Works, Limited, Montreal, Que.

GEAR COUNTERS
Hart Mfg. Co., R. A., Battle Creek, Michigan.

GEAR-CUTTING MACHINES
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Fellows Gear Shaper Co., Springfield, Vt.
Petrie, Ltd., H. W., Toronto, Ont.
Whiton Machine Co., D. E., New London, Conn.

GEAR TESTING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.

GEARS, CAST
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Hull Iron & Steel Foundries, Hull, Que.
Dominion Engineering Works, Limited, Montreal, Que.

GEARS, CUT
Brown & Sharpe Mfg. Co., Providence, R. I.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Gardner & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto, Ont.
Hepburn Ltd., John T. Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

GEARS, DRESSED
Kennedy & Sons, Wm., Owen Sound, Ontario.

GEARS, FORGED
Canada Foundries & Forgings Co, Welland, Ont.

GEARS, HERRINGBONE
Hamilton Gear & Machine Co., Toronto, Ont.

GEARS, RAWHIDE (See Gears, Cut)
Hamilton Gear & Machine Co., Toronto.

GEAR, SILENT CHAIN
Gardner & Son, Robt., Montreal, Que.
Can. Link-Belt Co., Ltd., Toronto, Can.
Hans Renold of Canada, Ltd., Montreal, Quebec.

GEARS, WORM
Hamilton Gear & Machine Co., Toronto.

GENERATORS, ACETYLENE
L'Air Liquide Society, Toronto, Ont.

GLOVES, PROTECTIVE
Industrial Glove Co, Toronto, Ont.

GOGGLES, SAFETY
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co, Ltd., Toronto.
Liquide Air Company, Toronto.

GRAB BUCKETS
Can. Link-Belt Co, Toronto, Ont.
Morris Crane & Hoist Co, Ltd, Niagara Falls, Ont.
Cleveland Twist Drill Co, Cleveland, O.

GREASE CUPS, PRESSED STEEL AND BRASS
Can Winkley Co., Ltd., Windsor, Ont.

GREASES, LUBRICATING
Canadian SKF Co., Toronto, Ont.

GRINDING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Can Fairbanks-Morse Co., Ltd., Montreal, Que.
Norton Co, of Canada, Ltd., Hamilton

GRINDING MACHINES, ABRASIVE BELT
Norton Co. of Can. Ltd., Hamilton, Ont.

GRINDING MACHINES, AUTOMATIC
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, BENCH
Blount Co, J. G., Everett, Mass.
Geometric Tool Co., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
McDougall Co, Ltd., R, Galt, Ont.
Norton Co of Canada, Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co, of Canada, Ltd, Dundas, Ont.

GRINDING MACHINES, CENTER
U.S. Electrical Tool Co., Cincinnati, O
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES, CUTTER AND REAMER
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Petrie Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, CYLINDRICAL
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.
Norton Co., of Canada, Ltd., Hamilton.

GRINDING MACHINES, DIE
National Acme Co., Cleveland, O.
National Machinery Co., Tiffin, Ohio.

GRINDING MACHINES, DRILL
Bellevue Industrial Furnace Co, Detroit, Mich.
Bertram & Son Co., Ltd., The John, Dundas, Ont.

GRINDING MACHINES, ELECTRIC
Strand & Co., N. A., Chicago, Ill.

GRINDING MACHINES, FLOOR AND TOOL
Blount Co., J. G., Everett, Mass.
National Acme Co, Cleveland, Ohio
Norton Co. of Canada, Ltd., Hamilton, Ontario.
Petrie, Ltd., H. W., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.

GRINDING MACHINES, INTERNAL
Garlock Machinery Ltd., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Cleveland Pneumatic Tool Co., Toronto Ont.
Wisconsin Electric Co, Racine, Wis.

GRINDING MACHINES PORTABLE
Strand & Co., N. A., Chicago, Ill.

GRINDING MACHINES, SNAGGING
Blount Co, J. G., Everett, Mass.
Norton Co, of Can. Ltd, Hamilton, Ont.

GRINDING MACHINES, SURFACE
Brown & Sharpe Mfg Co., Providence, Rhode Island.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co, of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, THREAD
Pratt & Whitney Co, of Canada, Ltd.,

GRINDING MACHINERY, TOOL POST
Gisholt Machine Co, Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont
Wisconsin Electric Co, Racine, Wis.

GRINDING MACHINES, UNIVERSAL
Brown & Sharpe Mfg Co, Providence, Rhode Island.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Landis Tool Co, Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co, of Canada, Ltd, Hamilton, Ontario.
Petrie, Ltd, H. W, Toronto, Ont

GRINDING WHEELS
J. R Baxter & Co, Ltd, Montreal, Que.
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Can Fairbanks-Morse Co, Ltd., Montreal.
Norton Co of Can., Ltd, Hamilton, Ont.

GUN-BARREL MACHINERY
Steinle Turret Machine Co, Madison, Wisconsin

HACK SAWS, POWER
Atkins & Co, Inc, E C, Indianapolis, Indiana.
Petrie, Ltd, H W., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que
Starrett Co., L S, Athol, Mass.

HAMMERS, CHIPPING
Cleveland Pneumatic Tool Co., Toronto, Ont.
High Speed Hammer Co., Rochester.

HAMMERS, DROP
Bertram & Son Co, Ltd, The John Dundas, Ont.
Pliss Co, E. W., Brooklyn, N Y.
Brown Boggs & Co, Ltd, Hamilton, Ont.
Canada Foundries & Forgings Co, Welland, Ont.

HAMMERS, ELECTRIC
Brown, Boggs & Co, Ltd, Hamilton, Ont.

HAMMERS, PNEUMATIC
Can. Steel Foundries, Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto Ont.

HANGERS, SHAFTING
Canadian SKF Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Hamilton Gear & Machine Co., Toronto,

HOBBING MACHINES
Shore Instrument Co., Jamaica, N.Y.

HARDENING, CASE-HARDENING AND TEMPERING
Barnes Company Wallace Hamilton.
Chapman Double Ball Bearing Co., Toronto.
Petrie, Ltd., H. W., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Cleveland Pneumatic Tool Co., Toronto Ont.

HAMMERS, POWER
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

HOBS
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Tap & Die Corp, Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

HOISTS, ELECTRIC
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

HOISTS, ELECTRIC
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

HOISTS, HAND
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg Co, Lisbon, Ohio

HOISTS, PNEUMATIC
Morris Crane & Hoist Co., Ltd, Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

HOLDERS-ON, PNEUMATIC
Cleveland Pneumatic Tool Co, Toronto Ont.

HYDRAULIC MACHINERY
Bertram & Son Co., Ltd, The John, Dundas, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

IGNITERS, GAS ENGINE
Canada Foundries & Forgings Co, Welland, Ont.
Burke Machine Tool Co., Conneaut, O.

INDICATORS, SPEED AND TEST
Brown & Sharpe Mfg Co, Providence, R.I.

INSULATION
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.

IRON BARS
Steel Co. of Canada, Ltd. Hamilton, Ont.

JACKS, HYDRAULIC
Norton, A O., Boston, Mass.

JACKS, PLANER
Armstrong Bros Tool Co., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

JAPANNING AND VARNISHING OVENS
Brantford Oven & Rack Co. Brantford, Ont

JIGS AND FIXTURES (SEE TOOL WORK)
Fisher Motor Co., Ltd., Orillia Ont
Gisholt Machine Co., Madison, Wis.
Preston & Schwartz, Galt, Ont

KEYSEATING MACHINES
Morton Mfg Co., Muskegon, Mich.

BUYERS' DIRECTORY

Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

KEYS, MACHINE
Can. Dranw Steel Co., Hamilton, Ont.
Morton Mfg. Co., Muskegon, Mich.

KNIVES, MACHINE
Atkins & Co., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

KNURL HOLDERS
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

LATHE ATTACHMENTS
Hendey Machine Co., Torrington, Conn.
Petrie, Ltd., H. W., Toronto, Ont.

LATHE TOOLS
Armstrong Bros. Tool Co. ,Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

LATHES, AUTOMATIC AND SEMI-AUTOMATIC
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, BENCH
Hardinge Bros., Inc., Chicago, Ill.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

LATHES, BORING
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, CHUCKING (SEE LATHES, HORIZONTAL TURRET, AND LATHES, VERTICAL TURRET)
Acme Machine Tool Co., Cincinnati, O.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, ENGINE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd. H. W., Toronto, Ont
Rockford Lathe & Drill Co., Rockford, Illinois.

LATHES, EXTENSION AND GAP
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, O.
Petrie, Ltd., H. W., Toronto, Ont.
Steinle Turret Machine Co., Madison, Wis.

LATHES, PRECISION
Hardinge Bros., Chicago.

LATHES, RELIEVING
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.

LATHE, UNIVERSAL HAND
Brown & Sharpe Mfg. Co., Providence, Rhode Island.

LATHE, SPEED AND HAND
Blount Co., J. G., Everett, Mass.

LATHES, SPINNING
Pryibil Machine Co., Torrington, Conn.

LATHES, VERTICAL TURRET
Bertram & Son, Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

LATHES, WOOD TURNING
Blount, Co., J. G., Everett, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.

LEAD PIPE
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

LIGHTING AND GENERATING SETS
Beardmore & Co., Ltd., Wm., Montreal, Que.

LINOLEUM MILL MACHINERY
Bertrams, Ltd., Edinburgh, Scotland.

LIQUID AIR PLANTS
L'Air Liquide Society, Toronto, Ont.

LOCKERS, CLOTHES
Dennis Wire and Iron Works, London, Ont.

LUBRICANTS
Oakley Chemical Co., New York, N.Y.

LUBRICATING SYSTEMS
Bowser, S. F., & Co., Ltd., Toronto, Canada.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Ltd., Welland, Ont.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R. Toronto Ont.

MANGANESE STEEL
Can. Steel Foundries, Montreal, Que.

MANDRELS, EXPANDING
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MANDRELS, SOLID
Greenfield Tap & Die Corp., Galt, Ont.
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Pratt & Whitney Co., of Canada. Ltd., Dundas, Ont.

MEASURING MACHINES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MECHANICS' FINE TOOLS
Lufkin Rule Co., Windsor, Ont.

METALS, ALLOY
Canada Metal Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.

METAL WORKERS
Parker Co., Charles, Meriden, Conn.

MICROMETER CALIPERS
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Rice Lewis & Son, Ltd., Toronto, Ont.

MILLING ATTACHMENTS
Purke Machine Tool Co., Conneaut, O.
Hendey Machine Co., Torrington, Conn.
Hinckley Machine Works, Hinckley, Ill.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

MILLING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Burke Machine Tool Co., Conneaut, O

MILLING MACHINES, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence, R. I
Hardinge Bros., Inc., Chicago, Ill.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

MILLING MACHINES, BENCH
Burke Machine Tool Co., Conneaut. O.
Hardinge Bros., Inc., Chicago, Ill.

MILLING MACHINES, HAND
Brown & Sharpe Mfg. Co., Providence
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MILLING MACHINES, HORIZONTAL PLANER TYPE.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Kearney & Trecker Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto.

MILLING MACHINES, PLAIN
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, O.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

MILLING MACHINES, THREAD
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MILLING MACHINES, UNIVERSAL
Brown & Sharpe Mfg. Co., Providence,
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

MILLING MACHINES, VERTICAL
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, O.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto.

MOTORS, ELECTRIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Roelofson Elevator Co., Galt, Ont.
Williams Machinery Co., A. R., Toronto,
Wisconsin Electric Co., Racine Wis.

NAILS AND STAPLES
Canada Metal Co., Ltd., Toronto, Ont.

NIPPLES
Canada Metal Co., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton,

NITROGEN
Carter Welding Co. Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

NUT TAPPERS
(See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
National Acme Co., Cleveland, Ohio.

NUTS, FINISHED and SEMI-FINISHED
Galt Macine Screw Co., Galt, Ont.
National Acme Co., Montreal, ue.

NUTS (Up to 4-in.)
Steel Co. of Canada, Ltd., Hamilton.

NUTS, S.A.E., PLAIN AND CASTELLATED
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

OIL FILTERING AND STORAGE SYSTEMS
Bowser, S. F., & Co., Ltd., Toronto,

OIL STORAGE ENGINEERS
Bowser, S. F., & Co., Ltd., Toronto,

OIL HOLE COVERS
Can. Whitney Co., Ltd., Windsor, Ont.

OILS, SOLUABLE
Brantford Oven & Rack Co., Brantford, Ontario.

OXYGEN
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

OXY-ACETYLENE APPARATUS
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Atlas Press Co., Kalamazoo, Mich.

PAPER MILL CONVEYORS
Bertram Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd., Montreal, Que.

PATTERNS, WOOD AND METAL
Fittings, Limited, Oshawa, Ont.
Victoria Foundry Co., Ltd., Ottawa.

PHOSPHOR TIN
Canada Metal Co., Ltd., Toronto, Ont.

PHOTOGRAPHIC DUPLICATING MACHINES
Photostat Corp., Providence, R. I.

PIPE BENDING MACHINES
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Underwood Corp., H. R., Philadelphia, Pa.
Williams Machinery Co., A. R., Toronto.

PIPE CUTTING AND THREADING MACHINES
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

PIPE
Canada Metal Co., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.

PIPE FITTINGS
Canada Metal Co., Toronto, Ont.
Fittings, Limited Oshawa, Ont.
International Malleable Iron Co., Guelph Ont.

PIPE AND NIPPLE THREADING MACHINES
Landis Machine Co., Inc., Waynesboro, Pa.

PIPE FITTERS' TOOLS
Rice Lewis & Son, Ltd., Toronto, Ont.

PIPE THREADING DIE HEADS
Landis Machine Co., Inc., Waynesboro, Pa.

PISTON-RING MACHINES
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

PLANING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Williams Machinery Co., A. R., Toronto.

PLANING MACHINES, ROTARY
Bertram & Son Co., Ltd., The John, Dundas, Ont.

PLATE ROLLS
Bertram & Son Co., Ltd., The John, Dundas, Ont.

PNEUMATIC TOOLS
Cleveland Pneumatic Tool Co., Toronto.

POLISHING AND BUFFING MACHINES
J. R Baxter & Co., Ltd., Montreal, Q.
Blount Co., J. G. Everett, Mass.
Brown & Sharpe Mfg. Co., Providence.
Pryibil Machine Co., New York, N.Y.

PRESSED STEEL PARTS
American Pulley Co., Philadelphia, Pa.
Fisher Motor Co., Ltd., Orillia, Ont.

PRESSES, ARBOR
Atlas Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

PRESSES, DROP AND FORGING
Brown, Boggs & Co., Ltd., Hamilon.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

PRESSES, FOOT AND HAND
Brown, Boggs & Co., Ltd., Hamilton.

PRESSES, HYDRAULIC
Bertram & Son Co., Ltd., The John, Dunldas, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Perrin Ltd., W. R., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

PRESSES, POWER
Bliss Co., E. W., Prooklyn, N. Y.
Brown, Boggs, & Co., Ltd., Hamilton,
Hepburn Ltd., John T., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Stoll Co., Inc., D. H., Buffalo, N.Y.

PRESSES, SCREW
Brown, Boggs & Co., Ltd., Hamilton.
Petrie, Ltd., H. W., Toronto, Ont.

PROFILING MACHINES
Prtt & Whitney Co., of Canada, Ltd., Dundas, Ont.

PROTRACTORS
Brown & Sharpe Mfg. Co., Providence.
Lufkin Rule Co., Windsor, Ont.

PROPELLERS
Kennedy & Sons, Wm., Owen Sound, Ontario.

PULLEYS, CORK INSERT
American Pulley Co., Philadelphia, Pa.

PULLEYS, METAL AND FIBRE
American Pulley Co., Philadelphia, Pa.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.

PULP AND PAPER MILL EQUIPMENT
Dominion Engineering Works, Ltd., Montreal, Que.

PUMPS, HYDRAULIC
Cna. Fairbanks-Morse Co., Ltd., Montreal, Que.
Dominion Engineering Works, Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto Ont.

BUYERS' DIRECTORY

PUMPS, LUBRICANT AND OIL
Bowser, S. F., & Co., Ltd., Toronto.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Hepburn Ltd., John T., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.

PUMPS, POWER
Bowser, S. F., & Co., Ltd., Toronto.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hepburn Ltd., John T., Toronto, Ont.

PUNCHES, CENTER
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

PUNCHES, HAND
Brown Boggs & Co., Ltd., Hamilton.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Jardine & Co., A. B., Hespeler, Ont.

PUNCHES, POWER
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

PUNCHING MACHINES, HORIZONTAL
Bertrams Ltd., Edinburgh, Scotland.

PYROMETERS, ELECTRIC
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Hiram Walker & Sons Metal Products Co., Walkerville, Ont.

RACKS, CUT
Hamilton Gear & Machine Co., Toronto.

RACKS, STORAGE
(See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ontario.

REAMER HOLDERS
Simonds Canada Saw Co., Montreal, Q.

REAMERS, EXPANDING
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

REAMERS, SOLID
Butterfield & Co., Inc., Rock Island, Q
Morse Twist Drill & Machine Co., New Bedford, Mass.

REAMERS, TAPER
Brown & Sharpe Mfg. Co., Providence, R. I.
Butterfield & Co., Inc., Rock Island, Q.
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canad, Ltd., Dundas, Ont.

RECORDERS, TEMPERATURE
Taylor Instrument Co., Rochester, N. Y.

RECORDERS, TIME
Gisholt Machine Co., Rochester, N. Y.
Taylor Instrument Co., Toronto, Ont.

REGULATORS, TEMPERATURE
Taylor Instrument Co., Toronto, Ont.

RIVETS AND BURRS
Parmenter & Bulloch Co., Gananoque, Ont.
Steel Co., of Canada, Ltd., Hamilton,

RIVETS, CHAIN
Pittings, Limited, Oshawa, Ont.

RIVET-MAKING MACHINERY
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

RIVETING MACHINES
Can. Fairbanks-Morse Ltd., Montreal, Q.
High Speed Hammer Co., Rochester, N.Y.
Parmenter & Bulloch Co., Gananoque Ont.
Petrie, Ltd., H W., Toronto, Ont.

RUDDER FRAMES, STEEL
Can Steel Foundries, Montreal, Que.

RUBBER MILL MACHINERY
Bertram Ltd., Edinburgh, Scotland.

RULES, STEEL AND WOOD
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Windsor, Ont.

RUST PREVENTATIVES
Oakley Chemical Co., New York, N. Y.

SAND EQUIPMENT
Can. Link-Belt Co., Toronto, Ont.

SAND RAMMERS, PNEUMATIC
Cleveland Pneumatic Tool Co., Toronto

SAW FRAMES AND BLADES, HACK
Atkins & Co., Inc., E. C., Indianapolis.
Diamond Saw & Stamping Works, Buffalo, N. Y.
Rice Lewis & Sons, Ltd., Tornto, Ont.
Simonds Canada Saw Co., Montreal, Q

SAWING MACHINES, POWER HACK
Atkins & Co., Inc., E. C., Indianapolis.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

SAW SHARPENING MACHINES
Atkins & Co., Inc., E. C., Indianapolis.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

SAW SHARPENING MACHINES
Atkins & Co., Inc., E. C., Indianapolis

SAW TABLES, UNIVERSAL
Petrie, Ltd., H. W., Toronto, Ont.

SAWS, CIRCULAR METAL
Atkins & Co., Inc., E. C., Indianapolis.
Pryibil Machine Co., New York, N. Y.
Gisholt Machine Co., Madison, Wis.

SAWS, HAND
Atkins & Co., Inc., E. C., Indianapolis
Simonds Canada Saw Co., Montreal, Q.

SAWS, HOT AND COLD
Atkins & Co., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Q.

SAWS, HIGH SPEED STEEL
Atkins & Co., Inc., E.C., Indianapolis, I.
Butterfield & Co. Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWS, METAL BAND
Atkins & Co., E. C., Indianapolis, I.

SAWS, METAL CUTTING
Brown & Sharpe Mfg. Co., Providence.
Butterfield & Co., Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.
Starrett Co., L. S., Athol, Mass.

SAWS, SCREW SLOTTING
Atkins & Co., Inc., E., C., Indianapolis
Butterfield & Co., Inc., Rock Island, Q.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canda, Ltd., Dundas, Ont.

SAWS, SCREW SLOTTING
Atkins & Co., Inc., E. C., Indianapolis.
Butterfield & Co., Inc. Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q

SAWS, WOOD
E. C. Atkins & Co., Indianapolis, Ind

SCALES
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Lufkin Rule Co., Windsor, Ont.

SCREENS
Dominion Engineering Works, Ltd., Montreal, Que.

SCREW DRIVERS, OPTICAL, JEWELRY AND NOVELTY
Strand & Co., N. A., Chicago, Ill

SCREW MACHINE WORK
Cook Co., Asa S., Hartford, Conn
National Acme Co., Montreal, Que.

SCREW MACHINERY, WOOD AND LAG
Cook Co., Asa S., Hartford, Conn.

SCREW MACHINES
Brown & Sharpe Mfg. Co., Providence, Rhode Island.

SCREW MACHINES, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.

SCREW MACHINE PRODUCTS
National Acme Co., Montreal, Que.

SCREW PLATES
Butterfield & Co., Inc., Rock Island. Que.
Jardine & Co., A. B., Hespeler, Ont

SCREWS, CAP AND SET
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

SCREWS, SAFETY, SET
Galt Machine Screw Co., Galt, Ont

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Petrie, Ltd., H. W., Toronto, Ont.

SEPARATORS, MOISTURE AND OIL
Bowser, S. F., & Co., Ltd., Toronto, Canada.

SEPARATORS, OIL AND WASTE
Bowser, S. F., & Co., Ltd., Toronto.

SHAFTS, FLEXIBLE
Strand & Co., N. A., Chicago, Ill.

SHAFTING
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
Williams Machinery Co., A. R., Toronto.

SHAPES, COLD-DRAWN SPECIAL STEEL
Union Drawn Steel Co., Hamilton, Ont.

SHAPING MACHINES
Hendey Machine Co., Torrington, Conn.
Morton Mfg. Co., Muskegon, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Williams Machinery Co., A. R. Toronto.

SHEARS HAND
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

SHEARS, POWER
Bliss Co., E. W., Brooklyn, N. Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Stoll Co., Inc., D. H., Buffalo, N. Y.
Williams Machinery Co., A. R., Toronto, Ont.

SHEARING MACHINES, ANGLE, IRON BAR AND GATE
Bertrams Ltd., Edinburgh, Scotland.

SHEET LEAD
Canada Metal Co., Ltd., Toronto, Ont.

SHEET METAL WORKING MACHINERY
Bliss Co., E. W., Brooklyn, N. Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Stoll Co., Inc., D. H, Buffalo, N.Y.

SHEETS, NICKEL, MONEL AND FIBRE
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.

SHEETS, O.P.C.R. & B. A. AND BLUE ANNEALED
Steel Co., of Canada, Ltd., Hamilton, Ont.

SIDE FRAMES, LOCOMOTIVE
Can. Steel Foundries, Montreal, Que.

SLOTTING ATTACHMENTS
Brown & Sharpe Mfg Co., Providence, R.I.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

SLOTTING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.

SOLDERS
Canada Metal Co., Ltd., Toronto, Ont.

SPECIAL MACHINERY AND TOOLS
Brown Engineering Corp., Ltd., Toronto
Gisholt Machine Co., Madison, Wis.
National Acme Co., Cleveland, O.

SPIKES, RAILWAY AND PRESSED
Steel Co of Canada, Ltd., Hamilton, Ont.

SPINNING LATHES
Prybil Machine Co., P., New York City.

SPRING, MILLED
Barnes & Co., Wallace, Hamilton, Ont

SPRINGS, SMALL SPIRAL HELICAL, COMPRESSION, EXTENSION, TORSION AND SPECIAL
Barnes Company, Wallace, Hamilton,

SPRINGS
Barnes Company, Wallace, Hamilton.
Cleveland Wire Spring Co., Cleveland, O.
Steele Ltd., James, Guelph, Ont.

SPRINGS, FLAT STEEL, BRUSH HOLDER, CLOCK, SMALL FLAT SPRINGS
Barnes Company, Wallace, Hamilton.

SPROCKETS AND CHAINS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Renold Hanson of Canada, Ltd., Montreal, Que.

SQUARES
Brown & Sharpe Mfg. Co., Providence, R.I.
Lufkin Rule Co., Windsor, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

STAMPING, METAL
American Pulley Co., Philadelphia, Pa.
Barnes Company, Wallace, Hamilton.
Diamond Saw & Stamping Works, Buffalo, N. Y.
Parmenter & Bulloch Co., Gananoque, Ont.

STAMPS, STEEL
Diamond Saw & Stamping Works, Buffalo, N. Y.

STEEL CONCRETE REINFORCEMENT
Steel Co. of Canada, Ltd., Hamilton.

STEEL PLATE
British Empire Steel Co., Montreal, Que.

STEEL AND IRON BARS
Steel Co. of Canada, Ltd., Hamilton.

STEELS TOOL
British Empire Steel Co. Montreal Q.

STEEL, COLD-ROLLED STRIP
British Empire Steel Co., Montreal, Q.
Barnes Company, Wallace, Hamilton.

STEEL, CRUCIBLE, SPRING
Barnes, Company, Wallace, Hamilton.
British Empire Steel Co., Montreal, Q.

SHEETS, OPEN HEARTH STEEL
Steel Co., of Canada, Ltd., Hamilton.

STEEL, SHAFTING AND FREE CUTTING SCREW
Union Drawn Steel Co., Hamilton, Ont.

STEEL, SHEET
British Empire Steel Co., Montreal, Q.
Rice Lewis & Son, Ltd., Toronto, Ont.

STEEL, STAINLESS
Steel Co., of Can. Ltd., Hamilton, Ont.

STEELS, ALLOY AND CARBON
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Can Steel Foundries, Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton, Ont.

STEELS, HIGH-SPEED
Armstrong Bros. Tool Co., Chicago, Ill
Atkins & Co., Ltd., Wm., Sheffield, England
British Empire Steel Co., Montreal, Q.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton

STEEL TUBING, CLOSE JOINT AND WELDED
Standard Tube & Fence Co., Ltd., Woodstock, Ont

STERN FRAMES, CAST STEEL
Can Steel Foundries, Montreal, Que.

STRAIGHTENING MACHINERY
Bertram Ltd., Edinburgh, Scotland
Williams & Co., J. H., Brooklyn, N.Y.

STUDS
Galt Machine Screw Co., Galt, Ont

BUYERS' DIRECTORY

STUD SETTERS, SELF-OPENING
Geometric Tool Co., New Haven, Conn.

SWAGING MACHINES
Atkins & Co., Inc., E. C., Indianapolis, Indiana.

SWITCHES, RAILWAY
Can. Steel Foundries, Montreal, Que.

TACHOMETERS
Bristol Co., Waterbury, Conn.

TANKS AND PUMPS, OIL
Bowser, S. F., & Co., Ltd., Toronto.

TAP HOLDERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
William L. Procunier, Chicago, Ill.

TAPER PINS
Galt Machine Screw Co., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

TAPES, MEASURING
Starrett Co., L. S., Athol, Mass.
Lufkin, Rule Co., Windsor, Ont.

TAPPING MACHINES AND ATTACHMENTS
Burke Machine Tool Co., Conneaut, O.
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Wm. L. Procunier, Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

TAPS AND DIES
Butterfield & Co., Inc., Rock Island, Q.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

TAPS, COLLAPSING
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.

TEETH, DREDGE BUCKET
Kennedy & Sons, W., Owen Sound, Ont.

THERMOMETERS
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Greenfield Tap and Die Corp., Galt, Ontario.

THREAD-CUTTING TOOLS
Butterfield & Co., Inc., Rock Island, Q.
Greenfield Tap and Die Corp., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

THREAD CUTTING MACHINES
Landis Machine Co., Inc., Waynesboro, Pa.

THREADING MACHINES
Acme Machinery Co., Cleveland, Ohio.
Geometric Tool Co., New Haven, Conn.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Williams Tool Corp., of Can. Ltd., Brantford, Ont.

THREAD LEAD TESTING MACHINES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

THREAD-ROLLING MACHINES
Bliss Co., E. W., Brooklyn, N. Y.

TIE PLATES
Steel Co. of Canada, Ltd., Hamilton.

TIME RECORDERS
International Business Machine Co., Ltd., Toronto, Ont.

TONGS
Hepburn Ltd., John T., Toronto, Ont.

TOOL CASES
Rice Lewis & Son, Ltd., Toronto, Ont.

TOOL HOLDERS
Armstrong Bros., Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Bertrams Ltd., Edinburgh, Scotland.

TOOL POSTS, LATHE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Williams & Co., J. H., Brooklyn, N. Y.

TOOLS, SMALL
(See Machinists' Small Tools)
Armstrong Bros. Tool Co., Chicago, Ill.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Lufkin Rule Co., Windsor, Ont.
National Machine Tool Co., Racine, Wis.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S. Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A.R., Toronto,

TOOL WORK
Brown Engineering Corp., Ltd., Toronto, Ontario.

TORCHES, BLOW
Rice Lewis & Son, Ltd., Toronto, Ont.

TRACKWORK, RAILWAY
Can. Steel Foundries, Montreal, Que.

TRACKWORK, MANGANESE STEEL
Can. Steel Foundries, Montreal, Que.

TRANSMISSION MACHINERY
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound.
Petrie, Ltd., H. W., Toronto, Ont.
Renold, (Hans) of Canada, Ltd., Montreal, Que.

TROLLEYS AND TRAMWAYS
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Wright Mfg. Co., Lisbon, Ohio.

TROLLEY WHEELS
Langley & Austin, Galt, Ont.

TROWELS, PLASTERING
E. C. Atkins & Co., Indianapolis, Ind.

WRENCHES, MACHINISTS'
Armstrong Bros. Tool Co., Chicago, Ill.

TRUCKS
Can. Fairbanks-Morse Ltd., Montreal, Q.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

TUBING, SEAMLESS STEEL, BRASS AND COPPER AND FIBRE
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Goldstein Mfg. Co., Ltd., Toronto, Ont.

TURRET HEADS
Bertram & Son Co., Ltd., The John Dundas, Ont.

TURRET MACHINES
(See Lathes, Horizontal Turret)
Acme Machine Tool Co., Cincinnati, O.
Cook Co., Asa S., Hartford, Conn.
Gisholt Machine Co. Madison Wis.
National Acme Co. Cleveland O.
Pratt & Whitney Co. of Canada Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin

TURRETS, TOOL POST
Gisholt Machine Co. Madison, Wis.

UNIONS, PIPE
Fittings, Limited, Oshawa, Ont.

VALVES
Canada Metal Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Mon-
Dominion Engineering Works, Limited, Montreal, Que.

VISES, DRILLING MACHINE
Burke Machine Tool Co., Conneaut, Ohio.
Charles Parker Co., Meriden, Conn.
Cleveland Pneumatic Tool Co., Toronto, Ontario.
Kempsmith Mfg Co., Milwaukee, Wis.

VISES, PIPE
Charles Parker Co., Meriden, Conn.

VISES, PLANER AND SHAPER
Bertram & Son Co., Ltd., The John Dundas, Ont.
Philip Gies Foundry, Kitchener, Ont.
Hendley Machine Co., Torrington, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

VISES, WOOD WORKERS'
Charles Parker Co., Meriden, Conn.
Parmenter & Bulloch Co., Gananoque, Ontario.

VOLTMETERS
Bristol Co., Waterbury, Conn.

WAGON LEADERS
Can. Link-Belt Co., Toronto, Ont.

WASHERS, LOCK, SPLIT AND SPRING
Barnes Company, Wallace, Hamilton.

WELDING APPARATUS, OXY-ACETYLENE
L'Air Liquide Society, Toronto, Ont.
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto, Ont.

WELDING APPARATUS
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.

WELDING, ELECTRIC, ARC, SPOT AND BUTT
International Malleable Iron Co., Guelph, Ont.

WELDING MACHINES, OXY-ACETYLENE
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.

WELDING, ELECTRIC
McLaren Belting Co., J. C., Montreal, Que.
Steel Co. of Canada, Ltd., Hamilton.

WELDING ROD, TOBIN, MANGANESE, BRONZE AND ALUMINUM
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto, Ont.

WELDING SUPPLIES
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.

WHEELS, INDUSTRIAL
American Pulley Co., Philadelphia, Pa.
Hull Iron & Steel Foundries, Hull, Que.
Kennedy & Sons, Wm., Owen Sound, Ontario.

WINCHES, HEADGATE
Kennedy & Sons, Wm. Owen Sound, Ontario.

WINCHES, STOPLOG
Kennedy & Sons, Wm., Owen Sound, Ontario.

WIRE
Barnes Company, Wallace, Hamilton.
Canada Metal Co., Ltd., Toronto, Ont.
Dennis Wire & Iron Works, London, Ontario.
Greening Wire Co., B., Hamilton, Ont.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

WIRE, BLACK TEMPERED, MUSIC PHOSPHOR BRONZE AND PREMIER
Barnes Company, Wallace, Hamilton.

WIRE, COPPER AND BRASS, FINE AND HEAVY
Steel Co., of Canada, Ltd., Hamilton, Ontario.

WIRE STRAIGHTENING AND CUTTING MACHINERY
Brown, Boggs & Co., Ltd., Hamilton, Ontario.

WIRE, WELDING
L'Air Liquide Society, Toronto, Ont.
Carter Welding Co,. Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.

WIRES, SPECIAL
Dennis Wire & Iron Works, London, Ontario.
Greening Wire Co., B., Hamilton, Ont.

WOODWORKING MACHINERY
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Williams Machinery Co., A. R., Toronto, Ontario.

WRENCHES, DROP FORGED
Armstrong Bros. Tool Co., Chicago, Ill.
Canada Foundries & Forgings Co., Welland, Ont.

List of Directory of Dealers will be Found above Advertising Index

When answering advertisements kindly mention Canadian Machinery

DIRECTORY OF DEALERS

THE Buyers' Directory of CANADIAN MACHINERY was originally intended to contain information regarding lines actually manufactured by our advertisers. We now carry the advertising of leading machinery dealers, some of whom represent scores of manufacturers in addition to being manufacturers themselves in some cases. We recommend, therefore, if our subscribers cannot find what they want in our Directory that they communicate with the dealers whose names appear herewith.

MACHINE TOOLS, ETC.

Bertram & Sons, Ltd., John, Dundas, Ont.

The Canadian Fairbanks-Morse Co., Montreal, Que.

Garlock Machinery Ltd., Toronto.

H. W. Petrie, Ltd., Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

Yeates Machinery Co., London, Ont.

SHOP and FACTORY SUPPLIES

The Canadian Fairbanks-Morse Co., Montreal, Que.

Garlock Machinery Ltd., Toronto.

H. W. Petrie Ltd., Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

Yeates Machinery Co., London, Ont.

POWER EQUIPMENT, ETC.

The Canadian Fairbanks-Morse Co., Montreal, Que.

H. W. Petrie Ltd., Toronto, Ont.

WOODWORKING MACHINERY

The Canadian Fairbanks-Morse Co., Montreal, Que.

Garlock Machinery Ltd., Toronto.

H. W. Petrie Ltd., Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

Yeates Machinery Co., London, Ont.

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CANONSBURG GAS COAL CO.
COUNTRY CLUB COAL CO.
WEST PENN. BY-PRODUCTS CO.

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BRITISH-AMERICAN FUEL & METALS LIMITED
McKINNON BUILDING TEL. MAIN 7815 TORONTO

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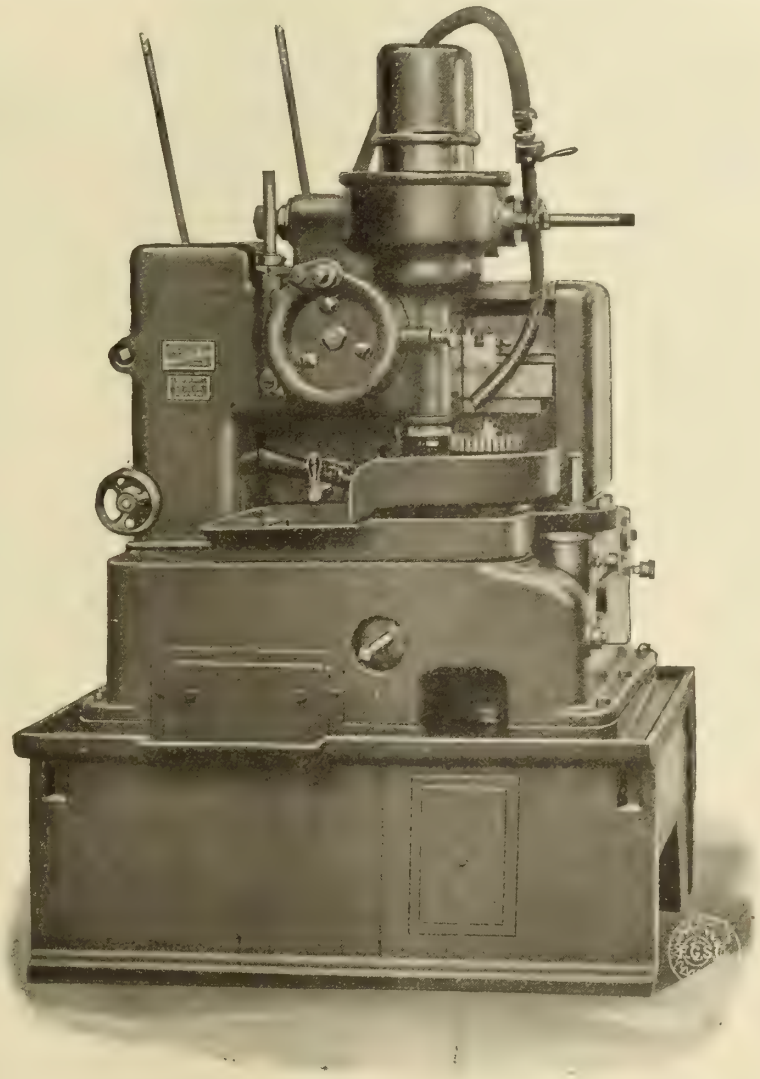
WITH THE
New Production Gear Shaper



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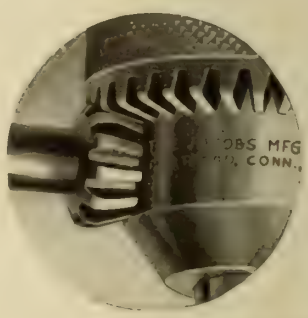
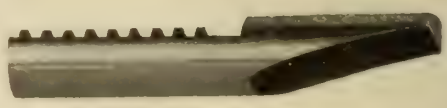
Jacobs Super Chuck

Patented 1909-1915. Other patents pending

A Look Inside

Here are the several parts—carefully designed, exactly fitted, perfectly made—that guarantee the Jacobs Super Chuck to hold a drill tight, to hold it right, and to keep on doing its work indefinitely.





FIRST THE BODY—scientifically casehardened; size limits within .0005″, arbor hole ground on a special fixture with six gauges to position it accurately in relation to the hole for the jaw.

THE SLOT FOR THE NUT, correctly located in relation to the jaw holes by means of micrometer gauges, insures a properly fitting thread on the nut and jaws.

NO WEAR ON KEY HOLES because of the deeply casehardened body, result—a well-fitting Gear on Sleeve and Key.

THE JAW, OF TOOL STEEL, has glass hard gripping surface; threads are tough, and all surfaces are ground on centers to within **a quarter of a thousandth** of an inch.

THE NUT, of special analysis steel, is ground after heat-treatment, in correct alignment with thread, tolerance .0005″.

THE BALL RACE comes within limits of .0001″; finest grade balls are used. An important point is the pitch of thread on nut—angle is 90 degrees to center line of jaw, so part cannot run over thread of latter.

The Jacobs Super Chuck centers a drill, **accurately**, and will continue to do so after years of use. It saves its cost time and again by preventing drill breakage. Its correct balance preserves bearings of your drilling machine—order a Super Chuck from your dealer.

The Jacobs Manufacturing Company

Hartford, Connecticut, U. S. A.

CANADIAN MACHINERY
MANUFACTURING NEWS

Vol. XXVIII. No. 2 | Published Weekly by the MacLean Publishing Company, Limited, Toronto, Ont. | July 13, 1922 | $4.00 a Year Subscription Price

READ AND PASS TO	Check	See Page	READ AND PASS TO	Check	See Page

ATKINS METAL CUTTING SAWS

Atkins Latest Improved Metal Band Saw Machine

(PATENTED

Atkins Metal Cutting Band Saw Machine

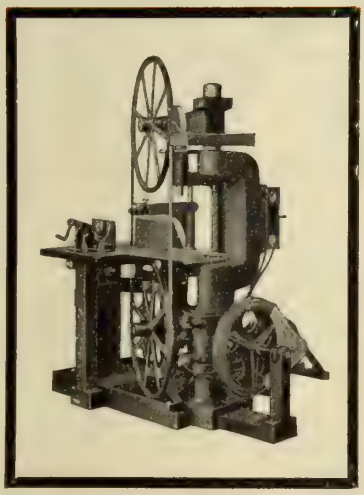
This illustrates ATKINS No. 3 Metal Band Saw Machine—fast, accurate and economical. It is the last word in metal cutting machines.

Large Capacity

For general machine shop use; cuts all kinds of steel, iron and metal up to 12 inches by 14 inches easily, quickly.

Important Features

The machine is provided with Automatic Tension Gauge which indicates the correct tension for the blade. This is a saw saver. Other features are Quick Acting Vise, adjustable to any angle up to 45 degrees. It also has Vertical Cut which is an assurance that the blade will travel in a straight plane; Automatic Stop to stop the saw the second cut is completed; Gravity Feed; Hinged Table, and Adjustable Saw Guides.



A Machine That Pays Its Way

If you want to save money and speed up production, get the complete specifications of this machine. Install one at the first opportunity.

Upkeep Expense Is Light

Hyatt Roller Bearings are used in the bearings which is a guarantee of long life for the machine as well as accurate and smooth cutting.

In Canada

You can obtain prices and complete specifications of Atkins No. 3 Metal Band Saw Machine by addressing our Canadian Works, E. C. Atkins & Co., Hamilton, Ont. Inquiries and orders given immediate attention.

Other Products

We manufacture Circular Metal Cutting Saws, Hack Saw Blades, Frames; Hack Saw Machines, Hand and Cross Cut Saws; Machine Knives, etc.

"A Perfect Saw For Every Purpose"

E. C. ATKINS & COMPANY

"The Sterling Steel Saw People" **HOME OFFICE AND FACTORY, INDIANAPOLIS, IND.** Established 1857

CANADIAN FACTORY: Hamilton, Ont. **MACHINE KNIFE FACTORY:** Lancaster, N. Y.

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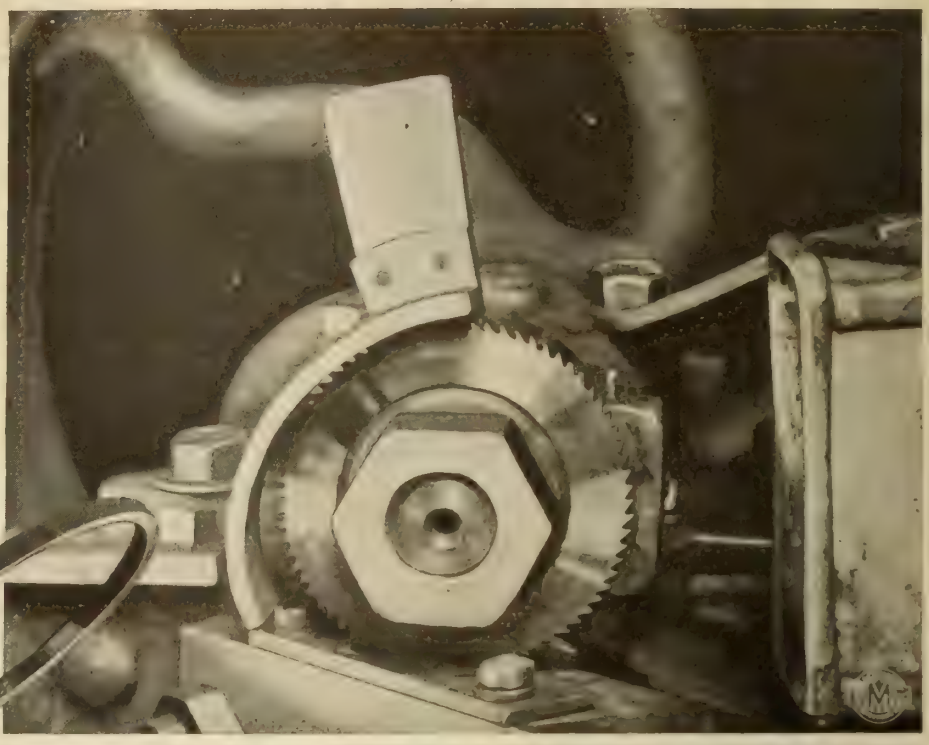
GTD *Little Stories of Real Production* GTD

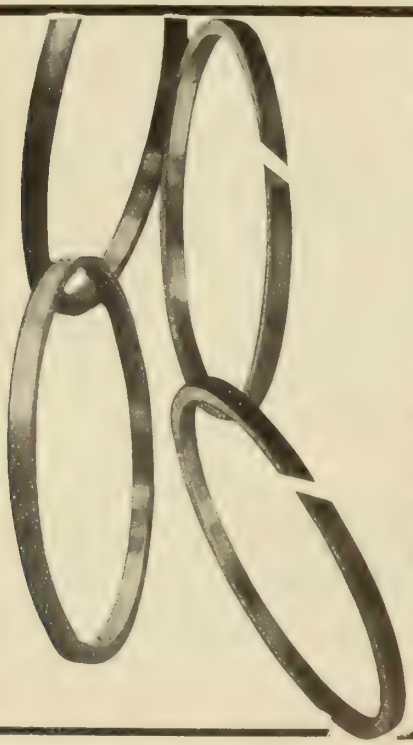
GTD

High Speed Slotting Cutters

REG U S PAT OFF
GTD
"MEANS PERFORMANCE"



Seven Times the Output Between Grinds



Manufacturers of piston rings are enthusiastic endorsers of GTD High Speed Slotting Cutters. Even those familiar with the performances of GTD Threading Tools, Drills, Reamers, etc., are amazed at the length of time GTD Slotting Cutters hold their edge.

One of these customers reports a maximum of 3,000 rings obtained with carbon cutters previously used against a minimum of 20,000 rings cut with GTD cutters; and accompanies it with an order for more of the same brand.

GTD Cutters will give you a lowered tool cost per work produced, and greater productive machine time. Changing tooling equipment is a big factor in lowering productive machine hours. Reduce it to the minimum.

GTD Quality is a standard recognized wherever big production and high grade workmanship are in demand.

You'll find GTD small tools to fit your every need described in our new catalog No. 46A. Write for it.

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GREENFIELD TAP AND DIE CORPORATION
OF CANADA, LIMITED GALT, ONTARIO
GTD Screw Plates, Taps, Dies, Reamers, Gages, Pipe Tools, Twist Drills, Milling Cutters

Where they tap nuts by the ton

Records Are Kept of Tap Performance

These show that Pratt & Whitney Taps score highest on two counts. Time between resharpenings is longer than ordinary. They can be sharpened and resharpened and still retain their original size long after other taps have gone to the scrap pile.

The "Con-eccentric land," an exclusive Pratt & Whitney feature — coupled with superior workmanship and rigid inspection both of the steel and the taps — are the secret of their long life.

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Pratt & Whitney Taps are **cheaper** to use than others. It's true whether you are tapping one or one million holes a day.

the taps they use are stamped

PRATT AND WHITNEY

201

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Drop-Forged Pliers and Screw Drivers

Efficient—Durable—Dependable

Ever-ready Tools for Every Kind of Work

Auto Pliers with slip-joint for automobile and general use.

Fence Pliers for wire stretching and splicing; three slots for wire cutting.

Side-Cutting Pliers—with checkered handles providing an ideal slipless grip.

Thin Bent Nose Pliers—with slip-joint—for any work where the clearance is limited.

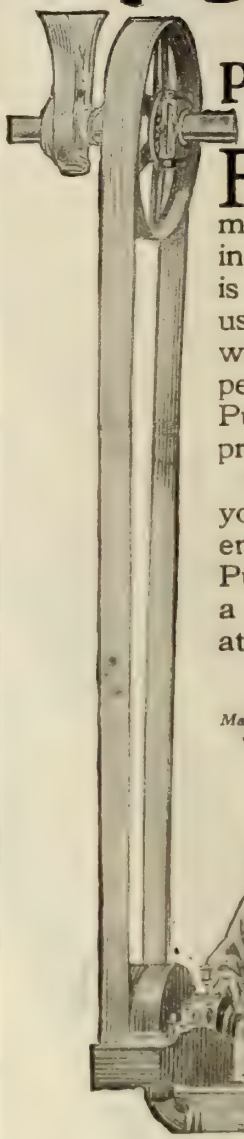
Screw Drivers—drop-forged from best quality of steel, and tempered; hardwood handles, fluted for firm grip.

J. H. WILLIAMS & CO., Limited

"The Drop-Forging People"

45 Thorold Road, St. Catharines, Ontario

AMERICAN STEEL SPLIT PULLEYS



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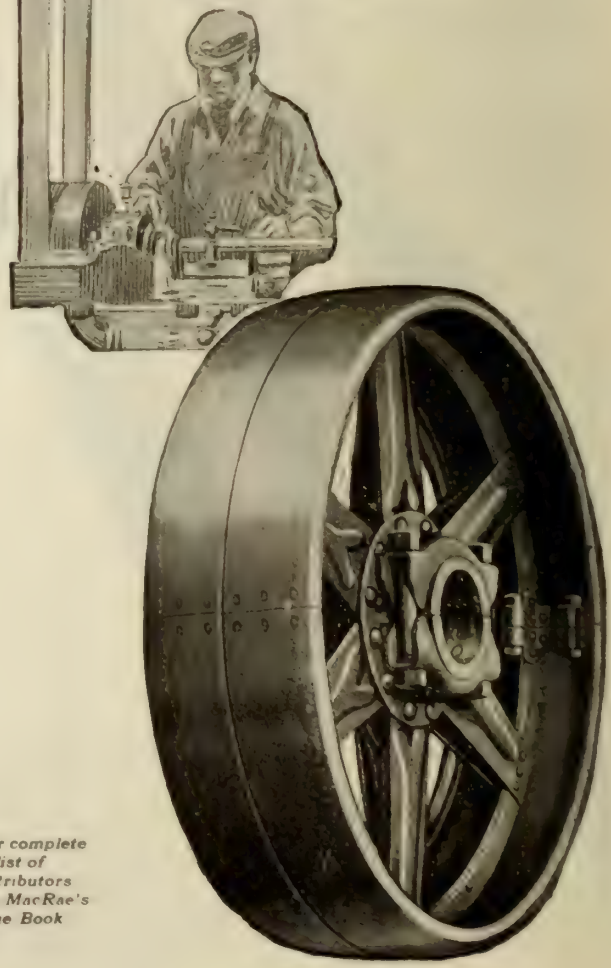
What you should expect from your pulleys is told in a book entitled, "Getting Maximum Pulley Efficiency." On request, a copy will be mailed to you at once.

The American Pulley Co.

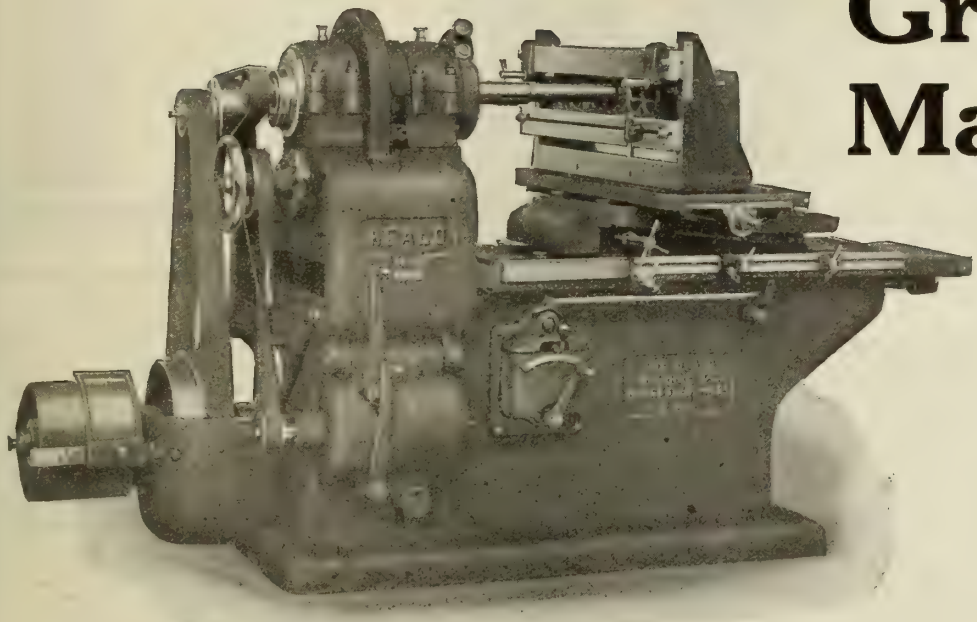
Manufacturers of Steel Split Transmission Pulleys, Steel Sash Pulleys and Pressed Steel Shapes

Philadelphia, Pa.



For complete list of distributors see MacRae's Blue Book

The Last Word on a Cylinder Grinding Machine



HEALD
Style No. 50

Simple — Massive
Large Capacity
Self Contained
Wide Range of Speeds and Feeds

The HEALD Style No. 50 Cylinder Grinder is an ideal machine for both the manufacturer and the repair shop. It is unusually massive, simple to operate, and has a hydraulic drive for the table instantly giving any speed desired, enabling the operator to get an unusually fine finish. With this drive it is possible to reverse the table at any desired point without shock or noise.

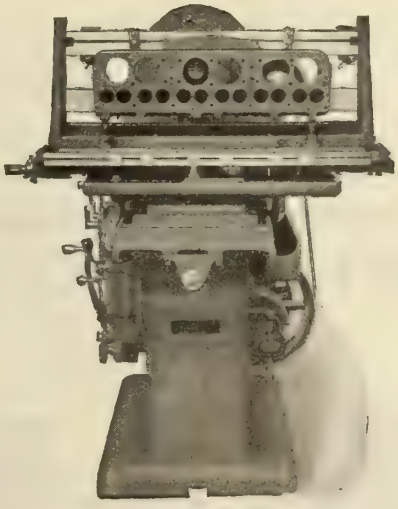
In addition to the adjustment secured by the HEALD Universal Locating Jig, there is sufficient vertical movement of the cross-slide table to take care of any slight vertical adjustment required after the bloc is in place. The head and spindle of the machine is similar to that which has been used so successfully for 17 years in all our other cylinder grinding machines.

The main driving shaft on the rear is mounted on ball bearings taking the power directly from the main line or motor.

The main and cross slide tables are unusually heavy, having extra wide ways, giving ample wearing surfaces and which are fully protected from grit and dirt.

Without doubt this is the finest machine tool of its kind on the market to-day, and whether you are a manufacturer and wish to add to your equipment or a repair man and expect to go into the regrinding business, this new machine is so far superior to anything of its kind you cannot afford to neglect looking into its advantages.

Let us send you our new bulletin No. 50 explaining it in detail.



Grinding a Hudson Super-Six. Notice the Massiveness and Width, Giving Great Rigidity.

The Heald Machine Co.

51 New Bond St. **Worcester, Mass.**

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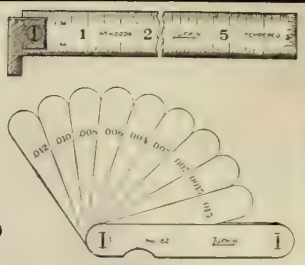
RELIABLE
MECHANICS' TOOLS

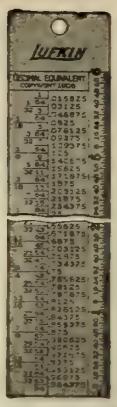
APPEAL TO EVERY PROGRESSIVE MECHANIC

Accurate, and having all the other essential qualities of precision tools; also many improvements which mean better work, easier done.

Their nicety of design and finish appeal to the eye. Their performance day in and day out will hold your approval.

Ask your dealer to show you a LUFKIN Send for Catalogue of Mechanics' Tools.





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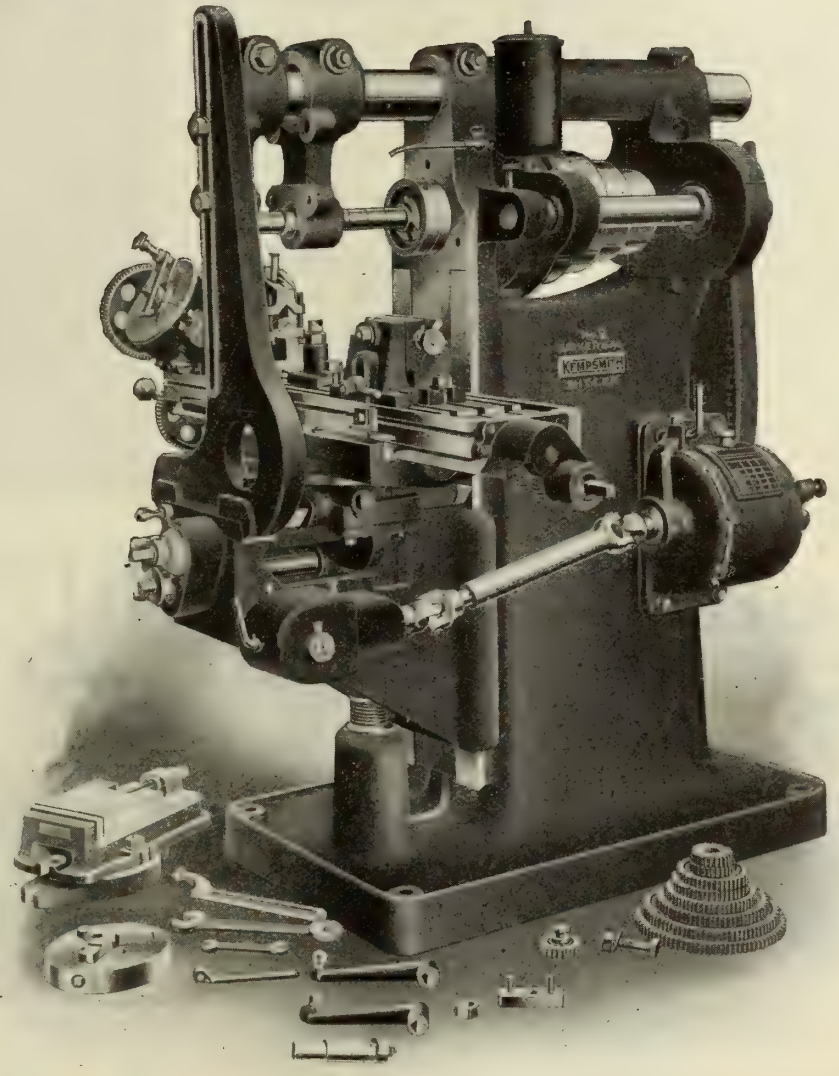

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Thirty-two years ago the Kempsmith Company began its career in a small one-storey frame building. To-day there are four main buildings, aggregating 106,000 square feet of floor area, besides various storage sheds, etc. Every building of the plant is a model of its kind.

It has always been, and will continue to be, the purpose of the Kempsmith Company to produce machines of the highest quality only, suited to the most advanced practice.

Every machine, whatever size or type, is put to test under cuts and conditions purposely more severe than it will encounter in even the most progressive shops and when it leaves our factory it has our positive and definite guarantee back of it.

Literature will be gladly sent upon request

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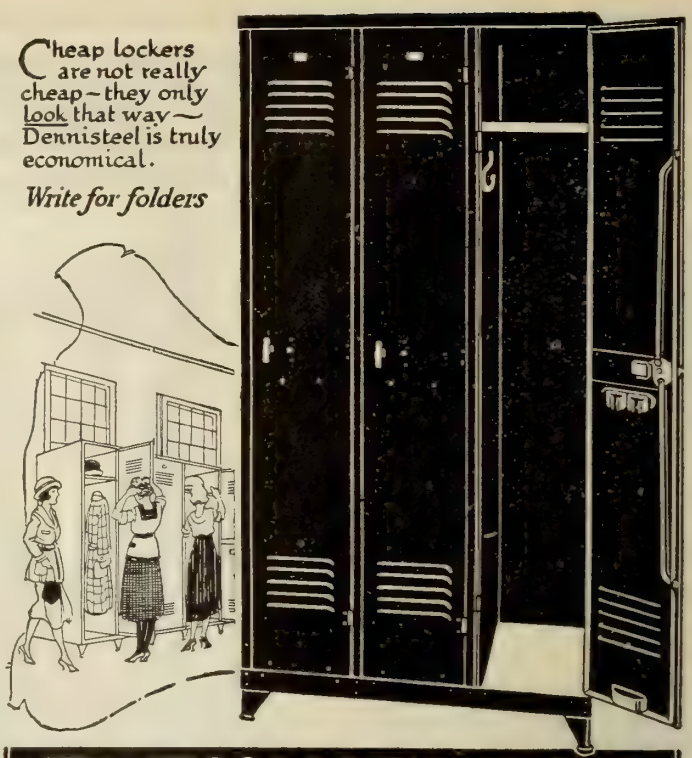

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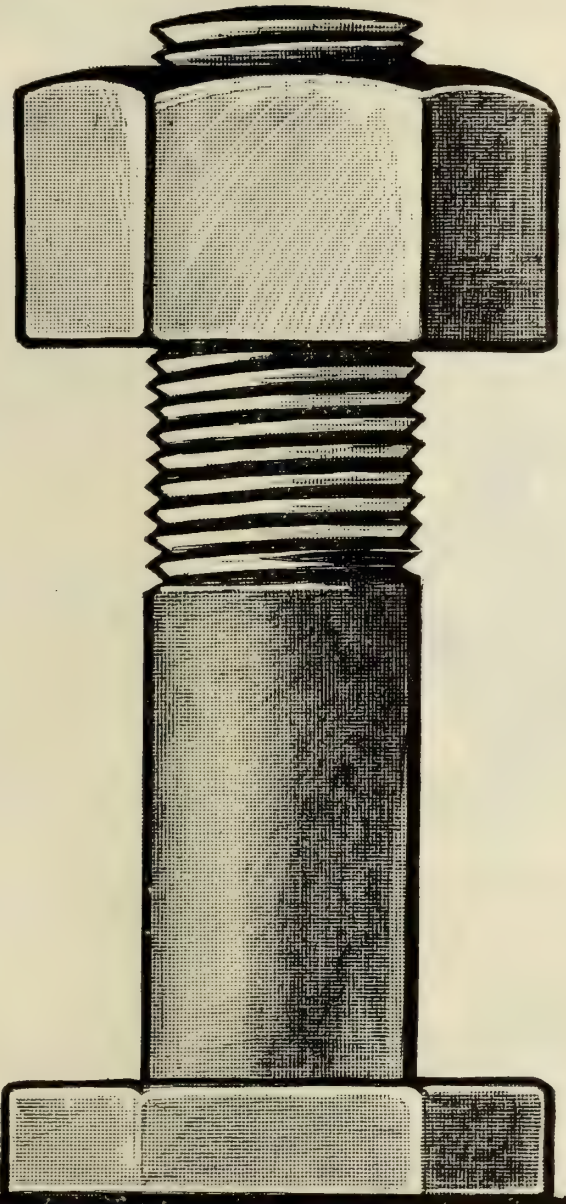

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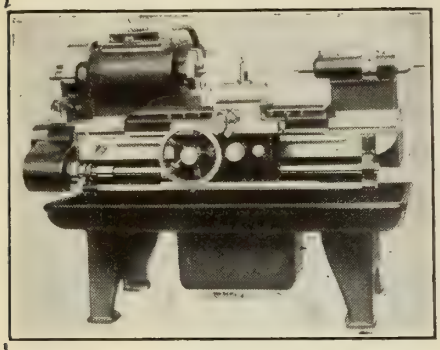
THE JOHNSON FRICTION CLUTCH

AS USED ON THE

"NEW" 12 IN. SUNDSTRAND MANUFACTURING LATHE



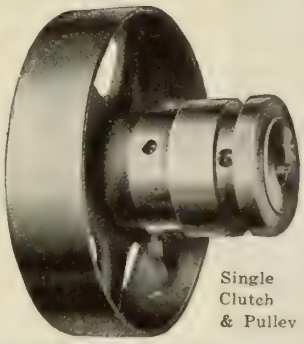
Progress in machine tool design demands a reliable and powerful friction clutch.

The Johnson Friction Clutch is proving of great value in machine tool designing.

Courtesy: The Rockford Tool Co., Rockford, Ill.

The main drive pulley is mounted on a No. 5 single clutch hub. The same movement that disengages the clutch automatically applies a brake which stops the spindle instantly. The sliding sleeve is machined to act as a brake.

A feature of the Johnson Friction Clutch is the ease of application to particular machine requirements.



Single Clutch & Pulley

WRITE FOR STOCK LIST AND YELLOW CATALOG.

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STEEL CASTINGS

QUICK DELIVERIES

High Carbon Steel
Manganese Steel
Chrome Steel
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QUALITY GUARANTEED

Sizes—½lb. to 5,000 lbs.

THE WILLIAM KENNEDY & SONS
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OWEN SOUND, ONTARIO
ESTABLISHED 1860

SHEET METAL WORKING MACHINERY

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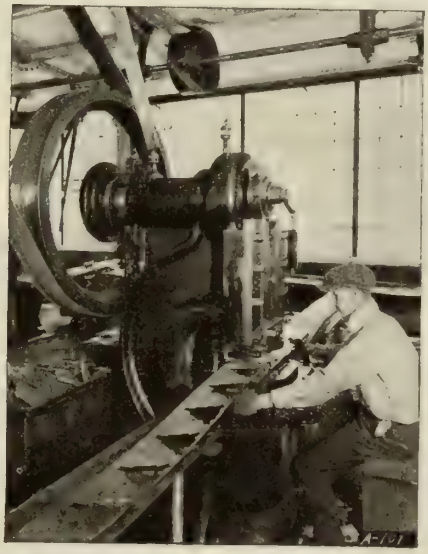

"Stiles" Punching Press on a blanking job

"STILES" PUNCHING PRESSES

Specially adapted for heavy punching and stamping work. Frames designed to give maximum strength and rigidity. Entire pressure through solid metal. Graduated eccentric adjustment.

Universally used in the manufacture of hardware, locks, cutlery, sewing machines, typewriters, etc., etc.

Built in a large number of sizes and different styles. With deep or narrow throats. Solid or adjustable tables. Write us your individual requirements, there is one that will just fit in.

"For Efficiency and Economy"
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"Standard the World Over"

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CANADIAN WHEELS of QUALITY

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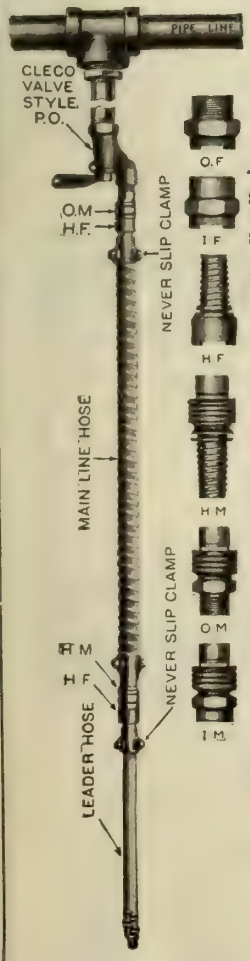


Cleco Pressure-Seated Air Valves

Bowes Air Hose Couplings—Cleco Never Slip Hose Clamps — Cleco Grooved Hose Nipples and Hose Clamp Tool

STYLE O.F. is an Outside Thread Female Pipe End. Made in sizes ⅜-inch to 1½-inch.

STYLE I.F. is an Inside Thread Female Pipe End. Made in sizes ¼-inch to 1½-inch.

STYLE H.F. is a Female Hose End with spiral shank to insert into the hose and has groove for the Never Slip Hose Clamp. Made in sizes ¼-inch to 1½-inch.

STYLE H.M. is a Male Hose End with spiral shank to insert into the hose and has groove for the Never Slip Hose Clamp. Made in sizes ¼ inch to 1½-inch.

STYLE O.M. is an Inside Thread Male Pipe End. Made in sizes ⅜-inch to 1½-inch.

STYLE I.M. is an Inside Thread Male Pipe End. Made in sizes ¼-inch to 1½-inch.

The Male and Female Ends of Bowes Couplings interchange in sizes ¼-inch to ¾-inch. Sizes 1-inch and 1¼-inch interchange. The 1½-inch ends interchange only with themselves.

BOWES COUPLINGS

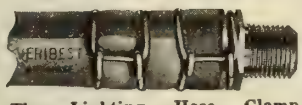
Are instantly connected or disconnected.
They are absolutely air-tight under all pressures.
They quickly pay for themselves by stopping costly leaks.
They interchange in sizes most commonly used.
They have no loose parts to be mislaid or lost.
They are made of brass and will not rust.
The U-shaped Gasket interchanges in couplings ¼-inch to ¾-inch.

CLECO AIR VALVES.

Style R.A. **Style P.O.** **Style A.**

Style P.O.—Made in sizes ¼ in., ⅜ in., ½ in., ¾ in., 1 in., 1¼ in., 1½ in., 1¾ in., and 2 in. Pipe Outlets. Inlets are one pipe size larger.
Style A—30° Angle Valves, are made in sizes ½ in., and ¾ in.
Style R.A.—Right Angle Valve, made in sizes ¼ in., ⅜ in., ½ in., and ¾ in.

CLECO GROOVED HOSE NIPPLES



Grooved Nipples when attached to the Hose with Wire Clamps as illustrated cannot "blow out." Wire clamp tool shown below applies the wires to hose.

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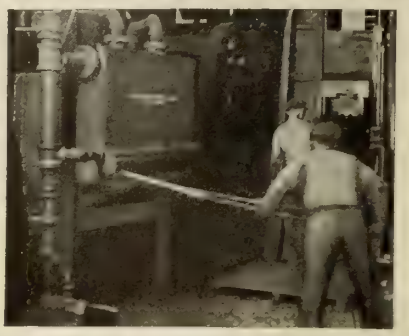

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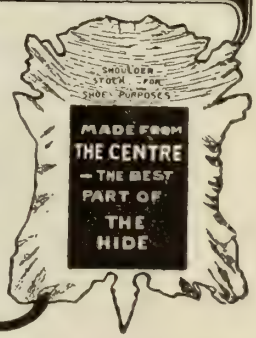

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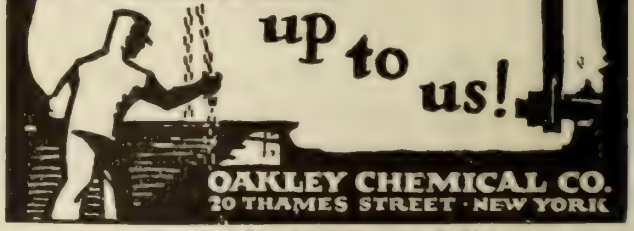

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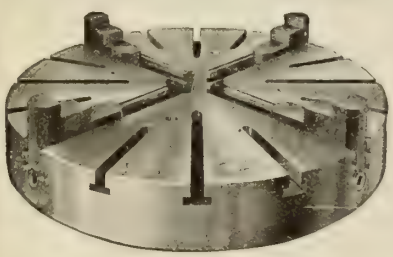

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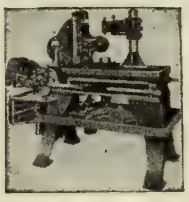

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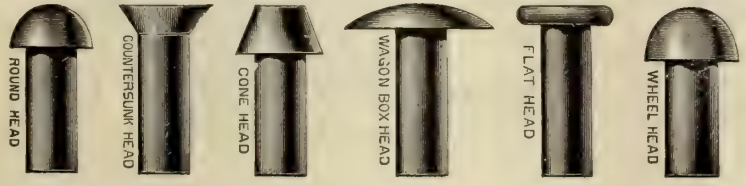

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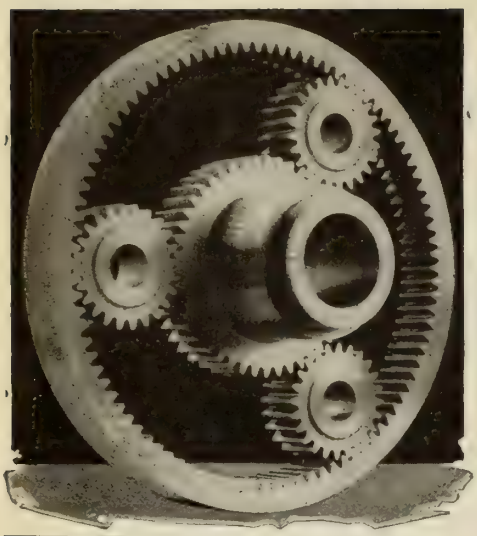

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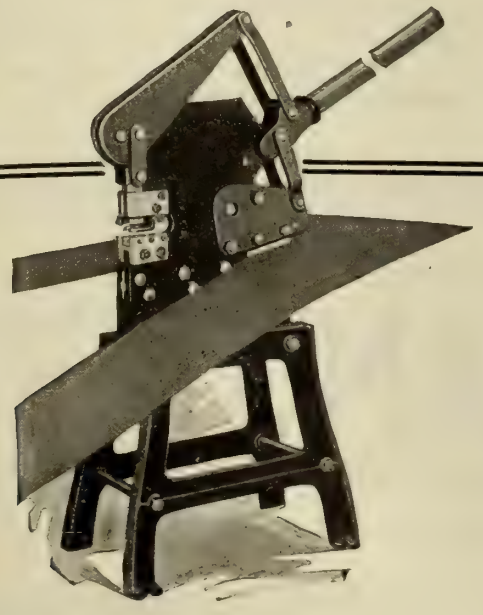

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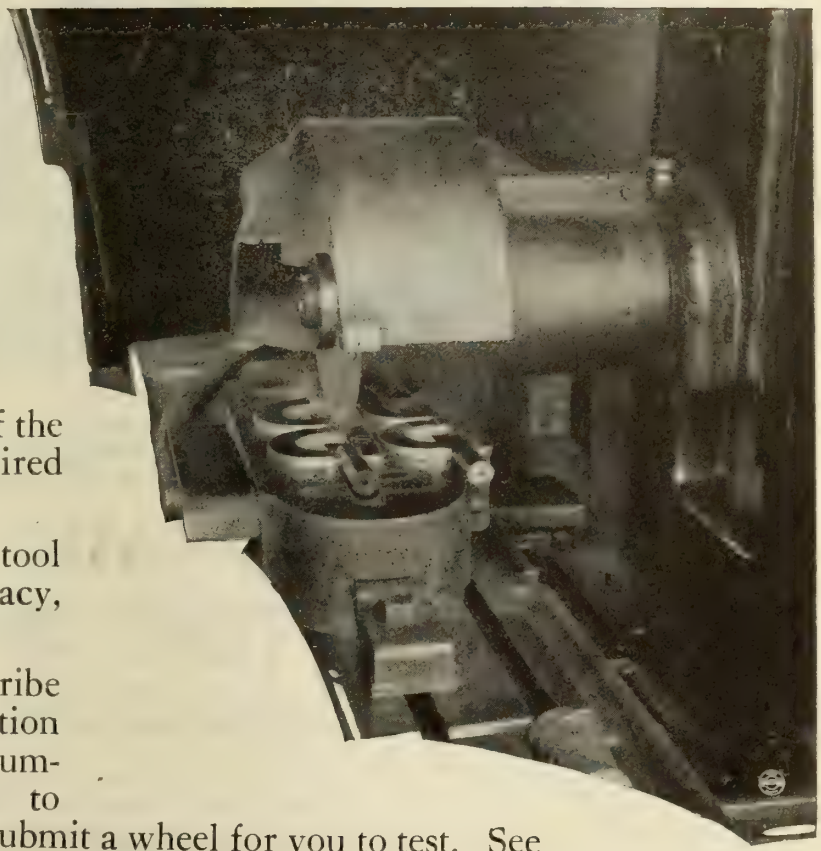

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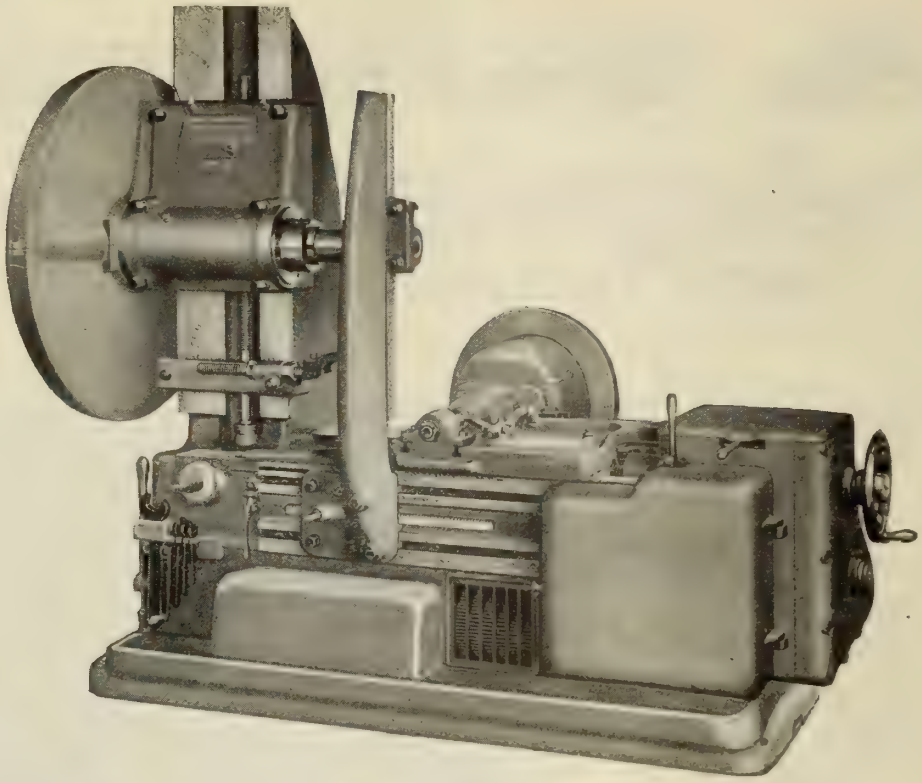

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CANADIAN MACHINERY
AND
MANUFACTURING NEWS

Vol. XXVIII, No. 2 July 13, 1922

Getting Service and Output From Sawing Machines

Angle, Set and Pitch of Teeth Must Be Right—Blades Should Have Proper Working Tension—Inserted Tooth Cutter—Intricate Shapes Produced on Shaping Saw

By J. H. RODGERS

EFFICIENCY in the cutting of metal by means of the sawing process requires a more thorough knowledge than one would at first suppose. The extent to which this method of metal cutting is now practised by the use of the hack saw, band saw or circular saw is the result of long experience in the development of improved steel and machine equipment. As any system of sawing is an evolution of the ordinary hack saw a few remarks on their handling and maintenance may be of interest.

The proper dimensions of saw blades should receive careful attention as it is very important that length, width and thickness be properly balanced. If too thin for length and width the edges become slack when strained in the frame, often resulting in crooked sawing or broken saw blades. On the other hand, if too thick unnecessary pressure is required to cut the metal.

Size and Shape of Teeth

The greater the number of teeth to an inch the more pressure required to cause a hack saw blade to cut. Thick, wide blades are made for heavy rapid cutting and should have coarse teeth as these require less pressure in cutting, do not clog easily, and are less likely to overheat and draw the temper from the points of the teeth. The angle of the teeth should be as great as possible for combined strength and speed of cutting.

Some mechanics believe that the finer the pitch of the teeth the longer the life of the blade. The pressure required to cause a saw to cut is in harmony with the area of its points, which area increases as the points become dulled. Fine teeth hack saws are legitimately demanded upon very thin stock sharp corners and tubing with thin walls. If the teeth are not combined with abnormal thickness they will stand a limited amount of abuse in excess of larger teeth, therefore they cover careless, and unavoidable awkward sawing to a limited degree.

Set of the Teeth

The object of set is to provide side clearance to the blade while cutting. This clearance is reduced as the teeth wear, therefore it should be sufficient to maintain ample freedom so as not to wear away in advance of the normal dulling of the blade. The diagram below is intended to represent a section of blade and several teeth.

If pressure is applied at A the resistance will be very great; the other points B, C, and D will decrease in resisting value according to the angle of inclination from the body of the blade. Consider B as representing the set of 10 pitch teeth, and C as representing the set of 14 pitch teeth. B has a greater resisting angle than C, therefore 10 pitch teeth of a certain thickness of blade carry a better set angle than a 14 pitch blade of the same thickness. If teeth are over set the angle of set becomes unfavorable. Small teeth combined with excessive thickness are bound to give a weak angle of set. If the body of a saw is extraordinarily thick for the size of teeth a proper amount of set cannot be obtained without injuring the structure of the metal.

Straining the Blade

One of the causes of frequent breakage is the way the blades are held in the frame. Hack saws should only be strained sufficiently to keep them taut. A saw strained to nearly the breaking point often breaks when placed in operation due to the additional strain of

Cuts 1 and 2 through courtesy of Newton Machine Tool Works. Cuts 3 and 4 by courtesy of Peerless Machine Co.

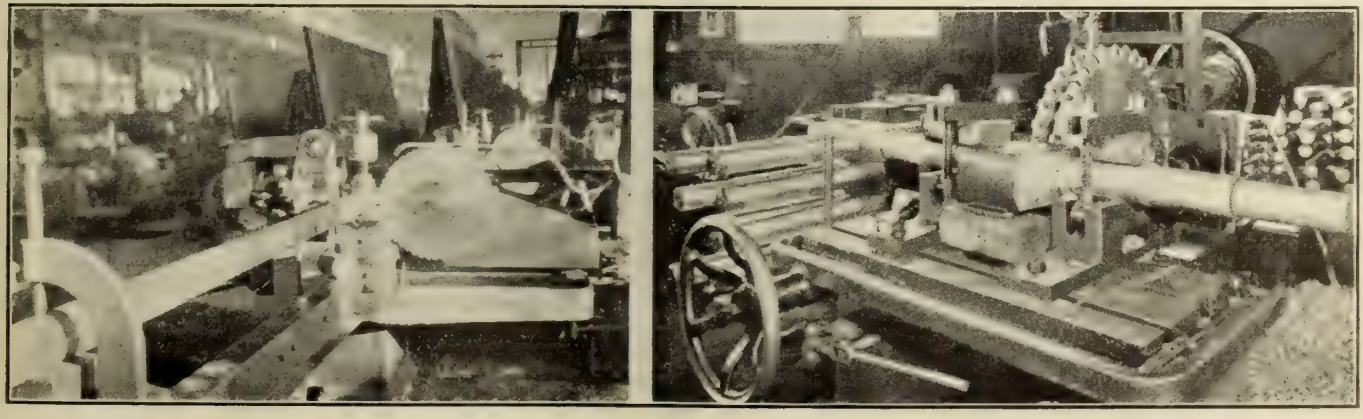


Fig. 1.—Left: Cold saw cutting-off machine cutting 3¼ in. bars. Right: Cutting out crank shaft webs.

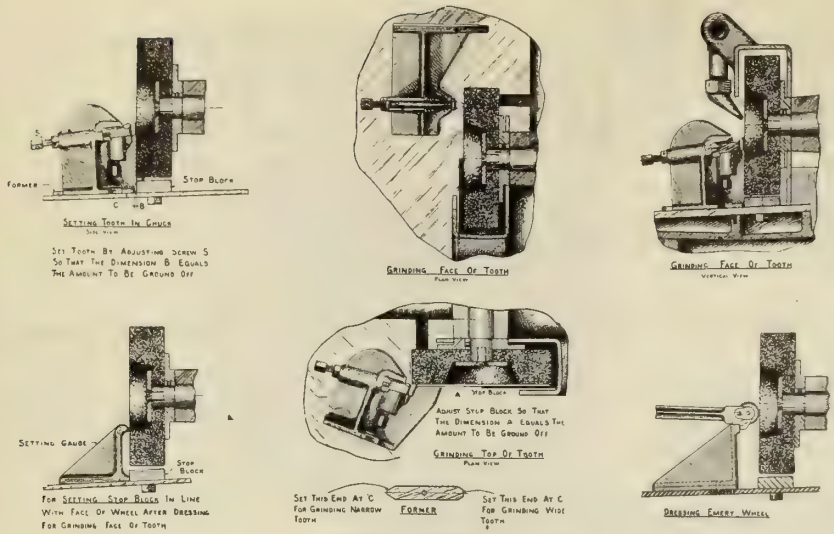

Former
Stop Block
Setting Tooth In Chuck
Set Tooth By Adjusting Screw S So That The Dimension B Equals The Amount To Be Ground Off
Grinding Face Of Tooth
Grinding Face Of Tooth
Setting Gauge
Stop Block
For Setting Stop Block In Line With Face Of Wheel After Dressing For Grinding Face Of Tooth
Stop Block
Adjust Stop Block So That The Dimension A Equals The Amount To Be Ground Off
Grinding Top Of Tooth
Set This End At C For Grinding Narrow Tooth
Former
Set This End At C For Grinding Wide Tooth
Dressing Emery Wheel

Fig. 2.—Sharpening inserted tooth cutters.

pressure applied. Some hack saw blades are made quite flexible by making a portion of the blade back of the teeth soft. This is done so that it will stand up against hard usage. This type of blade, however, although serviceable in many ways, has its disadvantages. They are not entirely suited for machine sawing as the tendency is to cut an irregular path owing to the lack of rigidy and temper in the blade. Chips will sometimes embed in the blade and cause breakage.

Similarity of Cutting Tools

In order to properly cut metal, the cutting tool must be provided with top, front and side clearance. Lathe tools, planer tools, milling cutters, twist drills, reamers, etc., all have three clearances. Hack saw teeth are metal cutting points, therefore the three clearances are necessary. Top clearance is provided and when worn away by use, cutting ceases. If front clearance is not provided, sawing is resolved into scraping, just as it would be in lathe and planer work. If side clearance is lacking through imperfect setting side friction is excessive, resulting in undue wearing away of the set, causing the generation of unnecessary heat, which tempers the points of the teeth, and the holding up of the blade causing slippage.

A common fallacy is to judge of the value of hack saw teeth by their speed of cutting. Slim weak teeth cut rapidly but owing to breakage, lack endurance. A correctly designed blade has proper cutting speed coupled with endurance. A machine with a 6 inch stroke causes the blade to travel six inches forward and six inches backward or one foot per stroke. Example, 60 strokes per minute times one foot equals 60 ft. per minute saw speed, which is sufficient for unannealled tool steel in wet sawing, 120 ft. per minute is sufficient for soft stocks, wet sawing, 80 ft. per minute for cast iron, which should be cut dry on account of slippage after the teeth become slightly dulled. When smoke is generated it indicates too high a speed.

The successful use of hack saws, whether hand sawing, wet or dry machine sawing depends upon the proper blending of the two controlling factors of speed and pressure. If a machinist revolves work in a lathe too rapidly, the work heats the cutting tool and lowers its temper and the tool refuses to cut. The remedy is to revolve the work at a less speed. The principal of cutting metal in a lathe and sawing metal is one and the same. If saw teeth dull unduly it is proof that the points of teeth are being tempered. They are over speeded. The remedy is to run the saw fewer strokes per minute. If saws or teeth break it is proof that pressure is excessive. In lathe work the softer the metal the more rapidly it can be fed to the tool. In sawing, the softer the metal the more rapid the saw can be run. Pressure is necessary to cause saws to cut; sharp saws require less pressure than dull saws. The proper pressure to cause a dull saw to cut will cause a sharp saw to hog in and break. Soft stock and small stock require less pressure than hard stock and large stock. Thin saws require less pressure than thick ones. Breakage is proof of too much pressure.

A common error is to use too much pressure with sharp saws and too little pressure with dull saws. It is good practice in starting new saws to use them under light pressure until the points are slightly dulled, after which the pressure can be freely increased.

Factors of Economy

Hack saws can be crowded well up to their tempering and breaking points and made to cut rapidly, in which case they will give a limited service, or they can be operated at a less rugged pace and they will give additional service. Hack saw machines are operated in two ways namely, allowed to cut without attention and attended. If unattended it is economy to save saws. If attended it is economy to save wages. It is not economy to carry saws to the point of breakage, nor to run them too fast with light pressure and glaze the teeth and cause slippage. Teeth can be tempered in both dry and wet sawing. It is simply a matter of sufficient speed and pressure. Sharp saws will stand a greater speed than dull saws. A sharp saw cutting successfully well up to the limit of speed and pressure will, when sufficiently dulled, temper its teeth and abruptly stop cutting. The safest formula for economical sawing is to keep well within the limit of speed and use sufficient pressure to keep the blade cutting. It is waste to enter the breaking zone.

Lubricate Saw Freely

In wet sawing under high speed many blades are entirely ruined by allowing the saw to cut in advance of the cooling liquid reaching the blade, or owing to the pump failing to function. A single stroke of the saw on hard metal is sufficient to soften the points of the teeth. The cooling liquid should be of ample volume and applied central upon the saw directly over the point of cutting.

Saw efficiency might be summed up briefly as follows: heavy machines break light blades; heavy blades refuse to cut in light machines; blades temper from over speed; blades break from over pressure; keep speed and pressure within limit; thick blades with small teeth have a weak set; loose blades buckle and break; over-straining breaks blades. Too high speed causes dulling; too great pressure breaks the teeth; make conditions conform to saw.

All beneficial instruction in regard to saw blades may have a negative value

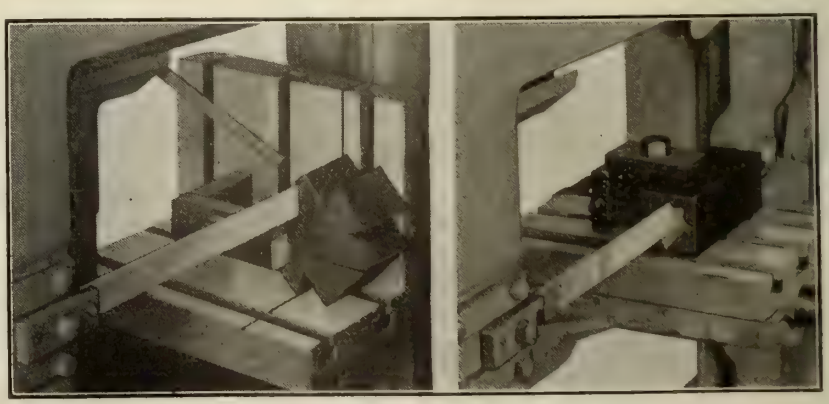


Fig. 3.—Cutting shapes on universal sawing machine.

if care is not given to the machines in which they are used. These should be kept in good repair and proper alignment to maintain the maximum production efficiency.

The remarks outlined for the use of hack saws likewise apply to band saws and circular saws. Various examples of the latter are used quite extensively in milling machines, and it is often difficult to distinguish between a saw and a cutter on this work, but the principles apply in all cases.

Large Cold Sawing Machines

Some examples of heavy duty sawing is shown in Fig. 1. The view on the left shows a 26-in. Newton cold saw cutting-off machine equipped with 22-inch diameter saws, cutting off 3¼ in. stock at the rate of 27 slugs an hour. The machines are equipped with air controlled clamps and stock trolleys which facilitate handling of material. When they are located in alternate positions one man can look after two machines. The rate of cutting here specified gives economic production for blades, although increased cutting speed can be obtained without overduly working of machines.

The view on the right illustrates an interesting operation for this type of saw. It shows a 32-inch saw working on the large crank shafts. The advantage of sawing these webs over the slotting method is the continuous cutting of the saw. The staggering of the cutters permits of maximum cutting at normal speeds.

Grinding the Inserted Tooth

The accuracy of the setting of the inserted teeth is a very important part of production service. Special grinders and tooth holding fixtures enable the operator to obtain the greatest degree of efficiency when re-grinding the cutters, as the proper contour and size is always maintained. Various views of the sharpening process are shown in Fig. 2. At the lower left is shown the method of setting the stop block by means of the setting gauge. After dressing the wheel face, the gauge is placed against the wheel and the stop block lined up and clamped. The cutter is placed in holder and clamped in position, the amount to be ground off being regulated by the space B, adjustment being made by screw S. The top centre view shows a plan of this operation. Details of the grinding of the top of tooth cutter is shown at lower centre, while the method of dressing wheel is indicated at lower right.

Universal Shaper Saw

A more extended application of the hack saw to production work is shown in Fig. 3, where a universal shaper saw is used in producing work of an intricate character. The left hand view shows the production of drop forge die blocks by means of saw cuts. The illustration on the right shows the cutting of a double square from a block that previously had a hole drilled through.

This saw is operated on the crank and connecting rod principle and the draw or cutting stroke takes place when the speed is reduced to the minimum when the operating speed is the maximum suitable for the work being handled. On the return stroke the blade is relieved by action of a cam on the crank shaft. A similar cam on the same shaft operates the feeding mechanism. The rate of feed can be regulated by a small handwheel, through a spring that compensates for the resistance of the material being cut.

A special attachment is furnished with the machine for the accurate cutting of irregular shapes. The table is fitted with a cross feed. An idea of the range of this machine may be had from Fig. 4.

Fig. 4.—Some of the work produced on universal shaping saw.

NEARING DANGER IN COAL SITUATION

Enquiry of officials handling records of incoming freight in Toronto, shows that there is very little coal of any kind coming across the international bridges for Canadian consumption. "We have a few cars, say three or four daily, representing hang-over shipments, where formerly we would have trainloads," was a statement given to Canadian Machinery. It was added that, while there were fair supplies on hand, some concern was developing as to the future.

At the present rate of production and consumption, one month will bring the critical period: that is, the first or second week in August. According to Industrial Digest, this estimate is compiled from reports of the United States Geological Survey and the Department of Commerce. If production is not increased by that time, it is said, the factories of the nation will have to shut down for a day or two each week in order to conserve the coal supply.

Since April 1 the anthracite mines of the country have produced only a few thousand tons of coal. During that period they usually mine about 20,000,000 tons, nearly one quarter of the entire year's requirements. They are so far behind now that if work in the anthracite regions were to start to-morrow it would be impossible to turn out a full supply this year, even if the mines operated constantly at maximum speed and had a continuous supply of all the freight cars they needed to take the fuel away.

In the bituminous industry the non-union mines are running at a terrific rate, producing between 5,000,000 and 6,000,000 tons a week. One Wednesday in the middle of June they broke a record by producing more than 17,000 carloads—the largest single day's production ever turned out in those fields. But in spite of the best they can do the nation's weekly consumption exceeds production by about 2,500,000 tons.

The situation in the bituminous industry, according to government reports, has never been paralleled before. With the certainty of a shortage before them, the consumers of soft coal nevertheless delayed their purchases until the new freight rates went into effect on July 1. Up to that time coal accumulated at terminal points, clogging up transportation facilities.

In Alabama at the close of June there was so much non-union coal on hand that the bottom dropped out of the market. An order by the Interstate Commerce Commission permitting Alabama coal to travel into the Chicago market at a competitive freight rate with West Virginia coal brought thousands of tons north from Alabama, but left the Birmingham market still overloaded.

Now that the rates have been reduced a heavy demand is expected. New England, which has been holding off, will probably put its orders in, and the rest of the nation will do likewise. Then the shortage will begin to be apparent in the market.

SHARPENING CUTTING TOOLS

Cutting tools should be sharpened against their edges, according to a booklet "How to Sharpen." With certain exceptions all kinds of sharpening, both on grinders and oil stones, should be performed with the tool edge working against the stone. One exception is when the tool itself is held still while the whetstone or oil stone is moved to accomplish the sharpening. Sharpening against the edge results in a minimum amount of wire edge being left. Straight strokes are productive of quickest results.

Discuss Plans for Blast Furnace Industry

Meeting of Mining Men and Metallurgists Before Minister of Mines—Adequate Magnetite Ore Resources Available—Government Bounty or Other Assistance Towards Development—Competition With Natural American Ores Big Problem—Further Exploration of Ontario Range Advisable

THAT the known large iron ore resources of Ontario are sufficient to support an iron and steel industry, provided these ores are beneficiated.

We believe that extensive drilling and exploration of the known ranges may prove that existence of available ore resources that would not require beneficiation.

We believe that the market can absorb large tonnage of beneficiated ores if the price is satisfactory and that both magnetic separation and calcining of siderites are recommended.

Be it resolved that the Ontario Government be requested to appoint a special committee consisting of at least one geologist, one metallurgist and one transportation expert to prepare a report upon the various phases in connection with the development of the industry.

The above resolutions were the result of a meeting, the first of its kind, held before Hon. Harry Mills, Minister of Mines, at the Parliament buildings, Toronto, July 5, to consider various questions looking to the practical development of Ontario's iron ore deposits. The meeting brought together quite a representative gathering of metallurgists, geologists, and manufacturers, all more or less directly interested in the question.

The discussion was directed along lines calculated to bring out information relative to the extent of the iron ore deposits of Ontario, but also their qualities from a merchantable standpoint, and the procedure deemed necessary to make the product attractive to the market.

Large Deposits of Magnetite Ores

Under the heading, "The extent of the iron ore deposits of Ontario," the discussion was lead by C. W. Knight, Dr. W. H. Collins, and J. D. Jones, general superintendent of the Algoma Steel Corporation. It developed that from the Ottawa region on the east to the Superior region on the north, there were frequent deposits of varying quantity. Some hematite ore had been discovered, but not in sufficient quantity to encourage extensive industry. It was, however, pretty welll established that in magnetite and siderite ores the province had exceptional resources. Notable examples referred to were the Moose Mountain mine, where according to J. Roland Cox, the magnetite ores were briquetted, and the Magpie Mine of the Algoma Steel Corporation. Both of these mines are at present inactive. During the war period they had been operated to advantage, but at the present time could not compete with the ores from the Messabe range in Minnesota, and other well organized American ranges in Michigan and Wisconsin.

Must Have Assistance

A significant statement was made by George S. Cowie, secretary of the mines department, Algoma Steel Corporation, that they had never made a cent out of the treatment of low grade ores. There had been some encouragement while coal was available at $2.75 a ton, but when it advanced to $12, it was enough. That was one reason why they were not operating the Magpie mine. They had spent something like three million dollars treating low grade ores in order to keep so much money in Canada. They did not intend to make further expenditure in that direction unless there was government encouragement of some kind, say by way of bounty. Such assistance he said was all that was required to bridge the gap that now existed between the producers of the ore and its purchase and use by Canadian furnaces.

Mr. Jones pointed out that, after an investigation of American mining and furnace enterprises, there was really no unsurmountable difficulties in Canada. Taking a mixture composed say, of 60% siderite and 50% magnetite, he could produce an ore that was cheaper by $1.57 than anything they could get from the straight American ores. What was needed here was a special study of ore conditions in order to give the furnaces the grades of ore necessary to meet the requirements of customers. There were no problems or conditions in Canada that were not existing in United States, and were being solved there while here very little had been done in an organized way.

On the suggestion that an association be formed to develop an ore industry and place the same on a commercial basis, Col. J. A. Currie, Parry Sound Iron Co., stated that in the United States, the organization of the industry was such that the amount and prices of certain grades of ore for specific purposes were matters of definite knowledge at the opening of the placing period, generally the first of the year. All question of chance was eliminated. The first matter to consider was, what incentive existed to buy Canadian ores? What guarantee could be given as to grades of ore? In the United States this was a definite matter.

Can Ontario Ores Compete?

In discussing processes for increasing the metallic content of low grade magnetites, G. C. MacKenzie, secretary of the Canadian Institute of Mining and Metallurgy, came to the conclusion that unless beneficiated ores could compete with natural ore both in quality and

General view of the blast furnaces at the plant of the Algoma Steel Corporation.

price, the venture must prove unprofitable.

J. Roland Cox, Moose Mountain Mine, replied that they had proven at this mine that Ontario ores can be treated commercially. During the war they had shipped ore as far as Tennessee, and there was again a prospect of business from that locality. The beneficiated ores from Moose Mountain, he declared, were superior to anything he had heard of, either physically or chemically. As far as the meeting was concerned, the statement could be taken as positive, that, operating on a large scale, say two to five thousand tons, and using ores of 35% in iron, low in phosphorous and sulphur, Ontario could compete with the natural ores of the United States. A ton of such ore was worth more than a ton of Messabe, being much higher in iron content. As to processes of beneficiating magnetite ores, Mr. Cox was of opinion that, from recent developments, a direct electric process would be evolved that would be satisfactory in every way. Cheap electric power was bringing this within the range of possibility, and at the present time some important individual investigations were being made.

When U. S. Bought Canadian Ores

T. B. Caldwell, Lanark, expressed the opinion that, so long as the Canadian furnaces had an easy buying market in the United States, they appeared to be satisfied. Last year they had shipped in more than five million dollars' worth. It was time that Canadians took steps to become more or less independent in this regard by development of their own resources. The war had taught not only the necessity but the feasibility of further development of the furnace industry. He stated that the range at Temagami, within 300 miles of Toronto, was an example of the rich deposits available throughout Ontario. This brought from Mr. Kidd, Ottawa, who is interested in eastern properties the interesting statement that, in the early eighties, ore to the amount of half a million tons, had been shipped from the Ottawa district to Cleveland and Pittsburg. This ore was suitable for high grade steel and would still be shipped to the United States were it not for the fact that the American Government had imposed a tariff of 60% against Canadian ores. He asked Mr. Morrow of he Steel Company of Canada why such ore was not acceptable to Canadian furnaces. Such ore was being sold to Pennsylvania interests.

Home Market Available

Mr. Morrow replied that anything that was acceptable to the Pennsylvania people was acceptable to the Steel Company of Canada. He was inclined to the opinion that acceptable Canadian ores had never been offered. If it had, it must have been off somewhere. Not only had market prices to be considered, but what was of prime importance, the chemical analysis based on furnace requirements. Different ores produced different grades of pig. He was of opinion that Canadian ores were available, but not in sufficient tonnages. The Steel Company required from two to three million tons yearly, and this had to be available before the close of navigation. As marketed at present, different mixtures were actually delivered to meet different requirements of the furnaces. His company produced a larger variety of products than any in the world.

Discussing beneficiation methods, J. D. Jones stated that at the present time, to his mind, by far the cheapest method would be to treat ores so as to make them amenable to blast furnace practice. The re-designing and building of blast furnaces and plants, costing three or four million dollars, was far in excess of what the cost of a concentrating plant would be.

Plans For Assistance

Different plans of government assistance were discussed. A bounty of 75 cents per ton at the mouth of the mine, for a period of years, say 10 or 15, was regarded with favor. Another proposition was that the government should build and equip plants, scattering repayment over a series of years, as in the housing plan. It was suggested further that electric power might be made available at a low figure as in Sweden where the iron and steel industry has developed to huge proportions, almost as the direct result of such encouragement. It seemed agreed that until there was such assistance for the Canadian industry, no progress would be made.

The question of tariff on mining machinery was also touched upon. Mr. Cowie stated that when they were starting the Magpie Mine and were in the market for a certain kind of brick, they had to prove that such brick was not made in Canada. They did so, and the brick came in free. Shortly after that, a duty was slapped on and, he said, that brick could not be obtained in Canada to-day. Mr. Cox also pointed out, as an instance of the peculiar working of the tariff regulations, that he had purchased equipment similar to some used in the silver mines, but, because his was an iron mine, he had to pay duty.

U. S. Ores Depreciating

Hon. Mr. Mills pointed out that these were matters that could be taken up with the Dominion Government. The object of the meeting was to discuss the feasibility of a furnace industry. On this the meeting seemed unanimous that Canadians should develop such an industry, rather than have people come in from other countries to develop it for them. One factor that tended to eliminate the factor of an impossible competition was that deposits, in the United States, of the hematite ores were depreciating and that in ten or fifteen years the treat- of low grade ores would have become an absolute necessity. Already at Babbit, in the Messabe range, a plant costing four million dollars was being built for the treatment of the lower grade ores. But he had no doubt that beneath the deposits of magnetite ores in Ontario concentrations of natural ore would be found. He read an extract from a paper prepared by J. E. Marks, Port Arthur, to the effect that during the past 13 years, Canada imported iron and steel products to the value of about $1,235,000,000, all of which should have been produced in Canada. He said that Canada should be in a position to produce seven million tons of steel.

The question of transportation was discussed by representatives of C. P. R. and C. N. R. and the meeting assured that there would be sympathetic co-operation from that quarter.

J. N. McKendrick, Galt, president of the Belcher iron mines, located on Belcher Island, Hudson's Bay, stated that they had there a practically unlimited deposit of ore with metallic content running from 40 to 54%, which could be laid down at Cleveland to meet American competition, and which could also be made available to the British market, as he had learned that the passages through Hudson's Bay were not as unnavigable for as long a period in the year as the Hudson's Bay Company represented them to be.

OBITUARY

Shipbuilding and allied interests will regret to hear of the death of William Newman, supt. of wrecking for the John E. Russell Wrecking Co. of Toronto. Mr. Newman, who had gone to St. Catharines to superintend the reconstruction of the freighter Joyland, which he raised near Clayton, New York, a few weeks ago, was walking the deck of the steamer when he stepped into an open hatchway and dropped to the hold of the vessel, sustaining serious injuries. He was taken to a hospital but died two hours after admission. Mr. Newman was born in Kingston forty-nine years ago, and had been associated with shipbuilding and salvaging interests for many years. During the war Mr. Newman was commissioned by the U. S. Government through the Canadian Stewart Co., to superintend the installation of special bulkheads in the big ocean liners commandeered for troop transport. He held the record for the launching time of large vessels.

Cast iron remains a question in welding. According to some welders, the difference between perfect success in some instances of cast iron welding and failure in others lies in the various degrees of preparation for welding and treatment subsequent to welding. Cast iron not prepared by adequate pre-heating is apt to crack, and the crack does not always take place at the weld. For best results, the entire casting should be at a red temperature, though there are cases where partial pre-heating is sufficient.

Machining Locomotive Piston and Cylinder Head

Multiple Tooling Used to Advantage in Machining Small Quantities—Standardizing Machine Equipment—Combining Feeds to Obtain Tapers—Work Finished in Two Settings

By H. ALTON

MODERN railroad shop practice does not lend itself to the use of automatic and semi-automatic machines to the same extent that a straight manufacturing proposition does. Nevertheless, in most shops there are a number of turret lathes and other machines, with and without automatic features but carrying multiple tooling, that are used in regular work machining relatively small numbers of pieces, but doing so very efficiently. At a first glance, the tooling set-ups do not impress one with the idea that they are efficient when employed for short runs. The fact that such practice does pay under these circumstances, is due to the standardization of certain boring bars, tool holders, and small tools. In the hands of experienced men this form of equipment becomes very versatile. Many jobs can be set up quite as quickly as general work on an engine lathe or other standard machine. The two machining operations described in this article, were accomplished in a railroad shop on the Bullard vertical turret lathe with some of the standard equipment developed for this purpose. In these operations it will be seen that the varied feeds and speeds, as well as combinations of feeds that are available, helps to a great extent in the application of the tooling.

Machining a Locomotive Piston

The piston casting is held in a three jaw chuck in the usual way as indicated in Fig. 1. In the first operation, turning and facing are done simultaneously. There are two facing tools held in the bar extending from the turret. These tools take what constitutes a roughing and finishing cut with one traverse of the turret. While they are cutting, the tool in the side head is turning the outside diameter down to a point where the lower ring groove will be located. A complete turning is, of course, prevented by the chuck jaws.

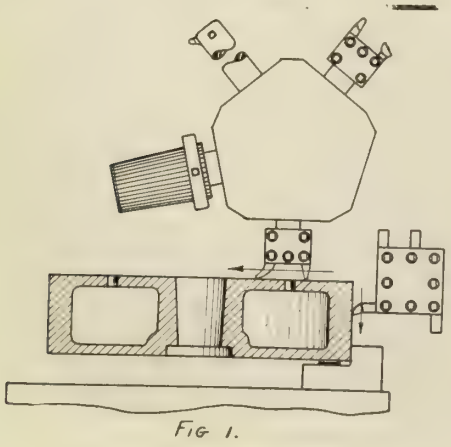


FIG 1.

Turning and facing piston.

After this work has been completed the turret is indexed and the edge of the piston is chamfered in the second operation. The tool is held in the turret and the proper angle of feed is accomplished by use of the vertical and transverse feed simultaneously. The angle is obtained by using certain index gears in combination with certain feed positions. As will be seen the round nose tool takes the first cut removing the major portion of the metal. It is followed by the square nose finishing tool held in the same holder. With the indexing of the turret, the operator also swings the side head around and brings into operation the two tools that rough out the grooves for the rings. While the chamfering is in progress the side tools are roughing out the grooves. These operations are shown diagrammatically in Fig. 2.

The third operation is shown in Fig. 3. The ring grooves are finished by the single tool in the side head, while the piston is rough bored by the tools carried in the turret. The taper feeding is here also accomplished by combining the vertical and transverse feeds. In Fig. 4 the fourth operation is illustrated, showing how the piston is finish bored and finish turned. In the fifth operation, shown in Fig. 5, the piston bore is reamed. A special reamer fitted with a stop collar is used. This latter fixture ensures that all bores will be machined to extremely close limiting diameters.

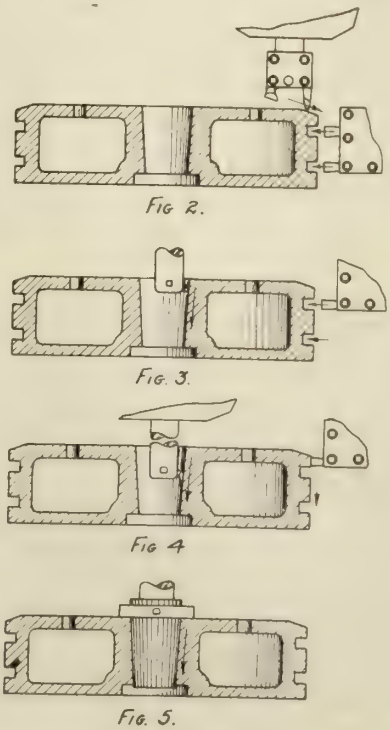


FIG 2.

FIG. 3.

FIG 4

FIG. 5.

Operations 2-3-4 and 5.

This operation completes the work done in the first setting.

The piston is turned over for the second setting, and is located and chucked as shown. In the first operation the turret tools rough and finish face while a double sub-operation is occurring simultaneously with the side head tools. These side head tools rough turn the remaining portion of the outside diameter, and then the edge is chamfered as shown in Fig. 6. The second operation is to rough out the counterbore with the turret tools and finish turn the outside diameter as shown in Fig. 7. The third and final operation is to finish the counterbore, which operation is sketched diagrammatically in Fig. 8.

Operations on a Cylinder Head

It will be noted that there is a certain general similarity between the tools used and their application, in this instance, and the ones used in machining the piston. This point illustrates the underlying fact that such equipment can be standardized and yet be used in a very general way. This cylinder head is machined practically all over—some surfaces being merely cleaned up for clearance. The head is chucked as shown in Fig. 9, special jaws being used. The

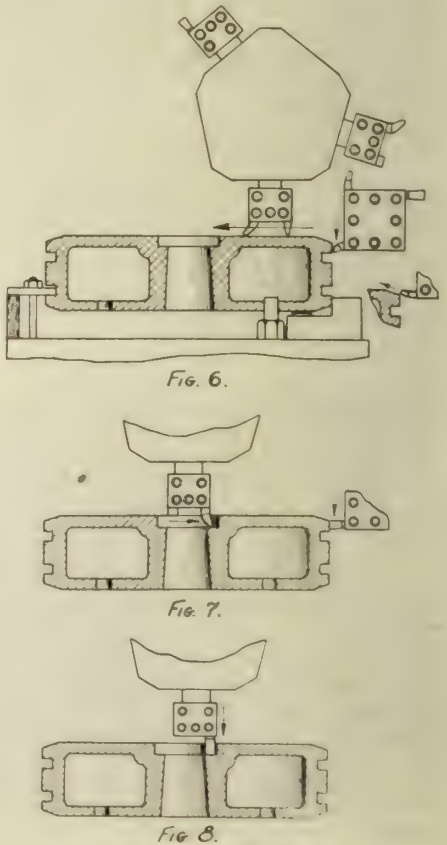


FIG. 6.

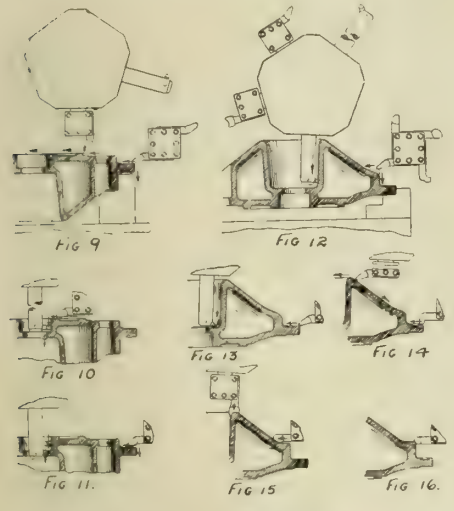
FIG. 7.

FIG 8.

Operations 6-7 and 8.

first operation is that of facing and turning as shown, both turret and side head tools being used. The second operation rough bores and rough counterbores the head with the turret tools, while certain finish facing operations are accomplished by the side head tools, as shown in Fig. 10. The bore and counterbore are finished in the third operation by the turret tools as shown in Fig. 11. At the same time the outer flange is finish faced, and the outside diameter finish turned by the side head tools. These three operations complete the work of the first setting.

For the second setting, the head is turned over and chucked as shown in Fig. 12. The first operation in this case is to rough bore the central recess with the turret tools and to turn and face the top surfaces with the side head tools. The taper attachment of the side head is



Operations on cylinder head.

used to obtain the necessary angular feeding. The second operation is to finish the taper bore, face the internal flange and form the fillet with the turret tools as shown in Fig. 13. While this is being done a side head tool is used to face the flange on the outside. The third operation is to finish face the tapered surface and square off the top surface by means of turret tools employing a combination of vertical and transverse feeds. While this operation is being done the side head tools are used to finish face the outer flange. These operations are shown in Fig. 14. The fourth operation is shown in Fig. 15. The top radius is formed by a turret tool and the shoulder is faced and the radius formed by a side head tool. The fifth and final operation is one of forming done by a side head tool, and shown in Fig. 16.

Machining Time

The time consumed in setting up and machining for one of these pieces compares favorably with that of engine lathe or boring mill performance, but when more than one part is to be put through, the saving in time becomes very evident. The stops on most of these machines can be set from gauges, test blocks, or even from the first piece.

Progress Report Of The Canadian Engineering Standards Association

THE progress made by the Canadian Engineering Standards Association, Ottawa, was presented and discussed at the last meeting held. Following are some of the interesting things commented upon.

Regarding the work of the sub-committee on the Canadian electrical code it was decided to forward to the minister of trade and commerce a memorandum outlining the present situation in regard to this question, and requesting him to convene a meeting of representatives of the various provincial governments, to discuss the possibility of interprovincial agreement and to acquaint the provincial governments with the difficulties now experienced by the industry. The following resolution was unanimously passed:

"Resolved that the memorandum on the proposed Canadian electrical code be approved, and that the secretary be rected to forward it to the minister of trade and commerce, calling his attention to the unsatisfactory situation at present existing in Canada due to the lack of uniformity in the requirements for electrical appliances and construction in the various provinces, and requesting the minister to consider the advisability of calling a conference of representatives of all the provincial governments with this association to discuss the matter with a view of obtaining interprovincial agreement and action." On the suggestion of Mr. Mountain it was decided to form a committee to consider the desirability of formulating standards for crossings of water and other pipe lines under railway lines.

The secretary reported that in response to an invitation received from the American Engineering Standards Committee, Mr. John Murphy, electrical engineer, board of railway commissioners, had acted as the representative of the C. E. S. A., in attending a conference held in New York to discuss measures to be taken in the United States with a view of obtaining uniformity in specifications for overhead crossings of electric lines over railways. This question in Canada is largely under the jurisdiction of the board of railway commissioners, and in order to obtain as far as possible an agreement between the requirements in force in Canada and those proposed in the United States it has been arranged that the American proposals, before their adoption, shall be forwarded for consideration and comment to a C. E. S. A. committee which is to be organized for that purpose. An invitation from the A. E. S. C. to take in a conference regarding colours for traffic signals was received. It was decided to thank the A. R. S. C. for this invitation, and to enquire whether a method of dealing with the matter similar to that adopted in the case of overhead crossings would be satisfactory to the A. E. S. C.

A suggestion from Mr. H. G. Bertram of the John Bertram and Sons Co., Dundas, was laid before the committee, outlining a scheme for the development of dimensional standards in Canada in connection with machine tool building. The committee expressed the opinion that action along the lines of Mr. Bertram's suggestion was very desirable, and the matter was referred to the chairman of the sectional committee on machine parts with a request for action if possible.

On the motion of Dr. Porter, seconded by Mr. Mountain, it was unanimously resolved that Mr. H. H. Vaughan be appointed chairman of the C. E. S. A. in succession to the late Sir John Kennedy. Mr. Vaughan expressed his willingness to accept the position and pointed out that, in his view, the thing which was now most necessary for the success and growth of the C. E. S. A. was the encouragement of the effective interest in the work of the association on the part of the manufacturing and industrial industries, this support being just as important and advantageous as the assistance rendered by engineers or scientific and technical societies. The election of Mr. Vaughan as chairman requiring the appointment of a second vice-chairman, Messrs. T. A. Russell and D. H. McDougall were unanimously elected as vice-chairmen, together with Dr. J. B. Porter as honorary secretary-treasurer, these gentlemen, with the chairman, forming the executive committee. The meeting of the main committee was followed by the fourth ordinary general meeting of the association, at which the annual report on the progress of work was presented, together with the auditor's financial statement for the year.

BOOK REVIEW

Modern Plumbing Illustrated is the title of a book recently offered by the Norman W. Henley Publishing Co., of New York. The author of this book, R. M. Starbuck, is one of the leading authorities on this subject in the United States. The book is of high standard and has been adopted as a reference book by many leading manufacturers and institutions in many countries. The book contains 407 pages (7½x10½) and treats in a comprehensive manner all problems relating to plumbing installation. Seventy full page plates drawn especially for the work, each plate having from four to eight pages of descriptive text. It is a helpful treatise to master plumbers and manufacturers in the science of sanitary plumbing. Price $5.00.

Montreal Tramways are importing from the mills near Chicago considerable tonnages of street railway rails. These are carried very largely on decks of grain carriers.

Machining Flange Coupling on Turret Lathe

Successful Production Largely a Question of Tooling—Difficulties Easily Overcome—Using Coarse Feeds—Overhead Support Aids to Rigidity—Simplicity of Design

THE USE of auto-lathes on chucking work which can be put in hand in quantities of 50 or more pieces at a time provides a well-tried and certain method of reducing production costs. Many firms who appreciate the saving which can be obtained by the use of auto-lathes have, however, been deterred from installing them by the fear that they would not get the best results from this class of machine on account of imaginary difficulties in tooling.

The auto-lathe is, in reality, a turret lathe in which all operations, save chucking, are automatically performed and one operator can, in consequence, look after a number of machines, so that the labour cost per machine hour is lower than on the combination turret lathe, although the production times may be the same.

The designing and laying out of tools for auto-lathes presents no difficulty to anyone having experience in tooling up turret lathes. The object of the present article is to examine the tooling on an article such as a standard flange coupling, which will show that the difficulties in tooling up auto-lathes are more imaginary than real.

Fig. 1 shows the lay-out for the first operation on the auto-lathe, this drawing giving the dimensions of the finished work-piece. At this operation the work is gripped by the boss in an 18-in. "Coventry" chuck fitted with a spring steady bush for the boring bars. A detailed view of this spring steady bush is inset in Fig. 2, which shows the set-up for the first operation.

The order of the tools can be followed from the lay-out, the first tool to be applied being the standard slide facing tool No. 1, which is brought up into position and held stationary by the standard retaining cam. The front cross slide No. 2 now feeds in, carrying a facing tool and a pusher which moves the slide facing tool transversely. Slightly behind the rough facing tool on the work the facing tool No. 3 comes in and finishes the face.

During the facing operations it will be noticed that there are four tools cutting simultaneously, and as they are operating on a rough casting there is considerable stress on the slide facing tool. To neutralise this, the base of the slide facing tool is tied up rigidly to the headstock by means of a vertical bracket integral with the base, this bracket being fitted with a bush which steadies on the overhead supporting bar carried on the headstock. This novel feature, which has been recently introduced on the slide facing tools ensures absolute rigidity and makes it possible to use much coarser feeds than could be employed previously.

The next tool to come into operation is a standard combination tool No. 4, which carries a boring bar for roughing the bore, a turning cutter for roughing the flange and a second turning cutter for roughing the spigot. This is followed up by a similar tool No. 5 for finishing the exterior of the bore and for sizing the spigot. Both combination tools are steadied by the overhead support as well as by the boring bar. The bore is finished to size by means of one of the standard Herbert boring bars with adjustable floating cutters.

At the second operation, Figs. 3 and 4, the method of chucking is particularly interesting, as it shows how concentricity between the two operations is ensured. A detailed view of the chuck

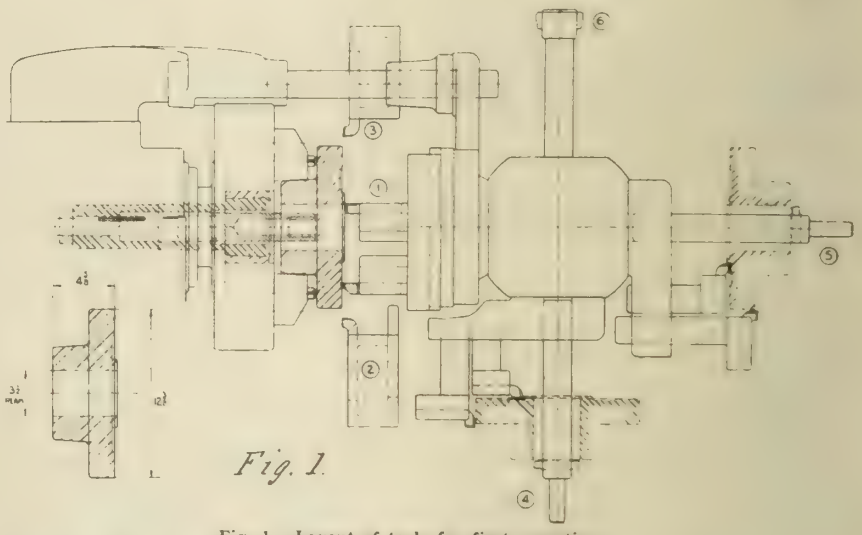


Fig. 1.—Layout of tools for first operation.

Material supplied through the courtesy of the Alfred Herbert Co.

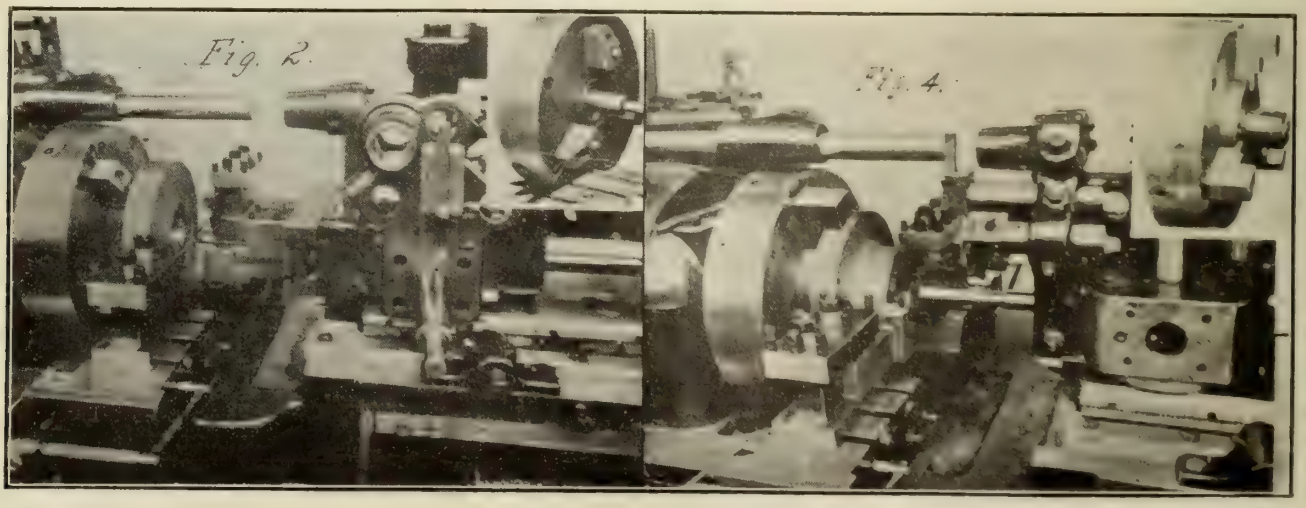


Fig. 2.—Set-up for first operation. Fig. 4.—Set-up for second operation.

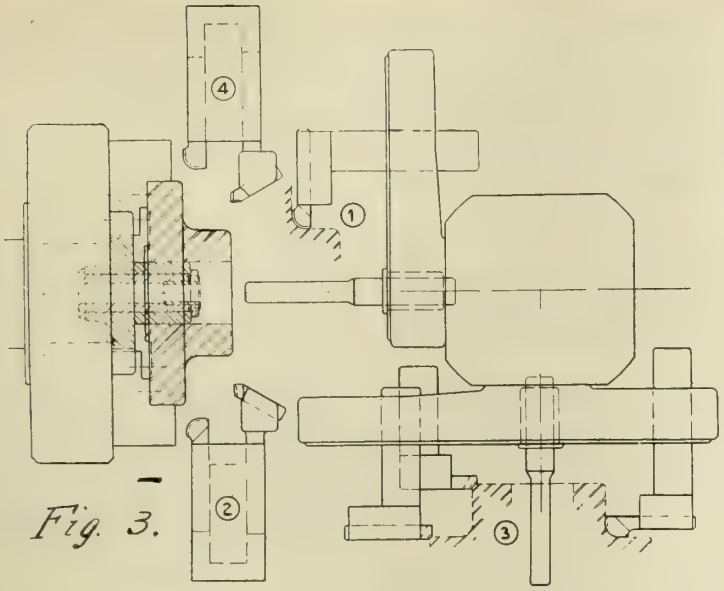


Fig. 3.

Fig. 3.—Tooling layout for second operation.

with the work removed is inset in Fig. 4, and shows the special locating plate which is bolted to the chuck. This is centred in the bore of the chuck by a spigot, and carries removable hardened locating plugs which are a sliding fit in the bore of the couplings. The work is gripped and driven by means of soft jaws bored out true, but the concentricity is ensured by the true central plug and not by the soft jaws.

The tooling of this operation is fairly simple. No. 1 is a combination tool carrying a cutter for turning the boss and simultaneously with this tool the front cross slide No. 2 comes in with two tools for rough facing the boss and shoulder. Nos. 3 and 4 are finishing operations on the same surfaces, but the combination tool No. 3 carries two additional cutters for forming the radii on the boss and the flange.

The total time for machining the complete piece, i.e., two operations, is 53 minutes, and couplings machined by this method run true when mounted on a test bar.

In the operations described the slide facing tools and two combination tools are part of the standard outfit of tools which obviously come in for a large variety of work, and in all cases it will be noticed that the cutting tools are of the simplest possible type, whilst the boring bars will probably be already in the tool stores of most works.

On the latest type of Auto-Lathe—the No. 5—setting-up is so much simplified that it is found quite profitable to machine quantities of 24 at a time on suitable work. We have a battery of auto-lathes running in our own works which we should be delighted to show our friends at any time by appointment. We have no doubt of our ability to convince them of the savings which can be effected by the installation of this type of machine.

Inspection And Inventory System At Hamilton Gear And Machine Plant

THE subject of inspection is always an interesting one. The Hamilton Gear and Machine Co., Toronto, are firm believers in careful inspection; and following are some methods in force which ensure the quality of material going into their various products.

They inspect the rawhide cylindrical blocks used for making their rawhide pinions, using a Brinell machine and taking reversed readings as follows:—The machine is equipped with a direct reading depth measuring device to indicate the depth of the impression made by the ball. They press the standard ball into the rawhide block, edgewise of the laminations, same way as the load is applied to the pinion tooth, indenting it a definite amount, and read on the dial the pressure used. By doing this they read the load bearing ability of the sample, for everything else is a constant but the load. Several samples are always inspected out of every shipment received.

They are always very careful with their steel castings and inspect them with a microscope, examining polished and etched specimens about ⅝ in. in dimension which are cut from the edge of the rim of the gear casting by two oppositely sloping hack saw cuts. This removes a piece in shape a triangular pyramid. After filing flat and polishing to a mirror finish, it is etched with an alcoholic solution of sodium picrate, which shows up the grain structure very plainly under the microscope and makes apparent the quality or defects in annealing or heat treatment. In this way it is possible to quickly and cheaply foretell whether the material will pass tensile test and it can be re-treated before any machine work is done on it.

"Mere softness as indicated by file or cutting tool is no indication at all that annealing has been properly done," says Chester B. Hamilton, Jnr., president of the firm. "The crystalline structure of steel may be very bad indeed and still machine nicely. No one who has not examined good and bad steel in this way with a microscope can have an idea of the great difference in the interior condition, i. e. the quality that counts. It seems like a fairy tale to say one can open a window in the side of a steel casting, look inside and see how well it was heat treated, whether it is strong and what percentage of carbon it contains and whether it contains impurities, yet it can be done in this way."

Mr. Hamilton is also interested in inventory and overhead, and states that as they do not manufacture for stock, but are in general a contract shop, their inventory is handled differently from a manufacturer's. They work up the value of the work "in process" from the individual time slips and material slips which bear charges against the various shop orders on which they are working. These slips are collected daily, used to check the workmen's clock record for the previous day, and priced and filed under the order number. Thus it is simply a matter of addition to find the value of the work in process. This would be a big job to do by hand and an adding machine is used for this work.

They distribute their overhead on the machine hour rate system, the total being so divided that each machine bears a share proportioned to the total as its installed cost is proportioned to the total value of running machines under average operating conditions. Thus, suppose one machine was worth one per cent. of the total, and the shop was operating on the average two thirds busy as measured in values of machines running. Then this one per cent. machine would bear one and one half per cent. of the overhead, and some other larger machine worth four per cent. of the total would bear 6 per cent of the overhead.

They do not follow this plan out absolutely, as they find it advisable to increase the rates on some machines which are chronically overloaded, and reduce them on some for which it is difficult to find work, but the above is the basis.

It is good practice to keep pneumatic hammers hanging in a tank of kerosene when not in use. This cuts all grease and dirt that may have accumulated. Don't lay hammers on the bottom of the tank as there they will catch the dirt. The kerosene in these tanks should be filtered frequently.

Some Notes on Hardening Various Screw Gauges

Results of Experimental Work—Effort to Obtain Process That Will Eliminate Warpage and Change of Shape—Methods of Heat Treating and Quenching Expansion and Contraction

By F. A. LIVERMORE, M.I.M.E., M.I.M.

THE present article is written, not in any way as a complete treatise on the above named subject, but with a view to assisting those interested in the more rapid production of the hardened gauges which will pass the National Physical Laboratory test. The following particulars have been obtained from experimental work conducted over a period of six months, but there is still much to be done to establish figures for various brands of steel. The heat treatment has been controlled from the laboratory, but the gauges have been hardened with certain precautions, in the ordinary way in the hardening shop. Now the essential requirements of screw gauges, as far as they are affected by heat-treatment are:—

(1). They must not change in shape. (become oval).

(2). They must not change in size (increase or decrease in volume).

(3). They must retain good surface after treatment.

If a gauge changes in shape and becomes oval, grinding which is extremely difficult, is necessary or it is worthless. If a gauge changes in volume and becomes smaller, it is useless; if larger, "lapping" is necessary. A good surface, whilst not as important as absence of change of shape or size, considerably adds to appearance and value of the gauge. The object of this research was the production of a gauge, well hardened, accurate to size, and with a sufficiently good surface, so that it would not be necessary even to polish after hardening.

Composition of Steel

The first assumption was made—"Provided there is not internal strain in the steel used, it is reasonable to hope that all gauges made in cast steel will give similar results under similar heat-treatment." This was found to be partially correct when the steels were approximately the same composition. Different cast steels give different results. Some appear to shrink, whilst others appear to expand, but gauges made from the same bar of steel give practically identical results.

In the early stages of the work some difficulty was experienced, and a number of gauges scrapped, owing to their being made from different steels. As a result of this, it was decided that until definite results were established, each gauge should be analysed for carbon and manganese before heat-treatment. From a number of preliminary results on different brands of steel, one having a high percentage of manganese was selected because—

(a) The manganese content of the steel appeared to affect the volume changes in the steel.

(b) This particular brand of steel could be quenched in oil and a better surface finish obtained than one quenched in water.

The steel analysed gave the following results:—carbon, 0.96 per cent.; silicon, 0.19 per cent.; manganese, 1.20 per cent.; sulphur, 0.03 per cent.; phosphorus, 0.02 per cent.

Heating Furnace

The furnace used for heating the gauges need not be of any particular kind as long as the metal is not heated too rapidly and uniformity during heating is obtained. Some months ago, in order to improve the surfaces of gauges, a small furnace having a reducing atmosphere (coal gas) and a direct passage to the quenching tank was designed. From this furnace a number of hardened gauges having a very good surface were obtained. However—it was found that quite as good results could be obtained when hardening from an ordinary furnace. A small Richmond gas furnace is very suitable for the work.

Heat-Treatment

It is well known that steel expands more and more as the temperature rises, and since in gauge work no change in volume is allowed, the quenching must take place at the lowest possible temperature, i. e. least volume expansion, at which correct hardness can be obtained. Now in order to find this exact temperature, pyrometric curves of the steel were prepared and the Ac: (calescence) and Ar: (recalescence) points carefully noted. From these curves it was decided to harden gauges from a temperature of 749. deg. C.—this temperature is sufficiently high to provide a fair margin for the hardener and at the same time it will secure a well-hardened gauge. Gauges quenched from this temperature are quite hard and cannot be cut by means of a file.

Whale oil is used for cooling purposes. This of course must be at a fairly low temperature, say about 30. deg. C. In order to prevent undue oxidation of gauges taking place during hardening also during transference from furnace to quenching tank, it is necessary to keep them from contact with the air as much as possible. This is done by providing for a reducing atmosphere in the furnace by means of excess gas, and also arranging for the quenching tank to be as near as possible to the furnace.

Tempering Gauges

Gauges are tempered in oil at 260. deg. C. sufficient time being given for obtaining uniform temperature throughout the metal. The volume changes which take place in the steel during the above detail heat-treatment can be best followed from the results obtained. The gauges were measured for all dimensions in the tool room by means of a simple micrometer instrument and Millward needles. The top, effective and core diameters were supplied to the laboratory. The following figures were obtained from almost the first heat treated gauges:—

The gauges were slightly oval on some of the dimensions.

It will be noticed from the figures that the greatest change has taken place in their effective diameter. The true results are not clearly shown until after tempering. This change in the effective diameter results from one of two causes. Either it is due to expansion or oxidation. With regard to the former, as previously stated, the metal expands during hardening expansion takes place in all directions, so that in the case of the plug gauge the expansion of the steel causes an opening out of the threads, and a consequent relative drop in the effective diameter.

If the gauge be heated in an upright position and the design be such that

		Gauge Hardened		
Part	Nominal Size	Before Hardening	After Hardening	After Tempering
Top	1.2000	1.1992	1.2008	1.1998
Effective	1.2170	1.2170	1.2180	1.2170
Core	1.4641	1.4633	1.4650	1.4640
		Gauge Hardened		
Top	1.2000	1.1992	1.2008	1.1999
Effective	1.2170	1.2170	1.2175	1.2169
Core	1.4641	1.4633	1.4650	1.4640

Part	Before Hardening	After Hardening	After Tempering	Measured Again Sept. 18	Measured Again No. 18
Top	1.1997	1.2009	1.1999	1.2000	1.2000
Effective	1.2170	1.2170	1.2160	1.2159	1.2159
Core	1.4640	1.4655	1.4647	1.4647	1.4647
Top	1.2000	1.2011	1.2002	1.2002	1.2002
Effective	1.2170	1.2170	1.2158	1.2157	1.2157
Core	1.4640	1.4652	1.4642	1.4641	1.4641

the weight of the metal above the thread gauge be large, the effective diameter does not drop so much, because during heat-treatment, expansion—(which causes opening out of the threads)—is partially prevented by the weight of metal pressing downwards. As regards oxidation, this also accounts for drop in effective diameter. However, much work has been done since the above figures were obtained and it has been found that if the above mentioned precautions are taken no oxidation will occur.

Now the sudden cooling of the metal during quenching prevents the steel from regaining its original size, and therefore until tempering has taken place there is considerable strain in the gauge owing to its tendency to get back to its former size. On tempering, this strain is done away with and the gauge resumes its normal dimensions. The sizes for machining of gauges at the present time are arrived at from the figures previously given (due allowance being made for shape of gauge) and the later successful work in overcoming oxidation. Final figures are now being obtained somewhat as follows:—

The above results, which as can be seen, come within the National Physical Laboratory's requirements, have all been obtained under ordinary workshop conditions. However, it is essential that the hardening be in the hands of a reliable man who will carefully follow instructions given him. The present article gives particulars for plug gauges only. Figures for ring gauges have not yet been finally established.

ELECTRIC WELDING OF SHEET STEEL PARTS

THE ADAPTABILITY of the spot welding machine to the joining of sheet steel parts has greatly aided in speeding up the assembly work on automobiles and other products made of light metal materials. The varied and rough service that autos are often subjected to, calls for maximum strength with minimum lightness. The safety of many lives depends on automobile parts being right to the last detail, particularly the brake mechanism, and the welding of parts must be properly performed. To this end these machines are constructed to accomplish their object in as perfect a manner as possible, and welding machines are usually built especially for the particular class of work they are likely to be called upon to perform.

The operation shown in Fig. 1 is the welding of brake camshafts on a Winfield electric welder, the material being of cold-rolled steel ¾ in. dia. at the point of weld. A strong and durable weld is obtained at a production rate of 125 welds per hour.

The capacity of the machine here shown is the welding of stock of from ⅜ in. to 1 in. round or equivalent sectional area. Current can be steped to suit the size of stock being welded. The circulation system is so designed that it is not necessary to break connections when changing dies. Machine is provided with adjustable stops to locate work in proper position. The machine requires a floor space of 40 in. by 54 in.

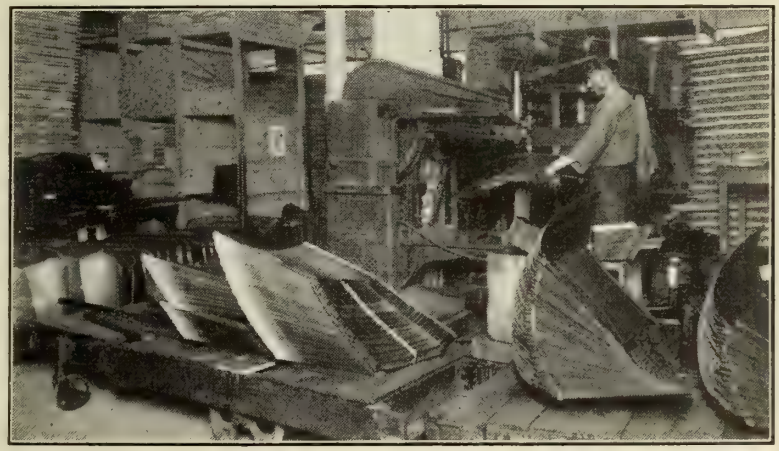


Fig. 2.—Assembly of automobile seat panels.

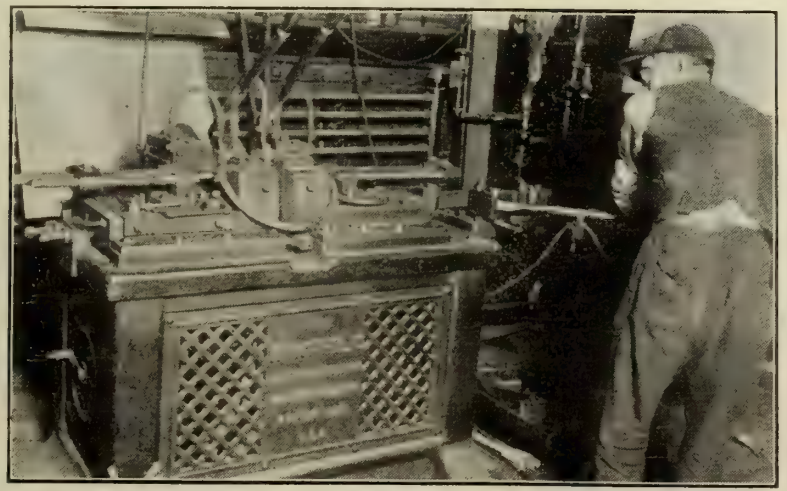


Fig. 1.—Welding automobile brake camshafts.

To protect the work from springing out of alignment the bed plate is provided with heavy tie rods.

The operation illustrated in Fig. 2 is the assembling of automobile seat panels, the welding being done on a Taylor machine. The work here shown is the joining of two pieces of No. 22 gauge sheet steel by means of 15 spot welds. The production rate is 800 panels—12,000 welds—per 9 hours, continuous performance. These machines have a wide range of application and require little skilled labor to operate.

No person should look directly at the flare of an electric arc or welding flame unless the eyes are protected with colored glasses, as the intense light is very injurious to the eyes.

News From the Welding Field

Mechanical Control of Oxy-Acetylene Torch

Cutting Metal by This Process Approaches Very Closely the Maximum Theoretical Efficiency—Obtaining Any Desired Shape By Means of Templates—Application of the Radiograph

By FRED J. MAEURER

WE have been trying for at least six months to have one of the largest companies in this territory to form a school of instruction for the operators of their plant, and held our first class this week. There were 35 operators present and six of the highest officials attended this class. We talked on care and maintenance of equipment, explained in minute detail the construction of regulators, torches and tips. This meeting lasted 2 1/2 hours and after it was over one of the heads of this plant told the writer that he thought this meeting was one of the best things he had ever attended. He also arranged that meetings would be held for all of the operators in this particular plant twice a mnth. There is no question that these meetings will effect a large oxygen and acetylene saving and also cut down their repair bills.

Radiagraph

The radiagraph is a portable, motor driven machine equipped with a 1-20 h.p. motor running 1,700 revolutions per minute, and can be set to travel or cut at twenty different speeds of from 1.5 inches per minute to 22 inches per minute, according to the thickness of the plate to be cut. The arm that holds the torch in place is so constructed that it is possible to move torch in or out, up or down, forward or backward and can also be set at any angle desired for bevelling plates. It was built for the cutting of straight lines and circles but with a little ingenuity it can be used for cutting of squares, ovals, and long irregular cuts.

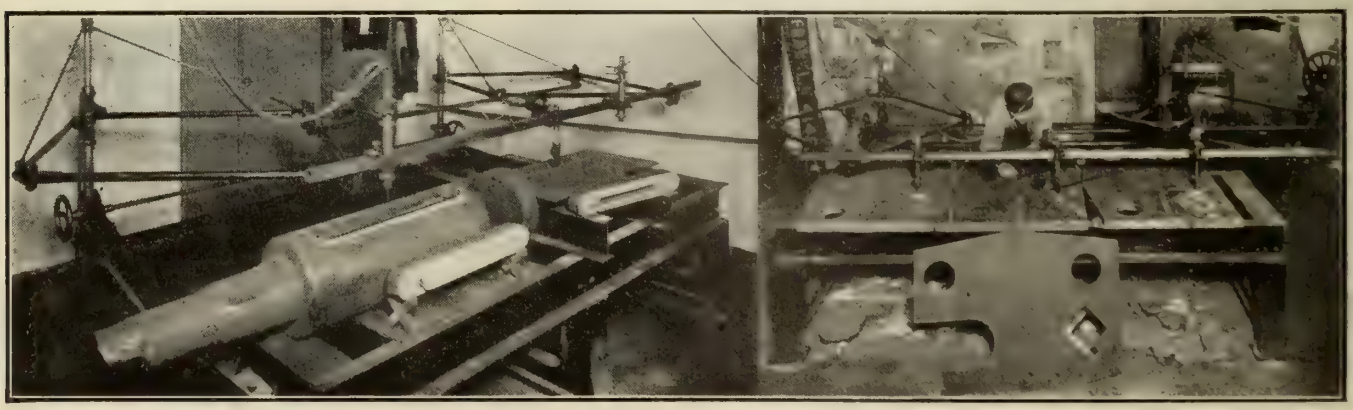
Fig. 1 shows a "close-up" of the finished cuts on plates also the machine, and we particularly call your attention to the smoothness and accuracy of these cutting surfaces. These slabs were cut into round pieces for forging purposes.

Fig. 2 shows the cutting of steel plates 2½ inches thick and 46 inches square as shown at D. The circles were used for flanges as shown at C, to be gas welded to steel shells 30 inches in diameter and 11 inches long. The outside cuts marked A were 45 inches in diameter, and inside cut marked B was 30 inches in diameter. The pieces to the right marked A were used as flue sheets and the outside cut was the only one made. Eighty-five 1½ inch flues were gas welded. The specifications called for steel castings and when it was found that no machining was necessary after being cut it was found that we could make these flanges and flue sheets much more economically and quickly than the foundries could. This also eliminated all question of porosity so common with steel castings. The speed of cutting was 6 inches per minute. When cutting circles with the radiagraph the inside tractor wheel is removed and a screw pivot is set on radius rod, the point of the pivot resting in a center punch mark. If a larger circle is to be cut the small radius rod can be removed and a larger one set in. Circles of any diameter can then be cut. You will also note that the trailer wheel is set to the radius of the circle.

The impression, due to printed reports, that steel cutting with the oxy-acetylene process could not be carried on above 10 inches in thickness, is surely all wrong, and we submit a picture (Fig. 3) of two mighty fine specimens of steel billet cutting 14¼ inches square, carbon content .30, that was cut with oxy-acetylene. The time for cutting was 6½ minutes per cut and oxygen consumption 100 cu. ft. You will particularly note how smooth, straight and clean each cutting surface is, and also the lack of oxide on the bottom of the cut. This certainly proves that steel cutting over 10 inches can be accomplished, with the above mentioned process.

While on the subject of heavy cutting, the writer witnessed a feat of handcutting sometime ago that we believe is the most remarkable on record. The cutting was done on 55 inch hexagonal ingots. The operator used a No. 10 tip and 195 lbs. of oxygen pressure, 7 lbs. acetylene pressure. Starting at the end of ingot the operator carried his cut along until he was cutting 37 inches clear through from top to bottom when a pocket formed on the bottom of the ingot and he was forced to stop. He then started on the opposite side of ingot and carried his cut through until he was cutting 33 inches clear through from top to bottom. The ingot was then broken by dropping a 5 ton ball on it. These measurements were then confirmed. There were four of these ingots to be cut and this operator did the same kind of cutting on the three that he did on the first one.

Figures No. 4 and No. 5 show some



This material was prepared by the author, who is engineer of Airco-Davis-Bournonville Co., for the American Welding Society. The first part appeared in June 29 issue.

of the most remarkable radiagraph cutting ever accomplished in this country. The parts cut were harveyized steel plate. The drawings and specifications called for a thickness of plate of .375 of an inch, 169.30 inches long and 89.78 inches wide, and were used for top and bottom plates for gun carriages supporting a 9 in. gun. No. 5, the top plate, shows center that was cut out. also a circle 12.602 inches in diameter cut out. It will be noted that the right side of this center piece is cut to a radius of 90.03 inches, also the bottom of right end is cut to a radius of 9122 inches. The balance of center piece is straight cutting. To accomplish this cutting it was necessary to make cuts very accurate and straight (down) as we were only allowed .015 of an inch either way because machining after cutting was not figured on. In fact, we were told that if our machines could not cut that close to line, they would have to look further for other methods. Special tracks were constructed and bent to the same radius as the cut to be made for the three uneven sides and straight tracks used for the one straight cut for both top and bottom plates. After the tracks were bent, they were bolted in place, and cutting started. After completion of cuts the plates were allowed to cool, when they were checked up by government engineers, and then O. K.'d. Four radiagraphs were used on this work, covering a period of close to eight months, these machines being in operation continually. All other opening in plates shown in photos were cut with the oxy-acetylene process. Anyone familiar with government requirements on this class of work will readily appreciate the most remarkable performance of these machines. To the casual observer watching this cutting being done, it appeared to be a very simple matter, but to those of us who had worked on this problem for weeks, it was anything but simple. Two

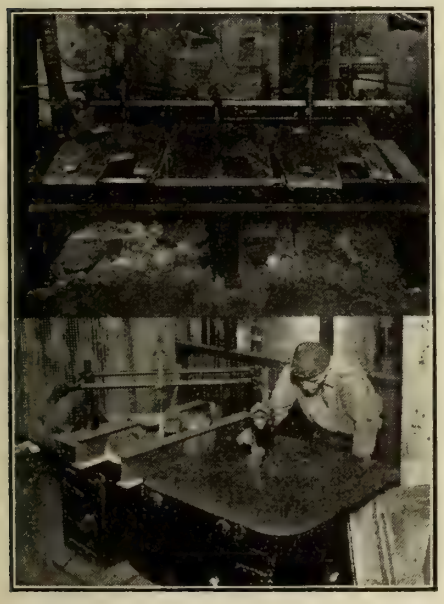


Fig. 12.—Top: Cutting two plates at once.

Fig. 10.—Lower: Tracing made directly on table top.

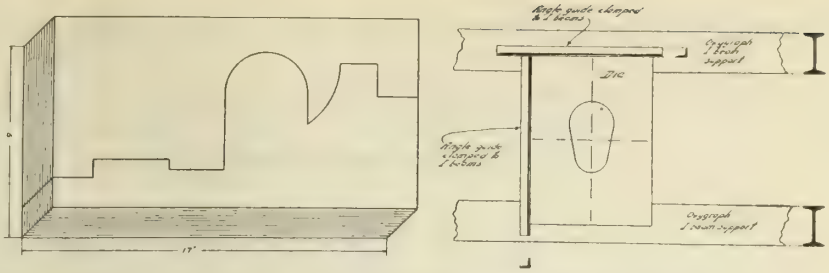


Fig. 11.—Only bottom plate required machining after cut was made.
Fig. 9.—Method of holding dies to be cut with oxygraph.

of our troubles bear mentioning here. When the tracks were built, and sample cuts were made on ordinary plate, it was found when checking up our openings that the radius on top and bottom did not conform to the radius of track, and radius of drawing, and after quite a bit of study we remedied this by moving the torch over to the center of machine so that it was directly in the middle of tractor wheel in front, and trailer wheel in back. Then our cuts come out strictly to line. When the first harveyized plate was cut, it was found, to our surprise, that the cut was very ragged and rough. Then it was found that we were cutting on the harveyized side so then we turned the next plate over and cut on opposite side.

The writer previously mentioned that the radiagraph was primarily built for straight line and circular cutting, but with a little ingenuity could be set up to cut squares, ovals and long irregular cuts. To make an irregular cut, a template can be made the same shape as the piece to be cut, and set on top of plate. The arm torch is then allowed to swing free, and tip is held close to template with a spring. In doing this there is hardly any limit to the shape of piece you wish to cut. In cutting ovals and squares the machine travels a complete circle while the spring holds the torch tip to the template.

In one of the largest mills in the central west engineers were confronted with a proposition that called for a cut to be made on ½ inch steel plates. These plates were approximately 8 ft. wide by 30 ft. long, as per Figure 6. This cut was 12 ft. in length and of sixteen different radii. After cutting they had to fit accurately other pieces for forms. Hand cutting was figured on, and it was found that too much chipping and grinding was necessary in addition; also to continue hand cutting involved the purchase of at least ten new hand cutting equipments. The engineers turned their attention to machine cutting and purchased a radiagraph. A template was then made like the cut to be made, with the various radii, out of ⅛ inch black iron, 15 inches wide. A special torch was then built, which swung freely on the post of the machine, and a spring attached to post and torch to keep torch against template, so that while the radiagraph would run on a straight track the spring would hold the torch to the template, making this cut exactly as laid out on blue prints.

In cutting one plate at a time, the set speed was 22 inches per minute and it was found that this was too slow, as these plates were to be delivered at a certain time that was fast drawing near. Four plates were then stacked up and cut one at a time. Eight plates were next stacked up, one on top of another, and cut at one time. These two cuts were so successfully made that it was decided to cut twelve plates simultaneously. After these plates were set up a bolt was set every three feet to hold plates as close together as possible. The speed of the radiagraph was set at 12 inches per minute. Thus the cutting speed on the single ½ inch plate was 144 inches per minute or 720 feet per hour. The cut was so successfully made as to speed, smoothness, straight vertically and so clean and to the line, that they were ready to be installed without any further labor. The balance of the plates were cut as described. To the writer's knowledge, this is the first time so many feet of half inch plate have been cut by a single cutting torch in one hour.

At this same plant, large steel slabs 31 inches and 11 inches thick were being cut by oxy-acetlyene, as shown in Fig. 7. This operation consisted of rounding off both ends and was being done with a hand operated machine, the torch moving up and down by a work screw and moved in and out to conform to radius on a bracket; one man operated a hand wheel on a screw to move torch in and out, while a third man held and moved hose in and out as the torch moved. The length of this cut was 44 inches and time consumed in making this cut by hand operated machine was 21 minutes. This cutting was a great deal more economical than free hand cutting, and smoother, but they found it did not eliminate the machine work that was necessary after cutting.

This operation required the service of three men to make a cut. The writer questioned the necessity of a man to hold the hose, and it was explained that this was necessary, as it was impossible for the second man to move in or out when the hose was lying down, as the weight of the hose would bind torch on bracket. The radiagraph was then used on this cutting, and not only did the cutting in 11½ minutes, but cut the gas consumption in half, requiring the services of but one man.

(To be continued)

Causes of Warping in Heating and Cooling of Ste

Problem One of Vital Importance—General Theory That of Changes in Volume—Furnace Conditions Should Be Carefully Watched—Experiments Disclose Interesting Results

IN REPLY to the question: "What are the causes of warping in the heating and cooling of steel?" submitted to the membership of the American Society for Steel Treating, the following statement was given by Stanley A. Richardson, instructor in metallurgy, Lewis Institute, Chicago:

The warping of steel has been a problem to steel treaters, it may be said, since steel treating began. With the increasing use of heat treated structural parts, particularly those of considerable length or cross section, the problem has increased in importance. It is held quite generally among shopmen that warping is in some way the result of nonuniform heating or cooling. Cracking, during or subsequent to heat treating, is thought to be due largely to the same thing. That is to say, warping and cracking are phenomena of like kind, differing only in degree. It is probably correct to say that the majority of technical men attribute these phenomena to the volume changes associated with the passage of a piece of steel through critical temperatures.

It is evident that the aforementioned views are not antagonistic, but are substantially in agreement. If a volume change causes a piece of steel to warp or crack, it must be because there is an interval between the time of the change in various parts of the piece, and this of course means that the rate of cooling, or heating, is not uniform. It is undoubtedly true, however, that there are many heat treaters who overlook the fact that a piece of steel undergoes a sudden expansion while cooling through the critical temperature, or, the reverse on heating.

In addition to the above, it is sometimes held that warping is due to a mechanical action, wherein the section of the steel cooled at the more rapid rate "upsets" the section cooling, at the slower rate. In view of the fact that in a piece of steel, one side of which is quenched in water, the quenched side is found to be longer than the side cooling in air, it is not clear to the writer just how this "upsetting" can take place. It is conceivable, and a matter of fairly common observation that steel can be warped by uneven heating before reaching the critical temperature. Such a condition is due, evidently, to the fact that because of differences in the rate of expansion of adjoining sections, stresses are set up which exceed the elastic limit of the steel and thereby produce distortion. Assuming homogeneous material, proper furnace design and proper furnace loading, should greatly reduce, if not eliminate this condition. Warping of this nature is probably more noticeable in the case of pieces of great length or uneven cross section. The tendency of steel to warp or crack under this condition is said to vary inversely with its thermal conductivity and directly with its coefficient of expansion. It is more pronounced, of course, in some steels than in others, probably reaching a maximum in high manganese steel, which can be cracked very easily by uneven heating.

The writer has listened to much discussion by practical men relative to the foregoing. However, after examining a number of the specimens presented, he is of the opinion that the real mechanism of warping in steels quenched from above the critical range, in the vast majority of instances at least, hinges upon the formation in the steel of varying amounts of the constituents marking the transition from austenite to pearlite, for example, martensite, troostite, and sorbite. It is a matter of common knowledge among metallurgists that each of the metallographic constituents of steel possesses a different specific volume or density. Quantitative determinations confirming this have been made by various authorities, notably Maurer and other prominent European metallurgists and physicists. Martensite, the constituent produced by quenching a piece of properly heated steel in water, has a greater specific volume than any of the other constituents. In a piece of steel, the greater dimension of which is length, this is equal to saying that the piece will be longer after quenching than before. Troostite and sorbite each have a specific volume somewhat less than that of martensite. When martensite and troostite, or troosto-sorbite are formed in quantity in a piece of steel, the ideal condition for distortion exists. The effect increases with the increase in the carbon content, which means of course that the effect depends upon the total amount of martensite and troosto-sorbite present. A piece of low carbon steel containing these constituents will undergo a slight deformation, whereas in a high carbon steel the deformation will be quite pronounced, or, in most cases due to its low ductility, the steel will crack. The cracks are usually parallel to, and close to the line dividing the martensite from the troostite, and appear to be due to the tension placed on the martensitic area by the contraction accompanying the formation of troostite. Frequently in a high carbon steel, cracks appear also in the martensitic area in a direction at right angles to the previously mentioned dividing line. The tendency to crack is influenced profoundly of course, by the degree of temperature to which the steel is heated above the critical point, being greater in steel highly overheated. That is to say, coarse grained martensite is more brittle than that of normal grain size. The production of concentrated areas of martensite and troostite in a piece of steel may be caused by uneven quenching or cooling of the piece, unequal temperature throughout at time of quenching, unequal drawing or tempering, and probably, nonuniform distribution, or concentration of the elements, particularly carbon. The last mentioned condition can usually be corrected by a thorough anneal, while the others depend upon factors peculiar to any individual plant.

The following simple experiments, performed in studying this problem, are interesting, and can be duplicated in any shop. They were carried out under shop conditions without attempt to exact quantitative data. The changes in dimension were measured chiefly by tracing the outlines of the pieces on paper before and after the heat treating operations. Pieces of 0.20 per cent carbon, 0.50 per cent. carbon, and 0.90 per cent. carbon steel each about 6 by 3 by 3-8 inches were heated to their respective proper quenching temperature and quenched about one-half of their width, that is about 1 1-2 inches in cold water, and the microconstituents noted. In addition, pieces of 0.50 per cent. and 0.90 per cent. carbon steel were heated and quenched uniformly, and then immersed for about one-half their width in cold running water and a drawing temperature applied to the upper edges with an acetylene torch. This temperature probably reached 900 deg. Fahr. at the upper edge of the piece and graduated downward to the surface of the water. The results obtained including the cracking were almost identical with those obtained by quenching but one-half of the specimens in water and not tempering.

In the case of 0.20 per cent. carbon steel it is necessary to quench the piece at least twice in exactly the same manner to produce a very marked deformation. This is to be expected when it is considered that steel of this carbon content can possess but 24 per cent. of saturated martensite. As the stresses set up by each quenching exceed the elastic limit of the steel, the effect, that is the distortion, is cumulative. If the piece is very wide a bulge will be noticed on the ends of the section farthest from the surface of the water, for example, the section cooling at the slowest rate. This bulge will have a greater length than the troosto-sorbitic area, but less than the quenched or martensitic area. Upon examination it will be found to consist of lamellar pearlite.

The only opportunity some people ever hear calling is the whistle at five o'clock.

Practical Ideas From Practical Men

INDEX STOP PIN FOR DIES

By I. N. B.

Sometimes it is difficult to use a pilot in locating a previously punched hole in blanking dies. The sketch herewith shows how this was accomplished in making the price shown in Fig. 1. The slot had to be in the vertical centre of the blank and 20 deg. off the bottom circular part. Fig. 2 is a top view of the die. The punch was fitted with a spring stripper which held the stock flat and did not distort it when the punch left it. The slot was punched first, at the same time the indexing punch cut a notch in the edge of the stock. The toe latch, located at the proper spacing distance engaged the notch and at the same time pressed it against the guide pins on the second stroke of the press when the piece is blanked out.

As the notching punch is opposite the guide pin it has the same bearing point when shifted to where the toe latch engages it, hence the slot comes in the proper position in the blank when the blanking punch removes it from the stock. If the slot was punched out after the piece was blanked out it would have a tendency to distort the ends. It will be noticed that the slotting punch is set at an angle of 5 deg. This is done so as to get the blank out of the narrowest width of stock possible. The toe latch is pivoted on a shoulder screw resting against a spring push pin. On feeding the stock forward the latch will ride on the edge of the metal at the same time holding it against the guide pins until the notch is engaged, when the push pins will cause the stock to move back and the opposite side of the toe latch lever will strike the adjustable set screw and the next stroke of the press will punch the blank. As the guide pins and the end of the latch is hardened and the bearing point is small there is not much pressure on the stock, and as the dies are unobstructed the operator has full view of the work to aid his sense of feel in handling the stock on work where the spacing is short. The foot can be kept on the treadle of the press for runs of a minute or more, thereby getting the full capacity of the press. The sketch shown is as used on a spring stripper punch but can be used with a fixed stripper on the die.

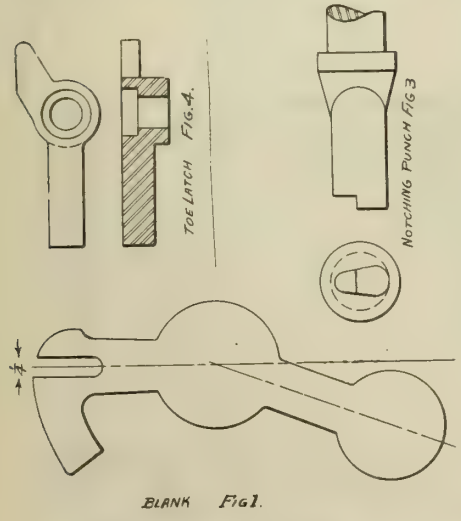
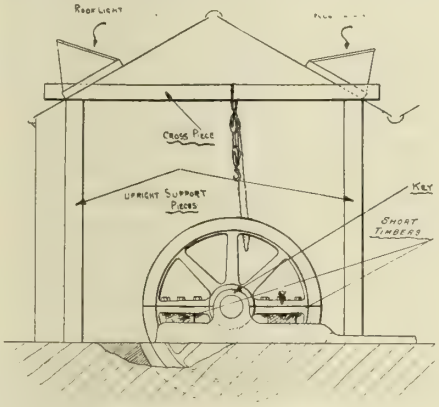


Fig. 1.—Blank. Fig. 3.—Indexing slot punch. Fig 4.—Index toe latch.

LIFTING AN 8 TON FLYWHEEL

By G. Blake

Some years ago while the writer was works engineer in a factory, we had a rather awkward job. The 8 ton flywheel on the engine became loose on the shaft; this flywheel was in halves and held together by bolts. The flywheel was held in position by one key and it was this key that caused the trouble, with the constant thrust on the one side it gradually began to wear (on the thrust side) slowly at first, then more rapidly until it became quite slack; fortunately it could not get out as there were bearings on either side of the boss of the flywheel. However, the key became so loose that it was decided to fit a new one. As already mentioned the flywheel was in halves, the difficulty lay in raising the half in which the key was fitted. Referring to sketch Fig. 2 it will be seen that the bottom half was supported by means of short stout pieces of timber, across the wheel pit, the timbers taking the weight of the bottom half when the nuts were slacked off. How we raised the top half of the flywheel is as follows; there was no overhead crane in the engine house, which by the way was of light construction. The two roof lights which were directly over the flywheel were utilized, a stout heavy baulk of timber was fixed up in position through the roof lights (see sketch Fig. 2) and was supported by two similar baulks of timber, one at either end, as near as convenient to the flywheel, the two uprights taking the weight while the roof lights prevented any side movement. A 5-ton chain block was slung to the cross beam. The rest of the story needs very little telling as the sketch Fig. 2 explains it clearly. The new key which by the way was prepared before hand, did not take long to fit and the engine was soon running again.



Lifting an 8-ton Flywheel.

HOW TO SPEND LESS FOR COAL

By W. F. Schaphorst

When coal is shoveled into a furnace, where does it stop? On the grates, of course. Are those grates efficient? Are they designed for the most economical combustion of coal? Are you needlessly burning money on your grates? These questions certainly should not be rudely brushed aside. Grates are worth thinking about because they may be either highly efficient or extravagantly wasteful. That's where you put the coal, in the very first step towards converting it into mechanical energy. That's where it lies through the whole combustion process. We do not take it from

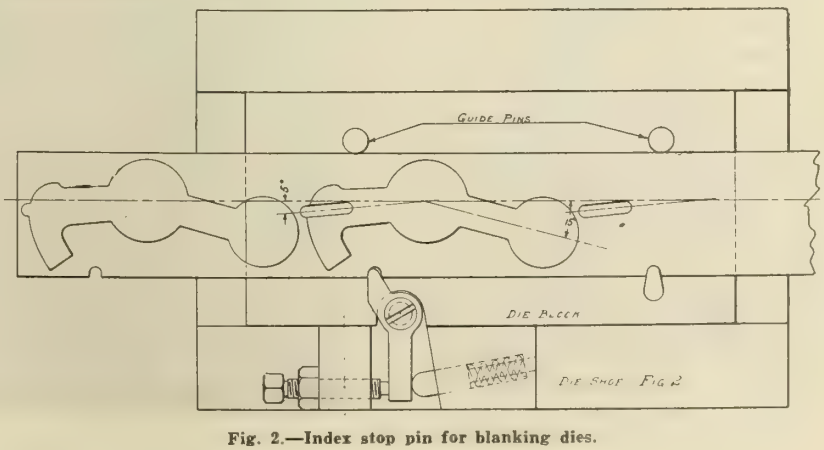


Fig. 2.—Index stop pin for blanking dies.

the grates and put it somewhere else, as we do other materials in turning out products—it "lives" for a few brief moments on the grate, gives a small part of its life to doing useful work, and also gives a greater share to wastefully heating exhaust steam or atmosphere. After death its remains drop through the grate in the form of ash.

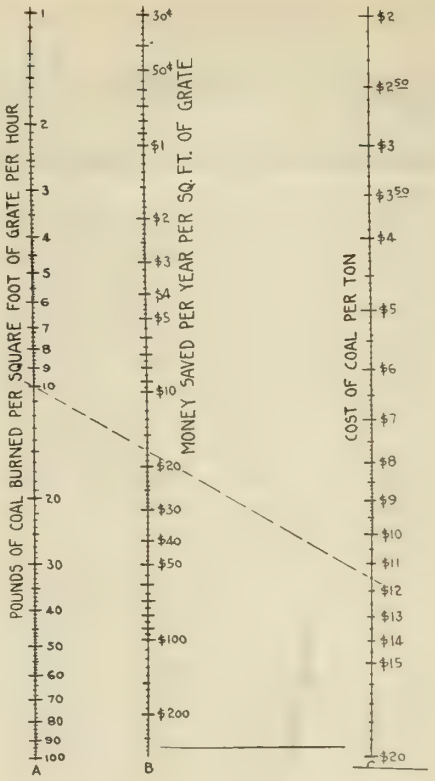
It is therefore plain that the grate has very much to do with the combustion of the coal. That is the place where economy must be effected first of all. I don't know why it is that the grate has practically been ignored by engineers in their efforts for economy in the power plant. It has been pointed out time and again that engineers delight in perfecting engines, turbines, steam lines, condensers, economizers, feed water heaters, and the like, but they keep away from the grate—perhaps because grates are usually so black and dirty. In the process of combustion one can't see any "wheels go round" and mechanical geniuses evidently lose interest.

Every little leak, however, is worth plugging nowadays, and as there are so many big leaks in furnace operation I will dwell on the subject for a moment longer. I have some figures here that should prove of interest.

In a letter from a prominent grate manufacturer he says, "grates will show a saving in fuel of at least 10 per cent. over ordinary plain grates in any case. It has gone as high as 20 per cent. We are willing to guarantee a 10 per cent. saving over plain grates." This statement alone gives us enough data on which to work. What was your coal bill last year? Are you using plain grates? If so, take 10 per cent. of your last year's bill and put most of it in the bank this year by improving conditions. Or, on account of the present high cost of coal perhaps you can "come out even" this year at least.

Getting down to a concrete problem let us say that your plant is a place where coal costs from $11.50 to $14 per ton. Let us assume that you run your plant 10 hours per day, and 300 working days per year, or 3,000 hours; assume that you burn 10 pounds of coal on your grate per square foot every hour; and lastly assume that the most economical form of grate can be purchased for $5.50 per square foot. How much money would be saved per square foot per year?

There is nothing difficult about the problem. You will readily figure that 3,000 pounds of coal are burned on a square foot per year. If 10 per cent. of this can be saved by installing better grates it is plain that 3,000 pounds of coal would be saved per square foot per year. At $11.50 per ton this amounts to $17.25 per year. That will be the saving at the end of the first year, but it is not the net saving. From it we must subtract $5.50, the cost of the grates, which leaves $11.75 as the saving. Thus you could instal new grates every year and still make good money. If your grate money is 100 square feet



you will multiply this by $11.75 to find the total net saving, or $1,175 per year.

To make the computing work still simpler, I have developed the accompanying chart. Simply lay a straightedge across the chart connecting the pounds of coal burned per square foot per hour (column A) with the "cost of coal per ton" (column C) and the intersection with column B immediately gives the saving on expenditures for coal per square foot of grate area per year. From this subtract the price you will have to pay for a square foot of grate and you can decide for yourself whether or not it will pay to make any change. The dotted line on this chart shows how the problem given above would be worked out via the straightedge. Column B shows the saving to be $17.25. Even if the saving were only 5 per cent. the investment would pay, but inasmuch as 10 per cent. is guaranteed I have based this chart on that figure.

EYELET SET

By J. H. W.

Herewith is a sketch of an eyelet set to be used when the material in the eyelet is of such a frail nature that it will buckle rather than turn over or roll, so to speak. The rounding section of the punch has a series of sharp chisel points which cut the metal so that it will turn over neatly.

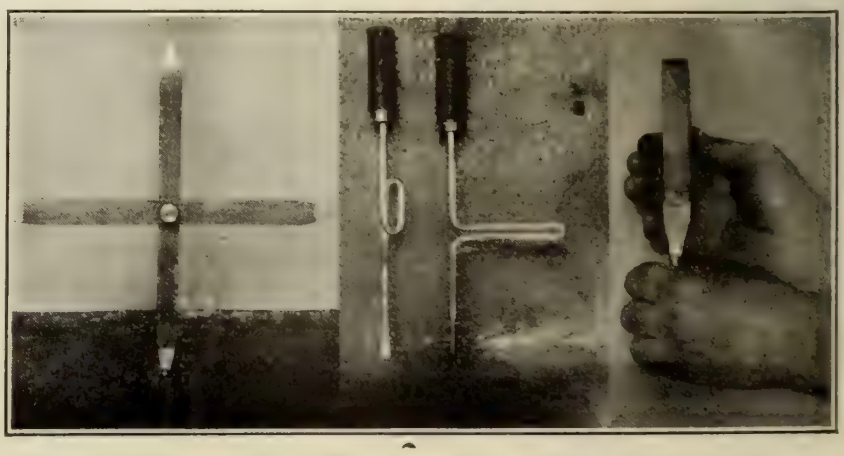
EXTRA LEVERAGE SCREW DRIVERS

By H. M.

The subject of extra leverage on screw drivers calls to mind the time honored monkey wrench, the application of which has long been familiar to the average machinist. There are numerous cases where the ordinary screw driver alone does not answer the purpose, and it is necessary to devise some means to procure a better purchase. While a monkey wrench or spanner may be utilized as an emergency tool, it must be admitted that the method is a clumsy one.

In the accompanying illustration are shown a few screw drivers equipped with means for additional leverage, and as these are seldom seen in general use they will likely be interesting to many readers. In the first view is shown a tool that will start any screw that is removable at all, and being constructed with four blades of different width and thickness, the right blade for the screw can always be used. One part of the tool is made of ⅝ x ¼ in. tool steel, the other of ½ x ¼ in. for the smaller screws. The two blades are held together by a knurled nut and bolt. It can be folded up and carried in a tool kit.

The second view shows two round shank screw drivers with a loop in the rod for leverage. These tools cannot be used in confined space as room is required for the loop to turn. A very handy driver can be made from old saw blades as shown at the right. One blade is bent double for the handle, care being taken to bring the holes in line. The blade of the driver is then made to the desired shape and riveted to the handle.



Several handy screw drivers.

New Things in Shop Equipment

INTERNAL GRINDING MACHINE

A new and highly efficient type of grinding machine of interesting design has recetly been developed and placed on the market. It is the invention of Fred E. Bright and is known as the Bright internal grinder. The new fundamental feature (patented in many coutries) is the revolving and reciprocating of the work carrying spindle in one bearing, eliminating the necessity for exact alignment of it with other essential parts of the machine. Due to this fact great accuracy and efficiency are possible in the finishing of straight round holes. The grinding wheel spindle is directly driven, so that slowing down due to belt slippage is avoided, and the wheel speed can be continuously and accurately maintained. Other features such as the simplicity of control and the accessibility of the work, are certainly worthy of note.

The wheel spindle driving motor is located at the top of the machine. The main motor for operating the work spindle and feed is placed at the back of the main frame. The machine is entirely self-contained and no belts or countershafts are required. The wheel spindle motor is of the induction type without brushes and operates at high speed. The outside diameter of the housing is only 5¾ in. and the motor generates 1½ h.p. Double-row ball bearings are provided for wheel spindle, one at top and bottom. Special extensions can be fitted to lower end of spindle to suit the various classes of work.

In order to change the speed of the wheel spindle, the frequency of the current driving the motor must be changed. The frequency-changing device ordinarily employed consists essentially of a variable speed d. c. motor driving an alternator. It is thus possible, by merely changing the resistance in the field circuit of the d.c. motor, to vary the number of cycles, and consequently the speed of the spindle motor. At 120 cycles, or the minimum speed, the spindle motor runs at 7,500 r.p.m.; at 200 cycles, the speed is 12,000 r.p.m., which is the maximum, these and intermediate speeds proving to be effective because of their maintenance at predetermined rate without slippage. Where a single grinding machine is used, a small frequency changing unit may be employed. Where a battery of the machines is operated, one installation may serve for the entire group.

The wheel spindle and its motor are mounted on a yoke that pivots about the supporting column. This column can be lifted by means of a lever at the right side of the machine, so that the wheel clears the work. After the wheel has been raised, the whole head can be swung to the left of the machine, so as to provide clearance for removal and replacement of the work, as shown in Fig. 2. The column consists of two telescoping parts, whose relative position is controlled by means of a screw operated by the handwheel at the top. It is thus possible to vary the length of the column, and, consequently, the height of the wheelhead.

The feed screw, which is mounted in the housing back of the wheel spindle, is provided with a large graduated wheel, that permits of a feed of 0.0001 in. per graduation. Automatic feed is made at each end of stroke. An automatic stop is provided for finished size. The wheel is dressed by means of a diamond fixed to the housing of the work-holding chuck. It is provided with screw adjustment as wheel wears down. The chuck or fixture holding the work is mounted at the top of a hardened steel spindle 3 in. in diameter and 20 in. long, that is carried in two phosphor-bronze bearings fixed in a housing that can be easily removed.

The wheel spindle is made of hardened steel, more as a protection when assembling than as a factor of wear, as the shaft runs continually in a film of oil and the pressure when grinding is so slight that the wear is almost nil.

The chief feature of the machine is that the spindle both rotates and reciprocates in the same bearing. Consequently, the work reciprocates in the same line about which it rotates. Since the wheel maintains one position only, a straight and round bore must result. The weight of the spindle and work is carried on one ¾-in. ball at the bottom.

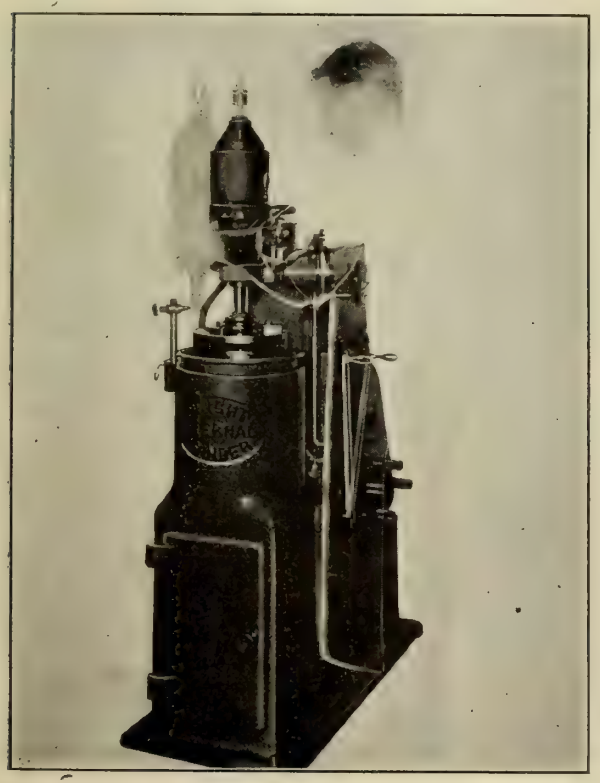


Fig. 2.—Convenient method of swinging spindle clear of work.

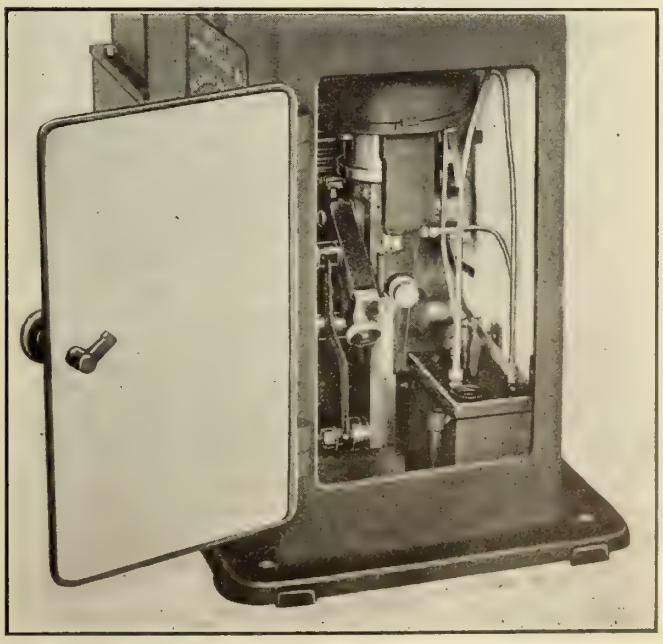


Fig. 3.—Interior view of base, showing work spindle mechanism.

This ball rests in a small pocket that allows sufficient clearance for it to travel eccentrically about the centre line of the spindle, so that it wears uniformly. Removable hardened steel disks are provided both above and below the ball.

The spindle is driven by means of three flexible steel keys, mounted in a bevel gear running on a separate bearing with clearance around the lower end of the spindle. As the spindle reciprocates, these keys slide in vertical splines. The bevel gear is mounted on ball bearings and is driven by a pinion carried on a shaft, also running in ball bearings, and connected directly to the speed-change gear box at the rear of the machine. The work spindle is lubricated by force feed from the small pump, Fig. 3, placed in the front of the base and driven by the stroke mechanism.

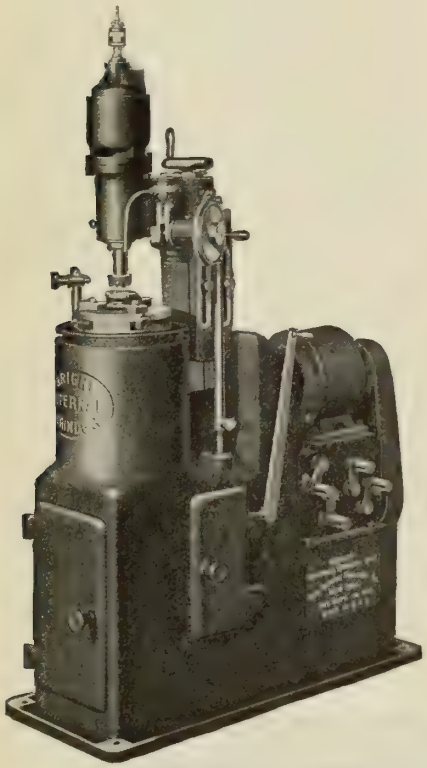


Fig. 1.—Bright internal grinder.

The oil is driven to the top of the top bearing, and works down through the two bearings to the bottom of the spindle, where it drops off into a small cup, from which it is led back to the tank of the oil pump. Some of the oil is diverted to the bevel gears, so that both they and their bearings run in oil. The oscillating action of the work spindle is obtained from a separate shaft driving a cam through worm gearing. The cam is designed to give a uniform motion to the spindle, although a variable speed can be obtained by applying suitable cams. The stroke is regulated by means of a small knurled screw. The spindle rotates at a speed of from 100 to 385 r.p.m., the reciprocating speeds varying from 4 to 48 strokes per min. These Bright grinders are made by the Garvin Machine Co., New York.

HORIZONTAL STAY-BOLT MACHINES

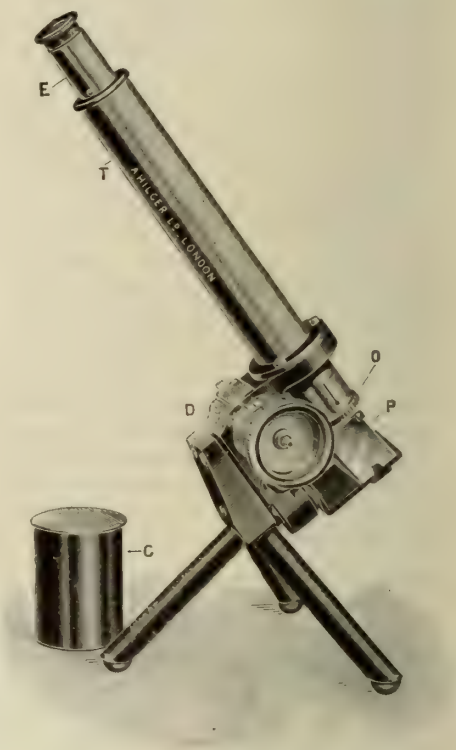
There has recently been placed on the market two horizontal stay-bolt machines adapted for turning simultaneously the taper and straight diameters on radial, button-head and crownstay bolt forgings, and for threading both straight and taper ends. Collet bushings and adjustable straps are provided for turnings. The front-head has a taper attachment which can be adjusted to any desired taper. The rear die-head cutters are straight while those at the front heat are tapered. Both die heads are automatically operated. The machine may be adjusted to any desired length by means of a permanent spacer bar. This bar having twenty-three holes accurately bored and spaced to correspond with the various lengths of bolts. The machine has a capacity of bolts 1½in. in dia. up to 36in. in length. The style A machine is designed for making stay bolts from the bar of either iron or copper. The cutting and threading tools are held in a turret which slides directly on the ways of the machine. The bar stop is automatically fed through the spindle of the machine. When threading the bolt special provision is made for advancing the dies quickly over the relieved portion with the lead screw still engaged. Both styles of machines are fitted with automatic tripping devices for turning and threading. Safety devices are provided so that no two feeds can be engaged at the same time. These machines are manufactured by the Millholland Machine Co., Indianapolis, Ind., and are known as the style A and style B Lassiter-Millholland sty-bolt machines.

CHEMICAL SPECTROMETER

A novel design of spectrometer has recently been developed. It is similar in appearance and size to a microscope, and takes no more room on the table. The telescope (T) has in its eyepiece a slit and small autocollimating prism for introducing the light. After passing through the object glass (O), the rays of light proceed to the 30° prism (P). This prism is silvered on the back surface, and the light then retraces its path through the object glass (O) to the eyepiece by means of which the spectrum is viewed. The prism (P) is mounted on a table provided with a lever, and is rotated by means of a micrometer screw pressing against the lever, to which screw is attached a drum, on which is engraved the scale of wavelengths. The index moves along a helical slot. An enlarged view of the drum is shown herewith. A cover (C) is provided for the prism for protection and to exclude extraneous light other than that from the slit; and a small mirror with clamp for attaching to the telescope is also provided (not shown in the illustration).

The instrument is supplied in wooden case with carrying handle, the outside dimensions of the case being 9½″ x 8″ x 16½″ (24 x 20 x 41 cm.) high. Thus it is very compact for storing and convenient for transport. Being self-contained the instrument may be quickly moved from the case with one hand, and is then ready for use.

A number of accessories are used with the instrument. For investigation of arc spectra an arc taking about 2½ amps. is quite sufficient. This will work well on any ordinary lighting circuit. A rough stand capable of carrying this can easily be made where saving of expense is imperative, and this with a resistance which may conveniently



Chemical Spectrometer

ly take the form of a board with a few carbon filament lamps connected in parallel, provides all that is necessary for the most accurate work.

It is manufactured by Adam Hilger Optical Works, 75A Camden Rd., London, Eng.

BOOKLET

The Electric Furnace Construction Co., Philadelphia, Pa., have recently issued new catalogues on their electric furnaces for melting, refining and superheating of iron and steel. This booklet illustrates the construction and operating features of their different furnaces. A booklet has likewise been issued covering the line of "Electro" steam boiler manufactured by them.

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AND MANUFACTURING NEWS

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Adequate Machinery Building

RECEIVING the support to which it is entitled, the movement to erect an engineering building on the grounds of Toronto Exhibition, should find it to be an easy matter to guarantee that it shall be self-supporting. This is the proposition behind all modern buildings erected there as representative of different Canadian industries. Old Machinery Hall has been long inadequate for its purpose. It is as far short of requirements in housing the best that manufacturers have to display, as a child's shoe would be for the foot of a lusty giant. In fact, accommodation has been so poor, that each year was conspicuous not for the number of firms represented as for the number of important enterprises that were noticeable by their absence. The new building, as proposed, will be a credit to Canadian industry from every point of view, will emphasize national ambition in the engineering field, and serve to advertise to advantage the utility of the product for purposes intended. Already much has been done in segregating industries in proper buildings, and the successful scale on which plans have materialized is, of course, as highly creditable to the enterprise of manufacturers interested, as it is to the aspirations of the Exhibition directorate. If the project is received in the proper spirit the new building will probably be ready for 1923.

Encourage Blast Furnace Industry

BETTER DAYS would seem to be in store for the Canadian steel and iron industry as a native proposition, judging from the enthusiasm and the practical discussion of interesting facts at the meeting held before the Minister of Mines for Ontario a few days ago. It was attended by metallurgists, mining and furnace men who have been closely identified with the industry up to the present time. If any apologist were needed for such a meeting, his chief duty would apply to the lack of encouragement that has been accorded an industry which, according to authentic report, is in every sense indigenous. It was established that Canadian ores, as produced, were the equal of anything on the market, both chemically and physically. This was the statement applied to the mine at Moose Mountain, where magnetite ores are briquetted, while as regards the investigations conducted by the Algoma Steel Corporation it was pointed out that by a mixture of Canadian siderites and magnetites, an ore could be produced cheaper by $1.57 than anything offered by American mines in a similar grade.

The problem is one that hinges on Government assistance to bridge the gap as between mines and blast furnaces, and organization by which the requirements of the market might be served by Canadians as it is now served by Americans. Opinion seems to be pretty much in favor of a bounty, say of 75 cents at the mine's mouth, but as an alternative proposition there seems to be something worth considering in the possibilities of electric power at a nominal figure. Such a plan seems to have been instrumental in developing the industry in Sweden, where power is available at a very low rate.

As confined to Ontario alone, there are frequent vast deposits of magnetic ores from the Ottawa region on the east, to the Superior region on the north, with here and there deposits of natural ore, but not in sufficient quantity to warrant commercial venture. In the Hudson's Bay region there are said to be ranges of the same character as that in Newfoundland, but while there seems to be fairly accurate knowledge as to available ranges, there has been no exploration or investigation as to concentrations at depth. Such work is essential for there seems to be no problem in connection with Canadian ranges that has not existed with developments in the American industry.

Canadian blast furnaces are willing to deal with producers, all things being equal in the matter of price and chemical analysis. There is a growing feeling that here is an opportunity for Canadians to develop an independent industry in the interests of the country, and that there should be no "laying away" of ranges in behalf of foreign interests.

Good Business in Mining Region

AS A SOURCE of good business for the steel and iron industry, and in that we include machinery manufacturers and foundry operators, the northern mines of Ontario are developing an importance that commands consideration. Not infrequently it occurs that demand from this quarter has helped to tide over many an enterprise which, confined to its usual field, might have found a lapse of operations necessary. The production of steeel and iron crusher balls for use in ore grinding has alone helped the foundry industry, and in the same connection there has been a steady call for parts and repairs. For example, it is estimated that the amount spent in 1920 for ball mill liner, castings and machine shop work was about four million dollars; for chemicals and apparatus, about three millions; for drill steel, more than half a million, and almost a similar amount for electrical supplies. Machine drills and parts called for an expenditure of $692,174. The gross wages paid by the industry in the year referred to amounted to $25,764,461. Mining operations two years ago were considered in their infancy. New mines are being opened up, plants extended and new equipment installed. As the riches of the North are continually revealed, the products of industry are going to find an increasingly profitable market. The mining region is worth watching in the interests of good business.

Steel Industry Flourishes Despite Coal Strike

Blast Furnace and Steel Mill Operations Grow—Wide Spread of Industries Represented by Canadian Demand—Prices Remaining Firm—Demand for Sheets Strong Factor—Sellers Predict Good Business Next Autumn

SOME JOBBERS REPORT AN EXCEPTIONAL JULY

IN spite of the coal strike, it is a remarkable fact that the rate of pig iron production as reported from Pittsburg has increased 20 %, and that additional furnaces have been blown in recently. In short, there seems to be no menace for the future, as far as the steel industry is concerned. Mills are filled with actual business for approximately two months, and are not forcing any tendency of the market to contract for Autumn supplies. The activity in all grades of sheets may be judged from the fact that leading interests are filled for three months. Some of the independents have retreated from advances over regular figures.

From a buyer's point of view, the hope is expressed that conditions as reported in the steel industry, will continue after the vacation period, while among sellers there are predictions that buying will resume just where it left off. The market may be said to present a moderate aspect with reference to the price situation. Basis prices seem to be firmly maintained.

So far as Canadian industry is represented in demands for iron and steel, there is quite a wide spread; that this, no concentration on any particular line of activity. Thus, a representative in close touch with the field, reports that the past two week's tonnages contracted for were made up of structural steel, rim material for the motor car industry, bar products for agricultural implements and considerable transmission material, or cold rolled steel. There is no doubt that the motor car industry is responsible for an increasing amount of business that is of direct interest not only to iron and steel men, but also to machinery manufacturers. The official report that the Ford Company of Canada is preparing to spend millions in new buildings at Ford, Ont., not only to handle increasing export business to evidently to entrench themselves still more strongly in the Canadian market, is warmly welcomed by the machinery industry.

Prices for the most part remain steady, though there is an undertone of firmness reflecting good general demand and tendency created by coal strike problems.

Montreal reports that iron and steel business for July indicates a better demand than has existed for any ten-day period this year. In fact, some jobbers declare that July will be the best month of the year. This is significant, for generally the month is one of the most indifferent of the year. The demand for sheets, black, blue annealed and galvanized is said to be far beyond visible supplies. Structural steel is also becoming increasingly scarce and deliveries to replenish stocks are stiffening up. Here again appears a policy of cautious selling on the part of the mills. The market for pig iron is strong and foundries are showing an inclination to cover for future. Summerlee Scotch iron is making its appearance on the Montreal market at $29.75 dock, as against Canadian $31.80 track. A good volume of business is developing in machine shop supplies.

Toronto

July 12, 1922

HAVING reached the stage where there is a fairly strong demand considering that it is now the middle of July with the supply in fair quantity so far as iron and steel is concerned, the Toronto market, in some respects, is quite keen. The indifference of a few weeks ago with reference to the coal situation seems to be disappearing as the result of reports that one month hence may see a more serious situation. Practically no anthracite is coming into Toronto. Some bituminous is moving, from independent sources, though not in anything like regular quantities. There are said to be fair supplies on hand and one even hears of a tendency to consider lower prices as a possibility, but this is probably confined to the more optimistic. Be these things as they may, there is an element of activity throughout the market and while it cannot be said that there are any price changes to speak of, still the undertone is decidedly firm.

Shipments from Pittsburg and vicinity are beginning to show some improvement in the American freight rates. Thus, the car load price from Pittsburg prior to July 1st was 38 cents; to-day it is 34, while the l. c. l. rate is 48 1/2; Montreal rates that were 58 and 73, are now 52 and 65 1/2; St. John, N. B. rates were 84 1/2 and 106 1/2 are now 76 and 96; Halifax rates were 86 and 108, now 77 1/2 and 97; Guelph and London rates were 38 and 54, are now 34 and 48 1/2; Windsor, formerly 35 and 50 1/2, now 31 1/2 and 45 1/2. The present Kingston rate is 48 1/2 and 61. Further reduction becomes effective August 1, when the Canadian Railway Board prices apply.

Importations of steel during the past few weeks represent a wide industrial spread. The demand for structural steel seems to have a temporary easing, but there have been calls for rim steel for the auto industry; bar products for agricultural implements, besides considerable transmission or cold rolled steel. In contrast with the activity among the railroads in U. S. in renewing rolling stock and trackage there is very little doing in that line in Canada, outside of some good tonnages in rails.

The demand for sheets seems to be developing exceptional proportions reflecting the building activity in larger centres and also the increasing business in the motor car industry. The steel furniture industry is also well represented in this increase.

In scrap metals, there is no marked movement. The demand is moderate and there is not a great demand coming forward to the dealers. Large tonnages of steel rails, from the Toronto Transportation Commission, going to the Steel Company of Canada at $15.50, represent a clear run. The rails have to be free from all of the extraneous materials carried from the roadbeds from which they were removed. Price ranges are as follows:

Copper, light ... ... per 100 lbs.	8 50
Copper, crucible	11 00
Copper, heavy	11 00
Copper Wire	11 00
No. 1 composition	9 00
New brass cuttings	6 00
Red brass turnings	6 50
Yellow brass turnings ...	4 85
Light brass	3 50
Medium brass	4 50
Scrap zinc	4 00
Heavy lead	4 50
Tea lead	3 00
Aluminum	11 00
Boiler plate, per gross ton ...	9 00
Heavy melting steel	11 00
Axles (wrought iron)	16 00
Rails (scrap)	11 00
Malleable	11 00
No. 1 machine cast iron	16 00
Pipe, wrought	6 00
Car wheel	16 00
Steel axles	15 00

Nor is there any marked activity in the so-called non-ferrous department. Prices show stability. It would seem that the market should reflect demand from the building industries but it is pointed out that in preparing for this overdue condition the brass founders producing plumbing fixtures,etc., were fairly well stocked and the material has to be absorbed. It is stated that last year one firm had as many as 16,000 bath tubs available against a building boom. This number of course means a corresponding supply of fixtures. Quotations are as follows:

Lake Copper	17 00
Electric Copper	16 75
Castings, copper	16 50
Tin	34 00
Spelter	7 25
Lead	6 75
Antimony	6 75
Aluminum	26 00

The iron and steel bars, a solidifying movement is still in progress, though it as yet, seems to lack certain unanimity. It is a trend which is characteristic of the prevalent feeling that the time is approaching when there must be gen-

erally higher levels in the steel industry. However, there are those who incline to the feeling that improving conditions will eventually bring about a volume of business necessary to more profitable production. This they feel is the explanation, rather than very radical price changes. However, prices continue to show marked firmness:

Iron bars	2 90 to 3 15
Steel bars	2 90 to 3 15
Reinforcing bars	2,90 to 3 15
Steel hoops	4 00
Tire steel	3 15
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in base	3 50
Small shapes	3 15
Sheets, black, No. 28	5 00
Sheets, blue ann., No. 10	4 00
Canada plates, dull, 52 sheets	6 00
Canada plates, all bright	6 00
Galvanized Sheets, No. 28	6 00

In machine tools there is some movement, though hardly positive enough to warrant enthusiasm. Some machinery is being sold, and it is remarkable that inquiries are fairly good, but the orders actually closed represent a small proportion. The indifference of the holiday season is a factor just now.

Small tools and supplies are improving in general demand. Wholesale hardware houses state that there is not the demand they had hoped for in mechanics' tools. The opinion is expressed that there is here a problem such as exists in the machinery business—that used tools are too easily available.

Supplies for the building trades, such as valves and pipe fittings are said to be moving nicely. Though the demand is strong no advances have been made by pipe interests.

There is considerable strength in manufactured cottons. Wide ducks have advanced 2 1/2 per cent.

Montreal

July 12, 1922

A generally better tone reported last week in many lines is still being maintained, and the firmness in quotations is common to practically all metal products. July and August are generally conceded to be quiet months in iron and steel, but up to the present the volume in business in July has been heavier than in any ten-day period experienced this year. Jobbers even now state that July figures are away ahead of those of June and they confidently expect that July will be the best month of the year so far. The lines in demand this week are practically the same as those that have been active for the past few weeks. Black, blue annealed, and galvanized sheets are featuring the market. The supply of the latter has not been sufficient to take care of the demand for some weeks past. The call for structural sections, merchant bars, and small steel products is much better than it has been for some time past. Pig iron sales are slowly increasing. Machine tools, nonferrous metals and scrap materials are all rather quiet. General supplies and miscellaneous equipment are moving satisfactorily.

Iron and steel—All kinds of sheets are very active, with the demand for galvanized sheets far exceeding the supply. Prices remain steady as the competition is keen. Great regret is expressed by one jobber in galvanized sheets at the unfortunate collision of the tramp grain steamer "Airedale" and the Donaldson freighter, "Orthia." The latter was inbound with a large tonnage of galvanized sheets. Locally it is understood that these sheets will not be suitable for sales purposes. It is quite a calamity according to the jobber who claims to be consignee of the greater portion of these sheets. Quite a demand for structural steel in small and medium sized lots is present locally. Stocks are getting rather well picked over, and at present jobbers are looking for a source of replenishment. Early deliveries from the U. S. mills are out of the question at any reasonable figure. Merchant bar sales are gradually increasing. Plates are very quiet. The demand for steel products such as spikes, nuts, bolts and other small lines, is good. Miscellaneous lines such as reinforcing bars, steel hoops, tire steel, spring steel, etc., is very satisfactory. Prices remain firm at the increased quotations announced last week. Large consumers are able to obtain somewhat better prices, but there is very little evidence of slashing prices to any great extent. Competition is keen, but it is realized that business must be done at a profit and for that reason prices are fairly stable. Local quotations are the same as last week. The Montreal Tramways have been importing a considerable tonnage of the special grooved street railway rails from mills in the Chicago district. These rails have been coming down by water, largely as deck loads on the grain carriers. A considerable tonnage of billets have also been shipped from the Illinois Steel Works on these grain boats for use in the local rolling mills. This steel is largely unloaded at Lachine and the C. P. R. haul it to its destination. Local quotations are as follows:

Iron bars	3 15 to 3 25
Steel bars	3 15 to 3 25
Reinforcing bars	3 15 to 3 25
Steel hoops	4 00
Tire steel	3 00
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	3 25
Small shapes	3 00

Pig Iron.—Sales of pig iron have been very satisfactory the past week. The largest orders have been for Summerlee Scotch iron, which is being pushed at present. This iron is quoted at about a dollar a ton less than Canadian iron at points where water delivery can be made. Up to the present very little of this pig iron has been sold inland. At the same time the sales of Canadian iron are increasing. The improvement is gradual and as yet has not yet reached those proportions which would be stated as satisfactory. No changes in price have been made locally. The foundries that are in the market freely state that they are covering themselves for a period in the future, and that the iron purchased is not for immediate consumption. Reports show that the consumption in this vicinity is gradually increasing, but it is still a long way below normal. Summerlee iron is quoted at $29.75 on the docks and the Canadian iron is held at $31.80 on tracks.

Machine Tools.—There is no change in machine tools. Iron working tools are very quiet. An odd sale of a single machine tool is reported frequently, but in most cases the tools are small. Wood working tools are in a little better demand. The lumber industry is a little more active, as also is the furniture business. All business is keenly sought and prices are cut very close to get business.

Machine Shop Supplies.—Activities in the smaller shops are of such volume that these shops are constantly in the market for small tools and general supplies. The larger industries and the railways also contribute their share to the general volume of business. No orders are large but there are a large number of well scattered orders that make up quite a fair volume of business. Prices in most lines are fairly stable, and are reasonably low. Thus from week to week good business is reported from all jobbers. There have been but a few price changes for some time past.

Non-Ferrous Metals.— The local jobbers state that the amount of business moving in non-ferrous metals has varied but little in the last few weeks. No large orders have been received, the demand coming from all over the province for small lots. No price changes have been made during the week. The local quotations are as follows:—

Electric Copper	17 25
Castings, Copper	17 00
Tin	34 50
Lead	6 75
Spelter	7 75
Antimony	6 50
Aluminum	23 00

Scrap Materials.—The foundries have not come into the market for any scrap materials in the way that was expected, from the recent purchases of pig iron. The advancing price of steel had a tendency to make prices firm. The demand has not increased and the amount of sales for the past few weeks has been below expectations. There has been no change in the local quotations which are as follows:—

Copper, light per 100 lbs.	8 50
Copper, crucible	11 00
Copper, heavy	11 00
Copper Wire	11 00
No. 1 compositon	9 00
New brass cuttings	6 00
Red brass turnings	6 50
Yellow brass turnings	5 00
Light brass	4 00
Medium brass	5 50
Scrap zinc	3 50
Heavy lead	4 50
Tea lead	3 00
Aluminum	11 00
Boiler plate, per gross ton.	9 00
Heavy melting steel	10 00
Axles (wrought iron)	20 00
Rails (scrap)	11 00
Malleable	10 00
No. 1 machine cast iron	20 00
Pipe, wrought	7 00

Pittsburg

July 12, 1922

PRODUCTION of pig iron has been running at the rate of 30,000 000 tons a year since the first of this month,

against rates of 25,000,000 tons on April 1, and 19,300,000 tons at the beginning of the year.

Thus, during the first three months of the coal strike, the rate of pig iron production increased 20 per cent. and the furnaces are going strong, as production has been increasing continuously up to date. It is significant that additional furnaces have been blown in during the past two or three weeks. As it costs money to blow in a stack, this is rarely done unless a run of several months is assured, hence the evidence is that those who have lately blown in furnaces feel assured of a coke supply for an indefinite period. This means also that the attendant steel works are expected to have a supply of coal.

In other words, three months of the coal strike has allowed blast furnace and steel mill operations to grow and there is no menace for the future. If a shortage of coal is looked for the search must be made elsewhere than the steel industry. Thus far, moreover, consumers of steel have exhibited no signs of being short of coal or of curtailing their consumption of steel, for if they were in such a position they would be calling upon the mills to curtail shipments of steel to them, and nothing of this sort is occurring, buyers exhibiting as much desire for good deliveries on their recent orders as formerly.

The steel market has relapsed into dullness as it invariably does at this time of the year. There is some trading, particularly in tubular goods, sheets and wire products, but in general the market is dull. Mills assert that the dullness is attributable to their own position, in that they are unwilling to sell freely, and state that buyers would place contracts or shipping orders for later delivery if given the opportunity. There is some question about this however. Very likely many buyers would place blanket contracts if they could do so along the lines followed by the market before the war, when contracts were hardly more than options and when a buyer did not wish to accept deliveries he could avoid responsibility by refraining from placing specifications. As to actual orders, the probability is that consumers do not care to buy much more than they already definitely ordered.

The average manufacturing consumer has covered for steel against the orders he has actually in hand or in immediate prospects for his manufactured goods but he in turn must await the advent of autumn to see how business is going to turn out late in the year.

The steel mill position is a sound one, for the time being, in that all the mills are comfortably filled with actual business for approximately two months. In some lines, the obligations extend farther. In merchant bars, the mills appear well sold up through September. In sheets the leading interest is nearly filled for three months, while independents probably have an average of two-thirds of their prospective output sold to October 1. They could have sold more had they not quoted prices above the regular figures, adhered to by the leading interest. There has been a tendency among independents to recede from their position and quite a number are now quoting all grades of sheets except automobile sheets at the regular prices, 2.40c for blue annealed, 3.15c for black and 4.15c for galvanized. On early deliveries premium prices are frequently obtained, 2.50c; 3.30c and 4.30c respectively. In automobile sheets only the leading interest is quoting 4.50c, independents demanding and securing 4.75c or even 4.85c.

Wire Products.—Woven wire fence has been reduced 2 1/2 points or say $4 a net ton, and discount to consumers being increased from 68 to 70 1/2 per cent. and the discount to jobbers in carload lots from 70 to 72 1/2 per cent. Fence has been a very poor seller for a long time, and the formal reduction is probably due to there being more or less price cutting. On nails $2.40 remains the regular quotations of the leading interest while $2.50 continues to be the regular quotation of independents though it is admitted that $2.40 has to be accepted on orders for any considerable tonnage. Plain wire is quoted at 2.25c by all sellers.

For weeks, rods had been nominal at $38 and it was a question what would really be done on a forced purchase. A regular price of $40 has now been named by the leading interest.

Bars, shapes and plates, remain quotable at 1.60c to 1.70c, depending on delivery, specifications, etc. For anything like early delivery the higher figure has to be paid.

With the steel market quiet, and likely to stay quiet, according to precedents, during July and August, the chief interest is as to the market for the late months of the year. Among sellers, predictions are made freely that buying will be resumed after the vacation period just where it was left off. Among buyers hopes appear strong that conditions will continue good, but no certainty is expressed. In many quarters a note of warning has been sounded, that market activity will depend largely upon prices and may be interfered with if sellers continue to push their recently acquired advantage over buyers. Some of the references are in rather strong language, a possible "buyers' panic" being mentioned, the idea being that if this should develop there would be a vigorous effort to liquidate stocks again. These warnings have been making more or less impression on many sellers and in general the market presents a more moderate aspect. Basic prices are very firmly maintained but on the whole there is less disposition to quote extra prices.

Sheet bars are now quite well settled at $35 for third quarter, while recently there were reports of odd lot sales at $37.50 and $38. The $35 price represents a stiff advance as $29 was the general price for the first quarter and this was done on much tonnage for second quarter also. Billets, by inference, are quoted at $35 also, there being no regular trading market.

Pig iron remains quotable at $25 for Bessemer and basic and $24 for foundry, f. o. b. valley furnaces, as for more than two months past, but the figures have become partly nominal and it is possible that the prices could be shaded. At any rate, the common expectation is that prices will be lower whenever the coal strike ends. Freight from the valleys to Pittsburg came down from $1.96 to $1.76 on July 1.

CHEAP CABLE FACILITY TO HELP BUSINESS

CARDIFF, the market city of a wealthy industrial area and the world's great coal port, is particularly desirous of developing a direct trade with Canada, and is determined to let no obstacle prevent its accomplishment. Canada and Cardiff are already linked up by regular direct sailings, and arteries of rails and highways lead from the port to all parts of Great Britain. To further aid the quick transmission of business the Imperial Cable department of the Post Office announce that the pre-war cable deferred service rates have been restored to the whole of Canada. Deferred telegrams between Toronto, Montreal, Quebec and other places in Eastern Canada and Cardiff only now cost 4 1/2d per word, and the average time of transmission by the Imperial route is within 1 1/2 hours. The Imperial is the only Atlantic cable under purely British control and worked direct from London to Halifax, N. S.

Cardiff has direct through communications with London where expert cable operators transit across the Atlantic, the system in operation combining speed and accuracy in working, so essential to the business man of to-day, and this specially quick service is at rates not exceeding other routes, while for certain parts of Canada the deferred rates are 1 1/2 a word cheaper. The facilities given by the Imperial Cable should materially assist in the development of trade between the Mother Country and the colonies, and it is interesting to note that although specially low rates are charged, the cable is making a satisfactory profit which goes to the direct relief of taxation. The same facilities offered by the American cable companies are also available by the Imperial route.

In return for a nominal royalty of 25 cents per ton on ore mined, the British Empire Steel Corporation has undertaken to construct in Newfoundland before 1928 a plant capable of producing 100 000 tons of iron or pig iron annually, according to an agreement between the corporation and the Newfoundland Government, just completed. The corporation further undertakes to erect coke ovens and to expend $3,000,000 in Newfoundland before 1926.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Toronto price:—	
Silicon, 2.25% to 2.75%	$29 15
Grey forge, Pittsburgh	$25 27
Lake Superior, charcoal, Chicago	31 65
Standard low phos., Philadelphia	30 00
Bessemer, Pittsburgh	25 00
Basic, Valley furnace	24 00

IRON AND STEEL

Per 100 lbs. to Large Buyers	Cents
Iron bars, base, Toronto	$3 00 3 15
Steel bars, base, Toronto	3 00 3 15
Iron bars, base, Montreal	3 15 3 25
Steel bars, base, Montreal	3 15 3 25
Reinforcing bars, base	3 15 3 25
Steel hoops	4 00
Tire steel	3 15
Spring steel	7 00
Band steel, No. 10 gauge and 3-16 in. base	3 55 3 65
Chequered floor plate ¼" and heavier	6 00
Bessemer rails, heavy, at mill	2 35
Steel bars, Pittsburgh mill prices	1 70
Tank plates, Pittsburgh mill prices	1 70
Structural shapes, Pittsburgh mill prices	1 70
Steel hoops, Pittsburg	2 50
F. O. B., Toronto Warehouse	
Small shapes	3 00
F. O. B. Chicago Warehouse	
Steel bars	2 48
Structural shapes	2 58
Plates	2 58
Small shapes under 3-in.	2 48

FREIGHT RATES

	Per 100 lbs. C.L.	L.C.L.
Pittsburgh to Following Points		
Montreal	52	65½
St. John, N. B.	76	96
Halifax	77½	97
Toronto	34	48½
Guelph	34	48½
London	34	48½
Windsor	31½	45½
Kingston	48½	61

Current surcharge 1 per cent.

METALS

	Montreal	Toronto
Lake copper	$ 17 50	$17 00
Electrolytic copper	17 25	16 75
Castings, copper	17 00	16 50
Tin	34 50	34 00
Spelter	7 75	7 25
Lead	6 75	7 00
Antimony	6 50	7 40
Aluminum	23 00	21 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$3 75	$3 50
Plates, ¼ up	3 40	3 25

PIPE—WROUGHT

Standard Buttweld Pipe S/C

Per 100 feet

	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
⅛ inch	$ 6.00	$ 8.00	$	$ ....
¼ inch	3.84	5.94	7.20	9.30
⅜ inch	3.84	5.94	7.20	9.30
½ inch	4.85	6.46	7.31	8.93
¾ inch	5.87	7.71	8.86	10.70
1 inch	8.16	11.05	12.58	15.30
1¼ inch	11.04	14.95	17.02	20.70
1½ inch	13.20	17.88	20.35	24.75
2 inch	17.76	24.05	27.38	30.30
2½ inch	28.08	38.03	.....	.....
3 inch	36.72	49.73	.....	.....
3½ inch	47.84	63.48	.....	.....
4 inch	56.68	75.21	.....	.....

Standard Lapweld Pipe S/C

Per 100 feet.

Below Dividing Line—Price Per Foot.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
2 inch	$21.46	$27.38	$31.08	$37.00
2½ inch	31.50	40.95	46.80	56.16
3 inch	41.31	53.55	61.20	73.44
3½ inch	48.76	65.32	72.68	89.24
4 inch	57.77	77.39	86.11	105.73
4½ inch	66.04	86.36	1.04	1.24
5 inch	76.96	100.64	1.21	1.45
6 inch	1.00	1.31	1.57	1.88
7 inch	1.30	1.76	2.02	2.45
8L inch	1.40	1.85	2.13	2.58
8 inch	1.61	2.13	2.45	2.97
9 inch	1.97	2.59	2.97	3.59
10L inch	1.82	2.40	2.75	3.33
10 inch	2.35	3.09	3.54	4.28

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4-in. and under 60 per cent.
4½-in. and larger, 50 per cent.
4-in. and under, running thread, 40%.
Standard couplings, 4-in. and under 30%
Do., 4½-in. and larger, 10%.

OLD MATERIAL

Dealers' Average Buying Prices

Copper, light	$ 50	$ 8 50
Copper, crucible	11 00	11 00
Copper, heavy	11 00	11 00
Copper, wire	11 00	11 00
No. 1 machine composition	9 00	9 00
New brass cuttings	6 00	6 00
Red brass turnings	6 50	6 50
Yellow brass turnings	5 00	4 85
Light brass	4 00	3 50
Medium brass	5 50	4 00
Scrap zinc	3 50	4 00
Heavy lead	4 50	4 50
Tea lead	3 00	3 00
Aluminum	11 00	11 00
	Per Ton	Gross
Boiler plate	$ 9 00	$ 7 00
Boiler plate	10 00	10 00
Axles (wrought iron)	20 00	16 00
Rails (scrap)	11 00	11 00
Malleable scrap	10 00	11 00
No. I machine cast iron	20 00	16 00
Pipe, wrought	7 00	6 00
Car wheel	17 00	16 00
Steel axles	10 50	15 00
Mach. shop turnings	4 00	6 00
Stove plate	16 00	14 00
Cast boring	4 00	5 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, 7-16 and up	30
Carriage bolts, ⅜ in. and smaller 6 in. and shorter	40
Coach and lag screws	45
Stove bolts	72½
Wrought Washers	60
Do., corru. head	60
Machine bolts, 7-16 and over	35
Machine bolts, ⅜-in. and less	35
Blank bolts	35
Bolt ends	35
Machine screws, fl. and rd. hd., steel cut thread	37½ & 10
Machine screws, o. and fil. hd., steel cut thread	30
Machine screws, o, and fil. hd., brass cut thread	15
Standard couplings, 4-in. and under, brass cut thread	30
Nuts, square, blank off net list	$1.00
Nuts, square, tapped off net list	50c.
Nuts, hex., blank off net list	50c.
Nuts, hex., tapped net list	
Copper rivets and burrs, list less	32c.
Burrs only, list plus	10%
Iron rivets and burrs	47%
Boiler rivets, base ¾ in and larger	$5.75
Structural rivets, as above	5 65
Wood screws, O. & R., bright	80
Wood screws, flat, bright	82½
Wood screws, flat brass	77½
Wood screws, O. & R., brass	75
Wood screws, flat, bronze	72½
Wood screws, O. & R., bronze	70

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent.
Set screws	Less 55%
Square and hexagon head cap screws	Less 50%
Round head cap screws	Plus 10%
Fillister head cap screws	Less 10%
Flat head screws	Net List
Button head cap screws	Plus 10%
Studs	Less 35%
Semifinished nuts up to and including 1-in.	Less 60%
Semifinshed nuts 1⅛ to 1¼ in	Less 55%
Semi-finished nuts 1⅜ to 2 in.	Less 25%
Coupling bolts	Less 10%
Taper pins, No. 2 to No. 5	Less 60%
Planer bolts without fillet.	Plus 20%
Patch bolts	Plus 50%
Hollow set screws	Plus 10%
Thumb screws	Less 85%
Thumb nuts	Less 60%

BILLETS

F. O. B. Pittsburgh

	Per gross ton
Bessemer billets, 4 in. x 4 in. and larger	$35 00
Open hearth billets	35 00
O. H. sheet bars	35 00
Forging billets	40 00
Bessemer rods	40 00

NAILS AND SPIKES

Wire nails, base	$3 65
Cut nails, base	4 35
Miscellaneous wire nails	72½ %

ROPE AND PACKING

Plumbers' oakum, per cwt.	6 30
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 23
British Manila rope	0 20
New Zealand hemp	0 20

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	Net..

Solder, strictly	$0 22½
Solder, guaranteed	0 24
Soldering coppers, lb.	0 62½
White lead, pure, cwt.	13 20
Red dry lead, 100-lb. kegs, per cwt.	10 75
Wood alcohol, per gal.	1 75
Whiting, plain, per 100 lbs.	3 00

CARBON DRILLS AND REAMERS

S. S. drills, wire size	55
Can. carbon cutters	10
Standard drills, all sizes	60
3-fluted drills, plus	10
Jobbers and letter sizes	55
Bit stock	60
Ratchet drills	10
S.S. drills for wood	10
Wood boring brace drills	55
Electricians' bits	30
Sockets	30
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	Net
Bridge reamers, carbon	50
Centre reamers	5
Taps, machine screw	less 50-60
Taps, hand, under 1"	less 40-50
chucking reamers	30 off
Hand reamers	25
High speed drills, list	30 to 40 off
Can. high speed cutters, less	10
American	plus 40

COLD ROLLED STEEL

[At Warehouse]

Rounds and squares	$4.50 base
Hexagon and flats	$5.50 base

MALLEABLE FITTING LIST

1 in. elbow	.32	.53
2 in. elbow	1.05	1.70
1 in tee	.43	.70
2 in. tee	1.45	2.40
1 in. coupling	.33	.53
1 in. locknut	.15	.23

Discount to dealers 70/5 off list.

SHEET

	Montreal	Toronto
Sheets, black, No. 288	$5.40	$5 00
Sheets, blue ann,. No. 10	4 05	4 00
Canada plates, dull, 52 sheets	5 50	4 90
Can. plates all bright	7 00	
Galvanized sheets, No. 28		6 00
Queen's Head, 28 B.W.G.	7 25	
Fleur de Lis, 28 B.W.G.	7 00	
Gorbal's Best, No. 28		
Colbornes Crown. No. 28		
Premier, No. 28, U. S.	6 45	6 00
Premier 10¾ oz.	6 00	6 40
Zinc sheets	9 00	10 00

PROOF COIL CHAIN

(Warehouse Price)

B. B. B. CHAIN

⅜ in., $16.45; 7-16 in., $14.00; ½ in., $12.95; 5-8 in., $13.15; ¾ in., $12.75; ⅞ in. $12.25; 1 in., $11.85; 1⅛ and 1¼ in. $10.55. Fire weld chain same sizes respectively are $14.00; $11.50; $10.40; $10.55; $10.15; $9.75; $9.35; and $8.25.

ELECTRIC WELD COIL CHAIN B.B.B.

⅛ in. $20.00; 316 in. ....16.50; ¼ in. $15.50; 5-16 in. $12.70.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	60/5
Vulcan	50
P.H. and Imperial	60/5
Nicholson	40
Black Diamond	40
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	60
Great Western-American	50
Kearney & Foot, Arcade	60/5

BOILER TUBES

Size	Seamless	Lapweld
1 in.	20.00	$
1¼ in.	22.00	
1½ in.	22.00	
1¾ in.	23.50	
2 in.	22.00	16.00
2¼ in.	24.00	20.00
2½ in.	25.00	20.00
3 in.	29.00	24.00
3½ in.	34.00	28.00
4 in.	43.00	36.00

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS

Castor Machine Oil, per lb.	34½
Royalite, per gal. bulk	21
Palacine	24
Machine oil, per gal.	33
Black oil, per gal. (Summer)	19
Cylinder oil, Capital	61½
Petroleum fuel oil bbls., net	10.80
Pure turp., single bbls., gal.	1.65
Linseed oil, raw, single bbls.	1.10
Premier Gasoline	35½

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	30%
Standard	30 and 10%
Cut leather lacing, No. 1	1.80
Leather in side, (Lacing)	1.60

TAPES

Chesterman Metallic, 50 ft.	$5 00
Lufkin Metallic, 603. 50 ft.	3 17
Admiral Steel Tape, 50 ft.	3 00
Admiral Steel Tape, 100 ft.	4 50
Major Jun. Steel Tape, 50 ft.	3 75
Rival Steel Tape, 50 ft.	4 40
Rival Steel Tape, 100 ft.	8 75
Reliable Jun. Steel Tape, 50 ft.	5 25

PLATING SUPPLIES

Polishing wheels, felt	$3 80
Polishing wheels, bull-neck	1 50
Emery in kegs, Turkish	08
Pumice, ground	05
Emery glue	25
Tripoli composition	08
Crocus composition	12
Emery composition	11
Rouge, silver	64
Rouge, powder, nickel	38

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	19
Brass sheets, 24 gauge and heavier base	21
Brass tubing, seamless	23

WASTE

XXX Extra	16	Atlas	18
Peerless	21	X Empire	13
XX Grand	15	Ideal	18
Superior	20	X Press	11½
X L C R	14		

Colored

Lion	12	Fancy	13½
Standard	10½	Popular	9
No. 1	13	Keen	7½

Wool Packing

Arrow	24	Anvil	16
Axle	20		

Washed Wipers

Select White	18	Dark colored	13
Mixed colored	14		

This list subject to trade discount

RUBBER BELTING

Standard 36.....28% Best grades 28%

ANODES

Nickel	.55 to .60
Copper	.38 to .40
Tin	.70 to .70
Zinc	.16 to .17

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Copper Bars, ½ to 2 in	$29 00	$28 00
Brass Tube		25
Plain sheets, 16 oz. in. 30 x 72	30 00	29 00
Copper sheet, tinned, 16 oz.	37 00	41 00
Copper sheet, planished, 16 oz. base	42 00	41 00
Braziers', in sheets, 6 x 4 base	30 00	29 00
Copper tubing, seamless		29

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$ 8 75	$ 9 00
Sheets, 3 1-2 lbs. sq. ft.	8 50	8 75
Sheets, 4 to 6 lbs. sq. ft.	8 25	9 00

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	.23
Acid, hydrochloric	.03¾
Acid, nitric	10¼
Acid, sulphuric	.03¾
Ammonia, aqua	.20
Ammonium, carbonate	.15
Ammonium, chloride	.18
Ammonium, hydrosulphuret	.75
Ammonium, sulphate	.10
Arsenic, white	.18
Copper, carbonate, anhy.	.32
Copper, sulphate	.08
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.14
Nickel carbonate	.32
Nickel sulphate	.14
Potassium sulphide (substitute).	.40
Silver chloride (per oz.)	.85
Silver nitrate (per oz.)	.65
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.35
Sodium hyposulphite per 100 lb.	6.50
Sodium phosphate	.15
Tin chloride	.30
Zinc chloride, C. P.	.30
Zinc sulphate	.06

Prices per lb. unless otherwise stated.

News From the Industrial Field

The Hidrokarbo Fuel Appliance Co., Toronto, are building a new heating boiler of the vertical, spiral, tubular type.

The Shell Oil Co. of Canada of Montreal will erect warehouses and storage tanks in Hamilton, Kingston, London and Windsor.

A. F. Byers and Co. of Montreal has secured the general contract for the erection of the International Harvester's warehouse in Montreal.

The Canada Machinery Corporation, Galt, recently increased their force by twenty men, due largely to the improved demand for woodworking machinery.

The construction of two dams has been commenced by the B. C. Electric Ry. at Stave Lake. These will be built by day labor at an approximate cost of $1,250,000.

The C. Turnbull Co. of Galt, Ont., makers of underwear have acquired adjoining property that will add 8,000 sq. ft. of floor space for manufacturing purposes.

Toronto Transportation Commission in their work of renewing the tracks and rolling stock of the Toronto street railway have already drawn on requisition, $11,624,115, from the city council.

Building permits to value of $41,215 were issued in Oshawa for June. This is much lower than May but it brings the aggregate for the first six months beyond the quarter million mark.

The town of Thessalon, Ont., will build a power plant and system at a cost of $50,000. Jno. O. Coulter, town clerk, is now receiving tenders for construction work.

The Steel Co. of Canada, Hamilton, has received the steel contract in connection with the $200,000 physicians' bldg. to be erected in Toronto. Contract for steel sash goes to Henry Hope and Sons, Toronto.

Montreal.—Darling Bros. of Montreal announce that they have been appointed agents in Canada for the Nash Engineering Co. of South Norwalk, Conn. manufacturers of the Jennings hytor vacuum and low pressure boiler feed pumps.

Reports from Toronto City Architect's Dept. indicate that building permits are beginning to slacken. The value of those for the first week of July aggregates approximately $725,000, as compared with values well over the million-dollar mark in the corresponding weeks in both May and June.

The C. P. R. Co., announce the appointment of H J. Humphrey to the position of assistant general superintendent. H. J. Main is promoted to the position of superintendent of the Trenton division.

The Foundation Co. of Montreal nas obtained the general contract for the erection of an office building at the corner of Sherbrooke and Grey Sts., for the Medical Arts Bldg. The cost will be about $1,000,000.

The water works plant of the town of Tecumseh, Ont., has been acquired by the town officials, who will henceforth operate it. The town will construct a new filter plant and system at a cost of about $9,000.

The Horton Steel Co. of Bridgeburg, Ont., have secured the contract for steel for a new school to be erected by the Board of Education. Sheet metal work will go to Thos. Irwin and Sons, Hamilton.

W. F. Frizzel, for twenty years superintendent of the Glace Bay power plant died on June 29, following a stroke of paralysis which he suffered on June 27. He had been unwell for some months, was a native of Hills County, N. S. and was 65 years of age.

J. G. Benedict, general manager of the Landis Machine Co., Waynesboro, Pa., sailed July 8th for a combined business and pleasure trip abroad. Mr. Benedict will be away for about two months and his itinerary will include England, France, Holland, Belgium and Germany.

Advices from Montreal indicate that the larger industries are contributing in no small share to a good volume of business in machine shop supplies. The orders are scattered also among the smaller shops, and jobbers declare that this trade is one of the redeeming features of general business.

In order to train export managers in matters pertaining to international trade, foreign tariffs, selling methods abroad, economic geography, trade cycles and currents, courses are being arranged by the department of Trade and Commerce at Ottawa to begin in the universities of Toronto, and McGill, January, 1923.

Extensive additions and repairs are contemplated by the Dominion Iron and Steel Co. to their plant at Sydney, N. S. Several new furnaces and heavy repairs will be carried out. Included in the equipment required will be electric machinery, wire, cranes, steel, fire brick, etc.

Construction operations will soon be resumed by the C. P. R. on the superstructure of the new pier being built at Vancouver for the accommodation of their Pacific liners. It is expected that the work will require at least 12 months and several hundred men will be engaged. The finished pier will be 850 feet long and 330 feet wide, the cost being approximately $2,000,000.

Industrial accidents are always regrettable incidents, and the Government report for the past half year showed a considerable increase over previous months. The inference, however, is the fact that these statistics reflect a relatively large increase in industrial activity, as past records show that the accident ratio corresponds closely to the volume of industrial enterprise.

The following new members have been added to the directorate of the British Empire Steel Corporation: Hon. C. P. Beaubien, Hon. Viscount Furness, Sir Trevor Dawson, Major-General Sir Newton J. Moore, K. C. M. G., M. P., Rt. Hon. Lord Invernairn, Hector McInnes, K. C., Dr. W. L. McDougald, Frank Ross, J. F. M. Stewart and Benjamin Talbot, J. P.

Contract for the construction of 3,000 houses at Ojibway, Ont., has been awarded to J. H. Jewell, of Windsor, by the Canadian Steel Corp. It is the intention of the corporation to develop Ojibway along the lines of a model town, and in addition to 3,000 dwellings a post office, police and fire stations, etc., will be erected. Work will be done by day labor.

A report from London, Eng., states that the London Canadian Corporation has set out to interest big British firms in the Canadian industrial field, and inducing them to locate branch plants in the Dominion. They bring to England expert knowledge of the Canadian situation and undertaking, when negotiations are completed, that one half of the capital required for the new venture shall be found in Canada.

Montreal.—An increase of nearly two and a half million bushels in the amount of grain shipped down the Lachine Canal in June 1922 over that of June 1921 was reported at the canal office when the records for the month had been completed. All varieties of grains showed an increase. In June 1922 there were 63,500 sacks of flour shipped through the canal, while in the same month a year ago there was none. Produce shipments showed a gain while there was a heavy falling off in coal shipments.

Announcement has been made of the shipment of an unusually large consignment of copper-nickel matter from the smelter of the Mond Nickel Co., at Conniston, Ont. With the re-opening of the International Nickel Company's refinery at Port Colborne, this augurs well for the early resumption of activities in the Sudbury Nickel district.

Exports of Canadian pulp and paper in May were valued at $8,522,830, compared with $6,490,359 in April, and $7,929,525, in May, 1921, according to a statement issued by the Canadian Pulp and Paper Association. United States received the greatest share of exports, accounting for $7,034,141. The United Kingdom came next with $187,153, followed with all others, $401,536.

Antimony Products Corporation, a new organization, it is reported, has taken over and is now operating the antimony mines at Lake George in New Brunswick. The new company is now incorporated in the State of New York and has some large contracts for crimson and golden sulphides with some of the largest rubber companies in the United States.

Copper shipments to the Atlantic refineries from British Columbia continue to be above 1,200 tons per month, and the advance in price, together with the increased demand, has brought the copper mining industry to the front again. Domestic manufacturing activity has increased to the point where the big brass mills must have larger quantities of copper with which to fill current requirements.

The strike of coal miners in the States has reacted advantageously for the coal fields in Nova Scotia. At the present time there are about 21 cargoes a month being delivered at Montreal in six vessels operated by the British Empire Steel Corporation. It is anticipated that at least 1,500,000 tons will reach Montreal from Cape Breton before the navigation season closes.

A report issued by the Ontario Mining Institute, shows that the mines of the province had a gross production in 1920 to the value of more than seventy-three millions, and that $30,492,249 was paid out for supplies of all kinds. The gross bill for wages amounted to $25,764,461. The fifty six million odd disbursed exceeded the gross value of all Canada's exports during the same period.

As a result of orders received for overseas markets the plants of the Wayagamack Pulp and Paper Co., of Three Rivers, Que., are reported now running at full capacity. The increase that has come recently has necessitated operating the plant the full 24 hours a day. Present enquiries would indicate that full capacity production will be the order for several months to come. In addition to the outside business, there has also been a noticeable improvement in the demand from the home market.

Four money by-laws authorizing the city to spend more than a half a million dollars on local improvements, extension of the waterworks, etc., were carried by large majorities in the city of Hull, Que.

The Chas. A. Strelinger Co., Windsor, have secured one-half of the entire contract for machine tools let by the Sarnia Board of Education for their new technical school and collegiate institute. Their order consists of five lathes, two gas furnaces, one electric furnace, torch-weld equipment, grinder and anvil.

Montreal.—C. B. Foster, assistant general pasenger agent of the Canadian Pacific Railway states the traffic has been exceptionally good over all the lines of the C P. R. as far as tourists were concerned. This year this business has been so far much better than it was last season, and bookings already indicate that it will keep up during the whole of the season. Both Grand Trunk and G. T. P. have had a busy tourist season so far.

Demand for lumber continued greater than production during the week ending June 10th, according to the weekly review of the West Coast Lumbermen's Association. Lumber cut during the week under review totalled 88,337,001 feet, with sales of 94,180,847 feet. Production of the 122 mills reporting was 9 per cent. above normal capacity. Thirty-five per cent. of the sales were for water shipment.

Windsor, Ont., is to have another automobile industry and will enjoy the distinction of being the first city in Canada to turn out steam cars. The name of the new concern is Windsor Steam Motors, a branch of the Trask Detroit Steamer, which is now turning out a moderate priced steam car in Detroit. Until the plant here is ready it is the intention of the Canadian concern to secure machines from Detroit to take care of the Canadian market.

Thirteen hundred manufacturing plants, employing some 17,000 persons, are located in British Columbia according to J. A. Cunningham, president of the British Columbia Manufacturers' Association. At the beginning of 1922 investigation showed thirty-one lumber companies and thirty-four general manufacturing plants added to British Columbia during 1921. The volume of business of basic industries was: agriculture $60,065,000; mining $23,066,641; lumber $64,970,000; fishing $22,329,000; other industries $58,000,000.

Montreal.—Mr. H. A. Terrault, the new director of public works claims to have saved the city of Montreal $120,000 in six months through the fact that a steam-driven thirty-million-gallon daily capacity pump has been changed to electric drive. A staff of about twenty five men have been dispensed with, and expenses all along the line had been reduced. The maintenance work was less and even the machine shop staff had been reduced. At the same time it was declared that ample provision had been made to take care of an emergency situation which might be created by the electrical power being cut off.

What is believed to be the first electrically operated dredge in Canada has been constructed by the E. O. Leahey Co., an Ottawa firm, at the Victoria Island shipyard and is now enroute to Kingston. It will be used in connection with the construction of the Queenstown Power canal. It is proposed to operate the dredge off hydro-electric power lines. Its estimated capacity is from eight to nine thousand yards per day.

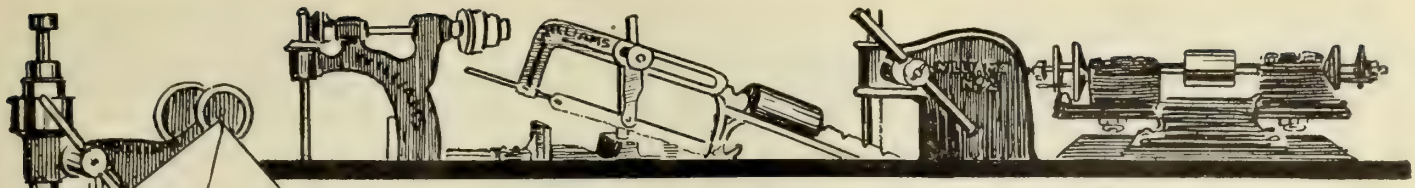
The board of control has decided in favor of proceeding with construction of the two city swimming baths on the basis of amended specifications which will make the cost of the baths $128,964 plus the architects' fees. The recommended tenders are: King Edward Avenue bath, Ed. Monette $60,500; Plouffe Park bath, A. Christie & Son, McDougall's Ltd., $68.454. Only authorization of the City Council is now required.

Montreal.—On July 5th, twenty-five Montreal aldermen visited the plant of the Canada Iron Foundries at Three Rivers at the invitation of the company. On their return, the aldermen stated that they were favorably impressed with the equipment of the company for manufacturing both small and large sized pipe.

The company have just completed the installation of equipment for the manufacture and testing of cast iron water pipe up to 48 inches in diameter, which is claimed to be the largest size pipe ever manufactured in Canada on a commercial basis.

Ottawa.—Complaints have reached the Hon. J. A. Robb, minister of Trade and Commerce, that higher rates are being charged for the movement of grain in Canadian lake carriers from Fort William to Port Colborne, than for transportation in United States vessels from Fort William to Buffalo. This is explained by the fact that certain vessels registered in the United States, which were formerly engaged in other classes of trade, are now readily available for the shipment of grain. Coasting laws prevent United States carriers from discharging their cargoes at Port Colborne. Thus Canadian grain is being diverted to the United States routes at Buffalo. There is, at present, no authority which can control steamship rates and the coasting regulations do not permit of competition having its full effect, regarding trade between Canadian ports.

Another complaint that has reached Mr. Robb from purchasers of grain exported to Great Britain by way of New York. The allegation made to the minister is that wheat reaching England does not grade as high as when it left the Canadian terminal elevators at Fort William and Port Arthur. The inference thus is that it has been subject to mixing between the shipping point and its destination.



Bargains in Re-manufactured Machinery

JUST now there are some particularly good buys being offered in Williams' Monthly Machinery List. Possibly there is just the machine you need: one that you can profitably use in the place of one that is not working satisfactorily.

Every Williams re-manufactured machine is guaranteed by us to be equal to new for all practical purposes.

If you are not receiving our Monthly Machinery list, write us and we will put your name on our mailing list.

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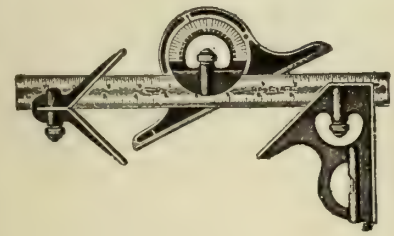
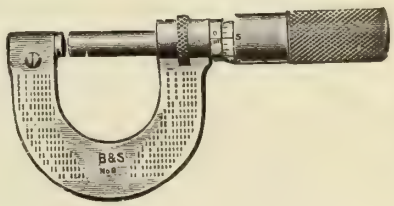


to manufacturing plants, machine shops and foundries is the reason we can guarantee you complete satisfaction from all orders placed with our house. We are prepared to make prompt delivery on



Various Kinds of Iron and Steel

Bar Iron
Sheet Iron (Black and Galvanized)
Mild Steel
Machine Steel
Cast Steel
High Speed Steel
Carbon Steel
Cold Rolled Steel

Machinists' Supplies

Hack Saw Blades
Machine Screws
Cap Screws
Drills (Carbon and High Speed)
Machinists' Tools
Starrett; Brown Co. Sharpe, etc.,
Files

Let Us Know Your Requirements

Rice Lewis & Son, Limited

Established 1847 TORONTO, ONT. 19 Victoria Street

A tape rolled into German bolts of cloth going to South America markets by which yardage may be told at a glance is described as an "innovation." It can hardly be so, since British manufacturers have been using this plan regularly for the past 25 years.

Montreal.—Contracts have been given out for the building of the new Chalmers Presbyterian Church. The main contract is for the sum of $38,834.00. The Dominion Bridge Co. Ltd., have the contract for the steel work at $2,743.-00 and D. A. Bethune Ltd., the plumbing and hot water heating for $6,450.00.

Ottawa.—Canada's purchased ice-breaker, the John D. Hazen, which was turned over to the Russian Government during the war, held by the French Government at Cherbourg and subsequently purchased by the Canadian Government shortly after the present government took office, will it is stated be on her way to Canada by the middle of July. The steamer will be used for ice-breaking work on the St. Lawrence.

Resumed negotiations between the British and Newfoundland Government and the Armstrong Whitworth Co. of London, may result in the establishment of a large paper making industry on the west coast of Newfoundland. This project was abandoned last winter owing to the failure of the Island Government to guarantee the necessary bonds. The present proposal calls for each Government to guarantee bonds to the value of $10,000,000; it is stated that the British Government have agreed to assume their portion. The Armstrong, Whitworth Co., may offer to purchase the interests of the Reid Newfoundland Co., one of the original promotors, and carry on the undertaking alone.

Mr. George Bertram, of the Lincoln Electric Welding Co., Toronto, is now associated with the James Fisher Co., 384 Yonge St., Toronto. Mr. Bertram will be vice-president of the Fisher Co., and will also have charge of accounts. His previous experience should be extremely valuable, as he has been engaged in many lines. He was at one time business manager of the Canadian Courier also Canadian Farm and has been president and secretary of the farm papers association.

Sydney, N. S.—Monday, July 10, the open hearth furnace of the Sydney Steel plant commenced making steel. This is the first time since November 22, 1920, and the pay roll in Sydney has amounted to $10,000 per day, according to reports from the British Empire Steel headquarters. In the lowest period of the depression there were but 1,300 men working three days a week. Business has been improving for the last three months, and everything points to continued improvement. Local business is reflecting the increased industrial activity. The mines are now on full time filling orders from Quebec and from the northern New England States.

ANGUS SHOP ASSESSMENT DOUBLED

On Friday, June 30, the committee of Montreal aldermen appointed to look into the question of the assessment of the C. P. R. Angus Shops agreed to a compromise in their recommendation that the amount be fixed at $2,000,000. This exactly doubles the figure suggested by the executive committee. For the past twenty years the shops have been assessed at $400,000. This year the agreement expired and the C. P. R. suggested that the new valuation be $750,000. Then the executive committee fixed the figure at a million dollars. The final figured arrived at is now two millions. This assessment is subject to the company employing not less than 3,000 men, and is to remain in force for five years.

FORD COMPANY TO DOUBLE

Ford Motor Co., of Canada have just completed a million-dollar land purchase along the Detriot River at Ford, Ont. It is officially announced that the Company proposed spending between five and six million dollars on the next three years in plant development there. New machine shops will be erected besides forge shops, foundries and body shops, and provision is to be made to manufacture certain materials entering into the completed product of the firm. The new river front property will be devoted largely to dockage and shipping facilities, as the Company has in view extensive plans in connection with development of export business. A new power plant will probably be erected and the capacity of the present plant increased from 250 to 300 cars a day.

To aid the quick transmission of business, the Imperial cable department of the British post office announce that the pre-war cable deferred service rates have been restored to the whole of Canada. Deferred telegrams between Toronto, Montreal, Quebec, and other places in Eastern Canada and Cardiff, Wales only now cost 4½d per word, and the average time of transmission by the Imperial route is within -½ hours.

Montreal.—The erection of two new schools for girls has been decided upon at a meeting of the Catholic School Commissioners. The first, 160 by 60 feet, will have seventeen class rooms and will be three storeys high. There will also be a residence for the teaching sisters. The contract, awarded to Ovila Filion, amounts to $175,800.00 to be commenced immediately. The second will have eighteen class rooms and a kindergarten, and will be 151 by 64.

T. Edwards Hewitt, manager of the Canadian office of Jones and Shipman, the British house of machines and small tools at Leicester, England, tells Canadian Machinery that their business in Canada shows decided improvement. This firm have now been located in Canada for the past three years, and are at present located at 163 King St. E. Toronto. Mr. Hewitt says "We have recently secured some very satisfactory orders for our equipment to be used in technical schools in Canada and this is all the more pleasing because we secured the business in the face of keen competition from foreign makers."

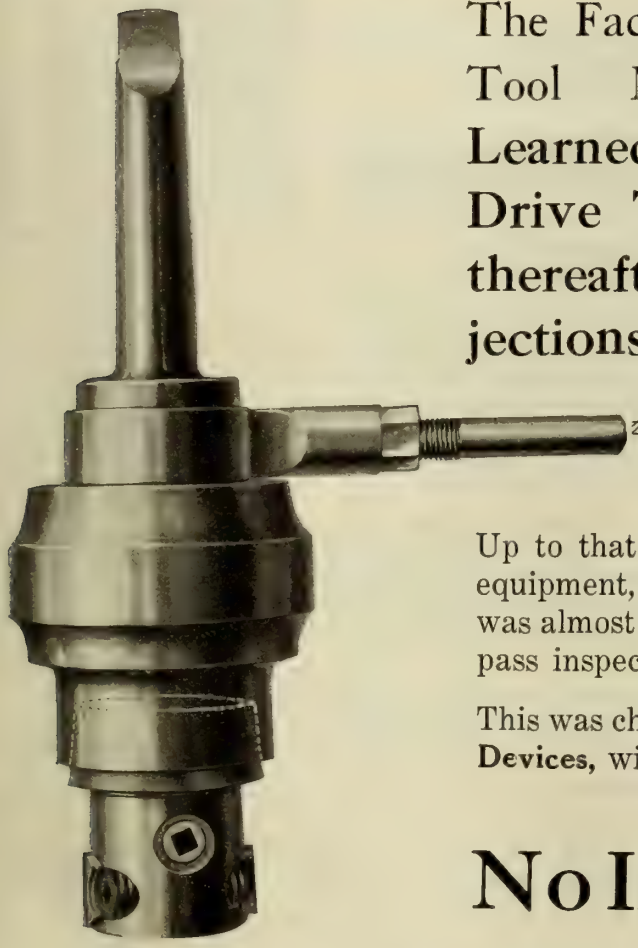
St. John, N. B.—Under date of July 5th, it is announced that the court of inquiry concerned under Captain L. A. Demers, Dominion Wreck Commission, find that the bridge tender of the Morrisey Bridge at Chatham, N. B., or his employer, the New Brunswick Provincial Government, is responsible for the C. G. M. M. Steamer "Canadian Squatter" colliding with the structure. It was found that the pilot followed a dangerous practice in going too near the bridge but the majority finding of the court, of which Captains McLean and Mitchell are members, relieves the pilot and shipmaster from any blame. Their certificates were returned to them. Captain Demers recommends more clear definition of the caretaker's instructions, and that regulations governing pilotage be framed by the Harbor-master.

Powley and Moody, 105 Bond St., Toronto, are finding their radio business exceedingly active. They are representing the Millard Radio Valve Co. of London, England, the latter mentioned firm being contractors to the British War Office, Admiralty Royal Air Board, Post Office, and other public institutions. The Millard Co. make a very complete line of reception and transmission valves, the latter from 20 watts to 10 k.w., including the well known "Silica" valve for high power stations. The leading valve made by this company is known as type O. R. A. the name applying that it oscillates, rectifies and amplifies. It is said to have very long life, and operates on low current consumption. It has the distinct feature of being noiseless according to the makers. M. G. N. Middletown, E. E. is vice-president, and C. A. Lowry radio engineer for Powley and Moody are directors of Radio Devices Ltd., Gananoque, Ont., Powley and Moody being selling agents for the latter mentioned line. Between both activities they are very busy.

NEW USE FOR CANADIAN WOOD

In the construction of storage batteries for automobiles it is necessary to use considerable wood, made in very thin corrugated sheets and designated as separators. Wood for battery separators must possess special chemical and physical properties and until very recently the wooden separators used in Canada were made almost exclusively of imported woods. The Forest Products Laboratories of the Forestry Branch, Department of the Interior, recently undertook research to determine whether any Canadian wood was suitable for separator work, and as a result found a most excellent material in the yellow cypress of British Columbia.

Worked Like Magic



Note the dotted lines illustrating position and size of friction Cone

The Factory Manager of a large Tool Manufacturing Concern **Learned of the Jarvis Friction Drive Tapping Device and thereafter there were no rejections.**

Up to that time they had been using regular standard equipment, and the bottoming taps did not bottom. It was almost impossible to tap the holes so that they would pass inspection.

This was changed like magic when the 20 **Jarvis Tapping Devices,** with **Cone Friction Drive,** were installed.

No Inspection Needed

The Jarvis Friction Tapping Device taps the holes to bottom, and then runs in a second time to do its own inspecting, and, when it finishes, every hole is thoroughly cleaned out to bottom.

Very little pressure is needed to drive the Device.

The Drive is controlled by pressure on the machine spindle.

Stripped threads are unknown.

Holes tapped in toughest metal with little tap breakage.

Standard Chuck.

No special taps required.

The Tap is freely started and stopped while rotating.

Adaptable to Drilling Machine or Speed Lathe.

Ask us about the Jarvis High Speed Tapping Devices, which act without clinching or binding.

And the Jarvis Quick Change Chucks and Collets, for Drilling, Counterboring, Tapping and Stud Setting.

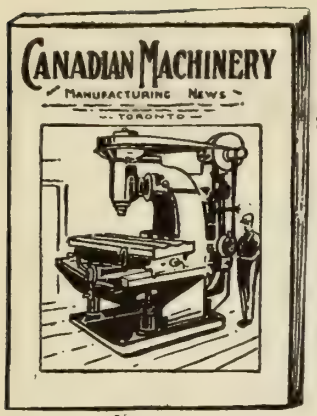
We are Sole Distributors

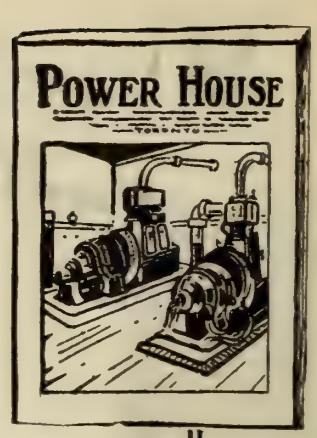
THE GEOMETRIC TOOL COMPANY

New Haven, Conn., U.S.A.

Canadian Agents :

Williams & Wilson, Ltd., Montreal. **The A. R. Williams Machinery Co., Ltd.,** Toronto, St. John, N.B., Halifax, N.S., Vancouver, B.C.





DO YOU Manufacture Industrial Equipment ?

Are you a manufacturer of twist drills, hack saws, mechanics' tools, wire guards, bolts, rivets, paints—do you manufacture lines of any description that can be used in machine shops, metal-working plants, power plants or foundries? If you do the publications you see illustrated here (Canadian Machinery, Canadian Foundryman, and Power House) can build a bigger demand for your products.

This group of technical newspapers is read by the men who are prospective buyers of your lines. You can bring to the attention of these men the reason why they should demand your goods when purchasing from their dealers. You can effectively do this by placing a message in the paper which serves the field in which your products are sold.

CANADIAN MACHINERY AND MANUFACTURING NEWS is published weekly and covers the machinery, iron and steel and general metal-working industries of Canada.

POWER HOUSE is published semi-monthly; it serves steam, electrical, water and gas power plants, and the power houses of all general manufacturing plants.

CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS is published monthly; it serves the grey iron, steel and non-ferrous foundries.

Each one of these publications reach proprietors, managers, purchasing agents, foremen—the men who direct the purchasing of goods. A message to these men in any of the MacLean Technical Newspapers is certain to have a strong influence.

Write for complete Data.

MACLEAN TECHNICAL NEWSPAPERS

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Montreal, Winnipeg, Vancouver

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Drop - Forged "C" CLAMPS

The design and careful selection of material used combine in this medium service Clamp the maximum of strength and stiffness consistent with convenient weight. It is specially adapted for that wide field of work where the extreme stiffness and greater weight of the Armstrong Extra Heavy C Clamp are not essential.

Armstrong Bros. Tool Co.

"The Tool Holder People."

306 N. Francisco Ave. Chicago, U.S.A.

Canadian Agents:
A. R. WILLIAMS MACHINERY CO., Toronto
WILLIAMS & WILSON, Montreal.

HEPBURN

POWER PRESSES

For Long Service—

After all, you could no doubt buy any number of presses that would give the same production the first few weeks of operation. But after a year—two years—three years—What then? If it is a **Hepburn** built Press you get production unslackened by constructional weaknesses.

Hepburn Power Presses are strong and well built. The cranks are made from solid forgings and give long strokes. Quick adjustability a feature of every press. Write for specifications.

We also make Vertical Engines, Compressors, Winches, Planers, Steam Pumps, Cranes, Special Machinery Forgings and Castings.

JOHN T. HEPBURN Limited

Engineers and Iron Founders

18-60 VAN-HORNE STREET, TORONTO, ONTARIO

Carbon Plates,

Rods, and Paste for Oxy-Acetylene Welding

WHERE the flow of metal must be restricted to a definite area, there is no substitute for carbon.

It is impossible to utilize the full advantages of the oxy-acetylene process without carbon dams, retainers, and plugs. Columbia Welding Carbon Products are indispensable in making heavy welds on castings without dismantling; in reinforcing welds to any strength desired; and in simplifying vertical welding.

C N C

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TORONTO - CANADA

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Two cents a word, including "Canadian Machinery" box numbers; minimum charge is $1.00 per insertion for 50 words or less, set in 6-pt. type. Each figure counts as a word. Display ads., or ads. set in border, are at the card rates.

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FETHERSTONHAUGH & CO.

PATTERNS

TORONTO PATTERN WORKS, 65 JARVIS Street, Toronto. Patterns in wood and metal for all kinds of machinery. (etfm)

BRANTFORD PATTERN WORKS ARE PREpared to make up patterns of any kind—including marine works—to sketches, blue prints or sample castings. Prompt, efficient service. Bell 'Phone 631; Machine 'Phone 733. Brantford Pattern Works, 49 George St., Brantford. Ont. (etfm)

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"RICARDO" ENGINES, PETROL OR PARAFfin, excellent for marine, commercial or stationary use. Brand new. 100 h.p. 4-cylinder, 150 h.p. and 250 h.p. 6-cylinder, 300 h.p. 12-cylinder, Thirty shillings per horse-power sterling London. Sykes, Patching, Sussex, England.

WANTED

SCRAP ENDS
STEEL PLATES 9, 10, 11 Gauge

Carloads or less. Suitable for making Iron Washers.

The Graham Nail Works
Toronto

STEEL

Air Pressure Tanks, Air Receivers, Steel Plate Tanks, Pneumatic Tanks, Tote Boxes, Shop Barrels, Steel Factory Equipment, Smoke Stacks, Gasoline Tanks.
Write For New Catalogue

THE STEEL TROUGH & MACHINE CO. LTD.
TWEED - ONT.

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FOR SALE OR ROYALTY—CANADIAN PATent No. 214964 on resilient wheel for automobiles and trucks, absorbs the shock in the leaf spring spokes of the wheel, either hard rubber or pneumatic tires may be used; simple, practical and substantial in construction. Reasonable terms. Wm. H. Schlake, Yuma, Colo.

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Light and Medium-Bench and Floor Repetition Castings; Capacity 15 tons per day.
Expert Metal and Wood Pattern Work. Our advice and estimates will save you money.
Semi-finishing operations on Lathe or Grill on Castings supplied if required.
ASK US.
THE KATIE FOUNDRY, GALT, ONT.

REGO WELDING *and* CUTTING APPARATUS

Oxygen, Acetylene, and a complete line of Welding and Cutting Supplies

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of Toronto, Limited
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Phones: Adelaide 2841 and 1524

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Japanning and Varnishing Ovens heated by Gas, Electricity, Steam or Coal, Kernchen and Apex Siphonage Ventilators, Bakers' Ovens, trucks, casters, etc. Write for Booklet.
BRANTFORD OVEN & RACK CO.
Brantford, Canada

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SITUATION WANTED AS SUPERINTENDENT or general foreman of machine shop, twenty years' experience. At present employed; best of references. Box 861T Canadian Machinery. (c23m)

MECHANICAL DRAFTSMAN DESIRES A change; age 30; married. Experienced in tool, jig and machine design. If you are looking for a young man who by practical shop experience, knows his job from the drafting office to the shipping platform, arrange interview, at your convenience. Box 788, Canadian Machinery.

MECHANICAL DRAFTSMAN AND DESIGNER desires position, preferably firm where advancement and responsibility is given. Competent chief draftsman with machine shop experience, well educated. Box 810, Canadian Machinery, Toronto. (C.18M.)

SALESMAN, 6 YEARS' MACHINE TOOL EXperience 10 years' general engineering with A1 practical and theoretical knowledge of mechanics, open to represent manufacturer in Toronto and district. Box 805L, Canadian Machinery.

CLOSING TIME

Advertisements for this section must be in our composing room Tuesday morning prior to day of issue.

In order that the announcements of your wants, machinery for sale, etc., etc., shall not be delayed, please try to have them in our office with the Tuesday morning mail.

Canadian Machinery

Machine Tools

FOR SHIPBUILDERS & IRON & STEEL WORKS

BERTRAMS LIMITED
EDINBURGH

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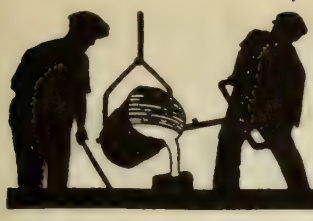
YOU'VE been going to send in that ad for weeks, so why not mail it now for next week's issue?

CANADIAN MACHINERY & MANUFACTURING NEWS

Classified Advertising Section

143-153 University Ave. Toronto, Ontario



Where To Buy Your CASTINGS

The Brown-Boggs Co., Limited
HAMILTON, ONT.
Grey Iron.

John T. Hepburn, Limited
TORONTO, ONT.
Grey Iron.

Sully Brass Foundry, Limited
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Brass, Bronze Copper and Aluminum.

Canadian Rumley Co., Limited
Queen West and Abell Streets,
TORONTO, ONT.
Grey Iron.

Galt Malleable Iron Co., Ltd.
GALT, ONT.
Malleable.

S. Vessot & Company
JOLIETTE, QUE.,
Grey Iron, Brass and Aluminum.

Miller Bros. & Sons, Limited,
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Grey Iron, Semi-Steel Castings up to 10 tons.

Can. Mead-Morrison Co., Ltd.,
MONTREAL, P.Q. WELLAND, ONT.
Grey Iron Machinery Castings.

Hugh Park Foundry Co., Ltd.,
OSHAWA, ONT.
Grey Iron, Patterns, Etc.

Hull Iron & Steel Foundries Ltd.
HULL, CANADA.
Steel, Manganese, Chrome.

Aurora Foundries, Limited,
AURORA, ONT.
Grey Iron.

Aluminum Last & Metal Co.,
KITCHENER, ONT.
Aluminum, Brass, Bronze and Special Alloys.

Can. Hanson & VanWinkle Co.
LIMITED
TORONTO, ONT.
Monel, Aluminum, Brass, Bronze, Grey Iron.

Tallman Brass & Metal, Ltd.
HAMILTON, CANADA
Brass, Bronze, Manganese Bronze, Aluminum.

Dom. Foundries & Steel, Ltd.
HAMILTON, CANADA.
Steel Castings all sizes.

Manitoba Steel Foundries, Ltd.
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Steel Castings up to 5,000 lbs.

Brantford Brass Foundry Co.
BRANTFORD, ONT.
Aluminum, Brass, Bronze, Specialty.

The Katie Foundry
GALT, ONT.
Grey Iron, Semi-Steel, Brass, Aluminum.

William Kennedy & Sons, Ltd.
OWEN SOUND, ONT.
Steel, Malleable and Heavy Grey Iron.
See Advertisement Page 8

Machinery & Foundries, Ltd.
BROCKVILLE, ONT.
Light and Medium Grey Iron.

A. F. McCulloch
OSHAWA, ONT.
Brass, Alum. Castings—Wood, Metal Patterns.

Corbet Foundry & Machine Co. Ltd.
OWEN SOUND, ONT.
Grey Iron, Brass.

Fittings Limited,
OSHAWA, ONT.
Malleable, Grey Iron, Brass, Aluminum.

W. W. Wells
370 Victoria Street, TORONTO, ONT.
Nickel and Monel Metal.

The Robert Mitchell Co., Ltd.
64 Belair Ave., MONTREAL.
Light Grey Iron.

Canadian Steel Foundries, Ltd.
MONTREAL, QUE.
Steel and Ferro-Alloy.

Langley & Austin,
GALT, ONT.
Copper, Bronze, Brass and Aluminum.

Maxwells, Limited
ST. MARYS, ONT.
Light Grey Iron, Tinning same a specialty.

The Eureka Planter Co., Ltd.,
WOODSTOCK, ONT.
Specialty Light Grey Iron.

Lindsay Foundry and Pattern Works, Limited
Victoria Avenue, LINDSAY, ONT.
Grey Iron.

Dominion Engineering Works, Limited
MONTREAL, QUE.
Grey Iron.

Smith's Falls Malleable Castings, Limited
SMITH'S FALLS, ONT.
Malleable.

Joliette Steel Co.
JOLIETTE, QUE.
Electric Steel and Ferro-Alloy.

International Malleable Iron Company, Limited
GUELPH, ONT.
Malleable.

Canadian Machinery BUYERS DIRECTORY

If what you want is not here, write us, and we will tell you where to get it. Let us suggest that you consult also the advertisers' index— last page of book, after having secured advertisers' names from this directory. The information you desire may be found in the advertising pages. This department is maintained for the benefit and convenience of our readers. The insertion of our advertisers' names undr proper headings is gladly undertaken, but does not become part of an advertising contract.

ABRASIVE DISCS
J. R. Baxter & Co., Ltd., Montreal, Que.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John, London, S.E., Eng.

ABRASIVE MATERIALS
J. R. Baxter & Co., Ltd., Montreal, Que.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John, London, S.E., Eng.

ACETYLENE, DISSOLVED
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Toronto.
Liquide Air Company, Toronto.

ANCHOR BELTS
Steel Co. of Can. Ltd., Hamilton, Ont

ANGLE BARS
Steel Co. of Can. Ltd., Hamilton, Ont.

ANVILS
Aikins & Co., Inc., E.C., Indianapolis, I.
Petrie, Ltd., H. W., Toronto, Ont.

ANCHOR BOLTS
Steel Co. of Can., Ltd., Hamilton, Ont.

ANGULAR HOLE DRILLING TOOL
Globe Engineering Co., Ltd., Hamilton, Ont.

ARBORS
Atkins & Co., Inc., E. C., Indianapolis,
Brown & Sharrpe Mfg.Co., Providence,R.I
Jacobs Mfg. Co., Hartford, Con.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.

BELLS, BRASS, BRONZE and STEEL
Canada Foundries & Forgings Co., Welland, Ont.
Canadian SKF Co., Toronto, Ont.

BARRELS, TUMBLING
McDougall Co., Ltd., R., Galt, Ont.

BARS, BORING
Armstrong Bros. Tool Co., Chicago, Ill.
Bertram & Son Co., td., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

BARS, BORING, PORTABLE
Underwood Corp., H. B., Philadelphia.

BARS, STEEL
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
British Empire Steel Corporation, Montreal, Que.

BEARINGS, BALL
Canadian SKF Co., Toronto, Ont.

BEARINGS, ROLLER
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

BELT CEMENT
McLaren Belting Co., J. C., Montreal, Que.

BELT DRESSINGS AND FILLERS
Dom. Belting Co., Ltd., Hamilton, Ont.

BELT FASTENERS
Bristol Company, Waterbury, Conn.
McLaren Belting Co., J.C., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

BELT HOOKS
Bristol Co., Waterbury, Conn.

BELT LACING
Bristol Company, Waterbury, Conn.
McLaren Belting Co., J. C., Montreal,

BELT LACING, STEEL
Bristol Company, Waterbury, Conn.

BELT LACING MACHINES
McLaren Belting Co., J. C., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

BELTING, CHAIN
Can. Link-Belt Co., Toronto, Ont.
Fittings, Limited, Oshawa, Ont.
Jones & Glassco, Montreal, Que.
Renold (Hans) of Canada, Ltd., Montreal, Que.

BELTING, FABRIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Dom. Belting Co., Ltd., Hamilton, Ont
McLaren Belting Co., J. C., Montreal, Que.

BELTING, LEATHER
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Can. Fairbanks-Morse Ltd., Montreal, Q.
McLaren Belting Co., J. C., Montreal, Que.
Smith Belting Co., Toronto, Ont.

BOLTS AND NUTS
British Empire Steel Corporation, Montreal, Que.
Fittings, Limited, Oshawa, Ont.
National Acme Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont

BOLT THREADING DIE HEADS
Landis Machine Co., Inc., Waynesboro Pa.

BOLTS, TRACK
Steel Co. of Canada, Ltd., Hamilton, Ont.

BORING and TURNING MILLS, Vertical
Bertram & Sons Co., Ltd., The John Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

BORING, DRILLING and MILLING MACHINES, Horizontal.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
Landis Tool Co., Waynesboro, Pa.

Vertical
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
McDougall Co., Ltd., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont
Rockford Drilling Machine Co., Rockford,

BORING TOOLS
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.

For list of Dealers see the last page of This Buyers Directory

BELTS, ABRASIVE
Oakey & Sons, Ltd., John, London, S.E., Eng.

BENDING MACHINES, POWER
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bertrams Ltd., Edinburgh, Scotland.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

BILLETS, BLOOMS and SLABS
Steel Co., of Can. Ltd., Hamilton, Ont.

BLOCKS
Wright Mfg. Co., Lisbon, Ohio.

BLOCKS, CHAIN (See Hoists, Hand)
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

BLOCKS, DIE
Canada Foundries & Forgings Co., Welland, Ont.

BLOCKS, PILLOW
Can. Link-Belt Co., Toronto, Ont.

BLOWERS
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

BOILERS, LOCOMOTIVE
Goldie & McCulloch Co., Ltd., Galt,

BOLT AND NUT MACHINERY
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Montreal, Que.

BOLT AND NUT MACHINERY, Automatic
National Acme Co., Cleveland, Ohio.

BUCKET CARRIERS, Pivoted
Can. Link-Belt Co., Toronto, Ont.

BUFFERS
Pryibil Machine Co., New York, N.Y.

BUFFING OR POLISHING MACHINES
(See Polishing and Buffing Machines)
Blount Co., J. G., Everett, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Pryibil Machine Co., New York, N.Y.
U. S. Electrical Tool Co., Cincinnati, O.

BUILDING MATERIALS
Bertram & Son Co., Ltd., The John Dundas, Ont.

BURNERS, OIL AND GAS
Rockwell Co., W.S., New York City.

BURRS
Steel Co. of Can. Ltd., Hamilton, Ont.

CABINETS, OIL
S. F. Bowser & Co., Ltd., Toronto, Ont

CALIPERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Starrett Co., L. S., Athol, Mass.

CAMS
Canada Foundries & Forgings Co., Welland, Ont.

CAN-MAKING MACHINERY
(See Sheet Metal Working Machinery)
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Bliss Co., E. W., Brooklyn, N. Y.
Smooth Mfg. Co., Jersey City, N. J.

CARBONIZING
Chapman Double Ball Bearing Co., Toronto.

CEMENTS, IRON CENTERING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.

CHAINS (See Sprockets and Chains)
Reynold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio

CHUCKS, DRILL
Jacobs Mfg. Co., Hartford, Conn.

CASTINGS, ALUMINUM, BRASS, BRONZE, COPPER, DIE-MOLDED, FERRO-ALLOY, IRON, SEMI-STEEL, STEEL.
See "Where to buy your castings" Section. Page number may be found by turning to Advertisers' Index.

CHAINS, DRIVING
Can. Link-Belt Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont
Jones & Glassco, Montreal, Que.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

CHASERS
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CHUCKING MACHINES
Acme Machine Tool Co., Cincinnati, O.
Brown & Sharpe Mfg. Co., Providence, R. I
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

CHUCKS, DRILL AND TAP
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canadian SKF Co., Toronto, Ont.
Cushman Chuck Co., Hartford, Conn.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg., New Britain, Conn.

CHUCKS, LATHE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Cushman Chuck Co., Hartford, Conn.
Geometric Tool Co., New Haven, Conn
Gisholt Machine Co., Madison, Wis.
Ker & Goodwin Machine Co., Brantford Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pryibil Machine Co., New York, N.Y.
Skinner Chuck Co., New Britain, Conn
Union Mfg. Co., New Britain, Conn.

CHUCKS, MAGNETIC
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CHUCKS, PLANER
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cushman Chuck Co., Hartford, Conn
Skinner Chuck Co., New Britain, Conn
Union Mfg. Co., New Britain, Conn.

CHUCKS, TAPPING
William L. Procunier, Chicago, Ill.

CHUCKS, VERTICAL BORING MILL
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Skinner Chuck Co., New Britain, Conn
Union Mfg. Co., New Britain, Conn.

CLAMPS, MACHINISTS'
Brown & Sharpe Mfg. Co., Providence.
Starrett Co., L. S., Athol, Mass.

CLEANERS, METAL, WASTE, GENERAL
Oakley Chemical Co., New York, N. Y.

CLOCKS
Chicago Watchman's Clock Co., Chicago.
Hardinge Bros., Limited, Toronto, Ont.

CLOCKS, TIME
Gisholt Machine Co., Madison, Wis.

CLOCKS, WATCHMEN'S
Chicago Watchman's Clock Co., Chicago, Ill.
Hardinge Bros., Limited, Toronto, Ont.

BUYERS' DIRECTORY

CLUTCHES, FRICTION
Can.-Link-Belt Co., Toronto, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.

COAL AND ASH HANDLING MACHINERY
Can.-Link Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

COAL-STORAGE SYSTEMS
Can. Link-Belt Co., Toronto, Ont.

COLLARS, SHAFT OR SET
Canada Foundries & Forgings Co., Welland, Ont.
Can. Link-Belt Co., Toronto, Ont.

COLLETS
Butterfield & Co., Inc., Rock Island, Que.
Hardinge Bros., Inc., Chicago, Ill.
Hendley Machine Co., Torrington Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

COMPOUNDS, CLEANING
Oakley Chemical Co., New York, N.Y.

COMPOUNDS—CUTTING, DRILLING, GRINDING, SCREW CUTTING
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Oakley Chemical Co., New York, N.Y.

COMPRESSORS, AIR AND GAS
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.

CONES, FRICTION
Norton Co., of Can. Ltd., Hamilton, Ont.

CONNECTING RODS AND STRAPS
Canada Foundries & Forgings Co., Welland, Ont.

CONTRACT WORK
Victoria Foundry Co., Ltd., Ottawa, Ont.

CONVEYORS AND ELEVATORS (SEE ELEVATORS)
Jones & Glassco, Montreal, Que.

COTTERS
Steel Co. of Canada, Ltd., Hamilton, Ont.

COUNTERBORES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

COUNTERS, REVOLUTION
Starrett Co., L. S., Athol, Mass.

COUNTERSHAFTS
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Johnson Machine Co., Carlyle, Man-
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

COUNTERSINKS
Butterfield & Co., Inc., Rock Island. Que.
Pratt &Whitney Co., of Canada, Ltd., Dundas, Ont.

COUPLERS, CAR AND LOCOMOTIVE
Can. Steel Foundries, Montreal, Que.

COUPLINGS
Steel Co. of Canada, Ltd., Hamilton, Ont.

COUPLINGS, PIPE
Fittings, Limited, Oshawa, Ont.

COUPLINGS, SHAFT
Can. Link-Belt Co., Toronto, Ont.

CRANES, ELECTRIC
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can.-Link-Belt Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

CRANES, LOCOMOTIVE
Can. Link-Belt Co., Toronto, Ont.

Bertram & Son Co., td., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

CRANK PIN TURNING MACHINE
Underwood Corp., H.B., Philadelphia, Pa.

CUTTERS, GEAR
Brown & Sharpe Mfg. Co., Providence. R. I.
Butterfield & Co., Inc., Rock Island, Q. Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CUTTERS, HIGH SPEED
Atkins & Co., Inc., E. C., Indianapolis.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CUTTERS, MILLING
Brown & Sharpe Mfg. Co., Providence, R. I.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.

CUTTERS, STAY BOLT
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.

CUTTING-OFF MACHINE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S, Athol, Mass,

CUTTING OFF MACHINES, PIPE (SEE PIPE-CUTTING AND THREADING MACHINES)
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.

CUTTING-OFF TOOLS
Armstrong Bros. Tool Co., Chicago, Ill.

CUTTING OIL FILTERS (SEE OIL FILTERING SYSTEMS
Bowser, S. F. & Co., Ltd., Toronto.

CUTTING, OXY-HYDROGEN
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Ltd., Toronto, Ont.

DEALERS, MACHINERY (SEE SEARCH-LIGHT SECTION)
Petrie, Ltd., H. W., Toronto, Ont.

DETACHABLE CHAIN
International Malleable Iron Co., Guelph, Ont.

DIAMONDS, BLACK AND ROUGH
Can. Desmond-Stephan Mfg Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

DIAMOND TOOLS
Can. Desmond-Stephan Co., Hamilton,
Wheel Trueing Tool Co., Windsor, Ont.

DIAMOND CROSSINGS
Can. Steel Foundries, Montreal, Que.

DIAMONDS, IMPORTERS
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Co., Windsor, Ont.

DIES, SCREW AND THREAD CUTTING
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.

DIES, SHEET-METAL AND SUB-PRESS (See Tool Work)
Brown, Boggs & Co., Ltd., Hamilton, Ont.

DIES, FORGING
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

DIES, SELF-OPENING, ADJUSTABLE
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Landis Machine Co., Inc., Waynesboro,
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DIES, THREADING-OPENING
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, .
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DIVIDING HEADS
Burke Machine Tool Co., Conneaut, Ohio.
Hendey Machine Co., Torrington, Conn.
Kearney & Treacker Co., Milwaukee,. Wis.
Petrie, Ltd., H. W. Toronto, Ont.

DOGS, LATHE AND MILLING MACHINE
Armstrong Bros. Tool Co., Chicago, Ill.

DRAFTING MATERIALS
American Lead Pencil Co., New York City, N.Y.

DRESSERS, GRINDING WHEEL
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ont.
Norton Co., of Can., Ltd., Hamilton.
Wheel Trueing Co., Windsor, Ont.

DRESSING TOOLS
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Co., Windsor, Ont.

DRILL HOLDERS
Armstrong Bros. Tool Co., Chicago, Ill.

DRILLING MACHINES, BENCH
Burke Machine Tool Co., Conneaut,, Ohio.
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Hardinge Bros., Inc., Chicago, Ill.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
U. S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, ELECTRIC AND HAND
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, GANG
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

DRILLING MACHINES, HEAVY DUTY
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
Rockford Drilling Machine Co., Rockford, Ill.

BORING, DRILLING AND MILLING MACHINES, (HORIZONTAL.)
Gisholt Machine Co., Madison, Wis.

DRILLING MACHINES, Multiple Spindle
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
National Acme Co., Cleveland, Ohio.

DRILLING MACHINES, Pneumatic
Cleveland Pneumatic Tool Co., Toronto. Ont.

DRILLING MACHINES, PORTABLE
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, RADIAL
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto,

DRILLING MACHINES, SENSITIVE
Burke Machine Tool Co., Conneaut, O.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Williams Machinery Co., A. R., Toronto.
Wisconsin Electric Co., Racine. Wis

DRILLING MACHINES, TURRET
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wisconsin.
Williams Machinery Co., A. R., Toronto.

DRILLING MACHINES, VERTICAL
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

DRILLS, CENTRE
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd , Dundas, Ont.

DRILLS, HIGH SPEED TWIST
Butterfield & Co., Inc., Rock Island. Que.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Cleveland Twist Drill Co., Cleveland, O.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DRILLS, RATCHET
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co , New Bedford, Mass.

DRILLS, TWIST AND FLAT
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.

DROP FORGINGS
Steel Co. of Canada, Ltd., Hamilton.

DUST HANDLING EQUIPMENT
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

ELECTRICAL INSTRUMENTS
Bristol Co., Waterbury, Conn.

ELECTRICAL SUPPLIES
Atkins & Co., Inc., E. C., Indianapolis.
Diamond State Fibre Co., Toronto, Ont.
U.S. Electrical Tool Co., Cincinnati, O.

ELEVATING TRUCKS (See Trucks)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

ELEVATORS AND CONVEYORS
Can. Link-Belt C., Toronto, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.

EQUIPMENT, ELEVATOR SAFETY
Jones & Glassco, Montreal, Que.

EMERY WHEELS (See Grinding Wheels)
J. R. Baxter & Co., Ltd., Montreal, Que.
Atkins & Co., E. C., Indianapolis, I.
Norton Co., of Canada., Ltd., Hamilton.

ENGINES, CAPSTAN
Kennedy & Sons, Wm., Owen Sound, Ont

ENGINE LATHE MANUFACTURERS
Oliver Machinery Co., Grand Rapids, Michigan.

ENGINEERS, MECHANICAL
Dominion Engineering Works, Limited, Montreal, Que.
Gisholt Machine Co., Madison, Wis.
Hamilton Gear & Machine Co., Toronto,

EXPANDERS, TUBE
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

FANS, ELECTRIC
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbank.-Morse Co , Ltd., Montreal, Que

FANS, EXHAUST
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Petrie Ltd., H. W., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass.

FANS, VENTILATING
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

FIBRE
Diamond State Fibre Co., of Can. Ltd., Toronto, Ont.

FILES AND RASPS
Nicholson File Co., Port Hope, Ont.
Simmons Canada Saw Co., Montreal, Que.

FILLER, IRON (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J.

FIRE ESCAPES
Roelofson Elevator Co.. Galt, Ont.

FITTINGS, PIPE
International Malleable Iron Co., Guelph.
Fittings, Limited, Oshawa, Ont.

FLEXIBLE SHAFTS
Strand & Co., N. A., Chicago, Ill

FLUXES, WELDING
Carter Welding Co., Ltd , Toronto, Ont.
Dominion Oxygen Co., Ltd. Toronto
Liquide Air Company, Toronto, Ont.

FORGING MACHINERY
Acme Machinery Co , Cleveland, Ohio
Bertram & Son Co., Ltd., The John, Dundas, Ont
Brown Boggs & Co., Ltd., Montreal.
National Machinery Co., Tiffin, Ohio
Steel Co of Canada, Ltd , Hamilton

BUYERS' DIRECTORY

FORGINGS, DROP
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Ltd., Toronto, Ont.

FORGINGS, HAMMER
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Hepburn Ltd., John T., Toronto, Ont.

FOUNDRY EQUIPMENT
McDougall Co., Ltd., R., Galt, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

FOUNDRY SUPPLIES
Rice Lewis & Son, Ltd., Toronto, Ont.

FROGS, SPRING OR RIGID
Can. Steel Foundries, Montreal, Que.

FURNACES, ELECTRIC
Rockwell Co., W. S. New York City.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

FURNACES, HEAT TREATING COAL
Rockwell Co., W. S., New York City.

FURNACES, HEAT TREATING OIL AND GAS
Bellevue Industrial Furnace Co., Detroit, Michigan.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Rockwell Co., W. R., New York City.

FURNACES TEMPERING AND ANNEALING
Bellevue Industrial Furnace Co., Detriot, Mich.
Brown & Sharpe Mfg., Co., Providence R. I.
Rockwell Co., W. S., New York City.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

FURNACES AND OVENS, ELECTRIC
Petrie, Ltd., H. W., Toronto, Ont.
Rockwell & Co., W. S., New York city.
Starrett Co., L. S., Athol, Mass.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

GAGES, MEASURING (See Tool Work)
Brown & Sharpe Mfg. Co., Providence, R. I.
Greenfield Tap & Die Corp., Galt, Ont.
Lufkin Rule Co., Windsor, Ont.
Starrett Co., L. S., Athol, Mass.

GAGES, RECORDING
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GAGES, SPECIAL MEASURING (See Tool Work)
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GAGES, THREAD
Brown & Sharpe Mfg. Co., Providence R. I.
Starrett Co., L. S., Athol, Mass

GALVANIZING
Fittings, Limited, Oshawa, Ont.

GAS, COAL COMPRESSED
L'Air Liquid Society, Toronto, Ont.

GAS, COMPRESSED
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

GASKETS
Diamond State Fibre Co. of Ca., Ltd., Toronto, Ont.
Smooth Mfg. Co., Jersey City, N. J.

GAUGES VACUUM AND PRESSURE
Taylor Instrument Co., Toronto, Ont.

GEAR BLANKS
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.
Dominion Engineering Works, Limited, Montreal, Que.

GEAR COUNTERS
Hart Mfg. Co., R. A., Battle Creek, Michigan.

GEAR-CUTTING MACHINES
Bertram & Sons Co., Ltd., The John Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Fellows Gear Shaper Co., Springfield, Vt.
Petrie, Ltd., H. W., Toronto, Ont.
Whiton Machine Co., D. E., New London, Conn.

GEAR TESTING MACHINES
Brown & Sharpe Mfg. Co., Providence. R. I.

GEARS, CAST
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Hull Iron & Steel Foundries, Hull, Que.
Dominion Engineering Works, Limited, Montreal, Que.

GEARS, CUT
Brown & Sharpe Mfg. Co., Providence, R. I.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Gardner & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto, Ont.
Hepburn Ltd., John T. Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

GEARS, DRESSED
Kennedy & Sons, Wm., Owen Sound, Ontario.

GEARS, FORGED
Canada Foundries & Forgings Co., Welland, Ont.

GEARS, HERRINGBONE
Hamilton Gear & Machine Co., Toronto, Ont.

GEARS, RAWHIDE (See Gears, Cut)
Hamilton Gear & Machine Co., Toronto.

GEAR, SILENT CHAIN
Gardner & Son, Robt., Montreal, Que.
Can. Link-Belt Co., Ltd., Toronto, Can
Hans Renold of Canada, Ltd., Montreal, Quebec.

GEARS, WORM
Hamilton Gear & Machine Co., Toronto

GENERATORS, ACETYLENE
L'Air Liquide Society, Toronto, Ont.

GLOVES, PROTECTIVE
Industrial Glove Co., Toronto, Ont

GOGGLES, SAFETY
Carter Welding Co., Ltd., Totonto
Dominion Oxygen Co., Ltd., Toronto
Liquide Air Company, Toronto.

GRAB BUCKETS
Can Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Cleveland Twist Drill Co., Cleveland, O.

GREASE CUPS, PRESSED STEEL AND BRASS
Can. Winkley Co., Ltd., Windsor, Ont.

GREASES, LUBRICATING
Canadian SKF Co., Toronto, Ont.

GRINDING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Norton Co., of Canada, Ltd., Hamilton

GRINDING MACHINES, ABRASIVE BELT
Norton Co of Can. Ltd. Hamilton, Ont.

GRINDING MACHINES, AUTOMATIC
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, BENCH
Blount Co., J. G., Everett, Mass.
Geometric Tool Co., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
McDougall Co., Ltd., R., Galt, Ont
Norton Co of Canada, Ltd., Hamilton, Ont.
Petrie Ltd., H W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont

GRINDING MACHINES, CENTER
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES, CUTTER AND REAMER
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Petrie Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, CYLINDRICAL
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.
Norton Co., of Canada, Ltd, Hamilton.

GRINDING MACHINES, DIE
National Acme Co., Cleveland, O.
National Machinery Co, Tiffin, Ohio.

GRINDING MACHINES, DRILL
Bellevue Industrial Furnace Co., Detroit, Mich.
Bertram & Son Co, Ltd. The John, Dundas, Ont.

GRINDING MACHINES, ELECTRIC
Strand & Co, N. A., Chicago, Ill.

GRINDING MACHINES, FLOOR AND TOOL
Blount Co, J. G., Everett, Mass.
National Acme Co., Cleveland, Ohio.
Norton Co of Canada, Ltd., Hamilton, Ontario.
Petrie, Ltd, H W. Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont

GRINDING MACHINES, INTERNAL
Garlock Machinery Ltd, Toronto, Ont.
Greenfield Tap & Die Corp, Galt, Ont.
Cleveland Pneumatic Tool Co, Toronto Ont.
Wisconsin Electric Co, Racine, Wis.

GRINDING MACHINES PORTABLE
Strand & Co, N. A., Chicago, Ill.

GRINDING MACHINES, SNAGGING
Blount Co, J G., Everett, Mass.
Norton Co, of Can. Ltd, Hamilton, Ont.

GRINDING MACHINES, SURFACE
Brown & Sharpe Mfg Co, Providence, Rhode Island
Petrie, Ltd, H W., Toronto, Ont.
Pratt & Whitney Co, of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, THREAD
Pratt & Whitney Co., of Canada, Ltd.,

GRINDING MACHINERY, TOOL POST
Gisholt Machine Co, Madison, Wis
Grenfield Tap & Die Corp, Galt, Ont
Wisconsin Electric Co, Racine, Wis

GRINDING MACHINES, UNIVERSAL
Brown & Sharpe Mfg Co, Providence, Rhode Island.
Gisholt Machine Co, Madison, Wis
Greenfield Tap & Die Corp, Galt, Ont
Landis Tool Co, Waynesboro, Pa
Morse Twist Drill & Machine Co, New Bedford, Mass
Norton Co, of Canada, Ltd, Hamilton, Ontario.
Petrie, Ltd., H W, Toronto, Ont

GRINDING WHEELS
J R Baxter & Co, Ltd, Montreal, Que.
Atkins & Co, Inc, E C, Indianapolis, Indiana.
Can Fairbanks-Morse Co, Ltd., Montreal.
Norton Co. of Can., Ltd., Hamilton, Ont.

GUN-BARREL MACHINERY
Stemle Turret Machine Co, Madison, Wisconsin

HACK SAWS, POWER
Atkins & Co, Inc, E C, Indianapolis, Indiana.
Petrie, Ltd, H W., Toronto, Ont.
Simonds Canada Saw Co, Montreal, Que.
Starrett Co, L S., Athol, Mass.

HAMMERS, CHIPPING
Cleveland Pneumatic Tool Co, Toronto, Ont.
High Speed Hammer Co, Rochester.

HAMMERS, DROP
Bertram & Son Co, Ltd, The John Dundas, Ont
Bliss Co, E W, Brooklyn, N Y
Brown Boggs & Co, Ltd, Hamilton, Ont
Canada Foundries & Forgings Co, Welland, Ont

HAMMERS, ELECTRIC
Brown, Boggs & Co, Ltd, Hamilton, Ont

HAMMERS, PNEUMATIC
Can. Steel Foundries, Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto Ont.

HANGERS, SHAFTING
Canadian SKF Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Hamilton Gear & Machine Co., Toronto,

HOBBING MACHINES
Shore Instrument Co., Jamaica, N.Y.

HARDENING, CASE-HARDENING AND TEMPERING
Barnes Company, Wallace, Hamilton.
Chapman Double Ball Bearing Co., Toronto.
Petrie, Ltd., H. W., Toronto, Ont.
Gisholt Machine Co, Madison, Wis.
Cleveland Pneumatic Tool Co, Toronto Ont.

HAMMERS, POWER
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd, Hamilton, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

HOBS
Brown & Sharpe Mfg. Co., Providence, R I
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

HOISTS, ELECTRIC
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont

HOISTS, ELECTRIC
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

HOISTS, HAND
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

HOISTS, PNEUMATIC
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

HOLDERS-ON, PNEUMATIC
Cleveland Pneumatic Tool Co, Toronto Ont.

HYDRAULIC MACHINERY
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Dominion Engineering Works, Limited, Montreal, Que

IGNITERS, GAS ENGINE
Canada Foundries & Forgings Co, Welland, Ont.
Burke Machine Tool Co, Conneaut, O

INDICATORS, SPEED AND TEST
Brown & Sharpe Mfg Co, Providence, R I.

INSULATION
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.

IRON BARS
Steel Co of Canada, Ltd, Hamilton, Ont.

JACKS, HYDRAULIC
Norton, A O, Boston, Mass

JACKS, PLANER
Armstrong Bros Tool Co, Chicago, Ill.
Starrett Co, L S, Athol, Mass.

JAPANNING AND VARNISHING OVENS
Brantford Oven & Rack Co, Brantford, Ont

JIGS AND FIXTURES (SEE TOOL WORK)
Fisher Motor Co, Ltd Orillia, Ont
Gisholt Machine Co Madison, Wis
Preston & Schwartz Galt Ont

KEYSEATING MACHINES
Morton Mfg Co Muskegon Mich

BUYERS' DIRECTORY

Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

KEYS, MACHINE
Can. Drawn Steel Co., Hamilton, Ont.
Morton Mfg. Co., Muskegon, Mich.

KNIVES, MACHINE
Atkins & Co., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

KNURL HOLDERS
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

LATHE ATTACHMENTS
Hendey Machine Co., Torrington, Conn.
Petrie, Ltd., H. W., Toronto, Ont.

LATHE TOOLS
Armstrong Bros. Tool Co. ,Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

LATHES, AUTOMATIC AND SEMI-AUTOMATIC
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, BENCH
Hardinge Bros., Inc., Chicago, Ill.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

LATHES, BORING
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, CHUCKING (SEE LATHES, HORIZONTAL TURRET, AND LATHES, VERTICAL TURRET)
Acme Machine Tool Co., Cincinnati, O.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, ENGINE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd. H. W., Toronto, Ont
Rockford Lathe & Drill Co., Rockford, Illinois.

LATHES, EXTENSION AND GAP
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison Wis.
McDougall Co., Ltd., R. Galt, Ont.
National Acme Co., Cleveland, O.
Petrie, Ltd., H. W., Toronto, Ont.
Steinle Turret Machine Co., Madison, Wis.

LATHES, PRECISION
Hardinge Bros., Chicago.

LATHES, RELIEVING
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.

LATHE, UNIVERSAL HAND
Brown & Sharpe Mfg. Co., Providence, Rhode Island.

LATHE, SPEED AND HAND
Blount Co., J. G., Everett, Mass.

LATHES, SPINNING
Pryibil Machine Co., Torrington, Conn.

LATHES, VERTICAL TURRET
Bertram & Son, Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

LATHES, WOOD TURNING
Blount, Co., J. G., Everett, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.

LEAD PIPE
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

LIGHTING AND GENERATING SETS
Beardmore & Co., Ltd., Wm., Montreal, Que.

LINOLEUM MILL MACHINERY
Bertrams, Ltd., Edinburgh, Scotland.

LIQUID AIR PLANTS
L'Air Liquide Society, Toronto, Ont.

LOCKERS, CLOTHES
Dennis Wire and Iron Works, London, Ont.

LUBRICANTS
Oakley Chemical Co., New York, N.Y.

LUBRICATING SYSTEMS
Bowser, S. F., & Co., Ltd., Toronto, Canada.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Ltd., Welland, Ont.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R. Toronto Ont.

MANGANESE STEEL
Can. Steel Foundries, Montreal, Que.

MANDRELS, EXPANDING
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MANDRELS, SOLID
Greenfield Tap & Die Corp., Galt, Ont.
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Pratt & Whitney Co., of Canada. Ltd., Dundas, Ont.

MEASURING MACHINES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MECHANICS' FINE TOOLS
Lufkin Rule Co., Windsor, Ont.

METALS, ALLOY
Canada Metal Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.

METAL WORKERS
Parker Co., Charles, Meriden, Conn.

MICROMETER CALIPERS
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Rice Lewis & Son, Ltd., Toronto, Ont.

MILLING ATTACHMENTS
Burke Machine Tool Co., Conneaut, O.
Hendey Machine Co., Torrington, Conn.
Hinckley Machine Works, Hinckley, Ill.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

MILLING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Burke Machine Tool Co., Conneaut, O

MILLING MACHINES, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence, R. I.
Hardinge Bros., Inc., Chicago, Ill.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

MILLING MACHINES, BENCH
Burke Machine Tool Co., Conneaut. O.
Hardinge Bros., Inc., Chicago, Ill.

MILLING MACHINES, HAND
Brown & Sharpe Mfg. Co., Providence
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MILLING MACHINES, HORIZONTAL PLANER TYPE.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Kearney & Trecker Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto.

MILLING MACHINES, PLAIN
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, O.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

MILLING MACHINES, THREAD
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MILLING MACHINES, UNIVERSAL
Brown & Sharpe Mfg. Co., Providence,
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

MILLING MACHINES, VERTICAL
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, O.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto.

MOTORS, ELECTRIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Roelofson Elevator Co., Galt, Ont.
Williams Machinery Co., A. R., Toronto,
Wisconsin Electric Co., Racine Wis.

NAILS AND STAPLES
Canada Metal Co., Ltd., Toronto, Ont.

NIPPLES
Canada Metal Co., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton.

NITROGEN
Carter Welding Co. Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

NUT TAPPERS
(See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
National Acme Co., Cleveland, Ohio.

NUTS, FINISHED and SEMI-FINISHED
Galt Macine Screw Co., Galt, Ont.
National Acme Co., Montreal, ue.

NUTS (Up to 4-in.)
Steel Co. of Canada, Ltd., Hamilton.

NUTS, S.A.E., PLAIN AND CASTELLATED
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

OIL FILTERING AND STORAGE SYSTEMS
Bowser, S. F., & Co., Ltd., Toronto,

OIL STORAGE ENGINEERS
Bowser, S. F., & Co., Ltd., Toronto,

OIL HOLE COVERS
Can. Whitney Co., Ltd., Windsor, Ont.

OILS, SOLUABLE
Brantford Oven & Rack Co., Brantford, Ontario.

OXYGEN
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

OXY-ACETYLENE APPARATUS
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Atlas Press Co., Kalamazoo, Mich.

PAPER MILL CONVEYORS
Bertram Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd., Montreal, Que.

PATTERNS, WOOD AND METAL
Fittings, Limited, Oshawa, Ont.
Victoria Foundry Co., Ltd., Ottawa.

PHOSPHOR TIN
Canada Metal Co., Ltd., Toronto, Ont.

PHOTOGRAPHIC DUPLICATING MACHINES
Photostat Corp., Providence, R. I.

PIPE BENDING MACHINES
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Underwood Corp., H. R., Philadelphia, Pa.
Williams Machinery Co., A. R., Toronto.

PIPE CUTTING AND THREADING MACHINES
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

PIPE
Canada Metal Co., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.

PIPE FITTINGS
Canada Metal Co., Toronto, Ont.
Fittings, Limited. Oshawa, Ont.
International Malleable Iron Co., Guelph Ont.

PIPE AND NIPPLE THREADING MACHINES
Landis Machine Co., Inc., Waynesboro, Pa.

PIPE FITTERS' TOOLS
Rice Lewis & Son, Ltd., Toronto, Ont.

PIPE THREADING DIE HEADS
Landis Machine Co., Inc., Waynesboro, Pa.

PISTON-RING MACHINES
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

PLANING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Williams Machinery Co., A. R., Toronto

PLANING MACHINES, ROTARY
Bertram & Son Co., Ltd., The John, Dundas, Ont.

PLATE ROLLS
Bertram & Son Co., Ltd., The John, Dundas, Ont.

PNEUMATIC TOOLS
Cleveland Pneumatic Tool Co., Toronto.

POLISHING AND BUFFING MACHINES
J. R. Baxter & Co., Ltd., Montreal, Q.
Blount Co., J. G. Everett, Mass.
Brown & Sharpe Mfg. Co., Providence.
Pryibil Machine Co., New York, N.Y.

PRESSED STEEL PARTS
American Pulley Co., Philadelphia, Pa.
Fisher Motor Co., Ltd., Orillia, Ont.

PRESSES, ARBOR
Atlas Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

PRESSES, DROP AND FORGING
Brown, Boggs & Co., Ltd., Hamilton.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

PRESSES, FOOT AND HAND
Brown, Boggs & Co., Ltd., Hamilton.

PRESSES, HYDRAULIC
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Perrin Ltd., W. R., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

PRESSES, POWER
Bliss Co., E. W., Prooklyn, N. Y.
Brown, Boggs, & Co., Ltd., Hamilton.
Hepburn Ltd., John T., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Stoll Co., Inc., D. H., Buffalo, N.Y.

PRESSES, SCREW
Brown, Boggs & Co., Ltd., Hamilton
Petrie, Ltd., H. W., Toronto, Ont.

PROFILING MACHINES
Prtt & Whitney Co., of Canada, Ltd., Dundas, Ont.

PROTRACTORS
Brown & Sharpe Mfg. Co., Providence
Lufkin Rule Co., Windsor, Ont.

PROPELLERS
Kennedy & Sons, Wm., Owen Sound Ontario.

PULLEYS, CORK INSERT
American Pulley Co., Philadelphia, Pa

PULLEYS, METAL AND FIBRE
American Pulley Co., Philadelphia, Pa.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.

PULP AND PAPER MILL EQUIPMENT
Dominion Engineering Works, Ltd., Montreal, Que.

PUMPS, HYDRAULIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Dominion Engineering Works, Ltd Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.

BUYERS' DIRECTORY

PUMPS, LUBRICANT AND OIL
Bowser, S. F., & Co., Ltd., Toronto.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Hepburn Ltd., John T., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.

PUMPS, POWER
Bowser, S. F., & Co., Ltd., Toronto.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hepburn Ltd., John T., Toronto, Ont.

PUNCHES, CENTER
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

PUNCHES, HAND
Brown Boggs & Co., Ltd., Hamilton.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Jardine & Co., A. B., Hespeler, Ont.

PUNCHES, POWER
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

PUNCHING MACHINES, HORIZONTAL
Bertrams Ltd., Edinburgh, Scotland.

PYROMETERS, ELECTRIC
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Hiram Walker & Sons Metal Products Co., Walkerville, Ont.

RACKS, CUT
Hamilton Gear & Machine Co., Toronto.

RACKS, STORAGE
(See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ontario.

REAMER HOLDERS
Simonds Canada Saw Co., Montreal, Q.

REAMERS, EXPANDING
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

REAMERS, SOLID
Butterfield & Co., Inc., Rock Island, Q.
Morse Twist Drill & Machine Co., New Bedford, Mass.

REAMERS, TAPER
Brown & Sharpe Mfg. Co., Providence, R. I.
Butterfield & Co., Inc., Rock Island, Q.
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canad, Ltd., Dundas, Ont.

RECORDERS, TEMPERATURE
Taylor Instrument Co., Rochester, N. Y.

RECORDERS, TIME
Gisholt Machine Co., Rochester, N. Y.
Taylor Instrument Co., Toronto, Ont.

REGULATORS, TEMPERATURE
Taylor Instrument Co., Toronto, Ont.

RIVETS AND BURRS
Parmenter & Bulloch Co., Gananoque, Ont.
Steel Co., of Canada, Ltd., Hamilton.

RIVETS, CHAIN
Pittings, Limited, Oshawa, Ont.

RIVET-MAKING MACHINERY
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

RIVETING MACHINES
Can. Fairbanks-Morse Ltd., Montreal, Q.
High Speed Hammer Co., Rochester, N.Y.
Parmenter & Bulloch Co., Gananoque Ont.
Petrie, Ltd., H. W., Toronto, Ont.

RUDDER FRAMES, STEEL
Can. Steel Foundries, Montreal, Que.

RUBBER MILL MACHINERY
Bertram Ltd., Edinburgh, Scotland.

RULES, STEEL AND WOOD
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Windsor, Ont.

RUST PREVENTATIVES
Oakley Chemical Co., New York, N. Y.

SAND EQUIPMENT
Can. Link-Belt Co., Toronto, Ont.

SAND RAMMERS, PNEUMATIC
Cleveland Pneumatic Tool Co., Toronto.

SAW FRAMES AND BLADES, HACK
Atkins & Co., Inc., E. C., Indianapolis.
Diamond Saw & Stamping Works, Buffalo, N. Y.
Rice Lewis & Sons, Ltd., Tornto, Ont.
Simonds Canada Saw Co., Montreal, Q

SAWING MACHINES, POWER HACK
Atkins & Co., Inc., E. C., Indianapolis.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

SAW SHARPENING MACHINES
Atkins & Co., Inc., E. C., Indianapolis.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

SAW SHARPENING MACHINES
Atkins & Co., Inc., E. C., Indianapolis

SAW TABLES, UNIVERSAL
Petrie, Ltd., H. W., Toronto, Ont.

SAWS, CIRCULAR METAL
Atkins & Co., Inc., E. C., Indianapolis.
Pryibil Machine Co., New York, N. Y.
Gisholt Machine Co., Madison, Wis.

SAWS, HAND
Atkins & Co., Inc., E. C., Indianapolis
Simonds Canada Saw Co., Montreal, Q.

SAWS, HOT AND COLD
Atkins & Co., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Q.

SAWS, HIGH SPEED STEEL
Atkins & Co., Inc., E.C., Indianapolis, I.
Butterfield & Co. Inc., Rock Island, Q
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWS, METAL BAND
Atkins & Co., E. C., Indianapolis, I.

SAWS, METAL CUTTING
Brown & Sharpe Mfg. Co., Providence.
Butterfield & Co., Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.
Starrett Co., L. S., Athol, Mass.

SAWS, SCREW SLOTTING
Atkins & Co., Inc., E., C., Indianapolis.
Butterfield & Co., Inc., Rock Island, Q.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canda, Ltd., Dundas, Ont.

SAWS, SCREW SLOTTING
Atkins & Co., Inc., E. C., Indianapolis.
Butterfield & Co., Inc.. Rock Island, Q
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q

SAWS, WOOD
E. C. Atkins & Co., Indianapolis, Ind

SCALES
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Lufkin Rule Co., Windsor, Ont.

SCREENS
Dominion Engineering Works, Ltd., Montreal, Que.

SCREW DRIVERS, OPTICAL, JEWELRY AND NOVELTY
Strand & Co., N. A., Chicago, Ill.

SCREW MACHINE WORK
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Montreal, Que.

SCREW MACHINERY, WOOD AND LAG
Cook Co., Asa S., Hartford, Conn.

SCREW MACHINES
Brown & Sharpe Mfg. Co., Providence, Rhode Island.

SCREW MACHINES, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.

SCREW MACHINE PRODUCTS
National Acme Co., Montreal, Que.

SCREW PLATES
Butterfield & Co., Inc., Rock Island. Que.
Jardine & Co., A. B., Hespeler, Ont.

SCREWS, CAP AND SET
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

SCREWS, SAFETY, SET
Galt Machine Screw Co., Galt, Ont.

SECOND-HAND MACHINERY
See last page of directory.
Petrie, Ltd., H. W., Toronto, Ont.

SEPARATORS, MOISTURE AND OIL
Bowser, S. F., & Co., Ltd., Toronto, Canada.

SEPARATORS, OIL AND WASTE
Bowser, S. F., & Co., Ltd., Toronto.

SHAFTS, FLEXIBLE
Strand & Co., N. A., Chicago, Ill.

SHAFTING
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Can Drawn Steel Co., Hamilton, Ont.
Williams Machinery Co., A. R., Toronto.

SHAPES, COLD-DRAWN SPECIAL STEEL
Union Drawn Steel Co., Hamilton, Ont.

SHAPING MACHINES
Hendey Machine Co., Torrington, Conn.
Morton Mfg. Co., Muskegon, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Williams Machinery Co., A. R. Toronto.

SHEARS HAND
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

SHEARS, POWER
Bliss Co., E. W., Brooklyn, N. Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Stoll Co., Inc., D. H., Buffalo, N. Y.
Williams Machinery Co., A. R., Toronto, Ont.

SHEARING MACHINES, ANGLE, IRON BAR AND GATE
Bertrams Ltd., Edinburgh, Scotland.

SHEET LEAD
Canada Metal Co., Ltd., Toronto, Ont.

SHEET METAL WORKING MACHINERY
Bliss Co., E. W., Brooklyn, N. Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Stoll Co., Inc., D. H., Buffalo, N.Y.

SHEETS, NICKEL, MONEL AND FIBRE
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.

SHEETS, O.P.C.R. & B. A. AND BLUE ANNEALED
Steel Co., of Canada, Ltd., Hamilton, Ont.

SIDE FRAMES, LOCOMOTIVE
Can Steel Foundries, Montreal, Que.

SLOTTING ATTACHMENTS
Brown & Sharpe Mfg. Co., Providence, R.I.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

SLOTTING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.

SOLDERS
Canada Metal Co., Ltd., Toronto, Ont.

SPECIAL MACHINERY AND TOOLS
Brown Engineering Corp., Ltd., Toronto.
Gisholt Machine Co., Madison, Wis
National Acme Co., Cleveland, O.

SPIKES, RAILWAY AND PRESSED
Steel Co. of Canada, Ltd., Hamilton, Ont.

SPINNING LATHES
Prybil Machine Co., P., New York City.

SPRING, MILLED
Barnes & Co., Wallace, Hamilton, Ont

SPRINGS, SMALL SPIRAL HELICAL, COMPRESSION, EXTENSION, TORSION AND SPECIAL
Barnes Company, Wallace, Hamilton.

SPRINGS
Barnes Company, Wallace, Hamilton.
Cleveland Wire Spring Co., Clevleand, O.
Steele Ltd., James, Guelph, Ont.

SPRINGS, FLAT STEEL, BRUSH HOLDER, CLOCK, SMALL FLAT SPRINGS
Barnes Company, Wallace, Hamilton.

SPROCKETS AND CHAINS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Renold Hanson of Canada, Ltd., Montreal, Que.

SQUARES
Brown & Sharpe Mfg. Co., Providence, R.I.
Lufkin Rule Co., Windsor, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

STAMPING, METAL
American Pulley Co., Philadelphia, Pa.
Barnes Company, Wallace, Hamilton.
Diamond Saw & Stamping Works, Buffalo, N. Y.
Parmenter & Bulloch Co., Gananoque, Ont.

STAMPS, STEEL
Diamond Saw & Stamping Works, Buffalo, N. Y.

STEEL CONCRETE REINFORCEMENT
Steel Co. of Canada, Ltd., Hamilton.

STEEL PLATE
British Empire Steel Co., Montreal, Que.

STEEL AND IRON BARS
Steel Co. of Canada, Ltd., Hamilton.

STEELS TOOL
British Empire Steel Co. Montreal Q.

STEEL, COLD-ROLLED STRIP
British Empire Steel Co., Montreal, Q.
Barnes Company, Wallace, Hamilton.

STEEL, CRUCIBLE, SPRING
Barnes, Company, Wallace, Hamilton.
British Empire Steel Co., Montreal, Q.

SHEETS, OPEN HEARTH STEEL
Steel Co., of Canada, Ltd., Hamilton.

STEEL, SHAFTING AND FREE CUTTING SCREW
Union Drawn Steel Co., Hamilton, Ont

STEEL, SHEET
British Empire Steel Co., Montreal, Q.
Rice Lewis & Son, Ltd., Toronto, Ont.

STEEL, STAINLESS
Steel Co., of Can. Ltd., Hamilton, Ont.

STEELS, ALLOY AND CARBON
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Can Steel Foundries, Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton, Ont.

STEELS, HIGH-SPEED
Armstrong Bros Tool Co., Chicago, Ill
Atkins & Co., Ltd., Wm., Sheffield, England.
British Empire Steel Co., Montreal, Q.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton

STEEL TUBING, CLOSE JOINT AND WELDED
Standard Tube & Fence Co., Ltd., Woodstock, Ont.

STERN FRAMES, CAST STEEL
Can Steel Foundries, Montreal, Que.

STRAIGHTENING MACHINERY
Bertram Ltd., Edinburgh, Scotland
Williams & Co., J. H., Brooklyn, N.Y.

STUDS
Galt Machine Screw Co., Galt, Ont.

BUYERS' DIRECTORY

STUD SETTERS, SELF-OPENING
Geometric Tool Co., New Haven, Conn.

SWAGING MACHINES
Atkins & Co., Inc., E. C., Indianapolis, Indiana.

SWITCHES, RAILWAY
Can. Steel Foundries, Montreal, Que.

TACHOMETERS
Bristol Co., Waterbury, Conn.

TANKS AND PUMPS, OIL
Bowser, S. F., & Co., Ltd., Toronto.

TAP HOLDERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
William L. Procunier, Chicago, Ill.

TAPER PINS
Galt Machine Screw Co., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

TAPES, MEASURING
Starrett Co., L. S., Athol, Mass.
Lufkin, Rule Co., Windsor, Ont.

TAPPING MACHINES AND ATTACHMENTS
Burke Machine Tool Co., Conneaut, O.
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Wm. L. Procunier, Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

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Butterfield & Co., Inc., Rock Island, Q.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

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National Acme Co., Cleveland, Ohio.

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Greenfield Tap and Die Corp., Galt, Ont.
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Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

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Williams Machinery Co., A.R., Toronto,

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Jones & Glassco, Montreal, Que.
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Renold, (Hans) of Canada, Ltd., Montreal, Que.

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Dominion Engineering Works, Limited, Montreal, Que.
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Bertram & Son Co., Ltd., The John Dundas, Ont.

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(See Lathes, Horizontal Turret)
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Steinle Turret Machine Co., Madison, Wisconsin

TURRETS, TOOL POST
Gisholt Machine Co. Madison, Wis.

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Kempsmith Mfg Co., Milwaukee, Wis.

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Canada Foundries & Forgings Co., Welland, Ont.

List of Directory of Dealers will be Found above Advertising Index

When answering advertisements kindly mention Canadian Machinery

DIRECTORY OF DEALERS

THE Buyers' Directory of CANADIAN MACHINERY was originally intended to contain information regarding lines actually manufactured by our advertisers. We now carry the advertising of leading machinery dealers, some of whom represent scores of manufacturers in addition to being manufacturers themselves in some cases. We recommend, therefore, if our subscribers cannot find what they want in our Directory that they communicate with the dealers whose names appear herewith.

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Bertram & Sons, Ltd., John, Dundas, Ont.

The Canadian Fairbanks-Morse Co., Montreal, Que.

Garlock Machinery Ltd., Toronto.

H. W. Petrie, Ltd., Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

Yeates Machinery Co., London, Ont.

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A. R. Williams Machinery Co., Toronto, Ont.

Yeates Machinery Co., London, Ont.

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Garlock Machinery Ltd., Toronto.

H. W. Petrie Ltd., Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

Yeates Machinery Co., London, Ont.

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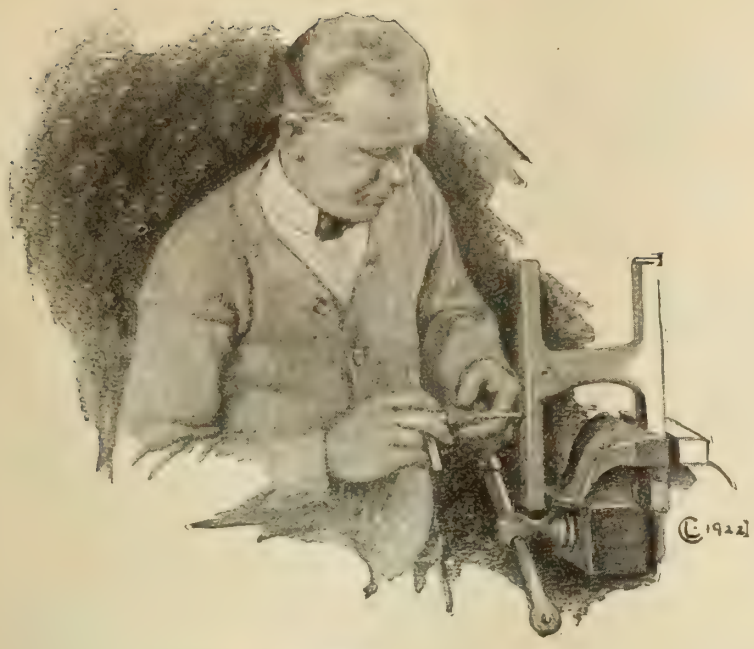
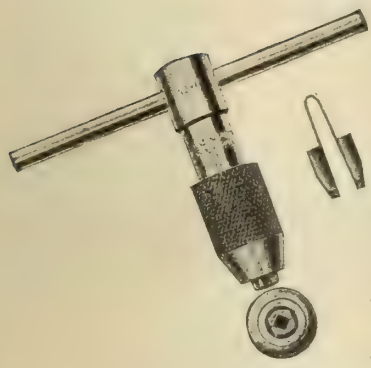


Another New Starrett Tool — T-Handle Tap Wrench No. 93



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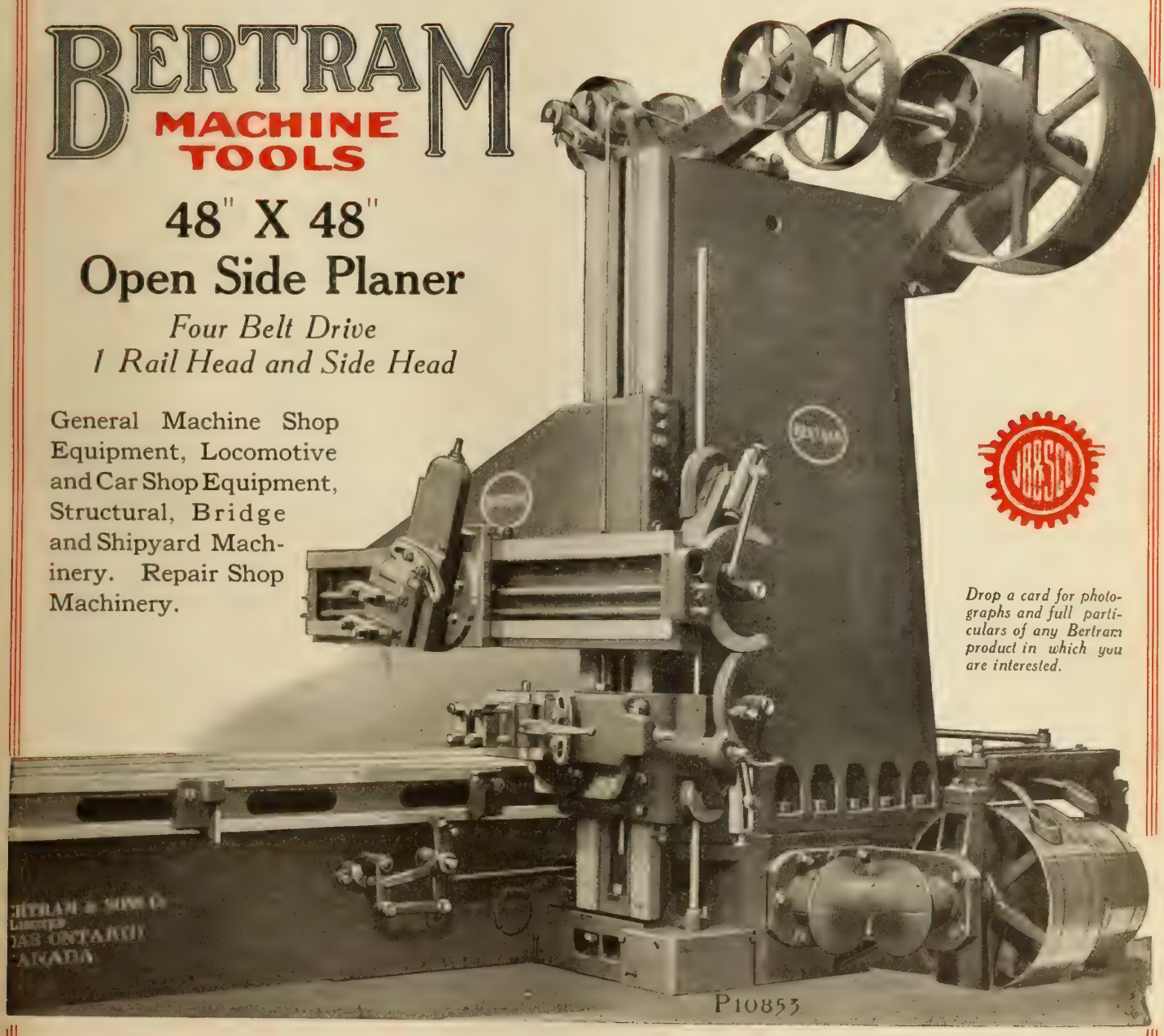

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The BERTRAM Page

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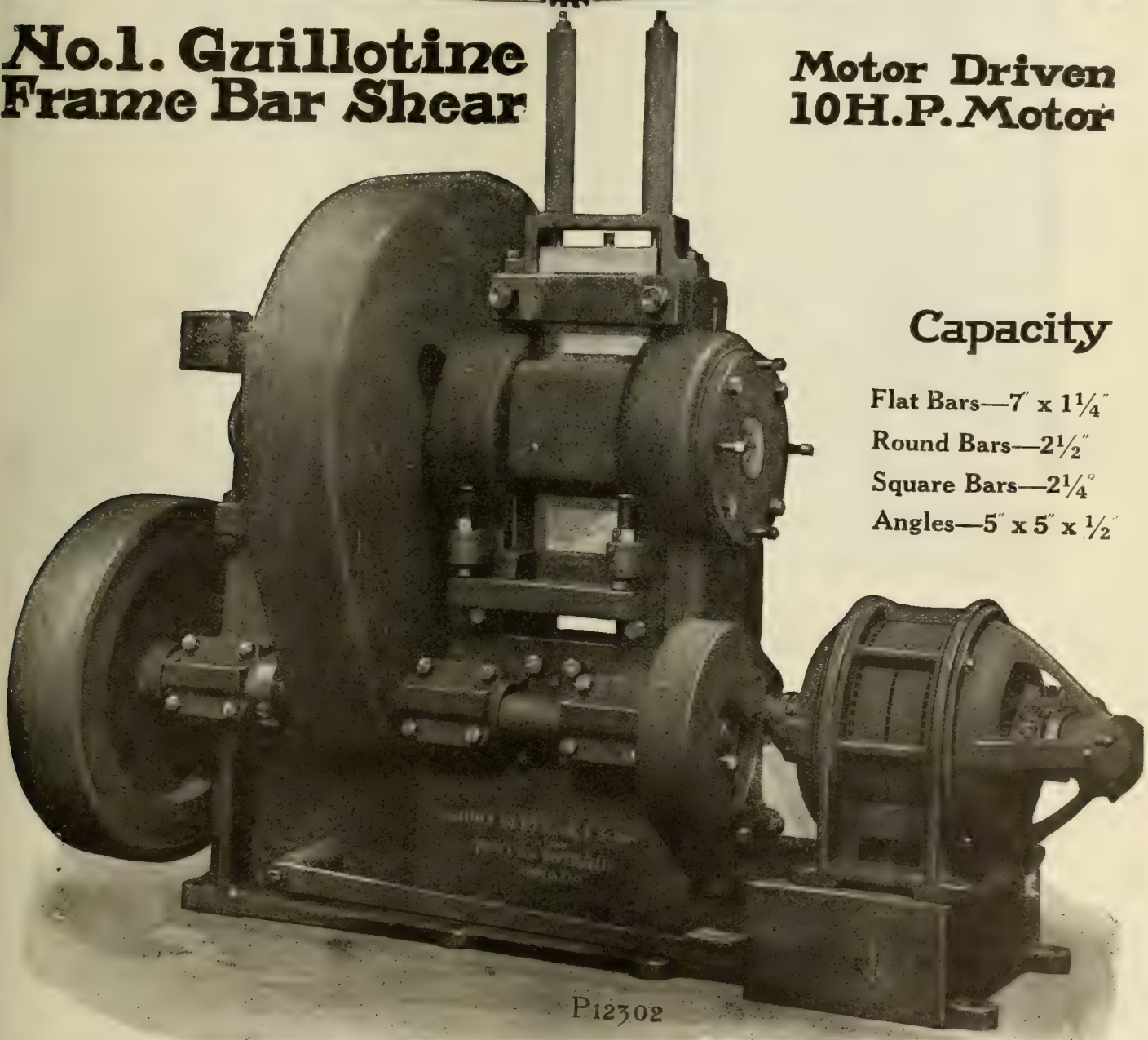

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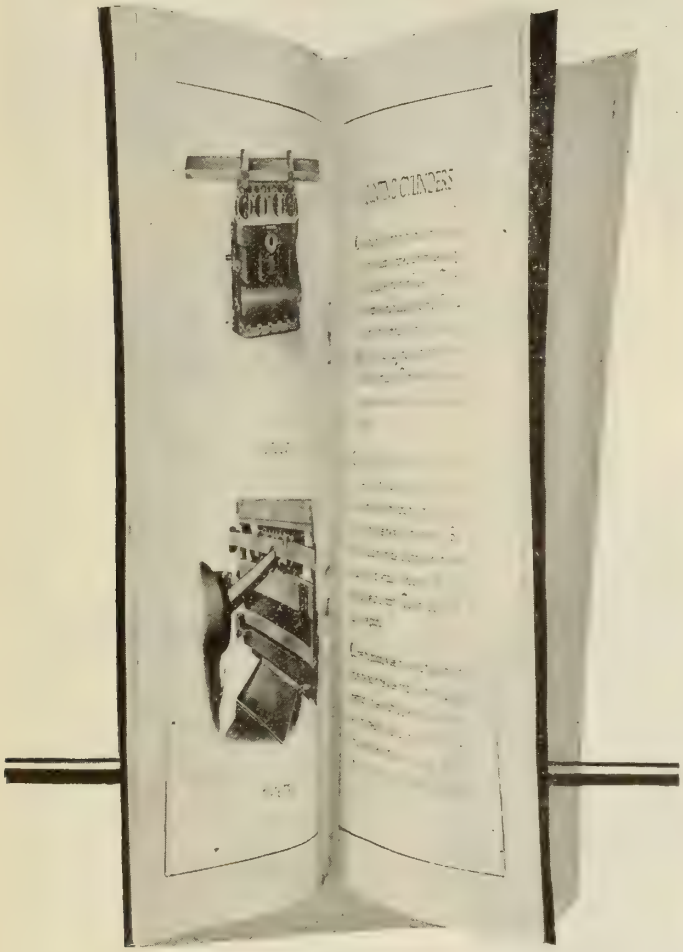

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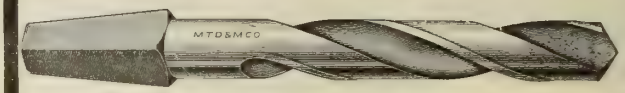

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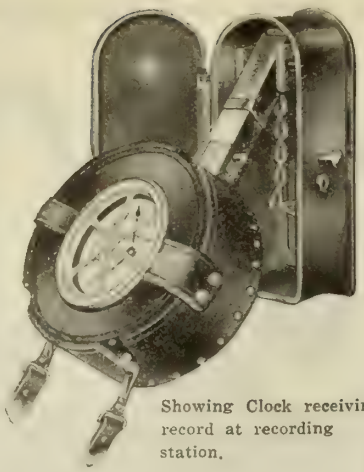

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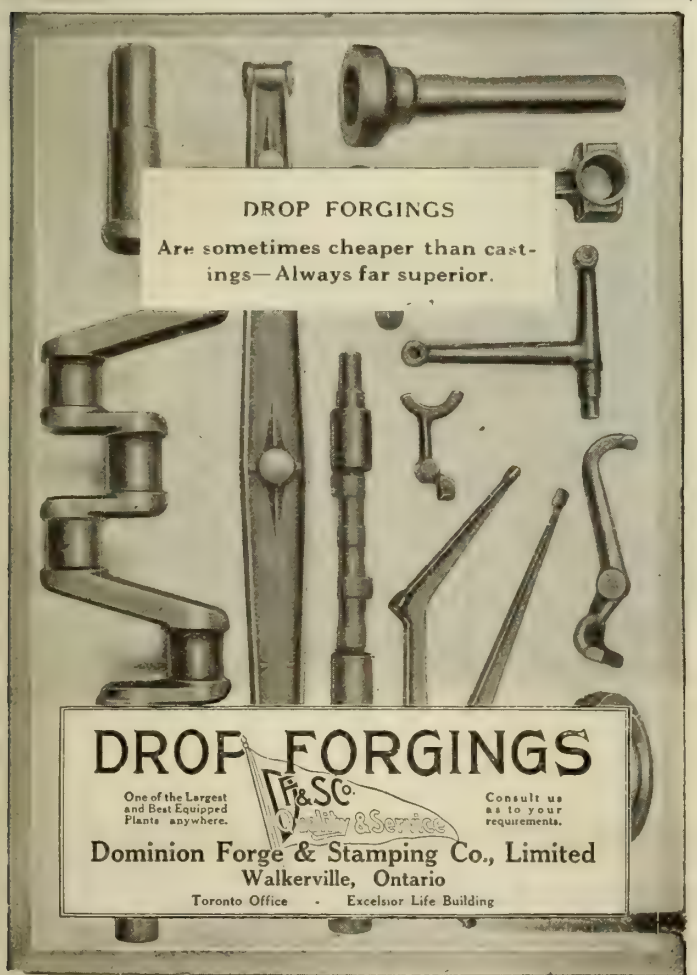
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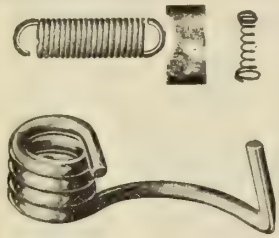

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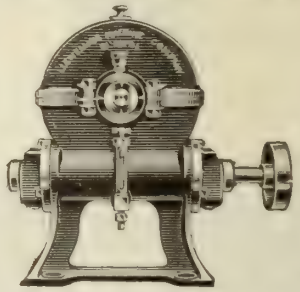


Totally enclosed Worm Reduction Gear.

D.H. Stag Tooth Wheel & Pinion

Specialists in High Speed-Reducing and Accelerating Gears.

Llewellin Machine Co., Bristol, Eng.

TELEGRAPHIC AND CABLE ADDRESS: Llewellins, Bristol, Eng.

THE MORSE CHAIN CO.

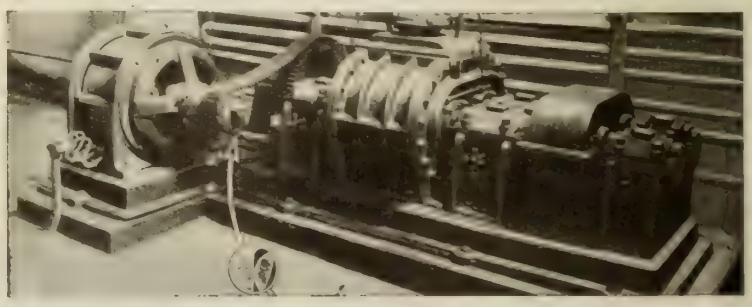
are the
Largest Manufacturers in the world
of
High Speed Silent Chains

The superiority of Morse Rocker Joint Silent Chain has never been seriously questioned.

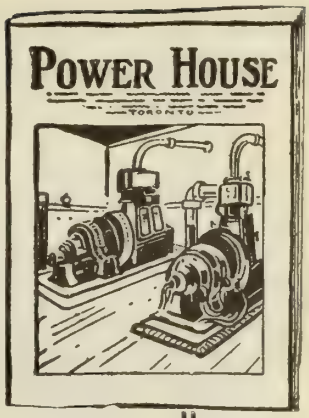
They speed up production, cut belt expense and overtime wages.

Catalogue Free.

Jones & Glassco (Reg'd)
Canadian Agents
Montreal - - Toronto



25 H.P. Morse Silent Chain to Positive Blower.



DO YOU Manufacture Industrial Equipment?

Are you a manufacturer of twist drills, hack saws, mechanics' tools, wire guards, bolts, rivets, paints—do you manufacture lines of any description that can be used in machine shops, metal-working plants, power plants or foundries? If you do the publications you see illustrated here (Canadian Machinery, Canadian Foundryman, and Power House) can build a bigger demand for your products.

This group of technical newspapers is read by the men who are prospective buyers of your lines. You can bring to the attention of these men the reason why they should demand your goods when purchasing from their dealers. You can effectively do this by placing a message in the paper which serves the field in which your products are sold.

CANADIAN MACHINERY AND MANUFACTURING NEWS is published weekly and covers the machinery, iron and steel and general metal-working industries of Canada.

POWER HOUSE is published semi-monthly; it serves steam, electrical, water and gas power plants, and the power houses of all general manufacturing plants.

CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS is published monthly; it serves the grey iron, steel and non-ferrous foundries.

Each one of these publications reach proprietors, managers, purchasing agents, foremen—the men who direct the purchasing of goods. A message to these men in any of the MacLean Technical Newspapers is certain to have a strong influence.

Write for complete Data.

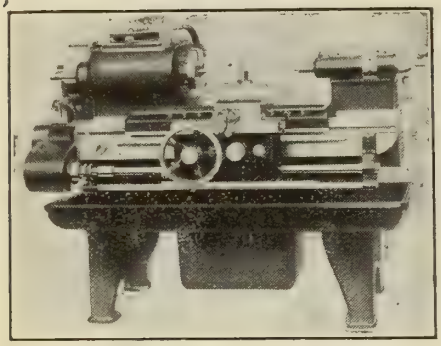
MACLEAN TECHNICAL NEWSPAPERS

153 University Avenue, TORONTO
Montreal, Winnipeg, Vancouver

THE JOHNSON FRICTION CLUTCH

AS USED ON THE

"NEW" 12 IN. SUNDSTRAND MANUFACTURING LATHE



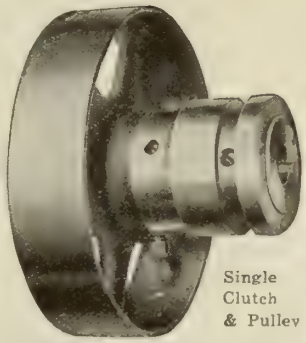
Progress in machine tool design demands a reliable and powerful friction clutch.

The Johnson Friction Clutch is proving of great value in machine tool designing.

Courtesy: The Rockford Tool Co., Rockford, Ill.

The main drive pulley is mounted on a No. 5 single clutch hub. The same movement that disengages the clutch automatically applies a brake which stops the spindle instantly. The sliding sleeve is machined to act as a brake.

A feature of the Johnson Friction Clutch is the ease of application to particular machine requirements.



Single Clutch & Pulley

WRITE FOR STOCK LIST AND YELLOW CATALOG.

THE CARLYLE JOHNSON MACHINE CO. MANCHESTER·CONN

STEEL CASTINGS

QUICK DELIVERIES

High Carbon Steel
Manganese Steel
Chrome Steel
Mild Steel

QUALITY GUARANTEED

Sizes—½lb. to 5,000 lbs.

THE WILLIAM KENNEDY & SONS
LIMITED
OWEN SOUND, ONTARIO
ESTABLISHED 1860

Raymond Springs

Right heat treatment.
Accurate to dimensions.
Yet no more expensive.
Modern testing facilities.
Only best materials.
No misfits.
Designs for every purpose.

CARBON OR VANADIUM STEEL
BRASS OR BRONZE

Raymond Mfg. Co., Limited
Corry, Pa., U.S.A.

GISHOLT

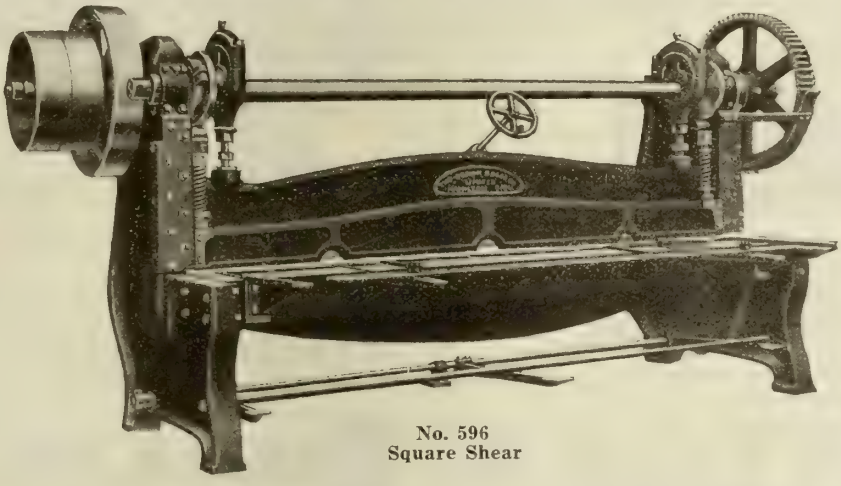
LABOR SAVING EQUIPMENT

TURRET LATHES
Hand Operated
For Chucking and Bar Work
AUTOMATIC TURRET LATHES
For Chucking Work
VERTICAL BORING and TURNING MILLS
UNIVERSAL TOOL GRINDERS
HORIZONTAL BORING and DRILLING MACHINES
CYLINDER GRINDERS
TOOL-POST TOOL HOLDERS
REAMERS, "SOLID ADJUSTABLE"
Shell and Chucking
BORING BARS
With Adjustable Cutters
PERIODOGRAPH
For Time Recording in Factories
Separate Catalogs on each Product
Send for the ones you want

GISHOLT MACHINE CO.
1207 E. Washington Avenue
Madison, Wisconsin, U. S. A.

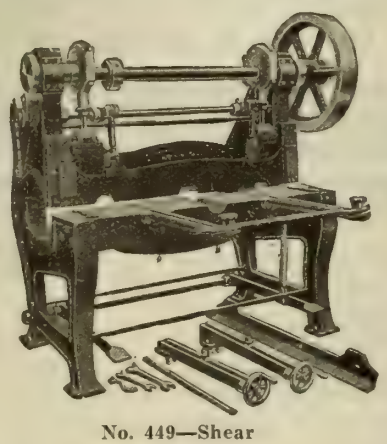
BROWN-BOGGS

B B



No. 596
Square Shear

Foot and Power Shears
that satisfy the workman's own ideals



No. 449—Shear

NATURALLY every workman has his own opinion of how a machine should operate and what it should accomplish.

"B-B" Foot and Power Square Shears always head the list for productive ability—for the simple reason that they line up closely with the workman's own ideals.

The material used throughout is the very best; wearing surfaces are large; gears are machined from solid stock. The knives are carefully tempered and are easily removed for grinding.

"B-B" Power Square Shears are made in "Overhead Driven" and "Underneath Driven" Types. Power Gap Shears in the same types. Foot Shears in many styles.

Catalogue No. 25 gives full details of the complete "B-B" Line of Metal Working Tools. Write for a copy.

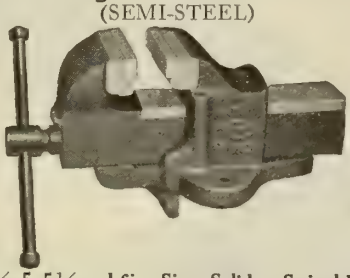
TORONTO OFFICE:
Holbrook Building

A. B. WALKER,
Representative

THE BROWN-BOGGS CO. LIMITED
HAMILTON, CANADA.

HINTS TO BUYERS

BEAVER VISES
A Thorough Canadian Product
(SEMI-STEEL)

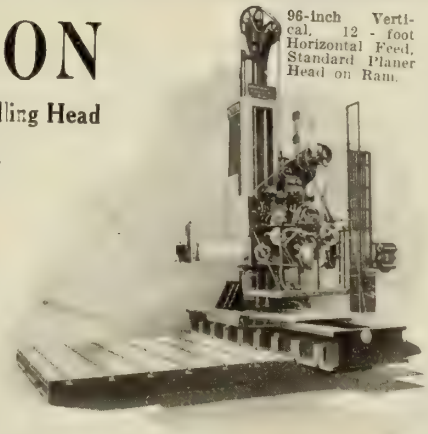


Super-Strength
Fine Workmanship
Good Appearance
The All-Purpose Vise

4, 4½, 5, 5½ and 6in. Sizes Solid or Swivel Bases
ATTRACTIVE PRICES; *Manufactured by*
Philip Gies Foundry, Kitchener, Ont.

ROCKFORD
HORIZONTAL BORING MACHINE
Unexcelled for Continuous Service
ROCKFORD DRILLING MACHINE CO.
ROCKFORD, ILLINOIS, U.S.A.

MORTON
72 inch Stroke Travelling Head
PLANER
Rigidly constructed to give years of accurate service. Equipped also for boring and milling. Morton means long service. Ask for catalogue No. 8-A.
Morton Mfg. Company
Muskegon Heights
Mich.

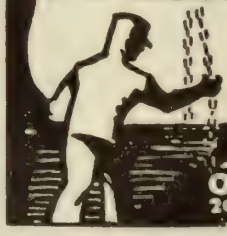

96-inch Vertical, 12-foot Horizontal Feed, Standard Planer Head on Ram.

A BALATA BELTING
Which We Guarantee Second To None And Entirely Satisfactory
Try One And Be Convinced
J.C.McLAREN BELTING CO.
Limited
MONTREAL TORONTO WINNIPEG
TRADE MARK
THE J.C. McLAREN BELTING Co LIMITED

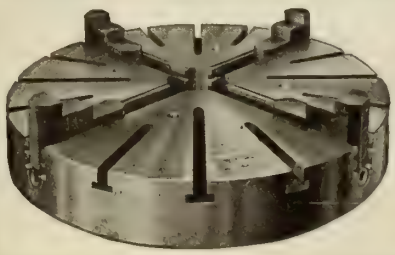
THOMPSON
UNIVERSAL GRINDING MACHINES
THE THOMPSON GRINDER CO.
SEND FOR BULLETIN NO. U.13. SPRINGFIELD, OHIO

MALLEABLES
OF QUALITY SINCE 1878.
SMITH'S FALLS MALLEABLE CASTINGS LTD
SMITH'S FALLS, ONTARIO.

OAKITE CLEANS
Put your Cleaning Problems up to us!



OAKLEY CHEMICAL CO.
20 THAMES STREET · NEW YORK



IRON BODY INDEPENDENT CHUCKS
They represent strength and economy with high-speed cutting tools. Accurate and dependable always.
Our All-Steel Independent Chucks have established records for accurate, long-wearing qualities. We also make Geared Scroll Chucks and the Geared Scroll Combination. Ask for particulars.
UNION MANUFACTURING COMPANY
New Britain, Conn. New York Office: 26 Cortlandt Street

WHEEL TRUEING TOOL CO.

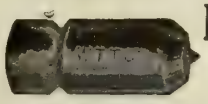
IMPORTERS OF

INDUSTRIAL DIAMONDS

Goods Submitted on Memorandum if Desired
JOHN W. GORDON, Manager

James Street, ST. CATHARINES, ONTARIO

WINDSOR



MANUFACTURERS OF

DIAMOND POINTED TOOLS

All Mountings Fully Guaranteed
Office and Factory:

88 West Pitt Street, WINDSOR, ONTARIO

Gear Cutting Machines

Hand Feed
Semi-Automatic, Fully Automatic
Also Lathe Chucks and Centering Machines

THE D. E. WHITON MACHINE CO.
NEW LONDON. CONN., U. S. A.

DUMORE HIGH SPEED GRINDERS

combine perfect balance with correct speed to insure a degree of accuracy never before obtained with portable grinders. Write for information concerning what they will do for you.

WISCONSIN ELECTRIC CO. 2940 Sixteenth St., Racine, Wis.

THE FELLOWS GEAR SHAPER

is used by the Largest Manufacturers in the Gear Industry. Catalog and Engineering Literature sent to those interested.

Address:

THE FELLOWS GEAR SHAPER CO.
SPRINGFIELD, VERMONT, U.S.A.

THE SKINNER CHUCK COMPANY
NEW BRITAIN, CONN U.S.A

Strand **Flexible Shafts and Equipments**

Flexible shaft equipments for grinding, polishing, drilling, reaming, scraping, scratch brushing, power screw driving and nut setting.

Write for circulars and prices.

N. A. STRAND & Co., 625 W. Jackson Blvd., Chicago, Ill.

PRESSES and SHEARS

Sheet Metal Working Machinery

THE D. H. STOLL CO., INC.
26 Lansing St., BUFFALO, N.Y.

MILWAUKEE MILLING MACHINES

ACCURATE RIGID DEPENDABLE

Manufactured in various types and sizes for all classes of milling.

KEARNEY & TRECKER CORPORATION
MILWAUKEE WIS., U.S.A.

NORTON JACKS

FOR ALL KINDS OF HEAVY LIFTING

Send for complete catalogue showing 50 styles 10 to 100 tons capacity.

Made only by A. O. NORTON, Limited
Coaticook, Prov. Quebec, Canada

VICTORIA Special Machinery

DESIGNS PATTERNS
CASTINGS FORGINGS

Send for Catalogue

Victoria Foundry Co., Limited, Ottawa, Canada

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Expert Drafting Office Service

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T. J. TUBIELEWICZ & E. G. ROUSSEAU
Machine Designers & Engineers
364 UNIVERTSIY ST. MONTREAL, P.Q.

Miller Bros. & Sons, Limited

Founders, Machinists, Millwrights and Engineers
120 Dalhousie St., Montreal

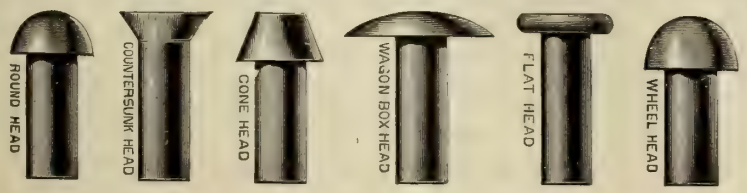
Contractors' Derricks and Equipment—Belt and Chain Elevators—Conveyors—Paint Machinery

Let Us Tell You About Our Machine

"TRY THE STEINLE"

Send Us Blueprints of Your Work

STEINLE TURRET MACHINE CO.
MADISON, WIS., U.S.A.



WE MANUFACTURE RIVETS of every description, 5/8 inch dia. and smaller

PARMENTER & BULLOCH CO., LTD.

The CHICAGO
APPROVED PORTABLE
WATCHMAN'S
CLOCK

with its special Waltham movement, its lock stations and its superior quality throughout, is especially desirable for mills and factories and for either indoor or outdoor patrol.

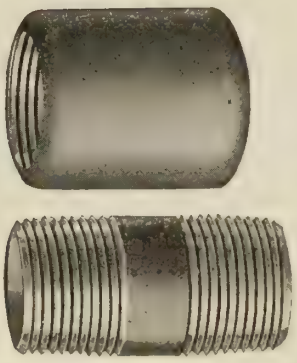
Write for Catalogue

CHICAGO WATCHMAN'S CLOCK WORKS
1526 S. Wabash Ave., Chicago

CANADIAN FAIRBANKS-MORSE CO. MONTREAL
B NNETT& WRIGHT, TORONTO

See
"Where to Buy Your Castings"
Section
on Page 48

WROUGHT PIPE
COUPLINGS and NIPPLES



Each length of M.R.M. Pipe is tested to withstand a pressure of 700 pounds per square inch.

Supplied in black or galvanized.

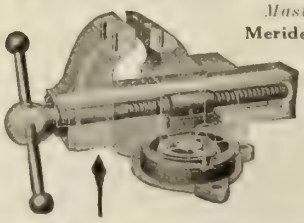
THE STEEL COMPANY OF CANADA LIMITED

HAMILTON MONTREAL

PARKER VISES
Have a Solid Underportion

to the front jaw instead of a hollow casting. (See arrow below). Just one of many reasons for the extra strength in Parker Vises. **Send for Feature Folder No. 12.**

THE CHARLES PARKER CO
Master Vise Makers
Meriden, Conn., U. S. A.



Why Don't You Write?

HARDLY a week passes that Canadian Machinery does not receive copies of this paper returned by the postal authorities because of the change in firm names or the address of some whose names are on the mailing list. Sometimes complaints reach us of the non-delivery of mail matter. It is not till the receipt of such complaints or the return of the paper, as the case may be, that we obtain any knowledge of the changes or removals of persons or firms. The adoption of the co-operative spirit on your part by notifying changes would make things a good deal more pleasant for both parties. The MacLean Publishing Co. want their mailing list to be in such shape that they will be able to render the perfect service to their subscribers. There is a lot of valuable trade matter mailed by this company and if you don't receive it—well, the fault is entirely yours.

GENUINE EMERY

Sizes 180, 160, 140, 120, 110, 100, 90, 80, 70, 60, 54, 46, 40, 36, 30, 24, 20, 18, 16, 14, 12, 10, 9, 8, hole.

EMERY FLOUR AND WASHED FLOUR

Emery, Glass, Flint, Garnet, Corundum, Carborundum — **Paper and Cloth** — **In Sheets, Rolls, Discs, Bands, Strips and Tapes, &c.**

JOHN OAKEY & SONS
LIMITED

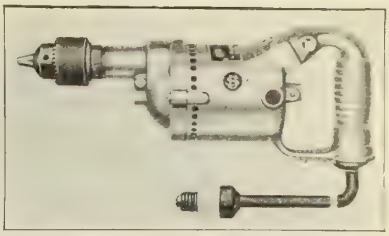
WELLINGTON MILLS
LONDON, S.E. 1, ENGLAND

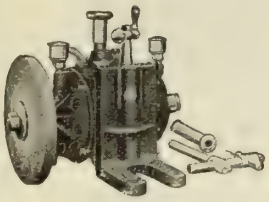
AGENTS

John R. Anderson, 36-38 St. Dizier St., Montreal
Sturgeons, Ltd., 64-66 Richmond St. E., Toronto
Frank Manley, 290 McDermott Ave. W., Winnipeg
Sankey & Manson, 839 Beatty St., Vancouver

U. S. ELECTRIC
Drills and Grinders
Can be Attached to any Lamp Socket

For drilling in metal these drills are the superior of every other kind of portable drill. Their operating cost is only half that of air drills. And they can be attached to any lamp socket.





Made in several sizes from 3-16" to 1¼". Motors wound for alternating or direct current, or both, 110 or 220 volts.

A trial will prove that our drills and grinders will save you time, labor, and expense. Order a few today.

For Sale By
The Canadian Fairbanks-Morse Co., Limited
Montreal, St. John, N.B., Toronto, Winnipeg, Calgary, Vancouver

THE UNITED STATES ELECTRICAL TOOL CO.
CINCINNATI, OHIO

One of These Gauges is Saving a Firm $1,200 a Month !

The same combination of circumstances may never occur in relation to your own gas supply, but this situation which is vouched for by the firm's own figures, actually exists. It may serve to suggest some place in your own plant where a reliable

TRADE MARK
BRISTOL'S
REG. U.S. PAT. OFFICE

Pressure Gauge

can save you money. Gas, air, steam and many liquids are being accurately measured and continuously recorded by one and another of the Bristol pressure gauges.

Full details will be found in Bulletin I-1005.

THE BRISTOL CO., Waterbury, Conn.
Canadian Distributor
A. H. WINTER JOYNER
TORONTO — MONTREAL

"Bristolize for '22"

Bring on Your Big Jobs!

No plant need turn down orders for lack of rugged, accurate equipment if they install

"JARDINE"
Power Hammers

There's a size and type for every job, light, heavy or exacting work—all can be handled on a "Jardine" Hammer.

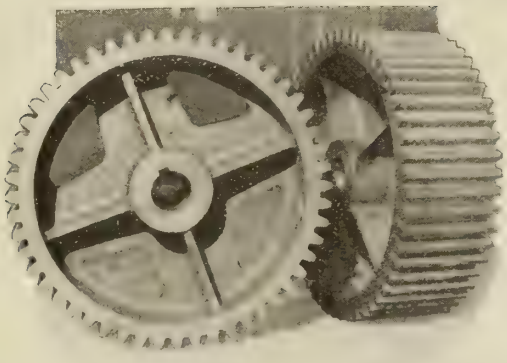
Take this Canadian Giant Power Hammer for instance. It is built to stand enormous shocks. Note the great strength of the anvil block. In two sizes: Nos. 25 and 50.

"Jardine" Hammers and other tools are described in catalogue No. 18. Write for a copy.

REGISTERED J TRADE MARK

A. B. JARDINE & CO., Ltd.
HESPELER, ONTARIO

Large Cut Gears



Let us supply those big heavy-duty drives

GEAR DATA FOR YOUR NOTE BOOK

Cut this out - - more coming late

STRENGTH OF GEAR TEETH

The Hamilton Gear and Machine Co.

1. From speed and diameter get pitch line velocity in feet per minute, = p.l.v.
2. Horse power × 33,000 = P. power in foot pounds per min.
3. Divide P by p.l.v., giving W, the working load on teeth in pounds.
4. Knowing the kind of material and the p.l.v. (1), get S, the allowable working stress in pounds per square inch from curves in diagram published in our last month's advertisement.
5. Divide W by S, giving K, a strength factor for the conditions of the load.
6. We have already assumed the diameter. Now take any pitch of teeth as a trial and find number of teeth.
7. From the table which we will publish in next month's advertisement find the value of K for a gear of the assumed pitch and number of teeth and of a face equal three times the circular pitch. This K is the strength factor for the assumed gear.
8. From face = 3 × c. p. for strength factor K (7) find the face needed for strength factor K (5).
9. If this gives a badly proportioned gear with too wide or too narrow a face try some other pitch or a different diameter.

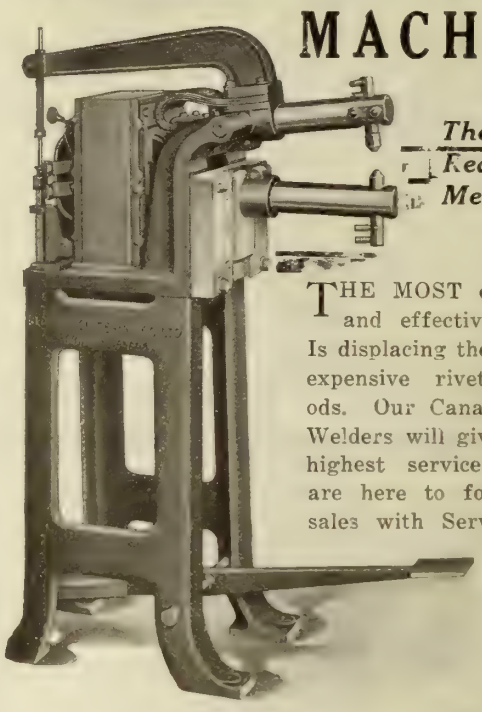
See next week's advertisement for diagram, and the following week for table to use in connection with the above.

WRITE US FOR QUOTATIONS.

Hamilton Gear & Machine Co.

Van Horne St. TORONTO

ELECTRIC WELDING MACHINES



The Cost-Reducing Method

THE MOST economical and effective method. Is displacing the slow and expensive riveting methods. Our Canadian-made Welders will give you the highest service, for we are here to follow our sales with Service.

Illustration Shows our standard Spot Welder adaptable for all classes of Spot and Lap welding up to ¼ in. thick

GLOBE ENGINEERING CO., LTD.

125 MARY ST. - HAMILTON, ONT.

Buried in the Work and Broke!

Next time a tap breaks below the surface of a large casting, don't let some makeshift method of removing it injure the thread and waste half an hour of valuable production time. Instead—

Walton it Out in a Jiffy

And save the casting.

Special analysis steel fingers of the Walton Extractor drop into the flutes of the broken tap—and grip. Then a few turns of a wrench applied to the squared end of the Extractor backs out the buried tap.

Sixty-day trial offer proves the Walton Extractor pays for itself. Write.

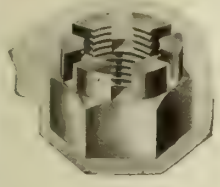
The Walton Co.

Hartford, Conn.

ACCURACY

Just now all jobbers should have a complete stock of SAE Cap Screws, Plain and Castellated Nuts and Taper Pins to meet the automobile repair trade requirements.

Your rush orders filled promptly by



The Galt Machine Screw Co., Limited

GALT, ONTARIO

Eastern Representatives:
Messrs. F. BACON & COMPANY
131 St. Paul Street West, Montreal, Que.
Western Representative:
Mr. D. PHILIP
138 Portage Avenue, Winnipeg, Man.

—you can take your holidays—if—

YOUR MACHINERY

is babbitted with

Harris Heavy Pressure Babbitt

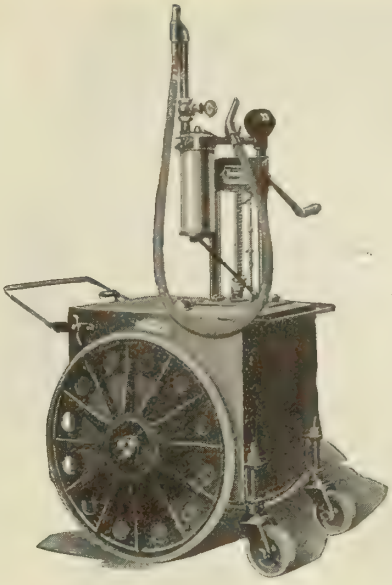
and your biggest engines with

Imperial Genuine Bearing Metal

Thirty-five years on the market

British Standard Metals

THE CANADA METAL CO., LIMITED
TORONTO HAMILTON MONTREAL
WINNIPEG VANCOUVER



Gasoline Quickly Available

Gasoline carried around the shop in open measures is dangerous. Moreover, this practice is wasteful, for much of the gasoline is lost by evaporation and spilling.

The Bowser Portable Wheel Tank is evaporation proof. No fumes can escape, so, the fire hazard is eliminated. The outfit is easily moved to the point of most convenient service.

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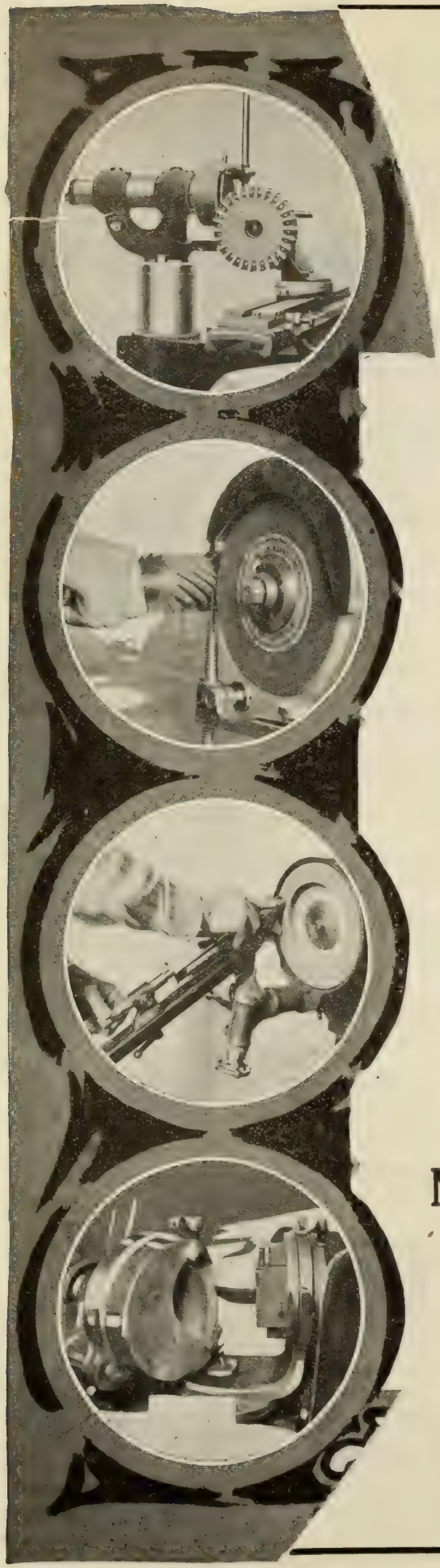

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CANADIAN MACHINERY
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MANUFACTURING NEWS

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Some Fundamentals of Milling Machine Practice

Reducing Principles to Working Basis—Minimizing Bad Effect of Excessive Impact and Rubbing—Number of Teeth a Governing Factor—Getting Maximum Service of Cutter

By S. R. GERBER, M.A.S.M.E.

PROGRESS in the art of milling can be greatly facilitated by reducing the principles to fundamentals. Unless these are thoroughly established and understood, a description of the methods in use are soon forgotten. When we stop to consider such elementary questions as, "what dulls a milling cutter?" we are brought face to face with facts that are basic in our machine shop problems, the most perplexing of which lose their sting when we unearth the fundamentals. We've often heard it said, in a matter-of-fact way, that the milling cutter should have so-and-so many teeth; that for a fine finish we must run at a low feed and high speed; for rough work we can use high feed and low speed and a number of other rule-of-thumb methods of practice that are handed down from master to apprentice without the reason why; without any conception of the elementary principles.

Milling is the removal of metal by means of a tool which rotates while the work is advancing toward it. This differs from the action of a lathe tool only in the length of the chip removed and the frequency with which the tool enters the work. For instance, a lathe tool, (which is stationary—the work revolving), is pushed into the metal and rubs only until the strain on the cross-slide overcomes the resistance of the metal, then it starts removing the chip. The tool is then under operation until the cut is made, when the operator again sets it for the next cut. The milling cutter is a disk with a number of lathe tools inserted in its periphery, and each tool operates exactly like the lathe tool rapidly following its predecessor. In the case of the milling cutter, each tooth rubs on the metal, then the action that follows is similar to that of the lathe tool in taking its cut, but usually not of such long duration.

What dulls a milling cutter? There are four distinct factors entering into the dulling of a milling cutter. They are:—1. impact, when tooth strikes the metal; 2. rubbing, before cleavage takes place; 3. cleavage, actual wedging into the metal; 4. shearing, when metal is being removed.

There are several causes of impact and rubbing during the milling operation. If the milling machine was absolutely rigid with no play in the table or carriage or overhanging arm; if the fixture were built so as to allow no spring; if there was no play in the spindle bearing; if the arbor were heavy enough to allow no spring whatsoever; and, with all that, if the teeth in the cutter were spaced so that one tooth did not leave the work before another entered, then there would be minimum impact and minimum rubbing. But the above specifications are impracticable, if not impossible, consequently, in the degree with which we fall short of these requirements, we reduce the life of the milling cutter.

Since, in practice, we cannot eliminate the causes that dulls the milling cutter, we attempt to ameliorate these conditions as much as possible. The machines are built more rigidly, the bearings and ways are made as snug as practical, the arbor is made large enough to reduce deflection to a minimum, though not too large to increase the size of the cutter to a point where surface speed becomes

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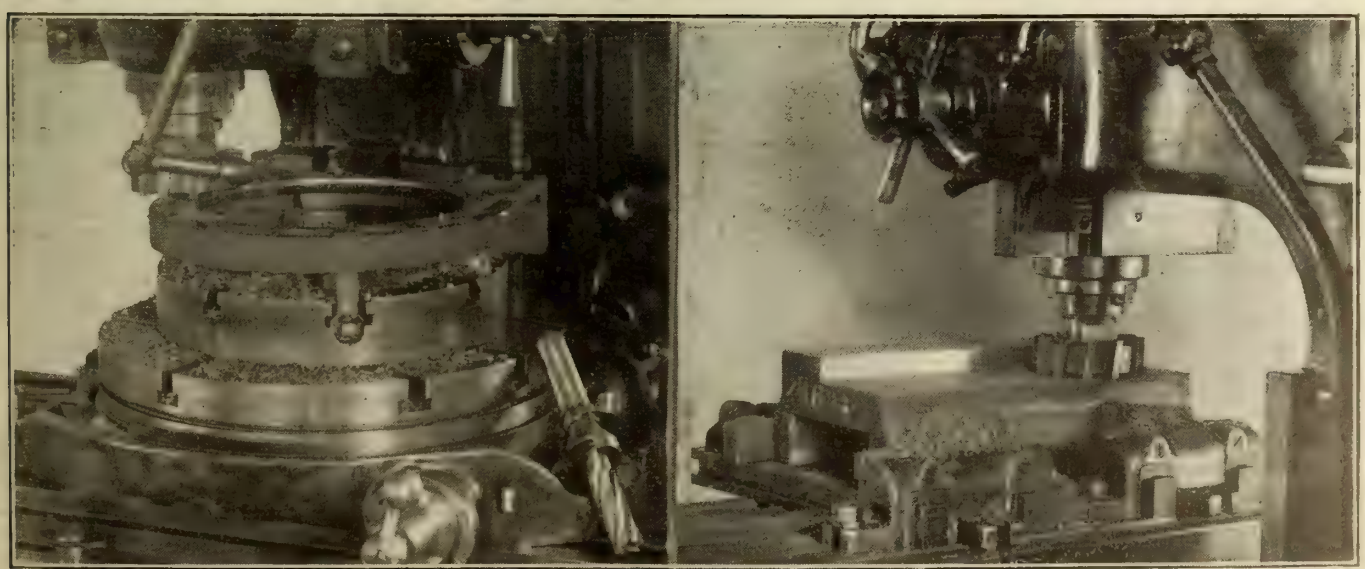


Modern methods of vertical milling.

a detrimental factor, and the cutter is made with the required number of teeth. These precautions tend to reduce the impact and rubbing to a minimum. Further reduction of harmful effect of the rubbing action is brought about by flooding the cutter with a copious supply of lubricant or coolant. This can hardly be overdone.

The effects of cleavage and shearing are reduced by proper grinding of the teeth of the cutter so as to insure the correct rake and clearance angles for the particular class of work under operation.

Life of The Tool

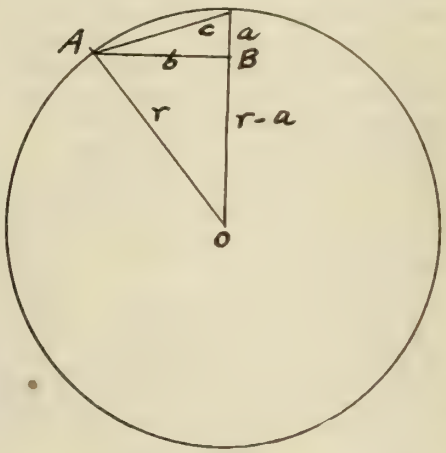
Surface speed, as applied to milling cutters, is a factor in the life of the tool as regards its impact, rubbing and shearing. The impact varies with the radius and velocity of the cutter, and the surface speed is also dependent upon the radius of the cutter and its r.p.m. The amount of wear on the cutter caused by the rubbing actio which takes place on the tooth of the cutter before it "bites" into the metal is also dependent upon the surface speed. And finally, the surface speed has the same effect on the tooth of the cutter as is suffered by the lathe tool during the actual cutting operation.

The feed per revolution per tooth of the milling cutter has a twofold effect on the life of the cutter. First, increasing or decreasing the feed per tooth directly increases or decreases the length of time the tooth rubs before "biting" into the metal. Second, varying the feed per tooth varies the length of time the tool is performing the actual shearing. Considering, therefore, the relative effects of the surface speed on the life of a milling cutter, and the feed per revolution per tooth of the milling cutter, as outlined above, it is evident that **a change in surface speed will have a greater effect on the life of the cutter than a change in feed.**

The life of the cutter can actually be lengthened by increasing the feed per tooth, because by so doing, the length of time the tool is rubbing before entering the metal is considerably reduced. If the feed per tooth were reduced to an extremely fine cut, the probabilities are that under ordinary conditions of milling machines, there would be practically no cutting at all, but merely rubbing—burnishing. And, on the other hand, if the feed per tooth were made very great, the rubbing would be practically eliminated. As the feed is increased, it is, of course, necessary to strengthen the teeth of the cutter, increase the size of the arbor, and generally make the machine more rigid. Evidently, if the arbor is not rigid enough, the deflection would increase proportionately with the heavier feed and the desired effect of reduced rubbing would be lost.

Number of Teeth

The number of teeth a milling cutter should have has received considerable attention of late and, consequently, some of the old rule-of-thumb ideas have been exploded. Fundamentally, the number of teeth a milling cutter should have is determined by the depth of cut. A milling cutter could be used with only one tooth in its periphery. But, during the interval when the tooth leaves the metal and starts around for its next strike, the strain on the arbor and the carriage of the machine has been released, so when the tooth starts to cut again it must take up all the slack, and so on, for each revolution. To avoid this, the teeth must be close enough to permit the next tooth to enter the work before the preceding tooth leaves.



With this in view we have devised a formula for the proper number of teeth in a cutter according to the depth of cut. This formula is limited in use to roughing cuts only because the number of teeth in a cutter used for making finish cuts depends partly upon the feed per tooth.

Let a=depth of cut minus a constant (to be determined); c=pitch of the teeth; n=number of teeth in cutter; r=radius of cutter; b=AB perpendicular to radius.

$$b^2 = \sqrt{r^2 - (r-a)^2}$$

$$c = \sqrt{b^2 + a^2}$$

$$c = \sqrt{r^2 - (r-a)^2 + a^2} = \sqrt{r^2 - r^2\ 2ar - a^2 + a^2}$$

$$c = \sqrt{2ar} = \sqrt{ad} = \sqrt{\pi d}$$

$$n = \frac{\sqrt{n^2 d}}{a} = \frac{\sqrt{9.87d}}{a}$$

Series of Tests

The following is a report of a series of tests made to substantiate the above fundamentals: In these tests a high speed steel cutter was used, 3 inches diameter, with a 1 inch arbor, and the depth of cut 3/32 inch. The cutter was flooded with a copious supply of a soluble oil compound.

The first run was made at 510 r. p. m. giving a surface speed of 400 feet per minute with a feed of .001 inch per tooth and a table travel of 15 inch per min. Under these conditions 2,735 linear inches of metal were cut. We then ground out every other tooth of the cutter, making the feed per tooth .0033 inch and made another run which lasted for only 2,270 linear inches. We have evidently increased the deflection of the arbor instead of having reduced the rubbing time before the tooth "bites." But there seems to be another element which has entered to reduce the life of the tool, namely the chip space. As long as the chip clearance is sufficient for the depth of cut, a greater number of teeth is desirable. In this case we have probably reached a considerable deflection of the arbor and the cutter with the greater number of teeth seemed to keep the arbor in the strained condition while with the cutter with less teeth, one tooth was out of work before the next one "bit" and that released the strain on the arbor and caused the edge of the next tooth to drop on the work. The hammer produced by this action may have been instrumental in dulling the cutter.

To further prove the above assumption we have increased the feed per tooth of the cutter with 18 teeth to the same feed as the cutter with 9 teeth had and our production was greatly increased. We cut 1,280 linear inches at a feed of .0016 inch per tooth and without changing any conditions except increasing the feed per tooth to .0035 inch. We cut 2,444 linear inches more, making a total of 3,724 linear inches on that run.

Our next run was made at 600 r.p.m. or 470 ft. per min. with a feed of .0035 inch, table travel 38½ inches per min. The cutter lasted for 1,310 linear inches of metal. This showed what a marked effect the small increase in speed had on the life of the cutter. This run was repeated and the cutter dulled accident-

(Continued on page 46)

High Speed Cutter. 3″ diam. 18 teeth.

R.P.M	Speed Ft. per Min.	Feed per Rev.	Feed per Tooth	Table Travel	No. of Inches Cut	Remarks
510	400	.003″	.0016″	15″	2735	
510	400	.003	.0016	15	1280	
510	400	.064	.0035	32	2444	Same cutter
600	470	.064	.0035	38½	1310	
600	470	.064	.0035	38½	350	Dulled accidentally
600	470	.064	.0035	38½	1950	
600	470	.072	.0040	43	1365	
370	290	.119	.0066	44	2920	
520	410	.072	.0040	37½	2728	

High Speed Cutter. 3″ diam. 9 teeth.

510	400	.030″	.0033″	15″	2270	
500	395	.048	.0053	24	2145	
500	395	.048	.0053	24	860	Bad stock

Keeping Careful Tab on Factory Operation Costs

Labor, Material, Overhead and Marketing Expenses Should Be Skilfully Analyzed—Contented Employee a Factor in Cost Reduction—Figuring Piece Work—System Essential in Keeping Records—Routing and Planning Work—Economic Methods in Handling Material—Watching the Details.

EVER since currency was introduced as the medium through which we transact business, and probably before that too, the problem of costs has been a very vital factor, not only in machine shops but in all lines of business. The cost problem is a very complex one. It cannot be ignored, for unless costs are known, the chances of succeeding in any business are few. In ninety-nine per cent. of the cases of machine shop activity, costs must be obtained if the business is to flourish and is to be intelligently handled.

One peculiar feature about factory costs is that practically everyone appears to take it for granted that they, as a unit, can be represented by a definite figure. Such is not the case, because in every set of cost figures there are always certain assumptions.

In connection with machine shop costs, one can classify the component items in a large number of ways. The classification that is probably the simplest, and appeals to most shop owners, is to divide the cost item into the four following sub-divisions, namely,—labor costs, material costs, overhead expenses, and the cost of marketing. On this division we will attempt a general analysis of costs as applied to the average machine shop.

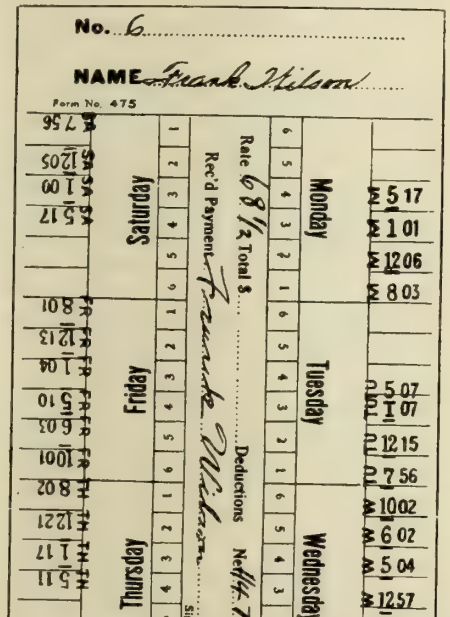
Labor Costs

In a large majority of instances, labor cost is the heaviest individual expenditure in a machine shop. As labor is paid largely by the hour, there is no better method of keeping a basic record of time than by means of one of the many designs of time clocks. In using time clocks it is very essential to have each employee record his own time. The details of how this can be best accomplished will have to be arranged for each individual shop. After this is arranged it should be seen that workmen proceed rapidly to their various duties. Similarly, foremen should see that workmen continue at their posts until quitting time. It is altogether too common a fault to see workmen slow up, or quit entirely, as the clock approaches the quitting hour. Much has been written along these lines, which leaves little room for further elaboration in this article.

Therefore, we will assume that arrangements have been made to check the number of hours worked by each man. Now each man is drawing down a certain sum for every hour worked, and in return he is expected to accomplish certain work,—to produce something. The average man is honest. He does his best, but what that "best" is, largely depends on a variety of conditions. Men produce more, and are at their best, if their mental attitude is one of contentment. Thus, in as far as cost is concerned, the only logical thing to do is to surround workmen with conditions that are conducive to contentment. Good light, both natural and artificial, is necessary. The shop must be neat and orderly. The lavatories and wash rooms should be clean and sanitary, the heating should be sufficient to maintain the buildings at the proper temperature, and the ventilation should be ample. All of these factors have very direct influences on a man's ability to produce, and this directly affects the cost figures.

To Satisfy the Average Man

Methods of producing a happy em-



Employee's weekly time record.

ployee through sporting and athletic societies, welfare and benefit movements, cafeterias, social intercourse, etc., have been advanced and tried out with varying degrees of success. In some cases there is no disputing the fact that they are valuable, and we have no word of condemnation. However, the employees often ask themselves if these things are necessary. The average man likes, in as far as possible, to be guardian of his own destinies and custodian of his own funds. Why not give the employee a square deal with this thought in mind? Any effort on the part of the firm, which may emanate from the best of motives, but which smacks of paternalism, is resented, mentally at least.

As suggested previously, provide men with good working conditions, sanitary, well heated and ventilated factories, give him good machinery and tools, and an opportunity to earn good wages, and you have satisfied the average man. Elaborate arrangements to entertain him in the noon hour, to care for him when he is sick, to attempt to guide his pursuits out of working hours, do not tend to satisfy the better class of mechanics. They know that all such activities cost the firm money. Why not distribute this money as wages or bonuses, and give the man directly all that he is worth? Allow him to distribute his earnings as he sees fit. Make him a responsible party. He comes to work for wages, not to be entertained. By giving a mechanic the ultimate in wages directly, you appeal to him in the most direct way. He values the trust and responsibility, becomes a more contented employee, and more loyal. Now these remarks appear to be a long way from costs, but upon close analysis they are found to be very directly related. A little money spent in bringing about the above conditions, will reduce costs to an extent that is very gratifying and is well worth the investment.

It is not intended to convey the fact better judgment is to be cast aside, and hard and fast rules adhered to. There are no two conditions alike and the far-sighted shopman can often see where his special conditions require treatment that would not ordinarily be advocated in a general way.

Piece Work Basis

Labor is often paid on a piece-work basis in manufacturing shops. This is an effort to control labor cost. Properly administered, a piece-work system is desirable. Machinery should be properly tooled, and properly speeded, and every effort put forth to discourage abuse of equipment. Many firms advocate methods of paying for piece-work along lines other than that of paying on the daily output. The average monthly output reduced to a figure per day should be considered as a basis of payment. Then shut-downs would become expensive. One firm even went farther than this, recently, and calculated its piece-work output over a six month period. That is to say, it took the output of the month just completed, and added to that the output of the previous five months and divided the total by six.

This sum was considered to be the piece-work for the current month on which remuneration would be paid. Thus results of either a good or a bad month would be felt for six months. It is claimed that the system is tending to do away with the abuse of machines. Inspection records show up good producers in men and machines, and many very valuable pieces of information can be obtained by intelligently analyzing these records.

Importance of Accurate Records

The method of checking time is a very broad question. The initial step, as before indicated, is by means of the time clock, which records are usually required in order to figure the payroll. Additional records are required to determine those items against which the payroll can be charged. In the small contract and jobbing shops each order should be given its number and duly entered. Following this, the shop foreman or superintendent should be advised, and the proper card entries made out. The job would then enter into the planning of the shop work and its various schedules and routing considered. A careful foreman would plan his work in such a manner that he would use all his largest, and good revenue producing machines to the very best advantage. Frequently, orders call for castings, and when such work is being planned and routed in advance, delivery dates from the shop's own foundry or an outside concern would have to be definitely ascertained. Then with this information, the execution of the work could be intelligently planned.

While on the subject of castings, it is well to bear in mind that castings are sometimes lost, and schedules have to be frequently revised to meet such unforeseen conditions. Files in the foreman's office should be complete, and each piece of work in the course of manufactures should be tagged. The machine number, date, operator or machinist, and the time operation started and finished, should be completely recorded for each sub-operation and operation on each piece. From these records, time and labor costs can be accurately calculated. It is not only important that the time spent on each and every piece of ordered work be recorded, but a machinist should be taught to account for all of his time, distinctly indicating the exact time that was spent in non-productive labor.

Some shops are content to have the eight or ten hours, which constitute a day, spread over the various jobs, with no indication of the fact that there may have been more or less non-productive time put in by the mechanic during t working hours. The non-productive t me we refer to, is that time spent in maintenance work such as mending belts, oiling machines, etc., as well as time spent in looking up or obtaining jigs, fixtures, straps, bolts, blocks, tools, and other equipment. If a man were inclined to allot too much time to actual productive machining time, he would soon be classed as a slow man. On the other hand if his reports showed an unusual amount of time consumed in non-productive labour, his record would attract attention. If it was found that he delayed or loafed between jobs, it would be to his own disadvantage. If it were shown however, that shop conditions were such as to cause a large amount of time to be lost in this way, these conditions would be apparent and would naturally come in for attention.

A Fertile Field for Losses

It is always a good policy to collect shop data on time records, in such a way that the allotment of the total time of the man can be shown, the total time on each individual revenue producing job shown, and lastly it is often very useful to reduce the above to production per man or per machine. Various organizations of the machine shop would determine different methods of collecting and recording the information, which to be of most use, would be tabulated according to the special requirements of the job in hand. Some direct deductions that can be made from these tabulated records would be those showing up of the best men and the best machines, and conversely the limelight would be thrown on the slow movers in men and machines, and lastly any unbalancing or congestion of the shop would be apparent. Such deductions are of special use to the jobbing shop of small or medium size.

It is often stated that the obtaining of these records costs too much. The simpler ideas should be made use of, at first, and then gradual improvements can be made. There is a point in the obtaining of labor cost records, beyond which it is not advisable to go, but this point differs in every shop. It will be found that by slowly building up a system, the new ideas will function better after a little time, and that the information obtained will save a far greater amount than it costs, if common sense is used in the methods put in use.

We cannot seem to forget that labor is usually the largest item on the cost list of machine shop products and it only seems natural that it should be given proper administration and guidance. Such a course often enables a shop to turn a probable loss into a profit, or a small profit into a larger one. In fact there is no more fertile field for losses than in the payroll.

Routing and planning work in a contract or jobbing shop is a very important item, as the two conditions often set up—the demands of rush work, and those of economical routing,—are frequently conflicting.

In the problem of guiding and employing labor in the shop handling varied work, there is no system that seems capable of taking care of all the different conditions met with, and for that reason the shop owner and the foremen should always consider the methods of getting the maximum production from the labour employed.

Tactful Leading Necessary

Probably few people realize that one of the greatest assets of a machine shop foreman or superintendent is his personality,—his tactfulness. Good machinists do not need to be driven, they should be led. Swearing at a man, or using any form of language that emanates from anger or passion, puts the average self-respecting man in a frame of mind that makes it difficult for him to produce for periods varying from an hour to a week, according to the man. We have never yet seen any good come from a heated argument. Thus a tactful, sympathetic foreman, who understands human nature, as well as he does modern machine shop practice, saves his salary many times over, because he does not place men in those frames of mind that makes it difficult for them to produce to advantage. He saves many hours every month. Now every hour saved is a reduction of the

DAILY COST CARD

NO 8020 NAME Jos. Purcel DEPT Woodworking

	TIME RECORD			ELAPSED TIME	RATE	COST	PIECES	ORDER NO.	OPERATION
8	MAR 27	8 00	F	1.36	.56	.90	75	2124	Polishing
7	MAR 27	6 00	S						
6	MAR 27	5 00	F	2.14	.56	1.25	110	3206	Bevel Sides
5	MAR 27	1 10	S						
4	MAR 27	1 10	F	3.05	.56	1.72	249	1816	Groove
3	MAR 27	9 05	S						
2	MAR 27	9 05	F	1.05	.56	.60	69	986	Face Ends
1	MAR 27	8 00	S						

TOTAL HOURS 8 RATE .56 MATERIALS 5.04 LABOR 4.48 TOTAL CHARGE 9.52

Sample of efficient daily cost card.

PRODUCTION COST CARD

NO 9020 NAME H. Adams DEPT Lathe

ORDER NO 3631 MACHINE NO 369

PART NAME Front Shaft PART NO 2032

OPER NAME Turn to size at A OPER. NO 1a

PIECES	P. W. RATE	AMOUNT	D. W. RATE	ELAPSED TIME	FINISH / START
236		3 83	.45	8.30	MAR 26 5 00 / MAR 26 7 28

O. K. WBJ. FOREMAN

Showing cost of machine work.

cost of the work passing through the shop.

It is not within the grasp of every machine shop to have the very best in machine tool equipment. Nevertheless it is always advisable to place first class men on first class machines. When this is done the quantity and quality of the work accomplished permits the shop to pay the prevailhigh wages and still make a profit. Records of work passing through the shop should always indicate the daily capacity of each machine, in both the case of manufacturing or contract work, so that the slow producers would be shown up. These are the machines that add to the cost. Careful investigation should be made in order to determine how long it would take a new and up-to-date machine to pay for itself. In this calculation, it must be borne in mind that the labor costs per diem on the two machines will be identical, and as far as labor is concerned, any increased production on a new machine would be clear profit.

In the larger shops, where manufacturing is done exclusively, the problem takes on a different aspect. The work goes through in lots and a rigid inspection system follows it up. The spot light is thrown on most of the weak points, and an organization is available to work up records making complete and exhaustive analyses. For that reason, the labor problem in some respects, is simpler in the larger shops.

In all classes of shops, a large labor turnover is an extremely undesirable feature. Irregularity in labor is another source of excessive costs. At all times great care should be taken to keep the agitator or chronic kicker on the outside of the factory walls.

Finally, the tactful handling of labor, providing good working conditions, good tools, and showing a desire to be human and sympathetic, does a great deal to eliminate waste and to reduce labor cost. Treat men well, and the good that is in them will respond to that treatment. Be tactful, but above all, be master of the situation.

Material Costs

The cost of material truly is deceptive. It looks a simple item, and one is apt to overlook some of the smaller items that it drags in its wake. Iron, steel, brass, and copper can be usually charged up at so much per pound, and the quantity can be obtained by direct methods.

Indirect costs, such as interest on investment, when large quantities of material are kept over long periods, insurance on same, and possible loss through theft or exposure to the elements, must be kept in mind. The problem of the falling market sometimes causes relative costs to mount. The rising market is only a point to be considered in figuring selling prices. It is often found that the scrap pile yields up A-1 material for certain work. In the event of scrap material being used, the shop should credit itself with the actual market value of new material, and this item would enter into the costs. Thus an equitable selling price could be established, as most selling prices are figured from the cost figures. These unexpected advantages should be capitalized for two reasons. The first reason is that the advantages are useful in couteracting unexpected disadvantages, and secondly if a low selling price were established on the article, the purchaser would in the future base his idea of the cost of the article on the original low price and subsequently if new materials were used, the article could not be reduced for the original low figure. A department to salvage waste material, is the means of saving a good deal of money at times, and is nearly always a paying investment.

The careful storing of all incoming material at a point or points convenient to the places where such material is to be used in the shop, eliminates lost time in routing such material to machines. If the stores are in the hands of competent men, who use card indexes and permanent inventory systems, handling costs will be kept at a minimum level. It is often the little things that are missing or short, that cause certain machines or departments to be held up.

The purchasing department can profitably study conditions and determine those items or materials that can be purchased to advantage in a finished or semi-finished condition. Savings are often made in this connection, as certain shops specialize in various lines and can produce them at figures lower than the average shop. Thus very considerable savings can be made by a live wide-awake purchasing department.

Overhead Expense

The overhead expense of any shop is always its own special problem. The item is the pooled expense of doing business, outside of the direct charges for material and labor. It covers the entire office expense, expense of administration, expense of supervision, cost of supplies, power, insurance, taxes of all descriptions, heating, drawing, designing, engineering service, experimental and development work, spoiled work, lighting, repairs, bad debts, interest on bank loans, interest on investment, depreciation of plant and equipment, funds for extension, liability in case of accidents, donations and other charitable gifts, and other indirect expense incurred in continuing the business, including that of selling expense, advertising and traveling salesman expenses, which subject we plan to deal with separately, later in this article.

It is common practice to pool these expenses and reduce them to cost per man per hour. Sometimes they are expressed as a percentage of the prevaling hourly rate of a machinist. It is only a compromise, at best, to express them in either of the two above mentioned ways. Logically, it is not good judgment to charge a certain rate per hour for a man's time on a small shaper or lathe costing less than one thousand dollars, and then to apply the same rate to the man when he is working on a six thousand dollar milling machine, or to a man working on a twenty thousand dollar planer which consumes more than ten times the power required by either of the two first mentioned machines. If an overhead rate is expressed as a percentage of the hourly rate paid the machinist, it quite often runs to 100 per cent. of this figure, but naturally it cannot be hard and fast, as it costs less to do high class bench work than it does to do ordinary work on big, heavy, expensive, and power-consuming machines.

The secret in figuring overhead is for one to have an intimate knowledge of all the special conditions in hand, so as to include all tangible as well as indirect expenses, and in addition place in those funds to be devoted to "reserve" and "depreciation" amounts sufficient to cover all reasonable future requirements. It must not be lost sight of, that whether a wheel is turned or not, overhead expenses continue. Depreciation in an idle plant is sometimes larger than in a going concern, and is at all times a heavy expense.

Every time a jig or fixture is used, it costs money. It was an expense to procure that jig and a return on the investment must be obtained. It also costs money to house that jig and keep it available for use. In the case of delicate and very accurate jigs an upkeep cost must be reckoned with. In heavy rugged jigs and fixtures that resist wear, it usually is safe to assume that changes in design will limit its life, and therefore it must earn its keep over a definite, and not an indefinite, period, or else it will be a losing proposition.

Every type of machinery is subject to maintenance costs. These figures vary in different shops. Any shop that has been operating for more than a year can make very close estimates as to the amount of their probable maintenance costs for considerable periods in advance.

Study Depreciation Costs

Some standard machines, such as lathes, are assumed to have a life of ten years. Other machines, such as planers, are given twenty years. Every machine should be alloted a certain length of life and its depreciation figured accordingly. This length of life is not necessarily the period over which it can be counted upon to do good work, as some machines become out-of-date, and of correspondingly less value, long before they are worn out.

Supplies required by shops are an important item in the overhead. Oils, belts, small tools, jigs, fixtures, cutting compounds, tool steel, fuel, pattern lumber and expense, foundry expenses or costs of castings, are a few of the many items. The list of supplies varies with the product manufactured, and other special conditions. It is always important to keep records of the consumption of supplies, so that a proper

figure can be obtained, when it is necessary to have same for estimates on prospective work.

Heating costs should be figured on a yearly basis in order that the summer business may be made to help pay the heating costs in the winter.

It never does any harm for a shop owner to audit independently his own books at the end of the year, and ascertain for himself all the various direct and indirect items that enter into his gross operating expenses. He will get many new ideas of expenses that are somewhat obscure but are inseparable from any business venture. He will be able to visualize and put in effect many economies, and will have a broader understanding of the word "overhead." It has been found good practice to give foremen figures which show the consumption of supplies over a given period. Comparisons with former consumption figures will be interesting, and may be the means of effecting a saving on many items.

In the matter of estimating on prospective work, records showing past performances are of great value. Nevertheless, it is often a matter of a shopman's ability to size up the work and to take into consideration all the special factors, which bring forth intelligent and accurate estimates. Experience is the great teacher as all estimates are very complex problems. Estimated figures should always be compared with the actual, as many valuable pieces of data can be thus secured.

Experience is the best teacher when it is necessary to unravel the problems that go to make up the elusive overhead.

Selling Costs

The last item of costs that must be charged up to an article is that amount which is required to place it in the hands of the consumer. To this account must be charged all costs of advertising, salaries and transportation charges of traveling salesmen, catalogues, sales pamphlets and other literature, expenses of crating, boxing, and packing, carting and loading expenses, and other items that are incurred in each individual sale. To add to this, is the cost incurred in some of the above connections where an unsuccessful attempt to close a sale has been made. Profits from actual sales have, of course, to take care for these indirect and unfortunate expenses. Branch offices, commission to agents, are all charges against the sales account. Many of the above items are in a class, which to a greater or less extent, can be controlled. Thus the executives of each individual shop must consider their own problems on their respective merits. If these expenses are recorded in such a manner that business can be traced more or less directly to them, the amounts that can be reasonably spent in the various ways, can be determined more or less intelligently.

A careless salesman whose actions tend to displease regular or prospective customers, is a source of expense, as he does great damage to the very valuable asset known as "goodwill."

In the case of firms whose product is exported, this end of the sales problem becomes a very complex one and it is not proposed to deal with it in this article.

Factors Making for Cost

Perhaps a few hints suggesting some of the obscure items of expense would be in order. Goods that arrive in damaged condition, and which are later the cause of claims or other troubles due to adjusting, etc., add to the cost of manufactured articles. Similarly outgoing goods that are badly packed are often the cause of direct expense to the firm shipping, and also the cause of the indirect expense of a dissatisfied customer. When shop routine is held up through the lack of small but important items, there is a tendency to cover up the matter, and it is not always brought to the attention of the proper executive. Guaranteed deliveries are sometimes an item of increased cost. A shop often gets behind schedule and overtime must be resorted to, in order to make promised deliveries. This factor adds to the cost of labor and other items.

A factor that is sometimes serious, and often an indirect loss, is for a firm to allow its accounts payable to become so large that is cramped for working capital. This means that extra cost is involved in the securing of money with which to operate, from the banks or other sources. In such cases opportunities to purchase advantageously are often allowed to pass. In dull times men are kept on the payroll for long periods when it is well understood that they have no opportunity of earning their money. These items have to be all paid for if a shop is to continue in business. Some plants fail to take advantage of side lines or fillers, or to reclaim scrap material. Such practices may only net nominal sums, but these amounts are very nearly one hundred per cent. profit. Some firms have a heavy burden to carry in the form of executives' salaries. Thus one may continue on down the line almost indefinitely.

The Proper Care of Belts

By J. H. WALKER

Managing Director of The Dominion Belting Co., Hamilton, Canada.

THERE ARE very few users of belts who give them the proper care. In the first place, they should be put on with clamps, or other means adopted, to take all the stretch possible out before lacing or attaching with other fasteners.

Every belt should have a proper dressing applied occasionally to keep it in condition. By this means drying out is prevented, and belts retain their gripping qualities on pulleys, which means a retention of the original power transmission.

A belt dressing containing resin or mineral oils should not be used, as these ingredients are most detrimental. Never use a belt dressing containing animal oils on rubber, balata, or stitched cotton duck belting.

The proper time to apply belt dressing is when the plant is closed down for a day or so; for instance, Saturday, as by Monday morning it has had a chance to penetrate the belt and keep it soft and pliable.

If kept in this condition there is no excuse for anyone resorting to the questionable remedy of applying resin, or any sticky dressing to get the proper power out of belts.

Belts used in saw mills and other plants that are shut down during the winter months should be taken off, rolled up, and kept in a warm place. If left on the pulleys and exposed to the changeable atmospheric conditions of a Canadian winter they will certainly have deteriorated by the spring.

Carelessness in starting up machinery too quickly is liable to cause belts to slip on pulleys, thus injuring them. This can be obviated by putting on the power gradually, which gives belts a chance to get a grip on the pulleys.

Another important matter is to have proper alignment of pulleys, as many belts give out before their time owing to defects in this respect.

Another mistake made by some belting users is practising false economy in getting belts too light for the work they have to do. While a certain weight of belt may at first do the work required, if it is necessary to keep it on a constant strain to accomplish this, both belt and machinery are going to wear out much faster than if there is a "reserve." In other words, heavy enough belts should be used to ensure their not being overstrained. This may cost a little more at first, but pays in the long run.

Correct Lighting Dependent on Proper Diffusion

Getting the Most From Natural Daylight—Modern Plants Constructed With That Object in View—Coating Walls With Light-Reflecting Colors—Better Lighting Systems

THE first part of this article appeared in the June 15 issue and brought out the point that due to the large number of mill whites on the market, it is often confusing to one not familiar with paint values, to determine just which particular coating is best suited to one's needs.

Price cannot always be used as a criterion, because the cheapest paint may not produce anything like the results anticipated. Even such a test as whiteness does not mean much because permanence of whiteness is just as important. There are other qualities too, such as opaqueness or masking value of the paint, and the ease of brushing which affect the quantity of paint and the labor cost of application. A mill white which covers much better than another and which is brushed out easier, may cost less in the end in actual dollars and cents expended for painting than another material that was originally quoted at an extremely low price.

In view of these facts, it was suggested that probably the best plan the average building owner, factory superintendent or maintenance engineer could follow, would be based on a competitive test carried on by such building owner's or maintenance engineer's own men, in his own plant, where all the determining factors could be taken into consideration and correctly estimated before coming to a decision.

Method of Procedure

For this purpose, it was suggested that an adequate sample—one gallon, five gallons or ten gallons (depending on the extent of the job) be ordered from each maufacturer whose mill white was worthy of consideration. No paint manufacturer has any objection to such a test being made in connection with his material as long as he is assured that the test will be unquestionably fair to his material and that his representative be given every opportunity to observe results along with the building owner's own men. The cans of mill white when received should be marked with a code number, preferably stamped into the metal, and the labels carefully removed, the code number being retained by one person only—the superintendent, factory manager, or other individual in charge of the test—and the unlabelled cans, free from any distinguishing mark, save the code be turned over to the painter for inspection and test.

The painter should be given instructions to coat two panels of the same size, of each manufacturer's product, two coats, on the same character and color of wood surface. All materials should be applied alike, and under the same conditions. These panels, when thoroughly dry, should be coded with the number of the paint used, and then put away in a dark closet, or in the drawer of a desk, or some other such place where no light can reach them. This is the best test of the non-yellowing qualities of white paint, because the average white paint, when isolated from daylight, has a tendency to yellow or turn dark. By placing these panels in a very dark environment, this tendency to yellow can be accelerated, enabling the test to prove out in from two to four weeks.

This will take care of permanence of whiteness. Incidentally, it will also give an idea of the comparative whiteness of one material with another, though a better test of this can be formed by the following: The superintendent or factory manager should then select a wall space in his factory, dividing this space off into equal sections. All samples should be tested in the same section of the factory and on the same wall, and subjected to the same lighting conditions, if possible, so as to have the test fair, and on a uniform basis.

Covering Capacity

The painter should now carefully measure a quart, half-gallon, a gallon or whatever quantity of paint he is going to apply, and brush this in the first section, marking the section with the code number of the paint used. The paint should be applied in this section until every drop in the can is used up. The next brand of material should be brushed out likewise in the next section, and so on down the line.

It will immediately be observed that some paints will "go farther" than others—cover more surface. If this test is carried out carefully, and the surface is of the right kind, so that all brands of paint are spread over a surface of equal and similar porosity, it will give a very excellent idea of the comparative covering capacity of the various paints.

The mistake should not be made of applying one material over brick, another over cement wash and a third over concrete. These surfaces all vary in their absorptive qualities, which is unfair to the paints. (The absorptive character even of different sections of the same concrete wall may vary, though this of course is a matter difficult to regulate). Following the application of the first coat, a second coat should be applied, having allowed 24 to 36 hours for drying. From these samples, if they are all painted on surfaces of the same density, shading and physical appearance, and exposed to an equal quantity of light, one can very readily determine which is the whitest.

The covering capacity can very readily be measured, while the opaqueness

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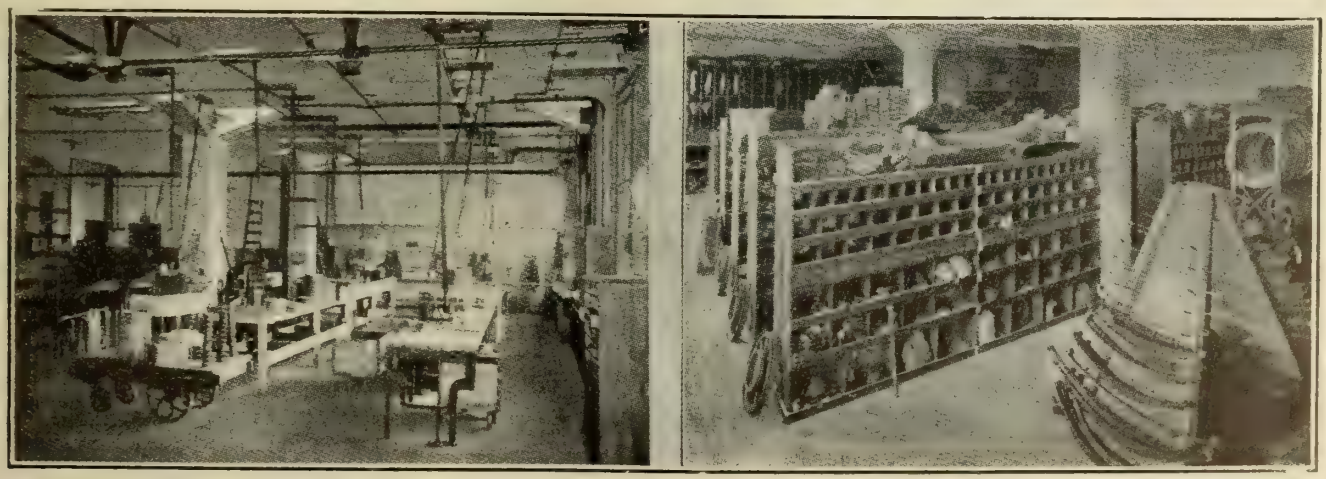
Extract from an article in Building Maintenance issued by the Truscon Laboratories.



Left:—Showing well-lighted shop. Right:—Every bin and corner well lighted.

or "masking value" is something that should be determined after both the first coat and the second coat. It is entirely a matter of paint judgment, and probably the factory manager should rely on his painter to tell him which material, in his opinion, has the greatest opacity and body to mask the surface.

The ease of brushing is another point which the painter can best determine for himself. Ease of brushing is exceedingly important, because on this feature depends the labor cost of applying the paint. If a man who is paid 70c an hour can brush out 1,200 square feet of surface with one paint, whereas he can brush out only 750 with another, in the same length of time, it is obvious that the second material is costing more to apply than the first—a factor to be taken into consideration in the total cost of painting.

Figuring Different Values

By giving certain values to the various factors of the test it can be readily determined what the relative qualities of the different paints may be. As shown in Fig. 3, there are nine samples applied to the wall, numbered 1, 2, 3, 4, 5, etc., respectively. After careful consideration No. 4 let us say seems to be the whitest. We will give this a value of 20 and judge the other paints 10, 15, 18, or similar figures, depending on the estimated degree of whiteness that these fall short of No. 4. If No. 3, however, gives best results under the permanence of whiteness test, then No. 3 is given a rating of 20 for this classification, and all others graded accordingly.

By summing the numerical values of each of the paints applied, the building owner or factory superintendent is able to obtain a fairly accurate estimate of the true value of the various products as light-reflecting paints. The value of this method of testing is due to the fact that it is not based on one point of advantage alone, but it endeavors to take what experience has proved to be the five most important points, into consideration. If the plant superintendent or maintenance engineer will follow this system and compare his results with the prices at which the various goods are offered, he will find that he has arrived at a safe basis on which to make his decision.

Aspects of Lighting

The eye is an organ, which, like all other human organs, has a tendency to adjust itself automatically to new conditions. It does this often without our having any direct consciousness of the fact. Thus, for instance, in a room painted all white there may probably be too much light or more light than the eye is accustomed to receive. Insensibly it adjusts itself to this new condition, even without the worker's knowledge. But the adjustment is not a remedy—it is only a temporary relief, and if the work is persisted in, may eventually result in eye strain with its various eye diseases.

Shadows Often Helpful

The explanation of all this is of course that we see objects not only by the light that they reflect, but also by their shadows. Take as an example the cubes shown in Fig. 4. The cube in the center is so well lighted from all sides that it is difficult to distinguish its various surfaces. There is no shadow. The cube at the right has shadow but too much shadow on top. The cube at the left is correctly lighted, so that its shape, form and contour are perfectly distinguishable. This fact is taken advantage of in some shops by painting not only the walls and ceilings white, but also the work benches and machinery.

It seems apparent that when conditions dictate the use of a colored dado one should aim to keep away from black and red. Green probably is the best color, since it is the one color to which our eyes are by nature already accustomed. Green may not always fit in with the general harmony or decorative scheme of the building interior—but when bright reds or deep blacks are used they should be used with other colors.

Nevertheless in a type of manufacturing plant that requires the use of a dado, if the ceilings are coated with blue ribbon eggshell white, and the walls and columns down to a point about the eye level with the same color, and all else below that with a quiet, cheerful green, much can be accomplished, not only in good lighting, but in relieving eye-strain. A black line about an inch or inch and a half in width, used at the exact point of meeting beween white and green, adds somewhat to eye-restfulness, since it makes a line of definite demarcation between the two colors.

Summary

To summarize the entire story, interiors of buildings should be decorated, coated and otherwise finished so as to obtain the maximum benefit and good out of both artificial and natural lighting. The advantages of good lighting are as follows: 1. Economy of electric installation. 2. Economy of electric maintenance. 3. Economy of electric current consumption. 4. Less eye strain. 5. Cuts down spoilage. 6. Reduces accidents. 7. Increases accuracy of work. 8. Makes possible more work at less cost. 9. Easier supervision. 10 Clean and sanitary. 11. Favorable appearance.

Having once decided that it is possible to increase the lighting efficiency of the interior of the building, the next step is to get in touch with illuminating engineers, who from their experience in such matters, can advise the factory manager or maintenance engineer on just what his requirements are, how they can best be taken care of and the cost.

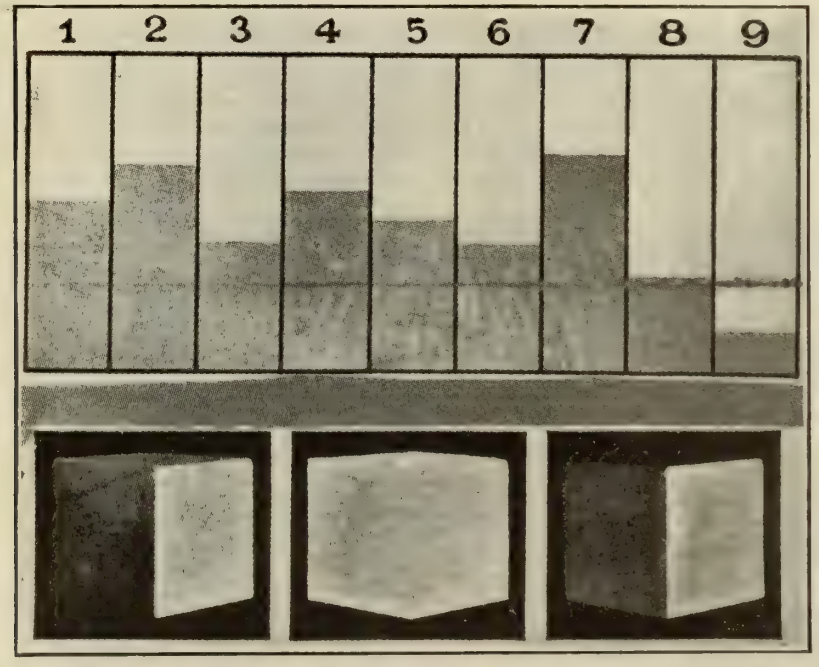


Fig. 3.—Top: determining by test the various qualities of paint. Fig. 4.—Lower: showing effect of reflected light.

MOTOR CAR EXPORTS CONTINUE HEAVY

Speaking of Canadian activities of the motor industry recently, Pierre du Pont, president of the General Motors Corp., made some optimistic comments on present and future prospects. He stated that "The corporation is developing in its Canadian plant a line of export models which meet the requirements of foreign countries in the matter of taxation, fuel consumption, weight, tire milage and economical upkeep, which are major considerations in influencing the purchase of American products in foreign countries. The export business of the corporation is running three times what it was forecast six months ago.

Labor Demand Reflects Industrial Activity

Railway Contractors Finding it Necessary to Increase Minimum to 30 Cents—Welland Canal Operations Likely to Absorb 3,000 Men—Motor Industry Easing Off After Good Season—Planning Extensions—Number of Placements by Labor Service Greatly in Excess of Last Year.

THE EMPLOYMENT situation continues to show the effect of seasonal activities on municipal, railway and public works. The fact that Welland Canal contractors will require some 3,000 men, and that the rate of wage indicated for laborers is 35 cents an hour, has caused some stiffening of the wage offered for railway work. This, as previously announced in this paper, has been from 25 to 30 cents. So much work is available, however, at higher levels, that railway contractors have been forced to move the minimum up to 30 cents. The employment service in Toronto, reports that they have had many calls for men which they have filled at 30 cents, but complaints reached them that the men either did not reach their destinations or remained on the jobs but a short time owing to better prices elsewhere. With the Toronto Transportation Commission paying from 40 to 50 cents an hour the average for city labor tends upwards. So far as machinists or skilled labor of that kind, are concerned, very little demand is reported. Some manufacturers are taking on more men, temporarily at least, but this is not absorbing the unemployed in this department, and these men are trying out something else for the time being.

Between Season in Motors

The motor car industry, during its period of activity, took on fairly large forces of skilled mechanics, but there are indications that now that the between season is approaching, there will be some lay offs. One firm stated that they were running along nicely on present season orders, but that, having loaded up with skilled mechanics, were proceeding to weed out. They gave their best wage rate as 75 to 80 cents an hour. Another concern stated that with the completion of one or two large contracts the off-season was in sight, and they were laying off men for five or six weeks, in which time they expected the advance business for next season would have developed sufficiently to fill up their ranks again. They were paying 60 and 65 cents an hour. The motor industry seems to have found its stride and has had a prosperous season. One indication of this in the Canadian field is the fact that the Russell Motor Car Co., have renewed payment on their common stock. This had been passed during the first quarter. Still more significant is the plan of the Ford Co., to make huge extensions to plant at Ford. Ont. This company has just declared a dividend of 15 per cent. The Durant people are also planning new buildings. These will give a floor space of 400,000 square feet, or five times the present area. The production of a car to compete with the Ford is proposed, and the extensions will provide for an output of 18,000 cars the first year. Of this number 10,000 will be for export. The industry as a whole is preparing for a record season in 1923.

There is a demand for farm labor. Parties of able-bodied men from the Old Country, arriving in the past few days, have been quickly absorbed. Farmers show a preference for this type of help as they take to farm life more readily and are more contented and more ambitious than are the habitues of a city, the majority of whom cannot live down what has been rather jocularly referred to as "the call of the wild," and in a little while float back to scenes of noise and bustle. Many farmers are signing desirable men up on yearly basis for $300 to $350 and found.

Increase in Placements

There is marked improvement in the showing of regular placements as between month of May, 1922 and the same month, 1921. For Ontario, there were placed in steady positions 12,116 while in 1921, the placements were 6,186. The Toronto figures are, May, 1922, 4,163; 1921, 1,897. Other provinces show similar gains. For Quebec, although the figures are much smaller than those of Ontario, statistics being from a limited range of cities, the placements were: May, 1922, 1,303; 1921, 974

At the close of May there was a 12 per cent. increase in employment in the iron and steel group, representing largely reaction from the temporary losses recorded by the railway car shops at the end of April during one of their recurrent shutdowns. During the latter part of May some of the car shops had closed down, but all were working again before the end of the month. In addition to this revival of activity, there was some expansion in practically every division of the industry, notably in rolling mills, shipbuilding and repairing, heating appliances, boilers, engines and tanks, iron pipe and small hardware. Improvement was indicated in all provinces, the additions to staffs in Ontario, however, exceeding those reported elsewhere. Statements were compiled from 734 concerns in the group with an aggregate working force of 109,329 persons, as compared with 97,299 in the preceding month, an increase of 12,030 This expansion caused the index number to equal that indicated for the corresponding period of last year, so that for the first time this year the situation did not compare unfavorably with that reported for the same month of 1921.

The level of unemployment as indicated by the manufacturers making returns at the close of May was higher than at any time since the end of March, 1921. The improvement since the preceding month was especially marked in iron and steel and lumber, the gains in the former indicating recovery from the shutdown in the railway car shops reported at the end of April. Sawmills were very much more active, causing practically all the gains in the lumber group. In addition, a distinctly favorable movement was evidenced in fish canning, pulp, paper, biscuit, rubber, glass, brick, cement, electric current, nickel, tin, and petroleum factories. The only noteworthy contractions occurred in the leather and textile groups, and, as mentioned before, these were largely of a seasonal character. Reports for the month under review were received from 4,169 manufacturers employing 411,936 workers, as compared with 386,728 on April 30, the difference representing a gain of 6.5 per cent. The tendency indicated at the end of May, 1921, was downward and employment was about 3 points lower than for the period under review.

Gains in Building Trades

Employment in the building trades, as indicated by the value of the building permits issued in 56 cities, showed another decided increase during May, the value rising from $14,082,170 in April to $17,765,326 during the month under review, an expansion of $3,683,156, or 26.2 per cent. The value of the building authorized during May, moreover, exceeded that reported for the corresponding month of last year by $4,363,161, or 32.6 per cent., the permits for May, 1921, having aggregated $13,402,165.

The volume of building contemplated in all provinces except New Brunswick, Manitoba and British Columbia, showed considerable gains during May, the increase of $1,343,883, or 51.3 per cent. in Quebec being the most noteworthy. The largest percentage gain occurred in Saskatchewan, where the permits, valued at $1,281,431, were 315 per cent. higher than for April. The declines in the provinces mentioned above were all slight, that of 14.4 per cent. in Manitoba being the most pronounced.

E. G. Koyle, formerly branch sales manager of the Refinite Co., Toronto, has been appointed to a similar position with the Canadian International Filter Co., Toronto.

Hints on Setting Up and Clamping Work on Planer

Efficiency of the Electric Drive—Increased Range of Open Side Planer—Development of Double Deck Platen—Multiple Tooling Speeds Up Production—Offset Table a New Feature

By H. ALTON

During the war, in the Canadian Pacific Railway Angus shops planers were used in place of bull-dozers for drawing brass cartridge cases. These references go to show how versatile the planer really is, and in the hands of an ingenious foreman should rarely be idle.

Electric Driven Planes

Up to the present we have only touched on belt driven planers. Of late years electric motor drive has become popular on the largest machines. The form of drive has been so successful on these large planers that it is almost universally adopted. The electric motor of today is a rugged machine and in itself is very reliable. The planer motors are, of course, reversible and often of the variable speed type. Some motors on planers are equipped with a more or less elaborate control board. The stroke is adjusted by dogs in much the same way as a belt-driven planer. The dogs, when functioning, operate an electric switch which reverses the direction of flow of the field current. Thus in bringing the sliding and revolving parts to a stop and reversing them regenerating effort is often obtained, tending to reduce the peak load. On large planers auxiliary dogs are often found, which, when required speed up the planer on the cutting stroke. This is done when there are places in the cutting stroke where the tool is cutting air. Then too, it is desirable to slow down the platen as a tool enters the cut. All these things can be accomplished by means of the auxiliary dogs.

Electric drive eliminates belt troubles and permits the machine to be stopped or started from various places. On large work of an uneven nature, the variable cutting speeds save time and money. A small motor on the standards is a great time saver in moving the cross rail. On the whole on large planers, the electric drive saves a great deal of the upkeep cost. There is a limit in sizes, however, below which it is probably not economical to go, and all small planers are belt driven.

Open Side Planers

One of the great friends-in-need in the contract shop is the open side planer. Work is handled on these machines the limit of which is only the size that can be passed through the doors of the establishment. Ingenious devices for supporting overhanging work are found in many shops. The principle of operation is identical with that of the double standard machine. The only difference in design is that the cross rail is of cantilever construction and is supported by the single post or standard.

It is not uncommon to see a planer of the double post design widened out to take in extra wide work. Some Canadian shops have done this to their decided advantage. In the works of one of the big tool manufacturers in Illinois a 48-inch planer has been widened out to 72-inches to take care of some of their own shop problems.

Double Deck Platen

Probably no apparently simple improvement in machine tool design of recent years is more important than that of the double decking of the planer platen. The top of the platen has the usual number of slots and holes. The latter only go through the top section of the platen. The bottom of the platen is solid and between the two a large space is cored out with large holes entering this chamber, at the sides of the platen. All chips that pass through the holes are held in the chamber until the operator has an opportunity of raking them out. When removing them, they are thrown clear of the tool and out on the floor. This design of platen renders it practically impossible to get chips and dirt into the driving gears.

Special Designs

There are some very successful planers on the market to-day that use the worm gear drive. Then a planer recently appeared on the market with a belt-and-pulley link in the gear train, reducing the speed. The manufacturers claim special merits for their respective designs which are, without doubt, all operating successfully.

In the final application of power to the platen the rack and pinion are the accepted standard. Usually platens are cast iron and in modern planers the racks are of steel. There is no more important point to look into than the method of attaching this steel rack to the platen. Cases where racks have become loose are uncommon but considerable damage was done in those few cases where they did work loose.

Multiple Tools and Production Set Up

We have considered various ways of using the single tool on the cross slide and now will dwell on the multiple tool machine. When designers figured they had reached, for the time being, at least, the ultimate in the productive ability of one tool they were able to increase the capacity of the planer for work by equipping it with side heads on standards. Then came the planer with two heads on the cross rail. Fig. 16 shows a large modern planer

Illustrations shown in Fig 16 by courtesy of Niles-Bement-Pond Co. Those in Figs. 17 and 18 through courtesy of Bett's Machine Co. Line drawings prepared by the author. First part of this article appeared in July 6 issue.

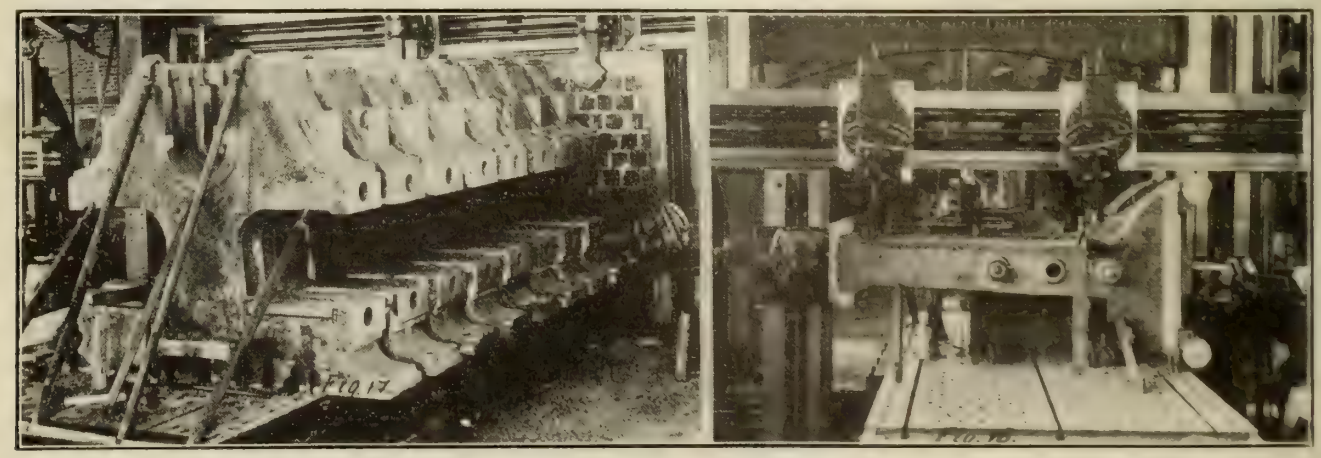


Fig. 17—Large planer with multiple heads machining housing casting for sugar machines. Fig. 18—Large planer with special patented sliding side head.

with three heads on the cross rail and one head on each of the two standards, making five in all. It will be noted that the planer is electric driven. There are several features of interest about this planer. Note the hand wheel construction for the vertical hand feed of the cross rail heads. The planer has one Vee way and one flat way. It is possible to use the five heads simultaneously, thus making intensive use of production time. Such practices, of course, materially enhance the ability of the planer to do work and increase correspondingly its earning power.

Fig. 17 shows a heavy duty planer 111 in. x 102 in. x 26 ft. planing length, built for machine shop in Alabama. The work shown on the table is a number of sugar mill housings having a combined weight of more than 64 tons. The planer is equipped with two cross rail heads and two side heads having power rapid traverse. All four heads are shown working on this job which in itself is a great saver of time. One of the cross-rail heads is extended down into the pocket at the top of the housings. The planer is driven by a reversing motor and the cutting speed is 30 ft. per min. with a return speed of approximately 75 ft. per min. The height from the table to the top of the housings is 90 in. and the crossrail is shown in its highest position with all four heads working. This method of handling eight housings in one set up where they formerly handled them one at a time is a great time saver and can be duplicated on other large and bulky work.

Best Design Metal Planing Machines

The common practice on metal planers is to mount the side heads on the face of the housing, arranging at the same time for a sliding movement for adjustment and feeds in both a vertical and lateral direction along these faces. In a good manw cases, and particularly on the smaller and lighter types of planers, this arrangement of mounting the side heads is very satisfactory. But there are many times, particularly on the larger and heavier machines, where the side head is too far away from the work for it to be used effectively on account of the lack of adequate support when the tool slide is extended.

The machine shown in Fig. 18 is one of the larger Betts planing machines of the new type which has a capacity of 13 ft. 2 in. between the housings, 8 ft. 2 in. under the cross rail and a planing length of 20 ft., which, of course, can be made any desired length. This machine is designed with a novel device, upon which a patent has been applied for, the purpose of which is to overcome the objection above referred to, as it enables the operator to adjust the side head close up to the work on the table as occasion requires and still have the advantage of a rigid support without excessive overhang of the tool slide. In other words, this design of planer gives the widest possible lateral movement to one or both of the side heads, retaining all the advantages of a wide planer with two uprights.

As will be noted in Fig. 18 the centre of the table is offset with the centre of the machine and the side head on the right hand housing will take care of the work without the necessity of extending the slide beyond a point where it does not receive proper support. The left hand side head is carried on a sliding base having its bearing at the top, on the under side of the cross rail, and at the bottom, on the foot of the upright. This base has a sliding fit on the underside of the cross rail and can quickly be moved in and out either by hand or by power. When it is in position it can be clamped to the cross rail as well as to the foot of the upright, on which it also has a wide bearing thereby making the whole construction practically one solid unit, and absolute alignment is assured at all times. It can be clearly seen that since this base, which is a steel casting, is held to the bottom of the cross rail, it will move up and down with the cross rail whenever the latter is adjusted for different heights, only requiring that the two clamps be loosened which clamp the base member against the foot of the housing.

When the base is fully extended it is flush with the side of the permanent upright and in this position the table will accommodate work the full width between housings, which in case of the photographs shown is 13 ft. - 2 in., when it is moved along to the right as far as it will go, it is right up against the side of the table. It is a very simple matter to move this base quickly by power from its extreme left hand position to its extreme right hand position. Both side heads are of course in line with rail heads so that no extra travel is required when taking cuts with rail heads and side heads at the same time which is a very important point on any planer having side heads.

Since this base which carries the side head has lateral movement which is easily controlled the operator can bring this tool right close up to the work without excessive overhang of the tool slide and thereby is enabled to take a much heavier cut than would otherwise be possible with overhanging tool slides. This construction can be applied to either the right or left hand side head or both as may be desired. All four heads are equipped with Betts patented feed and power rapid traverse arrangement. These feeds are entirely independent of each other in all directions. Thus the operator can take a cut with either one or both side heads while at the same time he can move the cross rail heads quickly along the cross rail by power rapid traverse or vice versa. The power rapid traverse to the heads as well as to the sliding base which carries the side head is operated through a double friction clutch by means of conveniently located gears, no shafts or idle gears are running when power rapid traverse is not used.

The same motor which raises and lowers the cross rail also furnishes power for quickly moving the heads, which as before stated can be applied to any one or more, while at the same time the others are used for regular feeding. The feed and power rapid traverse arrangement is absolutely fool proof. The table is of the original double plate box type construction, heavily ribbed, and is driven through all steel gears and steel rack. The driving power on this particular machine is furnished by a 75 h. p. reversing motor, giving cutting speeds of 20 to 40 feet and return speeds of 40 to 80 feet per minute. Forced feed lubrication is provided for the table tracks as well as for the driving gears and driving shaft bearings and the oil is filtered with a Bowser oil filter system.

The machine shown in Fig. 18 has the sliding base extended half way and is engaged in taking four cuts on a heavy steel casting used in connection with the manufacturer of steam hammers. It can be clearly seen that a heavy cut with the left hand side head supported in the usual way would be difficult if not impossible on a standard planer of equal size. This new type of planer will do practically all of the average work usually handled on an open side extension or convertible planer, and in addition it will handle the jobs more economically because all four cutting tools can be used to take heavy cuts. It has all the advantages of the open side planer combined with the well known rigidity and stiffness of the double housing planer.

Every additional piece of work that a planer will turn out represents not only a saving of interest of its cost but affects every item of shop expense. Therefore in the purchase of a planer, the first cost should not be the foremost consideration. The design of the tool in relation to the work to be accomplished should be carefully studied and a selection made only after a planer has measured up to certain specifications which govern good machine tool design.

Making the planer pay dividends, resolves itself to two special ideas. The first is to keep the planer busy by using it in quiet periods on a wide variety of work and the second is to keep as many heads as possible busy. A man in charge of a planer should never become imbued with the idea that it is only a necessary evil. The planer is a versatile machine. It is a precision machine, and intelligent thought given to planer problems will be found to pay good dividends on the time invested.

A Winnipeg despatch states that reports originating in strike circles across the line credit the railway shops in Winnipeg with making repairs on engines and rolling stock for American roads since the strike began. Officials there declare the rumors ridiculous. The Winnipeg shops are working full time preparing equipment to handle what is expected to be the biggest crop in the history of the west. They could not handle foreign rolling stock even if they desired or their men would consent.

Autobiography of Sixty-Four-Year-Old Engine

Born in 1858, Nine Years Before Birth of Dominion—Product of Dumfries Foundry—Cylinders Rebored Only Once in That Time —Still Going Strong With Chas. Barber & Sons, Meaford—Vertical Slide Valve Type—Has Passed Through Stirring Times

IT HAS often occurred to me that in any autobiography that I might be guilty of, it would be a difficult matter to establish certain matters pertaining to my birth. It seems reasonable to say that certain of the materials entering into my composition were originally in the shape of iron pigs, the ore from which came from a place I have often heard referred to as "the other side." Perhaps they brought my steel from the same place, but the fact that I wish to remember is that the castings, the pistons, the driving rods, and all that were turned out and assembled by the men of the Dumfries Foundry Co. in Galt in 1858. I understand that the firm has since changed its name to the Goldie & McCulloch Co.

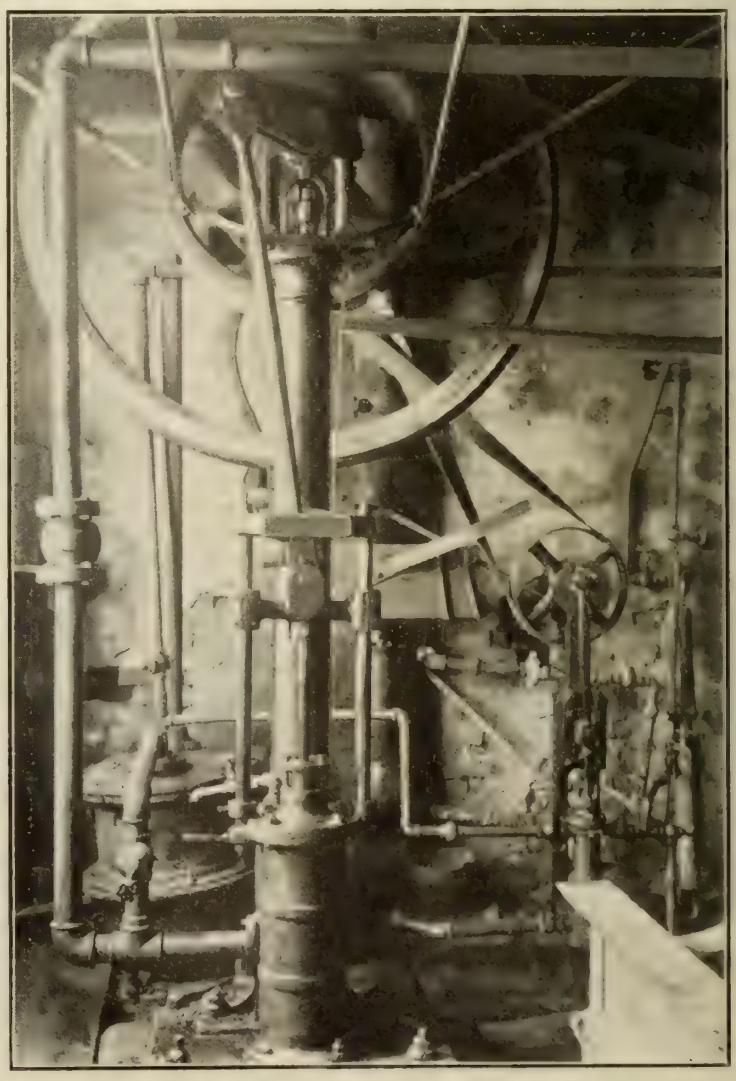
It seems absurd that a steam engine such as I am should claim to be a member of any particular sex. If I were a female person, does it not seem ridiculous that I should boast about my 64 years of age? Moreover, in that time I have heard so many names applied to me that I confess I am a bit confused. I recall that, when they had me crated, and ready for shipment, one of the men came up to me with a brush and pot of glue and asked some person where "this bird" was going. The reply was that I was going to a village called Leith, near Meaford, and that it was a mighty good place to go. Let me whisper that my first job at turning the wheels of industry was in a brewery. But they fed me on steam from water, and, in spite of my surroundings, I never missed a stroke. Well, an engine must age quickly, in appearance, for I hadn't been on the job very long before the engineer referred to me as an "old girl." I took this in good part, but imagine my consternation when one day about 10 years ago a party of men looked me over and one of them referred to me as "some baby," while it wasn't so long after, that some youth with no germ of reverence in his soul, called me an "old coffee grinder." I think it was the boss who replied that "if you have done your work as well as she has by the time you are 60 years of age, you will not have to view the future with alarm." I thought that was rather fine, and I certainly delivered the goods that day, but there again he seemed to classify me as feminine.

So I have concluded that the sex of the steam engine. like that of a mud turtle or a concrete mixer, is largely a figure of speech. I just want to say that I have been wedded to work all of my life, that I feel fit as a fiddle yet, and if I couldn't do a good day's work I wouldn't want to be here.

To return to the story. A few years happened and I was moved to the machine shop of Chas. Barber at Meaford. Call it the irony of fate, or just engine luck, whatever you like, but to come from a brewery to a place where they were making water turbines seemed quite a radical change. However, I had always been noted for my sobriety, and I understand that, at the present time the national drink is water and quite a few places that once were breweries are specializing in what are known as kickless libations. I have often wondered how an engine would behave if given a shot or two of "double distilled damnation." I overheard a man remark once that he had had a few shots and felt all "gummed up"; so I supposed that would be my experience. Nothing, not even a human being, can do a good day's work as a regular thing, on gummed cylinders. Believe me or not, just as you like, but I should know what I am talking about when I say that in all my 64 years' experience, I have only had my cylinders rebored once, and that is the only time I was ever shut down for any length of time. That, I should say, is a record. I suppose there are those who will say that had I been fed on an alcoholic substance, my cylinders would have given out long ago. All I have to say is, it depends on the cylinders.

During my lifetime, a lot has happened to Canada. I had just taken on my first job at a time when there was some kind of row between Upper and Lower Canada over representation by population. In those days Upper Canada had about one million and a quarter of population while Lower Canada or Quebec, had about one million. Galt, I may say, had about 5,000. John A. was a prom-

(Continued on page 30)



Steam engine built by Dumfries Foundry Co., Galt, sixty-four years ago. Still in operation in plant of Chas. Barber & Sons, Meaford.

Much Malingering Under Compensation Law

Board Reports Unusual Number of Complaints—Decisions Beyond Influence—Decrease in Accidents Due to Unemployment—Pensioners Seem Satisfied—Collective Liability System Working Well—Average Period of Widowhood About Three Years

CHARGES and complaints by employers of malingering and of employees being improperly kept upon compensation by doctors, under the Workmen's Compensation Act, have never been so frequent as at the present time. On the other hand, claims and applications for more compensation than is felt to be justified have never been so insistent. Even the good offices of persons supposed to have influence have at times been requisitioned, according to the 1921 report of the Compensation Board.

"Neither influence nor favoritism, pressure nor threats can be permitted to effect the broad decisions," the report continues, "any more than any of these things should be allowed to prevail with a court, a jury, or an arbitrator. Nor are they any more justifiable. It would be easier to grant requests which are not felt to be justified than to refuse them, but such a course would be a gross violation of duty and would soon bring discredit and disaster upon the operation of the act.

"Every care is used to avoid malingering, and as has often before been stated the board does not believe that malingering prevails to any serious extent. The accident frequency and the average time loss have varied but little since the act first came into operation."

Claims Decrease in Number

During the year the board paid out $6,189,263.49 in settlement of 45,191 accident claims. This shows a considerable decrease as compared with 1920 when compensations totaled $7,780,145.25 paid on 54,851 accidents. Fatal accidents numbered 386 in 1921 and 452 in 1920. This large sum meant an outlay of $20,637 per day, covered by 485 checks, while the reports of accidents averaged 151 daily.

The workmen's compensation act during its seven years of operation has dealt with 271,807 claims for which $27,947,653.45 was awarded in compensation and medical aid benefits. Employers pay the cost and the board merely distributes the money in a way that makes unnecessary all the claims for damages through the courts, which were so frequent in the old days. Now for every $100 of pay roll, the employer pays the board $1.12, and out of the huge sum of two and three-quarter billion dollars of pay roll in Ontario, industrial concerns have paid the province the money sufficient to meet nearly 28 millions in claims.

Those who benefit are not only the workmen crippled or injured in the industries covered by the act, but also widows, children and parents of workmen who have been killed.

The act, since it was first passed in 1914, has undergone a certain amount of evolution. Then the compensation provided for workmen was 55 per cent. of the loss of earning capacity, and for dependents a pension of $20 a month to the widow, with $5 a month for each child under 16. In 1919 these amounts were increased to $30 and $7.50 respectively, and to $40 for the widow and $10 for each child, in 1920. In the same year an amendment was added to cover the cost of all necessary medical aid as the result of an accident.

Simplifies Procedure

Distinguishing features of the act are collective liability of the employers in each class of industry, and simplicity and inexpensiveness of procedure. It differs from the old law which it superseded by covering all accidents arising out of and in the course of the employment instead of merely those which were caused by the negligence or breach of duty of the employer, and in substituting informal administration by a board for the technicality and stringency of court procedure. It differs from the compensation laws of most of the United States in making the employers in the various classes of industry collectively, and not individually, liable for payment of the benefits, though certain employers, such as railway and navigation companies, municipalities, etc., included in what is known as schedule 2, are upon the individual liability basis.

Regarding the system in operation, the report states: "The board feels there is no doubt as to the general superiority of the collective liability system. Individual liability, uninsured, would often ruin the employer and leave the crippled workman or his dependents without compensation. Individual liability, insured with private companies, is very much more expensive than collective liability administered as are the Ontario and other provincial acts. This is plain from a comparison of our rates with those of neighboring States. The reason is very pointedly shown in the last report of the Manitoba board, where the system was changed a year ago from individual liability with private insurance to collective liability. This report points out that under the former law 36 cents out of every dollar collected from the employer was allowed the insurance companies for expenses and profits. This was the percentage agreed upon between the companies and the board, after investigation, as being the proper and necessary allowance which the insurance companies should receive. In Ontario only two cents out of every dollar is absorbed in administration expenses. In other words, a dollar had to be collected in Manitoba to pay 64 cents in benefits, while in Ontario one dollar paid 98 cents in benefits. This means that if the system formerly prevailing in Manitoba were adopted Ontario employers would be paying $1.53 for every dollar of their present rate of assessment, or 53 per cent. more than they are now being charged. From 40 to 60 per cent. is in fact the percentage which it is usually admitted is added to the accident cost for the expenses and profits of private insurance"

An objection sometimes raised to the collective liability system was the possible lessening of incentive to accident prevention where the careless employer pays the same rate of assessment as the employer who takes precautions to avoid accidents. This objection had been met by a system of merit rating which has been in effect since 1917, under which as now applied a maximum difference of 55 per cent. of assessment is made between the employer with a good accident experience and the one with a bad experience, refunds up to 30 per cent. being made to the former and additional charges up to 25 per cent. levied upon the latter. Under this system $311,874.16 was refunded and $184,844.47 collected from employers for the year 1920.

There was also a provision in the act under which any employer who is flagrantly careless can be called upon to pay a special assessment, and this has been applied in a number of cases where such action was found to be warranted.

One of the reasons for the decrease in accidents in 1921 as compared with 1920 was the decrease in industrial activity and consequent unemployment.

For 1920 the average cost for each compensation case was $168.91 plus $26.28 in medical aid, as compared with $144.14 and $19.85, respectively in 1919.

For medical aid only cases $77,749.15, or an average of $5.00 for each case, was expended. In 1919 the average cost was $4.23.

There was spent for temporary disability $1,617,231.73, of which $1,184,660.92 was for compensation and $432,570.81 for medical aid. The average costs were $52.08 for compensation and $19.02 in medical aid, or a total of $71.10 for each case as compared with $55.01, of which $39.48 was for compensation

and $15.53 for medical aid, in 1919.

Permanent disabilities cost on the average $989.58, for which $189.39 was for compensation for temporary disability, $714.48 compensation for permanent disability, and $91.71 for medical aid. Comparable figures for 1919 are $128.74, $538.94 and $55.26, a total of $722.94 For compensation in permanent disability cases in 1920 there were expended $2,189,905.45 in compensation and $223,673.78 for medical aid.

On the average, deaths cost $3,778.89, of which $19.72 was compensation for temporary disability, $3,613.15 benefits to dependents, $96.25 for funeral expenses and $49.77 for medical aid. The total cost of deaths was $933,387.19, of which $291,094.06 was for compensation and funeral expenses and $12,293.13 was for medical aid. For 1919 cases, the average costs were: for compensation for temporary disability, $23.19; death benefits, $3,596.84; funeral expenses $72.50; and medical aid, $35.06; total, $3,727.59.

Great Variety of Causes

Mechanical causes were responsible for 12,881 cases, or 31.42 per cent. of cases, as compared with 32.75 per cent. in 1919, 35.92 per cent. in 1918, and 31.70 per cent. in 1917.

During 1920 there were 8,227 cuts, lacerations, and punctures, 5,459 bruises, contusions, and abrasions 2,561 crushing injuries, 1,856 fractures, 1,714 burns and scalds, 1,561 sprains, strains, twistings, and wrenchings, 775 eye injuries, 195 dislocations, 77 hernia, 56 cases of concussion, 10 cases of internal injuries, 10 industrial diseases, and 245 cases of other injuries causing temporary disabilities.

Of the 2,439 cases of permanent injury, there were 321 cases of disability exceeding ten per cent. of that earning capacity, as compared with 308 in 1919. There were altogether 151 cases of permanent injury to eyes. There were 15 cases of disfigurement, 1 case of loss of sense of smell, and 6 cases of impairment of hearing. There were 14 cases of permanent total disability, as compared with 12 in 1919 and 28 in 1918. These cases divide: loss of use of both hands, 1; loss of use of both legs, 2; loss of both legs, 1; loss of both eyes 2; paraplegia, 2; hemiplegia, 1; hypochondria, 1; mental confusion, 1; insanity, 2; general debility, 1.

There were no cases other than of temporary disability caused by industrial diseases in 1920. There were 10 cases, one each of anthrax and mercury poisoning, and, 8 cases of lead poisoning.

The board has made an exhaustive study of the separate cases in which pensions were awarded to the families of men who were killed in accidents.

In the 1,374 cases in which pensions were awarded there were 3,530 dependents. There were 1,187 widows, 2,117 children, of whom 64 were posthumous and 3 invalids over age 16, 123 mothers, 59 fathers, 7 grandchildren, 2 grandparents, 24 sisters, 9 brothers, 1 aunt, and 1 foster-mother of dependent children.

Statistics on Widowhood

Of the 1,187 widows drawing pensions in 1920, 168 have re-married. In these cases it was found that the average period of widowhood was 2.88 years. Fifteen re-married inside of a year, 35 during the second year, 55 during the third, 24 during the fourth, with a decrease each year to 7 in their seventh year of widowhood. The age of widows at the time of re-marriage shows the largest number, who gave up single blessedness was between the ages of 30 and 35, who numbered 47 as compared with 34 between 20 and 25, and 33 between the ages of 25 and 30.

That pensioners are satisfied with the workings of the board was revealed in the enquiry conducted to obtain various particulars regarding each case. On this point the report states:

"The pensioners were asked to state any complaint which they might have. Response was made in nearly every case. In seventy cases only out of 1,042 cases of pensions a complaint was made; in the other cases the pensioner replying either stated there was no complaint or made a commendatory statement; and in one hundred and sixty-eight cases failed to send in any response.

It is the policy of the board to encourage the "safety first" movement and a total of $46,696.23 was paid in 1921 to safety and accident prevention associations.

AUTOBIOGRAPHY OF ENGINE

(Continued from page 28)

inent Conservative in those days, while George Brown was one of the advocates of reform. Things were shaping towards Confederation and I was some engine on that 1st of July, 1867, our first Dominion Day. I remember the American Civil War, which Canadians helped to win, and also that first of June in 1866 when the Fenians crossed over at Black Rock near Buffalo and threatened to clean up Canada. However, I still plugged away, and was pleased to learn shortly afterwards that the Fenians had returned home, not without losses, and that these unfriendly acts were stopped.

Among other events of an unpleasant nature that have occurred in my day was the Red River rebellion in 1869, when Louis Reil, and some French and half-breeds on the Red River, resented the action of the government in taking over the Northwest. This trouble was crushed, and the country settled down to business. I want you to know that I was shaking a pretty mean piston when Winnipeg, then Fort Garry, was in the making. I was in fine shape during the building of the Intercolonial and the Canadian Pacific railways, and have passed through all kinds of those political crises which seem necessary in the building of a young country, and it is some source of satisfaction that the country and I have come through it unscathed and still have a future. I think it was during a political campaign that I was bored for the second time in my existence.

The Northwest rebellion came along in 1885, and was short-lived, as was also Louis Riel, once they nabbed him. Then fourteen years later, occurred the South African war, and Meaford sent some of her boys in the first contingent to aid the Motherland. Maybe I didn't regret that I was only a steam engine in those days, but I did the next best thing and kicked out a good day's work at home. Then, in 1901, the whole country mourned the death of Queen Victoria. It was not long after this that the Duke of Cornwall and York visited Canada.

You must remember that during all of these years, Canada has been growing by leaps and bounds, not only in population, but in development of resources. When I was but a kid, they still illuminated the streets with coal oil lamps, and the houses to. Horses were used for Toronto street cars. If a person wanted to go anywhere he probably went on horseback. It took three or four hours to drive over to Owen Sound, and here I want to say that I hope I'll live to see the day when there will be some kind of railroad running over to that town. To drive that distance in winter time is no joke. Well, now we have gas and electricity and these have brought about great changes in methods of doing things. To add to the pep of the times, along came the motor car, and the internal combustion engine and aeroplanes, all that sort of thing. Speed and increased production have supplanted the methods of saddle days. I want to claim a certain amount of credit, for I have had some share in it all, having helped turn out equipment used to generate electricity. Interesting, is it not, to think that an engine of my age should be identified actively in a modern engineering plant?

The most tremendous event of my career was the world war. This was a gigantic struggle, and early in the game I could see that it was going to demand the best in all of us. We were pushed to the limit, but again came through victorious. The fact I want to press home here is that a lot of things, some big and some little, some good and some bad, can happen in the course of sixty-four years, but if you are made of the right stuff, stick to business and measure up to its demands, you are bound to come through. Take it from one who knows more about revolutions than Ireland or Mexico put together, the man or engine who minds his own business, and does it well, won't have time to get into trouble.

There goes the whistle, and I guess they'll choke me off for the night. Take a look at my picture. I'm of the vertical, slide valve type, and differ somewhat from my more graceful, modern brothers or sisters. But though I may be odd looking, I know something about "the amplitude of time," and don't owe anybody anything.

Recent Developments in Mechanical World

The Metric System by Easy Stages

WITH THE object of accelerating the introduction of the international metric system, the Decimal Association of London, England, now recommends gradual modification of the existing Imperial system of weights and measures. For instance, states Hardware and Machinery, it is proposed that the existing table of avoirdupois weights would be greatly simplified and that closer co-ordination with the metric system could be secured by the present adoption of the following interim table: 7,000 new grains, 1 metric lb.; 16 new drams, 1 new oz.; 16 new oz., 1 metric lb.; 2,000 metric lb., 1 metric ton. The metric lb. and its parts would weigh about 10 per cent. more than the Imperial lb., and 2 such metric lbs. would be exactly equal to 1 kilogram. The suggested abandonment of all the present confusing intermediate denominations of weight between the pound and the ton simply follow the practice already successfully established in the United States of America, and also in some of the British colonies.

Unique British Hydro-Electric Installation

A WATER power station with some original and most interesting features has just been completed in Scotland. A small head of water had been used for a long time in driving two mills by old-fashioned breast wheels. Owing to the increasing demand for power, states a writer in Hardware and Machinery, the question of re-organizing the installation became pressing. It was eventually decided to use the water power for generating electricity, and to augment the supply of water power by arranging a high level reservoir into which water could be pumped during the hours when the mills were not working. Actually the mills work for about 50 hours per week. During these working hours the water runs down from the high level reservoir through the same pipe up which it had previously been forced, and it drives a Pelton wheel, which generates the additional power required. This plan has frequently been discussed by hydraulic engineers, especially in connection with tidal power.

Protecting Iron and Steel

RAPID PROGRESS has been made in acquiring that knowledge of the relation of pigments and finished paints to corrosion which is necessary to a better protection of iron and steel. Predictions founded on theory that a basic paint, or one containing a chromate pigment, would inhibit rusting, while one made up from lampblack or graphite would accelerate rusting, have, in the main, been found correct. The effect of the pigment upon the character of the oil film making up the paint, however, has shown itself also to be very important. Many basic pigments, says the Valve World, such as basic lead carbonate or zinc oxide which in themselves inhibit, do not withstand the weather; lampblack and graphite, on the other hand, make a very impervious and highly resistant paint film. The logical conclusion in protecting iron is, therefore, to use a basic pigment and a little lampblack, and when well dried out to apply a lampblack or graphite finishing coat. Experience has shown also the importance of brushing the paint well on to the iron; a good paint may fail on account of poor application.

French Railways Adopt Petrol Motors

FOR SOME time past, the French State Railways have been carrying on experiments to ascertain the possibility of using petrol-driven motor traction on lines on which traffic is limited. These trials have, states The Engineer, given very satisfactory results. A 60 hose-power motor weighing 14 tons and drawing a carriage weighing 10 tons easily reaches a speed of over 30 miles an hour, the speed being very slightly reduced when a second carriage is added. On local lines of normal gauge it is estimated that motor traction would enable a saving of from 5f. to 10f. per kilometre to be made, the present figures for steam traction being more than 14f. M. Le Trocquer, Minister of Public Works, who has been following the experiments with interest, considers that the results obtained are sufficciently satisfactory to warrant a circular to all Prefects of Departments, asking them to study the possibilities of applying traction by petrol motors to the departmental railways. Local railways have been much affected by the present high working expenses, which are not balanced by the increase in fares. It is estimated that the operating cost may be halved by the adoption of petrol-motor traction on many of the smaller local lines.

Life of Buried Steel Oil Tanks

SOME investigations carried out in America on the life of buried steel oil tanks, on behalf of insurance associations, showed that:—(1) Cinders stimulate corrosion probably because of the electrolytic action between the steel and the carbon in the cinders. (2) The best soil coverings given in order of protective quality are: oily sand, sand, gravel, clay, loam and cinders. (3) Red lead followed by asphalt gives the best results as protective covering. (4) Tide-water and ground water do not stimulate corrosion to any great extent. (5) If a tank is buried below the zone of active oxygen it is usually below the zone of corrosion. (6) Steel tanks buried under favorable conditions should last more than thirty years. In damp ground they will last from fifteen to twenty years, states The Engineer. To resist corrosion best steel tanks should be coated with red lead and asphalt and buried in clean sand 3ft. or more below the surface, avoiding ground water and tide water if possible.

Carrying Capacity of Bearings

EXPERIMENTS at the British Bureau of Standards determined the maximum safe load and static friction under loads of ball and flexible roller bearings. Tests were made on balls of 1.25in. and 1.50in. diameter in grooved races and on rollers 1.25in. in diameter and 5.25in. long in flat and cylindrical races. The total deformation and area of contact of bearings and races, says Practical Engineer, were measured and compared with Hertz's theory. The results agree roughly with Hertz's theory. The differences are ascribable to inhomogeneity of the material. The ratio of friction to load is practically constant and equal to 0.00055 for all three sizes of balls up to a "critical" load, which varies with the diameter of ball—1,300 lb. for 1.00in., 1,700 lb. for 1.25in., and 2,200 lb. for 1.5in. balls. A similar "critical" load, 25,000 lb., was found for the roller bearings with a ratio of friction to load equal to 0.00075. This "critical" load at which the friction began to increase more rapidly was in all cases lower than the safe load as determined by permanent deformation and as calculated from Stribeck's law.

Iron being the base of the mechanical, and sulphuric acid the base of the chemical arts, Ontario ore seems to be the answer.

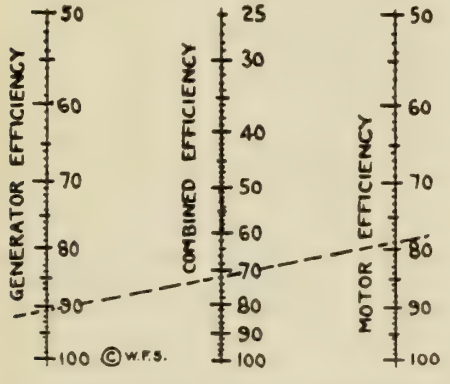
Practical Ideas From Practical Men

WHAT IS THE COMBINED EFFICIENCY?

By W. F. Schaphorst

In the electrical transmission of power we always have at least two efficiencies to consider—the efficiency of the generator and the efficiency of the motor. Where the distance between generator and motor is great the line efficiency also must be considered, but in most factories and shops using electric power distribution the line efficiency is so nearly 100 per cent. that it can be neglected. I have therefore neglected line efficiency on this little chart.

For example, if the efficiency of the generator is 91 per cent., and motor 79 per cent., the dotted line drawn across this chart shows the combined efficiency to be 72 per cent. The chart will figure



any combination where the efficiency of either generator or motor is over 50 per cent.

One of the much mooted questions is: which is best—electric or belt transmission? The answer is: "It all depends on conditions." The object of this chart, therefore, is to help you answer the question for yourself. With ball bearings and low belt tensions the efficiency of belts and shafts may reach a very high figure—95 per cent. and over. That is a point that must be taken up with the manufacturer. But if it is made certain belt transmission will provide even 80 per cent. efficiency that, in most cases, would eliminate the electric drive, although, of course, efficiency is not the only thing to be considered.

To assist users of the chart I give these average efficiencies of generators and motors at full load: Direct current generators—50 Kw, 90 per cent.; 100 Kw, 91 per cent:; 1,000 Kw, 93 per cent—Motors, ¾ h. p., 64 per cent.; 5 h. p. 80 per cent.; 15 h. p., 84 per cent.; 30 h. p., 90 per cent., 150 h. p., 92 per cent.

Alternating current generators: 50 Kva. 90 per cent.; 100 Kva, 91.5 per cent.; 500 Kva, 94.5 per cent.; 1,000 Kva, and over 95 per cent.—Motors, 1 h. p., 76 per cent.; 10 h. p., 85 per cent.; 100 h. p., 90 per cent.; 200 h. p., 92 per cent.

DIFFICULT PATTERN PROBLEM

By D. A. Hampson

Machine shops come in contact with architects but little, and vice versa, though occasionally a blue print from the building profession does find its way into our realm. It was in connection with the new bank building in town that we once more encountered an architect's design, this time as a request for a price on the part shown by Fig. 1.

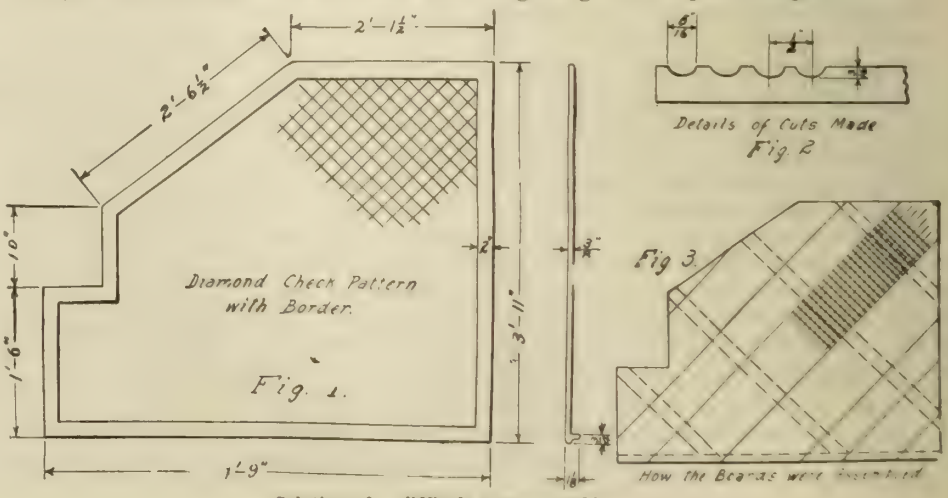
An examination of the drawing shows that it requires a pattern less than half an inch thick and roughly 47 in. x 57 in. Also that this area is covered with a series of diagonal grooves as shown at Fig. 2—over two hundred and fifty in all—which end in a plain border all around. Everyone familiar with the mechanical trades will say at once that such a design is ridiculous—that two pieces of steel corrugated floor plate could be welded together at a fraction of the cost of the pattern alone and be a better job, that the cost of making one such pattern for one casting is entirely out of proportion.

We knew all of this, and the more we studied the drawing the less we felt inclined to quote on the job. Those who have had experience with diagonal grooving jobs will agree with us that such work is the most deceiving of all the simple jobs that crop up, both as to speed and cost and to accuracy. To set a saw gauge at an angle, pass your boards over the saw, and expect your cuts to come out evenly spaced and parallel is a seeming impossibility. Even if you have a series of holes or slots for spacing and have the assistance of a second person to help keep the boards in place and to support these exasperatingly long overhanging ends, you have the same trouble.

In this case, we called up the builder and told him frankly that no engineer planned that piece, that it would cost the best part of fifty dollars to get out the pattern, and that we didn't want the job. He countered by saying that it would take too long to correspond with the architect in New York and for us to go ahead and make the piece as cheaply as possible. Well, when a disagreeable job is forced on you, you usually get it out of the way as soon as possible—and that's what happened to this stair casting.

The solution was so simple that it is ridiculous, yet in half a dozen cases of this kind, no one has thought of that way out. Fig. 3 shows how it is done. We had a grooving tool of the desired radius and, aside from that nothing but the cut-off and ripping gauges on the saw were used. One man did the work alone. A sufficient number of ⅜ in. boards were gotten out and jointed carefully on the edges. Then each board in turn was placed against the cut-off gauge and grooved across the grain, spacing by means of a latch dropped into a notched bar which was part of our regular pattern shop equipment. Next the boards were grooved lengthwise. This gave us the diamond check pattern required, but at an angle of 45 degrees to the outsides of the piece as detailed, which was easily remedied by the "solution" by cutting off the edges of the boards to the same angle.

Referring to Fig. 3, it will be seen that the diamond effect is obtainable this way and that by placing battens, as indicated by dotted lines, the assembly was made reasonably secure. The molding rib along one edge, also helped to stiffen. Thus a fairly good pattern was made up for about half what we thought possible. The boards were grooved clear to the ends and the plain border was obtained in the foundry by the molders measuring off a two-inch strip and sweeping away the impression of the grooves from there to the edges. The casting came out well and we felt that we had contributed much toward making "a go" of a poor design.



Solution of a difficult pattern problem

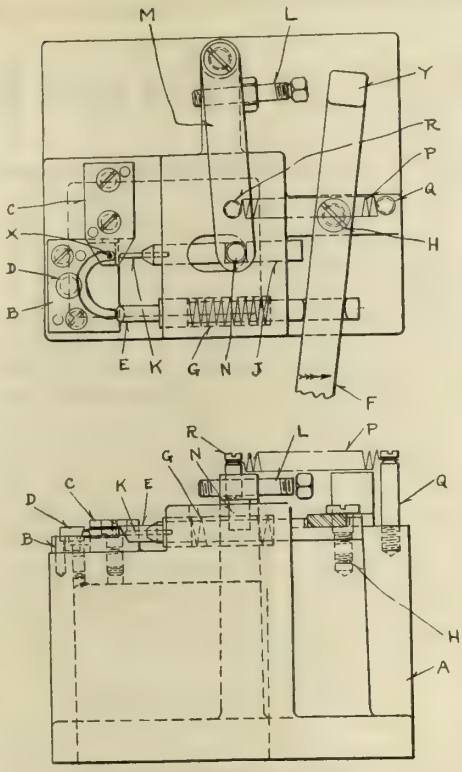
A LEVER OPERATED DRILL JIG

By F. Scriber

For the speedy manipulation of parts to be machined and for handling clamping members the operative mechanism used in the drill jig shown by the accompanying illustration provides a striking example of plunger and lever arrangement for both the holding while drilling and the ejection following the drilling of small work. This shows one operative lever only for performing both the clamping and removing of the part being machined this lever being used to operate all of the attendant mechanism, the various units being as follows.

The base of the jig is indicated as A and this is made of cast iron. Held to the upper side of this by screws and dowels is a hardened steel block B which is grooved out to locate the work; a block C is likewise held to the upper side of A this being used to locate the work radially and also to hold down the end of the work where drilled at X. This block is machined out to suit the work and also to act as a stop for the same. At D a pin is provided which is grooved to fit the contour of the work, while a plunger E having a beveled end which comes in contact with the work holds down the same and pushes it against the stop at X. To operate this plunger E a lever F is provided which enters a notch cut in the plunger. This lever is used to pull back the plunger as a spring G pushes it forward to its clamping position. This lever pivots on stud H. At J another plunger is provided in the end of which is a pin K, the object being to strike the end of the work when lever F is pushed in the direction of the arrow. The end Y of the lever strikes screw L held in short lever M, in the end of which is a pin N passing through an elongated slot in the casting and entering a slot cut in the plunger J. These parts, with the exeception of the spring P attached to pins Q and R for pulling back this ejecting arrangement, completes the construction of this drill jig.

In using this tool an operator puts the work in the groove of block B as



Lever operated drill jig.

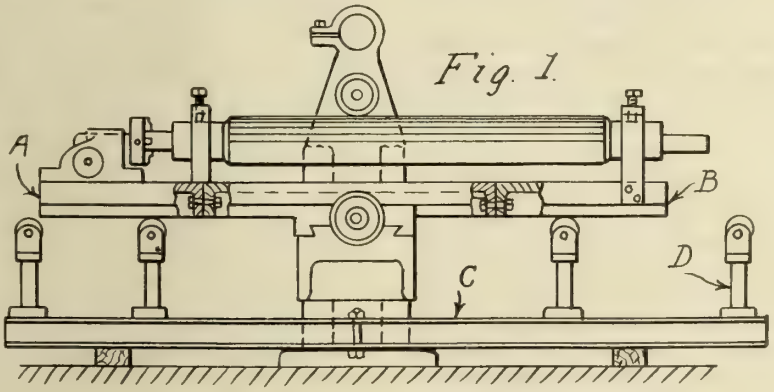
shown, at the same time holding back lever F and in turn spring pin E. When lever F is released the spring securely holds the work in place and requires but a few seconds of time to handle. Upon the completion of the drilling operation the act of pushing back lever F causes the plunger K to strike the work, thus knocking it out of place with a circular movement, permitting it to be readily pushed to one side by hand for the insertion of another part. The simple completeness of this drill jig and features of construction are of such a nature that they readily suggest themselves for use in tools for quantity production.

EXTENSION TO MILLING MACHINE TABLE

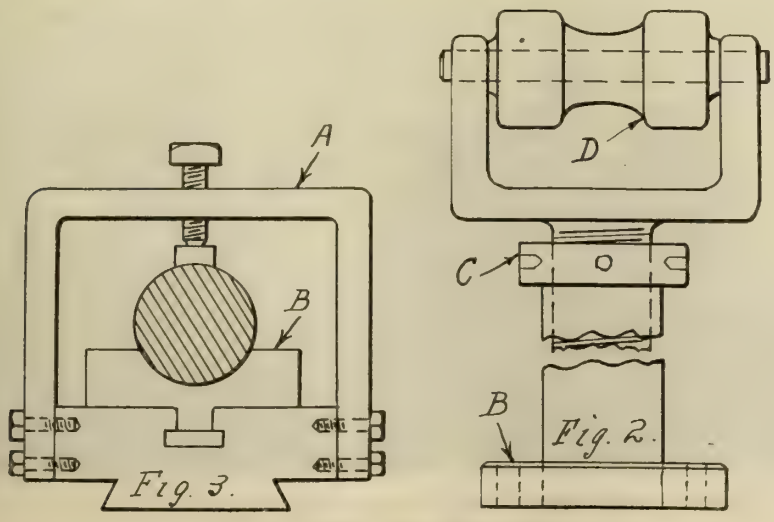
By Geo. Barrett

In most machine shops, where special machinery is made, the foreman is frequently required to provide ways and means of producing the work with the limited equipment in his shop. The sketch Fig. 1 shows the extension to a milling machine table, which was designed in order to mill the corrugations in large paper mill rolls. These rolls were previously imported from the States and the saving in cost of transportation, duty and exchange more than paid for the expenditure for the attachment here shown.

This consists of two additional lengths A and B fixed to the ends of the table proper. There is also a six-inch I-beam C, which is bolted to the base of the machine to carry four supporting rollers D. These are shown in detail in Fig. 2, the column A being made of 3 in.



Extension to milling machine table.



Details of table and work supports.

iron pipe and screwed into flange B. The vertical adjustment is made by the rotation of the ring nut C, which raises or lowers D to desired position. The massive weight of these rollers would not permit them to be carried on the centres of the dividing head, so this difficulty was overcome by making a special rest D, Fig. 1. This rest consists of a machine steel strap which is bent to the width of the table and bolted to same on either side. The main member B is made of cast iron, machined all over, having a tongue on bottom to fit slot in table, the circle being laid off and bored to suit the required height of dividing head centre. These rollers call for great accuracy on account of working in pairs and if one is out of true it would cause and paper to tear. The fixture described has been used on quite a number of rolls with good results.

New Things in Shop Equipment

REGRINDING MACHINE

An 18 x 72-in. autopart regrinding machine that has a greater capacity than previous ones of the same make has recently been placed on the market. Power-driven table traverse is provided, and the machine can be operated by belt from line shaft or from a motor located at rear of machine. It can be readily adapted to all classes of cylindrical grinding. The general dimensions are similar to those of the 18 x 55-inch machine made by the Norton Co. of Worcester, Mass.

PLAIN CYLINDRICAL GRINDER

A recent addition to the Norton line of grinding machines is one that has been developed to meet the demand for high production but occupying less space than the 10 in. machine, by shortening the distance between work centres. The latest grinder has a centre distance of 18 inches, as it was felt that this would accommodate a very large group of parts to be ground, particularly parts produced by automobile companies, and accessory makers. This machine is manufactured by the Norton Co. of Worcester, Mass.

SURFACE GRINDING MACHINE

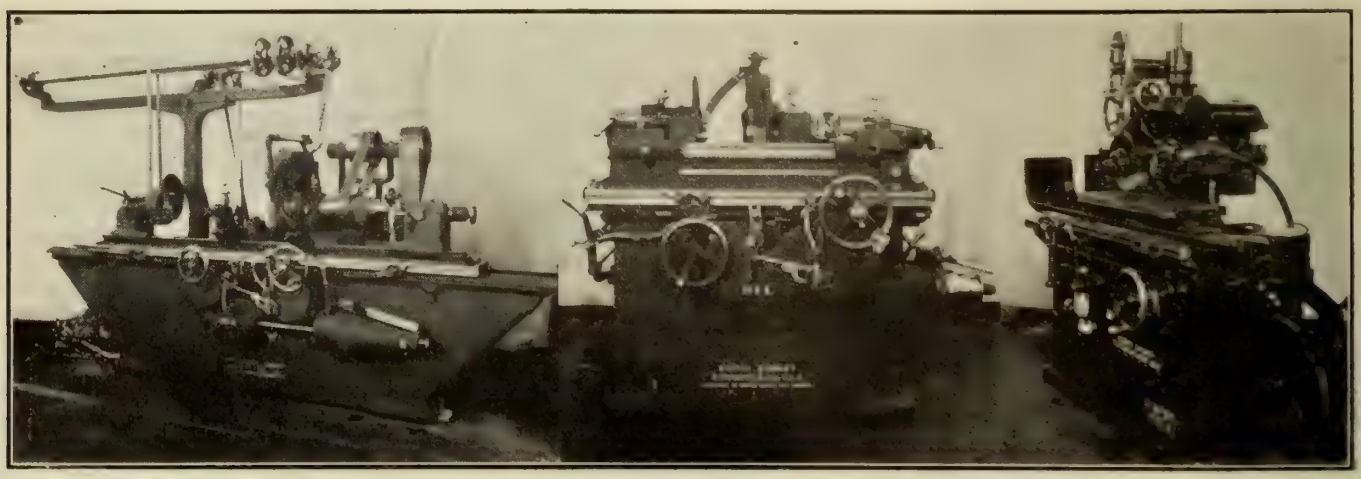
A new design of precision surface grinder intended for high production work, has just been offered to the trade. The table surface has an area of 36 in. x 6 in. and has a capacity of work to a width of 8½ in. The clearance between 10 in. wheel and tables is 10¼ in. A notable feature of the machine is the improved spindle construction. This consists of thumb screw adjustment for both end and radial thrust and flood lubrication. The thrust is taken by hardened steel flange running between bronze washers. The wheel spindle operates at 1,342 r. p. m. and is driven by a 4 in. belt. A 15 h. p. motor is belt connected to the main drive shaft which runs at 815 r.p.m.. Table travels at a speed of 80½ ft. per min. The hand traverse mechanism engaging automatically when the power traverse is disengaged. Power operated vertical feed can be given to the wheel, each graduation on the index wheel representing a movement of 0.00025 in. A portable tank is provided for the cutting lubricant, and this tank can easily be removed and cleaned without interrupting the operation of the machine. The machine weighs about 6,500 pounds and occupies a floor space of 10 ft. 8 in. by 5 ft. 3 in. This grinder is manufactured by the Norton Co. of Worcester, Mass.

INSIDE MICROMETER

A new low range inside micrometer has recently been developed and placed on the market. This micrometer, graduated to read thousandths of an inch, has the usual half-inch run of spindle with a measuring range from 2 in. to 32 in. It embodies the unique sturdiness of the previous style of micrometer of this make and retains the regulation diameter of barrel, spindle and thimble the extra large surfaces allowing for figures of generous size. The rods, fitted with hardened tool steel anvils adjustable for wear, are interchangeable on the threaded stud at end of micrometer head and can be used in combination. A detachable handle is furnished and so arranged that the micrometer can be used for right or left-handed work, a feature peculiar to this tool. The standard set packed in a pocket-size case consists of the micrometer head and adjusting wrench, five rods and one half-inch spacer, the capacity afforded being 2 to 7 inches. When five additional 5-inch spacers are used the maximum range of 32 in. is secured. Thus the tool is capable of gaging the smallest automobile cylinder and will take care of the larger measurements in shop use.

The inside micrometer can be quickly transformed into a height gage by use of height gage attachments. By attaching a rod of proper length to the micrometer any desired range from 3 in. to 32in. can be obtained. The rod is inserted downward through the steel case-hardened base until the anvil finds the surface from which measurement is to be taken. A quick-clamping knurled nut easily operated by the fingers, firmly holds the measuring rod in a perpendicular position. Such a tool is useful in obtaining the height of projections from plane surfaces, the location of bushings in jigs, etc. It is particularly convenient on planer work which often requires measurements to be taken from the bottom of a groove to points above and for setting planer tool or the milling machine table. The V-shaped groove in the bottom of the base adapts the tool for use in cylindrical works, measuring distances between shafts for alignment purposes, etc. By inserting a .250 inch drill rod in the base and attaching any standard indicator, a surface gage is in readiness for use in straightening shafts so for checking variance in distance between surfaces. A surface gage scriber can be easily clamped to the rod, forming another handy tool.

This differs from the height gage-alignment attachment No. 6 in construction and is intended mainly for height gage purposes. Having a larger base area than similar low-priced attachments, greater stability is insured. The reamed hole, which fits the sturdy measuring rod to a nicety, is also greater in size and depth. The upper end of support, vertically split at right angles, is adjusted to afford a sliding friction as the rod is inserted and will tend to



Left: Regrinding machine. Centre: Plain cylindrical grinder. Right: Precision surface grinding machine.

prevent side play, should wear take place from constant use. It also holds the base and micrometer measuring rod intact when the tool is lifted from one surface to another, while its knurled exterior is convenient in handling. These tools and attachments are manufactured by the Reed Small Tool Works, Worcester, Mass.

SLOW SPEED DRIVE FOR BORING MILL

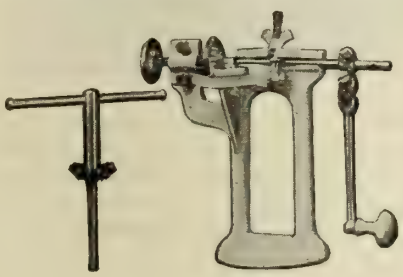
The mechanism that permits the slowing down of the speed of a boring mill spindle has recently been developed and placed on the market. By the addition of this mechanism a boring mill may be slowed down so as to perform the turning of tires on the same machine at a much slower speed. The attachment consists of a set of sliding gears, so that by sliding the small upper gear into the clutch of the large upper gear, a direct drive can be obtained so as to utilize the regular speed of the boring mill. A special cover is provided to protect all the gearing and also the shifting rod for sliding the gears into engagement. The arrangement makes a machine capable of both very high and very low speeds, and the device does not interfere with the operation in either range. These attachments are made by the Cincinnati Planer Co., Cincinnati, O., and have been designed for application to their own machines.

TRIANGLE BENCH SAW

An interesting type of portable bench saw has recently been developed and placed on the market. This saw is made in two sizes, the smaller one designed for cutting metal ⅛ to ½ inch dia. and the larger cutting from ½ inch to 1 inch dia. This saw is operated by ⅛ h. p., 110 volts, enclosed motor, arranged for either a. c. or d. c current. The shaft spindle is driven by means of worm gearing at a speed of 110 r. p. m. Provision is made for greater speed when cutting soft material such as brass and copper. Circular saws are hollow-ground and are 3½ inches in dia. x 1/32 inch thick. Work holding device is equipped with handle that permits of very rapid operation in clamping. The device clamps and holds square, round or hexagon stock without any change in the arrangement. An adjustable stop is provided for cutting the pieces off to the desired length. It is stated that rods of 3/16 inch diam. have been cut off with this machine at the rate of 18,000 ft. per hour. The machine weighs about 20 lbs. and is manufactured by the Triangle Metal Products Corporation, Rochester, N. Y.

VALVE REFACING LATHE

A small refacing machine for repairing valves of all kinds has just been placed on the market. This lathe is designed to be mounted on the bench or held in a vise and is adjustable to take any valve ¼ in. to ½ in. steam diameter and valve head up to 2¾ in. diameter, therefore its range of work is practically unlimited pertaining to its use in the automotive field. By lifting a gate in the top of the lathe, the valve may be laid in a V channel which acts as a guide for the valve stem while a tension screw holding the gate against the stem allows the valve stem to be rotated freely, yet it prevents chatter and vibration or a springing or distortion of the valve while in cut. The centering adjustment of feed control is mounted on a sliding block, traveling on a guide insuring accurate centers and even tension of the valve against



Valve Refacing Lathe.

the cutter, refacing the valve in perfect alignment with the stem, therefore a very meritorious feature of recognized importance is embodied in this tool.

Mounted on a very firm base is the cutter which is held in place by two screws, one acting as a pivot on which the cutter swings to the desired angle or degree while the other screw acts as a lock on the adjustment, holding the cutter firm and rigid. The crank which is attached to the end of the valve stem to revolve it against the cutter, is provided wih a tension slot and several adjustments to meet the varying valve stem sizes. Application of this crank will not mar the stem as no set screw or other cutting edge comes in contact with the stem. This lathe is substantially built, combines no complications or delicate parts and is universaly adjustable to all work within reasonable bounds. It is built by the R. S. Whitney Manufacturing Co. of Lewiston, Maine.

HIGH-SPEED TAPPING ATTACHMENT

A high-speed tapping attachment with a capacity of 3/16 inch taps in steel and ¼ inch in cast iron or brass has recently been placed on the market; the entire weight of the unit is only 3¾ lbs. The drive, both in the forward and reverse direction, is obtained through friction clutches. The drive is by means of two cones, the upper one directly connected to the shank which fits into the drill spindle. By means of a train of gears both cones are driven at the same time in the opposite direction. Between these two cones is a third conical member faced with leather on both sides. This centre cone is mounted on the spindle driving the tap by means of an Oldham coupling, so that it is free to centre itself on the two other cones, and does not tend to throw the spindle out of alignment when driving. The tapping spindle is carried and supported in a bearing in the lower half of the aluminum housings. Oil is delivered freely to the upper and lower bearing but provision is made for preventing the oil from reaching the leather friction surface. Phosphor bronze bearings are provided for the hardened and ground steel journals. The construction of the device permits the thrust to be transmitted to the main drill spindle. Owing to the purchase drive the speed of the tap can be regulated by means of the pressure applied to this spindle. A special type of tap holding chuck is provided which protects the tap against breakage, as it permits the tap to follow a drilled hole, in case the spindle is not in exact alignment. This device is manufactured by the Eastern Tube and Tool Co., Brooklyn, N. Y.

SCREW CUTTING DIES

An addition to the line of reliable two-part screw cutting die has recently been placed on the market. All commercial sizes are being manufactured. A special feature of the die is the manner in which the face is ground, so that the chips curl ahead of themselves instead of allowing them to fill and plug the clearance spaces. The principle applied is that of the comparatively well known "gun" tap to secure the same effect when cutting internal threads. It is claimed that the chips cannot become wedged in the clearance spaces and therefore cutters are less likely to be broken. These dies are manufactured by Conant & Donelson, Conway, Mass.

HIGH-POWER FILING MACHINES

A large-capacity high-power filing machine has recently been placed on the market. The length of the stroke is adjustable by means of an eccentric inside the column which is easily accessible. The eccentric is connected to the vertical sliding mechanism by means of a telescopic connecting rod, which permits the use of files from 3 to 14 inches long. A counter weight is provided for balancing the moving parts. The table has a surface of 24 x 30 inches and tilts for draft for clearance in four directions. The work clamping arm swings over the table and the pressure with which it holds the work down on the table can be regulated. By means of a cam inside the cone pulley the file on the upward stroke is given 1-32 inches relief. A constant flow of air on the file keeps this free from cutting. The lower arm can be adjusted so as to bring the edge of the file in line with the surface being filed. A four-step cone pulley provides speeds ranging from 80 to 320 strokes per minute. The length of the stroke varying from ½ to 7 inches. A half h.p. motor is provided, operating at 1,800 r.p.m. This machine requires a floor space of 22 x 38 inches and weighs approximately 700 lbs. The machine is manufactured by the Oliver Machinery Co. Grand Rapids, Mich.

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Cost of Pig Iron Production

BUYERS of pig iron are sometimes at a loss in seeking an explanation of prevailing prices at 100 per cent. higher than those of eight years ago. The boast of $1.50 five weeks ago was not introduced without some protest reaching the producers, asking them to reconcile differences as between now and then. They were accused of an unwillingness to take losses on high-priced material "carried over." This charge was refuted as having absolutely nothing to do with present prices of pig. When one considers the high price of coal, as compared with that of 1914-15, he confronts an item that has contributed to upward trends in almost every line of industry. At that time coal was selling at $1 per ton at the pit, whereas it is doubtful if it has sold under $2 since 1920. Coke laid down from Detroit is about $12. Labor in the days of low prices was available at 16 and 17 cents an hour. It takes an average of four tons of material to make one ton of pig iron, in proportions of two tons of ore, one-half ton of limestone and one and a quarter tons of coke. Consider the fact that there is no tendency toward lower prices on any of these items, and that freight is on a much higher rate than in 1913, and you have the basis of the contention that the price of pig to-day is quite low. The producer who therefore, in reply to a protest, stated that the business was not attractive at the present time, evidently had in view the fact that fundamental costs are still maintained by conditions over which he had little or no control. Further reductions in freight rates, and the settlement of coal strikes should be a factor in relieving the situation.

Problems Of Isolation

"OUR FUTURE depends on the revival of our foreign trade. Forty millions of people in a small island cannot live on taking in each other's washing," was the recent comment of Lord Riddell in a discussion of Britain's overseas trade. He thus touched upon problems of isolation which, about the same time, formed the theme of a speech by Thomas B. McAdams, president of the American Banker's Association, at their annual convention. He emphasized a fact which sometimes seems to be purposely lost sight of by public men in the United States, that such portions of Canada's production of three hundred millions of bushels of wheat as may not be needed for home consumption will come into direct competition with the United States in supplying the food demand of the world. "Shall we encourage isolation," said Mr. McAdams, "which can only result in loss to both countries, or shall we map out a broad-minded partnership under which Canada and America can work hand in hand in the development of the other's resources, and the broadening of their mutual business relations and unitedly co-operate in bringing to North America the trade of the world?"

Of course, it is presumed the term partnership here is used in its broadest meaning and carries with it no suggestion of national absorption. The expression is interesting as being representative of a purely business rather than a political viewpoint.

Problems of the Situation

REVIEWING economic conditions as they affect the machine tool industry in the United States, the National Machine Tool Builders' Association considers the matter under seven headings—demand, capital, labor, material, fuel, transportation and equipment. The claim is made that pig iron production being up to 70 per cent. of previous maximum, the machine tool demand should come along. Further, the contention is that radio and auto industries have given plans to many machinists until the tool builder faces labor shortage and increased cost due to high wages and low efficiency at the time machine tool demand will actually appear. Material prices are advancing and likely to go higher, car shortage will be apparent if business continues to increase at the same rate of increase as in the last three months, and the low demand for machine tools shows plenty of equipment.

The review is interesting since it refers to conditions as affecting a large market and discusses such influences as restriction of immigration and its bearing upon the labor market, the likelihood of a coal shortage and the extent to which substitutes such as oil and coke are being used and the fact that railroad equipment is not adequate to meet the demands of a strong comeback.

Canadian conditions considered under several headings would reveal, of course, that here the market is not self-contained or self-sufficient, so far, at least, as materials are concerned, and hence is more or less influenced by outsde developments. The demand for machine tools while still below normal, is showing more life, with an improvement in the woodworking section. The banks say they are meeting the requirements of industry, but that in the past six months there has not been much demand except as regards specialties as in contrast with standard lines. The labor market shows a healthy condition as far as laborers are concerned, with the skilled section still subject to seasonal or spasmodic tendencies. So far as materials and fuels are concerned, the market in the former is decidedly firm as reflecting conditions in the United States, with a strong demand from building operations, motor car industries and requirements for public works. The fuel situation as yet has not developed the aspects of a real problem and, it is hoped, may be solved shortly. There are few labor problems in sight, and as one manufacturer put it, "we seem to have a fair foundation for better business."

Coal and Rail Strike Serious to Steel Industry

Production Figures Revised But Still Show Increase of Thirty-Five per cent.—Canadian Business Continues Good—Steel Bars Advance 10 Cents—Turpentine Recedes to $1.65—Strong Demand for Sheets of All Kinds—Shortage of Specials

IMPLEMENT INDUSTRY BUYING PIG IRON

THERE IS a more serious tone to the iron and steel markets this week on account of strike developments in the coal and railroad industries. Production may have to be curtailed, to what extent is problematical, and reports from Pittsburg indicate that, as a result, the sellers' market may be prolonged. Estimates as to steel ingot production are being revised, but the increase for the half year is on a basis of 35 per cent. The actual production in the second quarter of the year was about equal to that for the entire second half of last year. The output in the past few weeks, however, is about 10 per cent. less than previously estimated, and does not represent a material increase. There is less prospect, therefore, of consumers being overstocked.

The Canadian market, in spite of seasonal tendencies, appears to be holding up well. There has been an advance of 10 cents in iron and steel bars, the maximum figure now being $3.25. There has been a persistent movement in this direction for some weeks. An advance of one cent in copper products is also announced this week. The reason given for this is that war stocks of materials have been pretty well absorbed and there is a greatly improved demand. There is a great market for sheets of all kinds. The prices are firm, the supply in specials is decidedly short. This is a reflection of the activity in building and in the motor car industry.

There has been a recession in the price of turpentine. Due to short supply and strong demand, prices showed an inclination to run well over $2.00 the gallon. For the present week, however, the price in barrel lots is given as $1.65, or $1.75 per gallon. The market for the time is in better shape, but dealers say they have here an item that has a tendency to fluctuate daily.

So far as pig iron is concerned, the agricultural implement industry is in the field for fair sized tonnage, not only covering in a reasonable way for future, but responding to an improved demand. Some very nice orders have recently been received from France for this industry, and of course, Western prospects contain sufficient cause for an amount of optimism.

The demand for machine tools continues light, but dealers declare there are times when the market develops quite a little spurt. In some quarters there are reports that the past week showed an improvement. There is a certain volume of inquiry, and the feeling is that this, of itself, indicates a healthy underlying condition. Just when it will break out is the question. Machine shop supplies continue in fair demand.

The Montreal market, though running into that part of the summer that is proverbially quiet, still reports activity in many lines. There is a marked demand for galvanized sheets and the supply is not what it should be. There is a firmness in non-ferrous metal and here slight advances are recorded. Large foundries, having covered their requirements in pig iron, that market has eased off a trifle. In shop supplies there is a demand developing in which the railways are conspicuous, although they have not appeared in such a way as to predict any general improvement of the market from that source. In fact, while there is a general undertone of confidence in the Montreal market, no radical changes are looked for until September.

Toronto

July 19

OUTSTANDING features of the Toronto market this week, include an advance of 15 cents in steel and iron bars, the maximum quotation on this item being $3.25 per cwt. and the minimum $3.15. An advance on copper and brass products of one cent a pound is also announced following a slight advance on the American market and the fact that large stocks of so-called war material have been absorbed. Turpentine may also be included among the week's active items, but this time it has made a considerable recession, and not an advance as was the rule in the past few weeks. Some quotations were in the vicinity of $2.00, but the price, barrel basis, is given as $1.65 or $1.75, gallon lots. The market appears to have a better supply in sight. The pig iron situation reveals the fact that the agricultural implement people have been buying in fair quantities. There does not seem to be much prospect of an easing in price at present. The reduction in freight rates will hardly manifest itself as a reducing factor this year, as materials to cover immediate requirements are pretty well in hand. Furnace men state that there is not much likelihood of better figures here until conditions have some stability and are more normal. In fact, there are those producers who declare that pig iron business at the present time is not what might be called attractive. The fact that buyers are inclined to base protests on a comparison of prices as between 1922 and 1914, brings forth the explanation that coke, limestone, ore, labor and freight, in short all factors entering into pig iron production, are still at high levels with no likelihood of marked improvement.

Scrap metal dealers declare that there is little activity in their department. There is a tendency toward firmness in copper, but this is hardly sufficient to cause a ripple on a placid surface. Not a great deal is being offered, and the buying while fairly steady does not run into large quantities. The price range follows:

Copper, light ... ... per 100 lbs.	8 50
Copper, crucible	11 00
Copper, heavy	11 00
Copper Wire	11 00
No. 1 composition	9 00
New brass cuttings	6 00
Red brass turnings	6 50
Yellow brass turnings ...	4 85
Light brass	3 50
Medium brass ...	4 50
Scrap zinc	4 00
Heavy lead	4 50
Tea lead	3 00
Aluminum	11 00
Boiler plate, per gross ton ...	9 00
Heavy melting steel ...	11 00
Axles (wrought iron) ...	16 00
Rails (scrap)	11 00
Malleable	11 00
No. 1 machine cast iron ...	16 00
Pipe, wrought ...	6 00
Car wheel	16 00
Steel axles	15 00

The advance of 10 cents in iron and steel bars seems to be the outstanding feature of the week. There has been a movement in this direction for some time and while it did not appear to be general, the mills finally confirm conditions on which the strength developed. The demand is exceptional. Prices follow:

Iron bars	3 15 to 3 25
Steel bars	3 15 to 3 25
Reinforcing bars	3 15 to 3 25
Steel hoops	4 00
Tire steel	3 15
Spring steel	7 00
Band steel, No. 10 gauge and 3-16 in base	3 65
Small shapes	3 25
Sheets, black, No. 28	5 00
Sheets, blue ann., No. 10 ...	4 00
Canada plates, dull, 52 sheets	4 90
Canada plates, all bright	6 00
Galvanized Sheets, No. 28	6 00

In the non-ferrous department, the market is showing a tendency that seems to be in unison with the general market, that is toward definite firmness. New York markets reveal this, but so far as the Toronto market is concerned no definite change is reported.

Lake copper	17 00
Electrolytic copper	16 50
Castings, copper	16 00
Tin	34 00
Spelter	7 25
Lead	7 00
Antimony	7 40
Aluminum	21 00

Machine tool demand continues quiet. Last week there was an improvement in some quarters. There is an encouraging demand for machine shop supplies.

The upward tendency in cotton ma-

terials continues. A three-cent advan- in cotton twines is reported, three-plies are 39 and four-plies, 42 cents.

The demand for steel sheets continues exceptionally strong, indicating not only the activity in the motor car industry but also that of building operations. Certain specials are difficult to get. Deliveries, it is reported, are not as good as demand should have.

Montreal

July 19

THE DULLNESS that is usually looked for in the iron and steel industries at this season of the year, has held off longer than was anticipated. July business up to date, is about equal to that of June for the corresponding period, but as the first ten days of this month showed excellent business, it will be seen that there is a slight reduction in the volume of business as compared with the first of the month. For the last week business has been spotty, one jobber will be moving certain lines while others will be getting business from entirely different sources in other products. The one steel item, that seems to be in common demand, is galvanized sheets. As has been reported from here for some weeks past, the supply does not equal the demand. Other lines of steel and iron are moving satisfactorily but not to the same extent. Pig iron sales are falling off a little. Machine tools remain the same as last week, continuing to be rather dull. Shop supplies are moving quiet as well as last week. There is a firmness in the non-ferrous metals, especially in copper, brass and spelter. The scrap metal markets are quiet. The general consensus of opinion among dealers and jobbers, is that there will be but little changes between now and the first of September. The year's business has been unusual in many ways but there appears to be the opinion that we cannot hope to escape the quiet summer period. There is exhibited, however, a great deal of confidence in the general situation, as reports from the United States are that, in all lines, business is improving, and from Western Canada the prospects of crop that is better than average, will all tend to help matters to a considerable extent. The rail haul will be of such importance that the railways will come into the market and help business in some of the larger shops that depend on the roads for the larger portion of their work. The requirements of the West in the line of manufactured goods will be increased as soon as the crops are harvested. Some prominent men are inclined to compare the present situation with that of last year, and in so doing, they appear to have good reason to express satisfaction.

Iron and Steel.—Although in some quarters there appears to be curtailment in buying, no serious falling off in the volume of business moving has been reported. Galvanized sheets are still featuring the market. It is stated there were nearly one thousand tons of galvanized sheets on the ill-fated steamer "Ortha" that was beached after a collision about a week ago. The Montreal consignees of this material have arranged for the goods to be replaced and hope to have same in Montreal early in August. This is much better delivery than it was possible to obtain for some time back. Production in the British mills is being increased, as there is no falling off in demand. Structural steel continues to be absorbed in medium and small lots, and up to time of writing no general attempt has been made to replenish the stores that are being more or less rapidly depleted. The call for merchant bars is being maintained at about the same level. The improvement in the demand is slow but steady. Small steel products are still being disposed of in very satisfactory quantities. The only steel product that is really dull, is plates. Miscellaneous products such as reinforcing bars, tire steel, hoops, band steel, etc., are moving well. There have been no changes in quotations during the week, but as there is a range of ten cents in the base quotations a little margin is given here. Large orders command somewhat closer prices than the smaller ones. On the whole there is a general stiffness to all quotations and but little price cutting is reported. The following are the local quotations:

Iron bars	3 15 to 3 25
Steel bars	3 15 to 3 25
Reinforcing bars	3 15 to 3 25
Steel hoops	4 00
Tire steel	3 15 to 3 25
Spring steel	6 00
Band steel, No. 10 gauge and 3-16" base	3 25
Small shapes	3 00

Pig Iron.—The splendid demand for pig iron that was present two weeks ago has practically spent itself. At the attractive quotations given at that time with a firmer market promised, many foundries covered their requirements for some time to come. The natural result is that purchasing has dropped off considerably. The smaller foundries are still coming into the market frequently for one or two cars, which factor is responsible for practically all the sales made during the week. The Summerlee iron is still available on the local market and is being disposed of in small quantities. It is more than probable that this iron will be on the Canadian market until the close of navigation. If the demand increases in the autumn, a good tonnage will be imported to take care of winter requirements. No changes in price have been made during the week, Summerlee still being quoted at $29.75 on dock and No. 1 Canadian product at $31.85.

Machine Tools.—Iron working tools are still moving very slowly. Very few sales have been made. There is evidence that more or less interest is being maintained in this line, because there are a fair number of inquiries. The large amount of idle equipment locally, is responsible for the small volume of sales. Some firms manufacturing radio equipment have purchased a few odd small machines lately. Outside of this work there is only a small amount of manufacturing in the local shops. Portable tools are moving rather well. Some of the large garages operate a small machine shop, and are good prospects for many electric and air driven portable tools.

The lumber industry and the furniture manufacturing firms are rather active and this activity has resulted in a little business in wood working tools.

The railroads have not come into the market for new equipment and thus far dealers have been unable to interest them. Prices have reached a level at which they will likely be maintained for some time to come.

Shop Supplies.—The shop supply business continues to improve form month to month, even if improvements connot be noted when comparing weekly figures. The large number of repair shops and contract shops in the province, all appear to have a very satisfactory quota of work and these firms come into the market regularly. The railways, together with the larger shops are furnishing a fair amount of business. Prices have not undergone any important revisions during the week, and sales about equal in volume to those of last week, were made.

Non-ferrous Metals.—A rather strong undertone is felt in the non-ferrous metals. Copper, brass, and spelter are very firm, quotations were advanced a quarter of a cent a pound on the local market. Both New York and London markets are reported as being firm. Sales have improved slightly during the week. The demand has been very scattered and few large lots have been sold. Other metals are firm and are moving as well as at any time in several weeks. The local quotations are as follows:

Lake Copper	17 75
Electrolytic Copper	17 50
Castings, Copper	17 25
Tin	34 50
Lead	6 75
Spelter	7 75
Antimony	6 50
Aluminum	**23 00**

Scrap Metal Markets.—Very little activity has been evidenced in the local scrap metal market. Sales locally have been small. Some sales have been made to outside points. These shipments have gone to Ontario largely, but a few have been made across the border. Holdings locally are small. There has been no change in quotations which are as follows:

Copper, light, per 100 lbs.	8 50
Copper, crucible	11 00
Copper, heavy	11 00
Copper Wire	11 00
No. 1 compositon	9 00
New brass cuttings	6 00
Red brass turnings	6 50
Yellow brass turnings	5 00
Light brass	4 00
Medium brass	5 50
Scrap zinc	3 50
Heavy lead	4 50
Tea lead	3 00
Aluminum	11 00
Boiler plate, per gross ton	9 00
Heavy melting steel	10 00
Axles (wrought iron)	20 00
Rails (scrap)	11 00
Malleable	10 00
No. 1 machine cast iron	20 00
Pipe, wrought	7 00

Pittsburg

July 19

CONTINUANCE of the recent rate of pig iron and steel production is very seriously menaced by the railroad strikes and coal strike developments. There is a strong balance of probability that there will be a little decrease in the next few weeks, and it is possible there will be a very considerable decrease. It is unlikely that consumers will be seriously incommoded, but the condition of there being a sellers' market in steel will be prolonged. How long the sellers' market will last no one can predict definitely, but it will last longer than it otherwise would have lasted.

As to the railroad developments, before the end of June some little congestion has developed on railroads serving non-union coal fields, particularly in Kentucky and West Virginia. The non-union fields, outside of those that had sympathetic strikes in connection with the regular union strike (of the United Mine Workers) that began April 1, had been shipping unusual quantities of coal and to unusual distances. On top of this natural congestion, which might have developed to serious proportions, came the strike of railroad shopmen, July 1, crippling all roads at least a trifle, and greatly crippling the roads already congested. Now there is danger of some other groups of railroad workers also going on strike. Thus by reason of transportation conditions supplies of coal have been very considerably reduced, and several by-product coking plants are feeling the effect.

Then, as to the coal strike, President Harding initiated a movement late in June to end it. Thus far the practical outcome of the Washington effort has been that the coal strike is much worse, in three respects at least; (1) In some non-union regions, where there had been sympathetic striking, this striking has increased. In the Connellsville region in particular, where it was altogether phenomenal for non-union men to stay out three months on a strike, when they have not had practice in striking like the union miners have had for a generation past. The strikes had been waning, quite gradually it is true, but still waning, and expectations were that by this time men would be coming back in numbers. Instead, immediately after President Harding's proposal fresh striking broke out in the Connellsville region. (2) Some union operators had made plans to attempt to start mines July 5, and whether the operators postponed the effort or the men acquired fresh courage and refused to return to work as it is alleged they had promised to do if given protection, no union mine in the Pittsburgh district has resumed. (3) The President's taking a hand in the particular district in which he did has given the United Mine Workers officials an idea that they can secure the unionization of some of the mines long non-union. Thus while last March the average bystander could hardly avoid the conclusion that the United Mine Workers would come out of this struggle decidedly weakened, the officials apparently think now they are going to come out of it stronger than ever. Instead of losing some mines hitherto union they evidently have hopes of getting some mines hitherto non-union.

President Harding's proposition cannot be discussed in detail, but the salient features are that the mines should resume work at the 1920 scale, an extremely high one, pending a finding of a commission to be established, while it is doubtful whether the commission could reach a conclusion in anything like a reasonable period and the men might start a fresh strike against the award, and the language of the proposal seems to intimate that instead of the mines resuming their former status, an indefinite number of mines formerly non-union are to be unionized. In trade circles the prevalent opinion is that the President was very poorly advised before making his proposal.

Steel Production.—Estimates recently made as to the rate of steel production must be revised materially. The publication not long ago of complete statistics of production in 1921 gives a fresh line on the proportion of the total output furnished by the 30 companies which make monthly returns of their ingot production, while the June report shows that there was an increase of less than one per cent. in the rate from May to June, whereas it was generally believed that there was a material increase. Increases were reported at various individual plants in June, and these increases no doubt did occur, but evidently there were decreases at other plants about which little or nothing was reported.

Revised estimates are that the annual rate of steel ingot production was 35,500,000 tons during April, 36,400,000 tons during May and 36,600,000 tons during June. The average rate during the first quarter of the year was about 26,800,000 tons a year, the average during the second quarter being about 36,150,000 tons, making an increase of 35 per cent. By another comparison, the actual production in the second quarter of this year was just about equal to the production in the entire second half of last year.

Thus there has been a great increase in production, at long range, but the production in the past few weeks has not represented any material increase and is about 10 per cent. less than recently estimated.

The balance between production and consumption is not altered by the revision in estimates, as there had been no estimate of consumption other than that derived from shipments, but it looks easier for consumption to absorb the production than it did, and there is less prospect of consumers being overstocked. Scared by the coal strike, consumers might easily have piled up too much steel, then starting to liquidate if they saw the coal strike ended and prospects of there being unlimited suppliees of steel. As matters stand, there is little prospect that it will be possible at any time this year to make steel at a much greater rate than of late. There would have to be much more disposition to mine coal, much bteter transportation conditions, and larger supplies of labor at steel mills. At several points lately scarcity of labor has developed at steel mills.

The steel market has been relatively quiet in the past week, as to the total turnover. Most lines are seasonably dull. The mill position continues very strong. Bars, shapes and plates command slightly greater premiums than formerly for early deliveries. Basic prices, for late deliveries, are practically unchanged on all commodities.

Pig iron has weakened somewhat in some districts, Alabama iron being down 50 cents to $18 Birmingham, while basic pig iron in the valleys has been done at $24, furnace, against $25, firm, quoted as the market during May and June. It is curious that there should be anything like a weakening in pig iron when coke prospects have just become decidedly poorer. It seems that buying demand has been lighter right along than was expected. A number of consumers are spreading over third quarter deliveries they had originally bought for second quarter entirely.

INDIA A LARGE PURCHASER

No other industry in India makes such large purchases of materials as the railroad industry. During the fiscal year 1920-21 the railways spent nearly $100,000,000 in purchases of materials, more thon half of which were imported from the United Kingdom. The chief materials purchased in India are rails, bridge work and wooden sleepers, while a start is being made at turning out parts of wagons and coaches. The extent to which the steel industry has progressed in India is shown by the purchase of rails in the country. In 1920-21 rails to the value of 62 lakhs of rupees were purchased in India as compared with 14 lakhs in 1915-16. This progress is almost entirely due to the enterprise of Messrs Tata and Sons, steel manufacturers, established in India in 1921. The United Kingdom, supplied about 97 per cent of the huge total of about $60,000,000 worth of supplies, Canada coming next, supplying several hundred thousand dollars' worth of special hopper wagons for coal and ore.

The Diamond State Fibre Co., 235 Carlaw Ave., Toronto, have secured some good orders from the Ford Motor Co. of Canada. Mr. Webster, manager of the Toronto factory tells Canadian Machinery that their fibre is used in various parts of the Ford motor, such parts as commutator rings, insulation parts, etc., being quite extensively used.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Toronto price:—	
Silicon, 2.25% to 2.75%	$29 15
Grey forge, Pittsburgh	$25 27
Lake Superior, charcoal, Chicago	31 65
Standard low phos., Philadelphia	30 00
Bessemer, Pittsburgh	25 00
Basic, Valley furnace	24 00

IRON AND STEEL

Per 100 lbs. to Large Buyers	Cents
Iron bars, base, Toronto	$3 15 3 25
Steel bars, base, Toronto	3 15 3 25
Iron bars, base, Montreal	3 15 3 25
Steel bars, base, Montreal	3 15 3 25
Reinforcing bars, base	3 15 3 25
Steel hoops	4 00
Tire steel	3 15
Spring steel	7 00
Band steel, No. 10 gauge and 3-16 in. base	3 55 3 65
Chequered floor plate ¼" and heavier	6 00
Bessemer rails, heavy, at mill	2 35
Steel bars, Pittsburgh mill prices	1 80
Tank plates, Pittsburgh mill prices	1 70
Structural shapes, Pittsburgh mill prices	1 70
Steel hoops, Pittsburg	2 50
F. O. B., Toronto Warehouse	
Small shapes	3 25
F. O. B. Chicago Warehouse	
Steel bars	2 48
Structural shapes	2 58
Plates	2 58
Small shapes under 3-in.	2 48

FREIGHT RATES

	Per 100 lbs. C.L.	L.C.L.
Pittsburgh to Following Points		
Montreal	52	65½
St. John, N. B.	76	96
Halifax	77½	97
Toronto	34	48½
Guelph	34	48½
London	34	48½
Windsor	31½	45½
Kingston	48½	61

Current surcharge 1 per cent.

METALS

	Montreal	Toronto
Lake copper	$17 75	$17 00
Electrolytic copper	17 50	16 50
Castings, copper	17 25	16 00
Tin	34 50	34 00
Spelter	7 75	7 25
Lead	6 75	7 00
Antimony	6 50	7 40
Aluminum	23 00	21 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$3 75	$3 50
Plates, ¼ up	3 40	3 25

PIPE—WROUGHT

Standard Buttweld Pipe S/C

Per 100 feet

	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
⅛ inch	$ 6.00	$ 8.00	$	$ ....
¼ inch	3.84	5.94	7.20	9.30
⅜ inch	3.84	5.94	7.20	9.30
½ inch	4.85	6.46	7.31	8.93
¾ inch	5.87	7.71	8.86	10.70
1 inch	8.16	11.05	12.58	15.30
1¼ inch	11.04	14.95	17.02	20.70
1½ inch	13.20	17.88	20.35	24.75
2 inch	17.76	24.05	27.38	30.30
2½ inch	28.08	38.03	....	....
3 inch	36.72	49.73	....	....
3½ inch	47.84	63.48	....	....
4 inch	56.68	75.21	....	....

Standard Lapweld Pipe S/C

Per 100 feet.

Below Dividing Line—Price Per Foot.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
2 inch	$21.46	$27.38	$31.08	$37.00
2½ inch	31.50	40.95	46.80	56.16
3 inch	41.31	53.55	61.20	73.44
3½ inch	48.76	65.32	72.68	89.24
4 inch	57.77	77.39	86.11	105.73
4½ inch	66.04	86.36	1.04	1.24
5 inch	76.96	100.64	1.21	1.45
6 inch	1.00	1.31	1.57	1.88
7 inch	1.30	1.76	2.02	2.45
8L inch	1.40	1.85	2.13	2.58
8 inch	1.61	2.13	2.45	2.97
9 inch	1.97	2.59	2.97	3.59
10L inch	1.82	2.40	2.75	3.33
10 inch	2.35	3.09	3.54	4.28

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4-in. and under 60 per cent.
4½-in. and larger, 50 per cent.
4-in. and under, running thread, 40%.
Standard couplings, 4-in. and under 30%
Do., 4½-in. and larger, 10%.

OLD MATERIAL

Dealers' Average Buying Prices

	Montreal	Toronto
Copper, light	$ 8 50	$ 8 50
Copper, crucible	11 00	11 00
Copper, heavy	11 00	11 00
Copper, wire	11 00	11 00
No. 1 machine composition	9 00	9 00
New brass cuttings	6 00	6 00
Red brass turnings	6 50	6 50
Yellow brass turnings	5 00	4 85
Light brass	4 00	3 50
Medium brass	5 50	4 50
Scrap zinc	3 50	4 00
Heavy lead	4 50	4 50
Tea lead	3 00	3 00
Aluminum	11 00	11 00
	Per Ton	Gross
Boiler plate	$ 9 00	$ 9 00
Heavy Milling Steel	10 00	11 00
Axles (wrought iron)	20 00	16 00
Rails (scrap)	11 00	11 00
Malleable scrap	10 00	11 00
No. I machine cast iron	20 00	16 00
Pipe, wrought	7 00	6 00
Car wheel	17 00	16 00
Steel axles	10 50	15 00
Mach. shop turnings	4 00	6 00
Stove plate	16 00	14 00
Cast boring	4 00	5 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, 7-16 and up	30
Carriage bolts, ⅜ in. and smaller 6 in. and shorter	40
Coach and lag screws	45
Stove bolts	72½
Wrought Washers	60
Do., corru. head	60
Machine bolts, 7-16 and over	35
Machine bolts, ⅜-in. and less	35
Blank bolts	35
Bolt ends	35
Machine screws, fl. and rd. hd., steel cut thread	37½ & 10
Machine screws, o. and fil. hd., steel cut thread	30
Machine screws, o, and fil. hd., brass cut thread	15
Standard couplings, 4-in. and under, brass cut thread	30% 30
Nuts, square, blank off net list	$1.00
Nuts, square, tapped off net list	50c.
Nuts, hex., blank off net list	50c.
Nuts, hex., tapped net list	
Copper rivets and burrs, list less	32c.
Burrs only, list plus	10%
Iron rivets and burrs	47%
Boiler rivets, base ¾ in and larger	$5.75
Structural rivets, as above	5 65
Wood screws, O. & R., bright	80
Wood screws, flat, bright	82½
Wood screws, flat brass	77½
Wood screws, O. & R., brass	75
Wood screws, flat, bronze	72½
Wood screws, O. & R., bronze	70

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent.
Set screws	Less 55%
Square and hexagon head cap screws	Less 50%
Round head cap screws	Plus 10%
Fillister head cap screws	Less 10%
Flat head screws	Net List
Button head cap screws	Plus 10%
Studs	Less 35%
Semifinished nuts up to and including 1-in.	Less 60%
Semifinshed nuts 1⅛ to 1¼ in	Less 55%
Semi-finished nuts 1⅜ to 2 in.	Less 25%
Coupling bolts	Less 10%
Taper pins, No. 2 to No. 5	Less 60%
Planer bolts without fillet.	Plus 20%
Patch bolts	Plus 50%
Hollow set screws	Plus 10%
Thumb screws	Less 85%
Thumb nuts	Less 60%

BILLETS

F. O. B. Pittsburgh

	Per gross ton
Bessemer billets, 4 in. x 4 in. and larger	$35 00
Open hearth billets	35 00
O. H. sheet bars	35 00
Forging billets	40 00
Bessemer rods	40 00

NAILS AND SPIKES

Wire nails, base	$3 65
Cut nails, base	4 35
Miscellaneous wire nails	72½%

ROPE AND PACKING

Plumbers' oakum, per cwt.	6 30
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 23
British Manila rope	0 20
New Zealand hemp	0 20

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	Net.

Solder, strictly	$0 22½
Solder, guaranteed	0 24
Soldering coppers, lb.	0 62½
White lead, pure, cwt.	13 20
Red dry lead, 100-lb. kegs, per cwt.	10 75
Wood alcohol, per gal.	1 75
Whiting, plain, per 100 lbs.	3 00

CARBON DRILLS AND REAMERS

S. S. drills, wire size	55
Can. carbon cutters	10
Standard drills, all sizes	60
3-fluted drills, plus	10
Jobbers and letter sizes	55
Bit stock	60
Ratchet drills	10
S. S. drills for wood	10
Wood boring brace drills	55
Electricians' bits	30
Sockets	30
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	Net
Bridge reamers, carbon	50
Centre reamers	5
Taps, machine screw	less 50-60
Taps, hand, under 1"	less 40-50
Chucking reamers	30 off
Hand reamers	25
High speed drills, list	30 to 40 off
Can. high speed cutters, less	10
American	plus 40

COLD ROLLED STEED

[At Warehouse]

Rounds and squares	$4.50 base
Hexagon and flats	$5.50 base

MALLEABLE FITTING LIST

1 in. elbow	.32	.53
2 in. elbow	1.05	1.70
1 in. tee	.43	.70
2 in. tee	1.45	2.40
1 in. coupling	.33	.53
1 in. locknut	.15	.23

Discount to dealers 70/5 off list.

SHEET

	Montreal	Toronto.
Sheets, black, No. 28	$5 40	$5 00
Sheets, blue ann., No. 10	4 05	4 00
Canada plates, dull, 52 sheets	5 50	4 90
Can. plates, all bright	7 00	6 00
Galvanized sheets, No. 28		6 00
Queen's Head, 28 B.W.G.	7 25	
Fleur de Lis, 28 B.W.G.	7 00	
Gorbal's best, No. 28		
Colbornes Crown, No. 28		
Premier	6 85	6 40
Premier 10£ oz.	6 85	6 40
Zinc sheets	9 00	10 00

PROOF COIL CHAIN
B. B. B. CHAIN

⅜ in., $16.45; 7-16 in., $14.00; ½ in., $12.95; 5-8 in., $13.15; ¾ in, $12.75; ⅞ in. $12.25; 1 in., $11.85; 1⅛ and 1¼ in, $10.55. Fire weld chain same sizes respectively are $14.00; $11.50; $10.40; $10.55; $10.15; $9.75; $9.35; and $8.25.

ELECTRIC WELD COIL CHAIN B.B.B

⅛ in. $20.00; 3-16 in. $16.50; ¼ in. $15.50; 5-16 in. $12.70.

FILES AND RASPS

Globe	60/5
Vulcan	50
P. H. and Imperial	60/5
Nicholson	40
Black Diamond	40
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	60
Great Western-American	50
Kearney & Foot, Arcade	60/5

BOILER TUBES

Size	Seamless	Lapweld
1 in.	20.00	
1¼ in.	22.00	
1½ in.	22.00	
1¾ in.	23.50	
2 in.	22.00	16.00
2¼ in.	24.00	20.00
2½ in.	25.00	20.00
3 in.	29.00	24.00
3½ in.	34.00	28.00
4 in.	43.00	35.00

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS

Castor Machine Oil, per lb.	34½
Royalite, per gal. bulk	21
Palacine	24
Machine oil, per gal.	33
Black oil, per gal. (Summer)	19
Cylinder oil, Capital	61½
Petroleum fuel oil bbls., net	10.80
Pure turp., single bbls., gal.	1.65
Linseed oil, raw, single bbls.	1.10
Premier Gasoline	35½

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	30%
Standard	30 and 10%
Cut leather lacing, No. 1	1.80
Leather in side, (Lacing)	1.60

TAPES

Chesterman Metallic, 50 ft.	$5 00
Lufkin Metallic, 603, 50 ft.	3 17
Admiral Steel Tape, 50 ft.	3 00
Admiral Steel Tape, 100 ft	4 50
Major Jun. Steel Tape, 50 ft.	3 75
Rival Steel Tape, 50 ft.	4 00
Rival Steel Tape, 100 ft.	8 75
Reliable Jun. Steel Tape, 50 ft	5 25

PLATING SUPPLIES

Polishing wheels, felt	$3 80
Polishing wheels, bull-neck	1 50
Emery in kegs, Turkish	08
Pumice, ground	05
Emery glue	25
Tripoli composition	08
Crocus composition	12
Emery composition	11
Rouge, silver	64
Rouge, powder, nickel	38

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	19
Brass sheets, 24 gauge and heavier base	21
Brass tubing, seamless	23

WASTE

XXX Extra	16	Atlas	18
Peerless	21	X Empire	13
XX Grand	15	Ideal	18
Superior	20	X Press	11½
X L C R	14		

Colored

Lion	12	Fancy	13½
Standard	10½	Popular	9
No. 1	13	Keen	7½

Wool Packing

Arrow	24	Anvil	16
Axle	20		

Washed Wipers

Select White	18	Dark colored.	13
Mixed Colored	14		

This list subject to trade discount

RUBBER BELTING

Standard 36 ....28% Best grades 28%

ANODES

Nickel	.55 to .60
Copper	.38 to .40
Tin	.70 to .70
Zinc	.16 to .17

COPPER PRODUCTS

Prices per lb.

	Montreal	Toronto.
Copper Bars, ½ to 2 in.	.29	.29
Brass Tube		.26
Plain sheets, 16 oz. in. 30 x 72	.30	.29
Copper sheet, tinned, 16 oz.	.37	.42
Copper sheet, planished, 16 oz. base	.42	.42
Braziers', in sheets, 6 x 4 base	.30	.30
Copper tubing, seamless		

LEAD SHEETS

	Montreal	Toronto.
Sheets, 3 lbs. sq. ft.	$ 8 75	$ 10 00
Sheets, 3 1-2 lbs. sq. ft.	8 00	10 00
Sheets, 4 to 6 lbs. sq. ft.	8 25	9 25

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra

PLATING CHEMICALS

Acid, boracic	.23
Acid, hydrochloric	.03¾
Acid, nitric	10¼
Acid, sulphuric	.03¾
Ammonia, aqua	.20
Ammonium, carbonate	.15
Ammonium, chloride	.18
Ammonium, hydrosulphuret	.75
Ammonium, sulphate	.10
Arsenic, white	.18
Copper, carbonate, anhy.	.32
Copper, sulphate	.08
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.14
Nickel carbonate	.32
Nickel sulphate	.14
Potassium sulphide (substitute)	.40
Silver chloride (per oz.)	.85
Silver nitrate (per oz.)	.65
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.35
Sodium hyposulphite per 100 lb.	6.50
Sodium phosphate	.15
Tin chloride	.30
Zinc chloride, C. P.	.30
Zinc sulphate	.06

Prices per lb. unless otherwise stated

News From the Industrial Field

Henry Ford is reported to be seeking a site in Mexico for an automobile building and assembly plant.

The Booth Coulter, Copper and Brass Co., Toronto, have added to their products, a line of art brass goods.

Dennis Wire and Iron Works Co., Toronto, has secured the contract for the ornamental iron work in connection with the technical school at Riverdale.

The steel contract for the two additional stories to the Telegram building, Toronto, has been awarded to the Dominion Bridge Co., of Toronto.

While oiling a machine in the plant of the Rodney Woodenware Co., Rodney, Ont., George Robinson, 60, was caught in the wheels and killed.

The Heine Boiler Co. St. Louis, Mo., are desirous of arranging with a Canadian firm to manufacture their boilers here for Canadian Export trade.

The steel work for the new machine shop to be erected by the Ideal Iron Works at Vancouver, B. C., will be supplied by Jas. Layfield Contracting Co. of Vancouver.

The A. R. Williams Machinery Co., Toronto are installing in Sarnia Technical School a Hisey-Wolf grinder, a Dumore tool post drill, and transmission equipment.

Unemployment relief during last winter cost the Dominion Government $1,300,000. One half of this was direct, while the other half was contributed through local authorities.

In our issue of July 13 appeared an article on Getting Service and Output from Sawing Machines. Credit should also have been given to Clemson Bros., for information supplied.

While American railroads are buying large quantities of material for renewal of rolling stock, Canadian roads state that their equipment is in good shape, and that practically no purchases are being made in that connection.

William H. Biggar, K. C., vice-president and general manager, G. T. R., died in Montreal July 7, after a brief illness. He was born near Belleville, 69 years ago. Called to the bar in 1880, he became solicitor for the Grand Trunk in 1910.

Kingston.—Building contractors in Kingston are on the outlook for work on the block surrounded by Wellington, Clarence, Bagot and Johnston Streets, the centre of which was totally destroyed by fire on the morning of July fifth. Eleven buildings were damaged and three of them totally destroyed.

The Durant Motors of Canada are now prepared to receive tenders for the erection of the new addition to their plant at Leaside. Plans are open at the office of E. A. Walberg, Room 909 Royal Bk. Bldg., Toronto.

The Tegles Construction Co., of Fort William has been awarded the general contract for the construction of the $500,000 grain elevator to be erected by M. M. Patterson Co., of Winnipeg, at Fort William, Ont.

G. H. Regan, district manager at Montreal for the Diamond State Fibre Co., Carlaw Ave., Toronto, is leaving on his vacation for two weeks. In the meantime enquiries will be taken care of at the Montreal office in the usual way.

In an effort to further the development of trade between Canada and foreign countries, Dr. J. W. Ross and Major G. B. Johnson, Canadian trade commissioners respectively for Shanghai China, and Glasgow, Scotland, will visit Canada shortly to get in personal touch with various exporters.

The Dominion Bridge Co., Toronto, have issued for circulation in booklet form, their current stock list of steel shapes and other metal products for immediate shipment. The booklet contains items as to weights, safe loads for beams, channels, angles, etc., and general information.

Kingston will next year celebrate its 250th birthday. The city was founded by Frontenac in 1672. Chief among the things to which the Kingstonian points with pride is the Canadian Locomotive Works, not as active to-day as they should be, but there are signs of better days approaching.

That a large industry would shortly establish a plant at Sault Ste. Marie, Ont., was indicated by a statement made by W. C. Franz, president of the Algoma Steel Corporation at a recent dinner of the Board of Trade.

Details as to the industry were not announced, but it is understood that it gives promise of being a very large affair, with a Dominion-wide business.

According to statistics from the Department of Labor, Ottawa, there was a slight decline for June in the index of wholesale prices, while the index of retail prices for food, fuel and rent show a very small increase. The total for food, fuel and rent averaged 20.58 for June as compared with 20.50 for May and 21.74 for June 1921. This decline in the food budget was due almost entirely to the decreases in sugar and in dairy products, except eggs which advanced slightly.

John Gray, Collingwood, formerly in the employ of the Shipbuilding Co. there, has organized the **Georgian Bay** Spring and Metal Co. to specialize in springs used in motor car and other industries.

The executive offices of the Canadian National Railways may be removed from Toronto. It is hinted that the Government may end the controversy as between Toronto and Montreal by establishing a nominal headquarters, where the Board of Directors will meet, at Ottawa.

Vancouver, British Columbia.—During 1921 the total gross tonnage of shipping (sea-vessels) out of this port was 2,659,366, representing 389 vessels, an increase of 53 vessels over 1920. In addition 107 foreign coastwise ships left the port, increasing the tonnage to 2,946,659.

Sir Robert Horne, chancellor of the Exchequer, declares that Great Britain is stronger financially than at any time since the armistice. At present rates of exchange her debt to the United States was £938,000,000. The recent reduction of her floating debt and also of the internal debt had increased financial stability throughout the country. He regarded the debt to the United States as a solemn obligation.

Sydney, N. S.—The billet and blooming mills at the Sydney steel plant are now working double shift, according to a statement issued by the British Empire Steel headquarters. This new activity will increase the force to over 2,300 men. For the first time in the twenty-two years of its history the plant has successfully entered the foreign market for finished steel products. Orders are on hand for nails, barbed wire and galvanized wire for Buenos Aires, South Africa, New Zealand, Costa Rico, Colombia, India and British West Indies.

Axel Lindstrom, Cape Town, South Africa, who recently arrived in New York to look over the machinery field, states that capital is needed in that colony to help develop vast resources. He states:—"We complain there about our taxes, just as people do the world over, but our taxes are only 1 shilling 6 pence, as against 6 shillings in England, showing that we are not so bad off after all. Most things are cheaper there than in this country, and one can live in the best hotel in Cape Town for $5 a day including meals as well as a room. A good suit of clothes, such as would cost $60 or $75 here, can be bought there for $40. For good workers in unskilled labor one pays less than $1 per day in Cape Town."

Cox and Wilcox, contractors, have been awarded the contract for the erection of a four roomed addition to Franklin school, Fort William, at a price of $53,447.06. Work will commence immediately.

The Hamilton Bridge Co., has secured the steel contract for the new factory of Dominion Dress Goods Co., at Brantford. The steel sash work goes to the Trussed Concrete Steel Co., of Walkerville.

Hamilton, Ont.—The Canadian By-Products Co., has been incorporated here under a Dominion charter with a capital of $600,000 to manufacture firebrick and refractories from anthracite ash. A plant is to be erected immediately and it is expected actual manufacture will be under way before the end of the year.

Toronto.—The Ontario Government has decided to encourage the development of the extensive iron ore deposits in the northern districts of the province, and has called a conference of experts and others interested in this industry. One of the matters to be considered is the use of hydro-electric power for smelting, there being an abundance of such energy in Northern Ontario.

London, Ont.—The London Bridge Works, Ltd., recently incorporated with a capital of $100,000, are starting operations here immediately. It will have a fair-sized plant, with a monthly capacity of about 250 tons of fabricated steel for bridges and buildings. In addition to the fabricated steel business, the company intends to build and equip a large warehouse for the distribution of steel products of all kinds, including structural steel shapes, steel plates,

Speaking to Mr. Downer, of the Downer Pattern Works, 265 King St., W., Toronto, Canadian Machinery found that business is picking up for this firm very nicely. They have just completed a monstrous wooden model of an Underwood typewriter, this being for exhibition purposes. It will be shown from coast to coast, and you could place 3,375 regular size machines in the space occupied by this huge model. Canadian Machinery had an opportunity of looking over the work which is so out of the ordinary that it cannot help but command attention.

Montreal.—Records of the grain shipments from the port of Montreal for the season of 1922 go to show that up to the first of July the record of 1921 has been exceeded by almost half a million bushels. There is every indication that this record will be maintained. The elevators have at present all the needed varieties in store for the many grain ships due from the Atlantic. The stocks contain Canadian and American wheat, Canadian and American oats, barley, American corn and Canadian and American rye. Forty million bushels of grain have already been shipped through the port of Montreal this season.

Introducing

JAMES D. JONES

Superintendent Algoma Steel Corporation Sault Ste. Marie, Ont.

To be general superintendent of a plant such as that of the Algoma Steel Corporation, Sault Ste. Marie, with its blast furnaces, its blooming mills, its rail and structural steel departments and multitudinous other activities, would seem to be a fair sized order for any man, no matter how efficient. But James D. Jones, who fills that position, can find time occasionally to function elsewhere. He impresses one as being young in years, but when he discusses different phases of the steel industry, it is evident he has not lost any time or overlooked much as regards what has been done and what might still be accomplished.

Readers of Canadian Machinery renew their acquaintance with Mr. Jones whenever the ore resources of Ontario are being considered. At the recent meeting before Hon. Harry Mills, minister of mines, to investigate the feasibility of a native blast furnace industry, Mr. Jones told the metallurgists and mining men present some significant things. He knows from experience just what can be done with the siderite and magnetite ores that predominate in Ontario. The famous Magpie mine was operated for some time by the Algoma Steel Corporation, and it was found that by mixing its siderite ore with magnetite in certain proportions, an ore was procurable at $1.57 cheaper than anything of the same grade from straight American ores. Mr. Jones is an authority on beneficiation and after visiting many important plants in the United States, declares that there are apparently no problems in Canada that are not existing and are being successfully solved in the United States. With proper study of ore conditions, in order to produce desirable grades, and with the development of organization, it is his opinion that a market will be available for all of the Canadian ore that can be produced.

One thousand men are now on the payroll of the Port Arthur Shipbuilding Co., the largest number attained for six years. Work is being rushed on the new lake freighter Matthewson, and over seven hundred workmen are engaged upon her hull and fittings.

Announcement mas made July 14 that the Consolidated Water Power and Paper Co., of Wisconsin Rapids, purchasers of the plant of the Kaministiquia Paper Co. at Current River, Port Arthur, were contemplating large extensions to the plant. Just how big the plans of the company are will not be known for some days.

The International Business Machines Co., are now displaying a complete line of Dayton Scales, International Time Recorders, etc. At their new sales and service store, 32 King St. West, Toronto. The new office and show room is centrally located in Toronto's downtown section. Demonstrators are in constant attendance to explain the operation of any of the company's products, and interesting window displays are regular features.

The huge increase in India's machinery importations during the past year, is explained by the fact that the Indian jute mills, textile establishments and other industries spent a large proportion of their unusual profits of the preceding years in replacements of and additions to plant, which had been held up during the war. That machinery imports are still maintaining this advance is evidenced by the returns for the month of March, 1922, machinery to the value of no less than 3.27 crores, or about 10 million dollars, being imported during that month, as compared with a value of 2-94 crores during the month of March, 1921. Of the year's total of 34 crores the share of the United Kingdom was 28 crores, of the United States 4½ crores, and of Germany one-half crore.

Some explanation of the improvement in industry in United States is found in the fact that the railways are in the market for very extensive renewals of rolling stock. Canadian roads are in pretty fair condition in this particular line but are now buying good tonnages of track material. As an example of what is taking place among American roads, the Illinois Central is receiving bids for from 500 to 1,000 gondola cars. The Western Pacific has placed an order for 2,000 refrigerator cars with the American Car and Foundry Co. The Northern Pacific has ordered 250 gondola cars from the Standard Steel Car Co. The Norfolk and Western has divided an order for 2,000 hopper cars as follows:—American Car and Foundry Co., 500; Standard Steel Car Co., 500 and Pressed Steel Car Co., 1,000. The Illinois Central has placed an order for 20,000 tons of rails with the United States Steel Corporation and the Ann Arbor road has ordered 1,800 tons of rails from the Midvale Steel and Ordinance Co.

Last week a building permit was issued for the erecting of a million capacity storage annex to the N. M. Paterson grain elevator in west Fort William. Construction of the addition was commenced some days ago and work is progressing rapidly. The Fegles Construction Co. are the builders. The new plant will be of reinforced concrete construction.

Building operations in connection with the erection of a paper mill at the present site of the Fort William Paper Co., are proceeding rapidly and the last of the many hundreds of concrete piles are being sunk. The new paper mill will consume the ground wood pulp of the pulp mill which has an output of approximately 110 tons of dry pulp daily.

Niagara Falls, Ont.—The Canadian Shredded Wheat Co., is enlarging its plant here, by the erection of wheat storage bins and cleaning room. These are being built of concrete and when completed will give storage capacity for 250,000 bushels and a cleaning capacity for 250 bushels an hour. The building will all be fireproof and will be completed about October 1st, at an estimated cost of $152,000 for buildings and equipment.

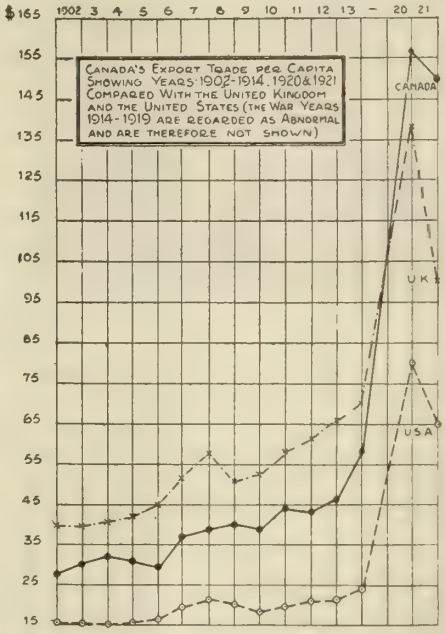
According to trade commissioners' reports, the British motor industry has lost considerable business because of the eleven-week engineering lockout, recently settled. Manufacturers state that many prospective purchasers have withheld their orders for the year and that other large orders have gone to other countries. Certain makers are well stocked with chassis. The Rolls-Royce and several other large plants were forced to shut down in early May. A few nonfederated firms turned out more cars during the lockout than ever before in their history. Small cars and several makes of motor cycles are much in demand, and firms manufacturing them have orders for several months' production. Prospects for the sale of new heavy trucks are poor, due to the stocks of about 12,000 army supply trucks obtainable at prices representing only a fraction of their original cost.

IS CANADIAN LOCOMOTIVE CHANGING HANDS?

Within the past two or three weeks there has been much talk and speculation around Kingston, in regard to the large plant of the Canadian Locomotive Co. There was a rumour to the effect that a large American concern had secured an option on the plant and the Baldwin Locomotive Co. was mentioned. Nothing definite has been announced as yet, but an official of the company admitted the giving of an option to some concern. The strength of Canadian Locomotive stock on the market tends to confirm the rumour of a purchase and operations in the near future. Although there has not been much trading, the common stock has been going around 78 on the Montreal market, a good showing for a company which has not been producing for many months. The people of Kingston are awaiting a definite announcement as the big plant is the most important industry in the city.

CANADA'S EXPORT BUSINESS

Ottawa, Ontario.—Canada leads the world in volume of exports per head of population. Computations made by the Department of Trade and Commerce show that Canada's exports now amount



Canada's export trade per capita.

in value to $150 per capita, as compared with $98 for the United Kingdom. In 1902 Canada was exporting products to the value of $28 per capita, as compared with $40 per capita in the United Kingdom and $15 per capita for the United States.

IMPLEMENT MEN EXPECT AVERAGE CROP

REPORTS received by the agricultural implement industry would seem to indicate that while crop prospects have been shaping favorably there are some doubtful factors which seem to detract somewhat from expectations for a bumper yield. One authority, for example, states that conditions have not been good in the territory west of Saskatoon and that Southern Alberta, owing to continued rains, is not coming along favorably. "I am rather inclined to the conservative view that we are not going to have a bumper crop but that rather, it will be a pretty fair average," said the manager of a large concern having extensive dealings with the agricultural community. "Of course, one may be somewhat premature in making predictions. Given a favorable summer, such conditions that now seem discouraging may be overcome, but speculation at any time should be exceedingly cautious."

Reports coming from Western sources state that the outlook at present is certainly better than it was at the same time last year. There has been some damage from frost, drought, insects and hail, but the total damage does not appear large or serious.

So far as export business in agricultural implements is concerned, France is the only European country that is doing any considerable amount of buying, and here it is on a scale that is fully up to the average. Germany is doing very little buying at the present time, but it is the opinion of the authority quoted above that economic processes going on there will eventually bring that country to world levels in the matter of selling, and that she will appear as a more or less aggressive buyer of certain lines once her abnormal problems are in hand. The same may be said of Russia, but here nothing definite can be said of the perspective.

OBITUARY

W. E. Dyer, assistant superintendent of the Ontario Malleable Iron Co., of Oshawa, and a resident of that town for over half a century, died last week from complications following an attack of influenza.

OTTAWA AND DICTRICT

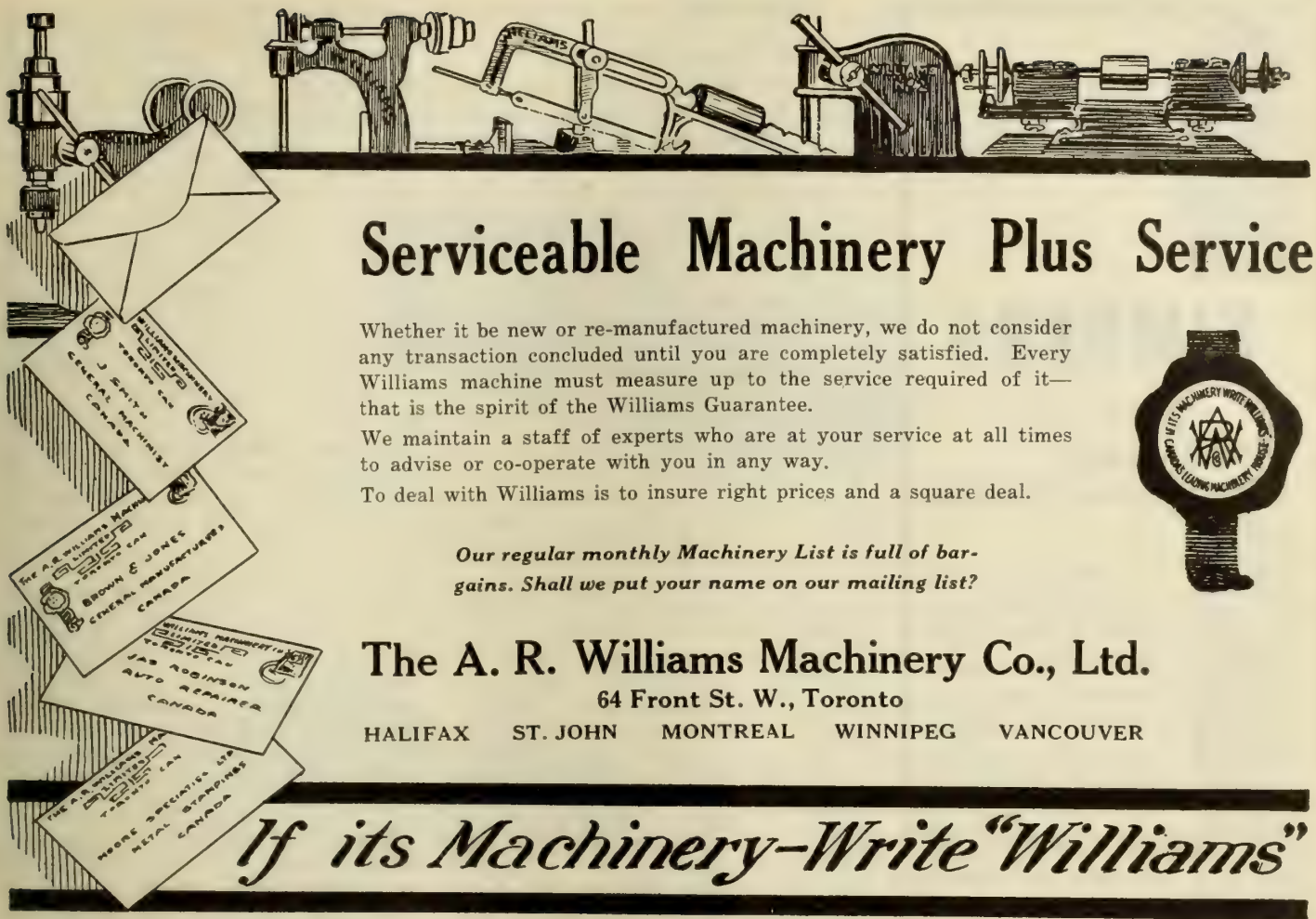
The city of Hull is installing a new 450 h.p. motor at the Hull waterworks plant on Brewery Creek. The new motor replaces a 300 h. p. motor that burnt out some time ago.

The Lion-Meade Rubber Co. is planning the erection of a large plant at Hull for the manufacture of tires, tubes and Meade valves. An option has been secured on six acres of land in Wrightville, a suburb. It is stated that the plant when in full operation will employ from 300 to 500 hands.

Carelton County Council has decided to delay the building of the proposed addition to the court house until such time as a better understanding has been reached with the city in regard to the length of time the city will continue to pay its share of the new buildings.

The John R. Booth Co. is building a new chimney stack which when completed will be the tallest in the city. The new stack, work on which has already commenced, is to be 267 feet above the ground and eight feet underground. The base, constructed of concrete will be 22 feet square and fifty feet high. Above will be 217 feet of brick masonry, the inside diameter will be 11 feet, 6 inches.

When purchasing high speed annealed steel it is always advisable to order sizes large enough for the removal of the outer surface, which may be slightly decarbonized. Scale and decarbonized surfaces should always be removed before hardening as a "soft skin" may result on the finished tool.



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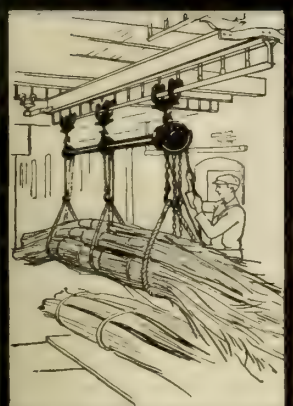

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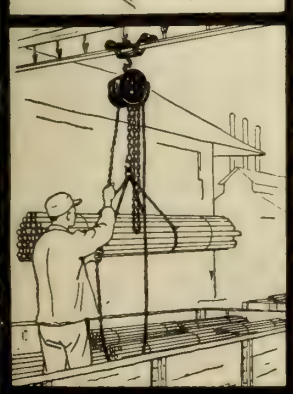

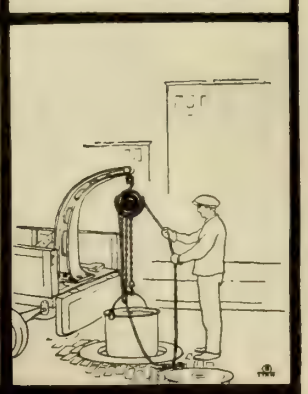

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We have received some complaints from subscribers to the effect that Canadian Machinery is not being delivered. In almost every case investigation has shown that our friends have changed their addresses and have NOT notified us.

Let every subscriber look at the address on the label of this issue of Canadian Machinery, and, if it is not correct, please fill in and mail to us the following—

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SIMONDS

Canada Saw Co., Ltd.
"The Saw Makers"
Montreal, Que.
St. John, N. B. Vancouver, B.C.

FUNDAMENTALS OF MILLING

(Continued from page 18)

ally at 350 inches, a third run gave 1,950 linear inches of metal cut.

Increasing the Feed

We then increased the feed per tooth to see if at this speed a higher feed would be beneficial. This run was made at a feed of .004 inches per tooth, speed 470 ft. per min., table travel 43 inches per min. We were able to cut only 1,365 linear inches of metal before dulling the cutter. This helped to prove our theory that the increased feed did not help to reduce the rubbing time but increased the deflection of the arbor. To carry this further we used a 9-tooth cutter at a speed of 400 ft. per min. with a feed of .0053 inches per tooth. We cut 2,145 linear inches of metal. This increase was due to the reduced speed. A second test under the same conditions gave only 860 linear inches of metal cut. That drop may have been due to bad stock because the cutter seemed to go bad at the start.

Our next run was made with the 18 tooth cutter at 370 r.p.m. or 290 ft. per min., and a feed of .119 inch per rev. or .0066 in. per tooth, table travel 44 inches per min. The cutter removed 2,920 linear inches of metal before it was taken out, and it was only slightly dulled. This increase was due, no doubt, to the decreased speed. But comparing this with our first test, we see that in spite of the great decrease in surface speed we have increased the life of the tool but very little. This, apparently, is due to the great increase in feed per tooth which has caused a greater deflection of arbor and consequently increased the time the tooth was rubbing on the stock. We had also increased the time the tool was in the stock cutting. A larger arbor would have helped to eliminate some of the rubbing at this high feed. However, the strain on the machine at this feed and speed was considered to be excessive.

We then reduced the feed per rev. to .072 inch making the feed per tooth .004 inch and the speed was increased to 520 r.p.m., or 410 ft. per min. Under these conditions we cut 2,728 linear inches of metal—about the same as at lower speed and higher feed. The results of the test are shown on the accompanying chart.

CANADA MAY SECURE MORE BRITISH CAPITAL

There is little doubt but that British industries will gradually come to Canada in larger numbers as did those from the United States, as British manufacturers come to realize the enormous benefits of manufacturing in Canada and achieve a more even balance between British and American houses prosecuting their activities in the Dominion. From all indications it is beyond conjecture that voluminous placements of British capital in various phases of Canadian development will take place in the near future, and that the movement will expand with the progress of time and the brightening of conditions. The rise of sterling, the prospect of rosier economic times, the realization of the necessity of meeting competition on the ground of the opponent, are all combining to centre in Canada an interest which wavered merely from force of circumstances. There is no reason to suppose that United States interest in Canada will ever decline—the tendency would certainly seem to be for this to increase—so that with capital coming, in addition, in substantial amounts from the British Isles and vieing with that from across the border, Canada should prosper exceedingly from the business rivalry and experience a period of development surpassing anything she has hitherto known.

T. A. Hollinrake, general manager, A. R. Williams Machinery Co, Toronto, has returned from a trip of several weeks to the Maritime provinces. His impressions, as to the industrial outlook in the East are optimistic. Building activity and conditions generally indicate that that part of the Dominion is keeping pace with a steady trend toward normal.

Truro, N. S.—On July 15 the planing and woodworking mill of McCullough Bros., Debert Station, about 12 miles from this place, was totally destroyed by fire. It is stated that there was no insurance on the mill.

Montreal.—It is announced that the Dominion Bridge Co. has secured four contracts for the steel bridge superstructures which are to be erected by the Public Works Department of the New Brunswick government. The sum of four contracts is understood to be in the vicinity of $40,000.

Montreal.—The Montreal Board of Trade plan to celebrate the one hundredth anniversary of that institution by taking a seven thousand mile trans-Canada tour by a special route embracing lake, rail and ocean. An offer is being made to British members of parliament to join the tour, and reports indicate that between twenty and thirty of them will avail themselves of the opportunity. The party leaves Montreal on the evening of September 1st, by Canadian Pacific Railway going to Toronto, thence to Port McNicoll where a lake steamer is boarded. At the twin cities, Port Arthur and Fort William the rail journey is resumed. Travel by C. P. R. continues to Vancouver and Victoria, the Canadian National coastwise steamer is boarded for a trip to Prince Rupert. A Canadian National train is here boarded and the party returns to Montreal entirely on the National System, arriving on Saturday morning, September 30th.

4,000 Threads in One Day

With a Geometric Threading Machine a thread .891″ Diam., 32 pitch, V, 7-16″ long, is cut on 4,000 Graphophone Brass Mouth Pieces in one day. Before the work was put on a Geometric Threading Machine, a solid die was used, and, with the necessary backing off, only 800 pieces could be threaded in one day.

Geometric Threading Machines give production increases that mean much.

Send for the booklets.

There are the Single Spindle, Double Spindle and Bench Threading Machines.

THE GEOMETRIC TOOL COMPANY

NEW HAVEN CONNECTICUT

CANADIAN AGENTS:

Williams & Wilson, Ltd., Montreal
The A. R. Williams Machinery Co., Ltd., Toronto, St. John, N.B., Halifax, N.S., Vancouver, B.C.

Classified Opportunities

Two cents a word, including "Canadian Machinery" box numbers; minimum charge is $1.00 per insertion for 50 words or less, set in 6-pt. type. Each figure counts as a word. Display ads., or ads. set in border, are at the card rates.

PATENTS

The old established firm. Patents everywhere. Head Office, Royal Bank Bldg., Toronto. Ottawa Office, 5 Elgin St. Offices throughout Canada.—Booklet free.

FETHERSTONHAUGH & CO.

PATTERNS

TORONTO PATTERN WORKS, 65 JARVIS Street, Toronto. Patterns in wood and metal for all kinds of machinery. (ctfm)

BRANTFORD PATTERN WORKS ARE PREpared to make up patterns of any kind—including marine works—to sketches, blue prints or sample castings. Prompt, efficient service. Bell 'Phone 631; Machine 'Phone 733. Brantford Pattern Works, 49 George St., Brantford, Ont. (ctfm)

FOR SALE

"RICARDO" ENGINES, PETROL OR PARAffin, excellent for marine, commercial or stationary use. Brand new. 100 h.p. 4-cylinder, 150 h.p. and 250 h.p. 6-cylinder, 300 h.p. 12-cylinder, Thirty shillings per horse-power sterling London. Sykes, Patching, Sussex, England.

WANTED

SCRAP ENDS
STEEL PLATES 9, 10, 11 Gauge

Carloads or less. Suitable for making Iron Washers.

The Graham Nail Works
Toronto

STEEL

Air Pressure Tanks, Air Receivers, Steel Plate Tanks, Pneumatic Tanks, Tote Boxes, Shop Barrels, Steel Factory Equipment, Smoke Stacks, Gasoline Tanks.
Write For New Catalogue

THE STEEL TROUGH & MACHINE CO. LTD.
TWEED - ONT.

OPPORTUNITIES

FOR SALE OR ROYALTY—CANADIAN PATent No. 214964 on resilient wheel for automobiles and trucks, absorbs the shock in the leaf spring spokes of the wheel, either hard rubber or pneumatic tires may be used; simple, practical and substantial in construction. Reasonable terms. Wm. H. Schlake, Yuma, Colo.

Grey Iron Castings

Light and Medium-Bench and Floor Repetition Castings; Capacity 15 tons per day.
Expert Metal and Wood Pattern Work. Our advice and estimates will save you money.
Semi-finishing operations on Lathe or Grill on Castings supplied if required.
ASK US.
THE KATIE FOUNDRY, GALT, ONT.

REGO WELDING *and* CUTTING APPARATUS

Oxygen, Acetylene, and a complete line of Welding and Cutting Supplies

Carter Welding Co.
of Toronto, Limited
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Phones: Adelaide 2841 and 1524
(TF)

"OVENS"

Japanning and Varnishing Ovens heated by Gas, Electricity, Steam or Coal. Kernchen and Apex Siphonage Ventilators, Bakers' Ovens, trucks, casters, etc. Write for Booklet.

BRANTFORD OVEN & RACK CO.
Brantford, Canada

SITUATIONS WANTED

SITUATION WANTED AS SUPERINTENDENT or general foreman of machine shop, twenty years' experience. At present employed; best of references. Box 861T. Canadian Machinery. (c28m)

MECHANICAL DRAFTSMAN DESIRES A change; age 30; married. Experienced in tool, jig and machine design. If you are looking for a young man who by practical shop experience, knows his job from the drafting office to the shipping platform, arrange interview, at your convenience. Box 798, Canadian Machinery.

MECHANICAL DRAFTSMAN AND DESIGNER desires position, preferably firm where advancement and responsibility is given. Competent chief draftsman with machine shop experience, well educated. Box 810, Canadian Machinery, Toronto. (C.18M.)

SALESMAN, 6 YEARS' MACHINE TOOL EXperience 10 years' general engineering with A1 practical and theoretical knowledge of mechanics, open to represent manufacturer in Toronto and district. Box 805L, Canadian Machinery.

CLOSING TIME

Advertisements for this section must be in our composing room Tuesday morning prior to day of issue.

In order that the announcements of your wants, machinery for sale, etc., etc., shall not be delayed, please try to have them in our office with the Tuesday morning mail.

Canadian Machinery

Machine Tools

FOR SHIPBUILDERS & IRON & STEEL WORKS

BERTRAMS LIMITED
EDINBURGH

After the Contract

Service-after-the-order follows the signature on every order accepted by the Hanna organization—in fact, is pledged by the act of acceptance. It is upon this fact more than any other that the growth and success of M. A. Hanna & Co. have been built.

HANNA

HANNA

M.A. HANNA & CO.

Chicago Toronto Cincinnati
Pittsburgh Buffalo Detroit
Philadelphia New York Toledo
Williamsport, Pa.

Where To Buy Your CASTINGS

The Brown-Boggs Co., Limited
HAMILTON, ONT.
Grey Iron.

Fisher Motor Co., Limited.
ORILLIA, ONT.
Die Castings.

Sully Brass Foundry, Limited
618 Brock Ave., TORONTO, ONT.
Brass, Bronze, Copper and Aluminum.

Canadian Rumley Co., Limited
Queen West and Abell Streets,
TORONTO, ONT.
Grey Iron.

Galt Malleable Iron Co., Ltd.
GALT, ONT.
Malleable.

S. Vessot & Company
JOLIETTE, QUE.,
Grey Iron, Brass and Aluminum.

Miller Bros. & Sons, Limited,
120 Dalhousie St., MONTREAL.
Grey Iron, Semi-Steel Castings up to 10 tons.

Can. Mead-Morrison Co., Ltd.,
MONTREAL, P.Q. WELLAND, ONT.
Grey Iron Machinery Castings.

Hugh Park Foundry Co., Ltd.,
OSHAWA, ONT.
Grey Iron, Patterns, Etc.

Hull Iron & Steel Foundries Ltd.
HULL, CANADA.
Steel, Manganese, Chrome.

Aurora Foundries, Limited,
AURORA, ONT.
Grey Iron.

Aluminum Last & Metal Co.,
KITCHENER, ONT.
Aluminum, Brass, Bronze and Special Alloys.

Can. Hanson & VanWinkle Co.
LIMITED
TORONTO, ONT.
Monel, Aluminum, Brass, Bronze, Grey Iron.

Tallman Brass & Metal, Ltd.
HAMILTON, CANADA
Brass, Bronze, Manganese Bronze, Aluminum.

Dom. Foundries & Steel, Ltd.
HAMILTON, CANADA.
Steel Castings all sizes.

Manitoba Steel Foundries, Ltd.
Office Winnipeg. Works Selkirk, Man.
Steel Castings up to 5,000 lbs.

Brantford Brass Foundry Co.
BRANTFORD, ONT.
Aluminum, Brass, Bronze, Specialty.

The Katie Foundry
GALT, ONT.
Grey Iron, Semi-Steel, Brass, Aluminum.

William Kennedy & Sons, Ltd.
OWEN SOUND, ONT.
Steel, Malleable and Heavy Grey Iron.
See Advertisement Page 8

Machinery & Foundries, Ltd.
BROCKVILLE, ONT.
Light and Medium Grey Iron.

A. F. McCulloch
OSHAWA, ONT.
Brass, Alum. Castings—Wood, Metal Patterns.

Corbet Foundry & Machine Co. Ltd.
OWEN SOUND, ONT.
Grey Iron, Brass.

Fittings Limited,
OSHAWA, ONT.
Malleable, Grey Iron, Brass, Aluminum.

John T. Hepburn, Limited
TORONTO, ONT.
Grey Iron.

W. W. Wells
370 Victoria Street, TORONTO, ONT.
Nickel and Monel Metal.

The Robert Mitchell Co., Ltd.
64 Belair Ave., MONTREAL.
Light Grey Iron.

Canadian Steel Foundries, Ltd.
MONTREAL, QUE.
Steel and Ferro-Alloy.

Langley & Austin,
GALT, ONT.
Copper, Bronze, Brass and Aluminum.

Maxwells, Limited
ST. MARYS, ONT.
Light Grey Iron, Tinning same a specialty.

The Eureka Planter Co., Ltd.,
WOODSTOCK, ONT.
Specialty Light Grey Iron.

Lindsay Foundry and Pattern Works, Limited
Victoria Avenue, LINDSAY, ONT.
Grey Iron.

Dominion Engineering Works, Limited
MONTREAL, QUE.
Grey Iron.

Smith's Falls Malleable Castings, Limited
SMITH'S FALLS, ONT.
Malleable.

Joliette Steel Co.
JOLIETTE, QUE.
Electric Steel and Ferro-Alloy.

International Malleable Iron Company, Limited
GUELPH, ONT.
Malleable.

Getting The Business
You Can Do Likewise
A Few Panels For Sale

APPLY

Canadian Machinery & Mfg. News
143 University Avenue,
TORONTO, CAN.

BRANTFORD BRASS FOUNDRY COMPANY
BRANTFORD, ONTARIO
FOUNDRY AND OFFICE 33 LEONARD ST

June 27th., 192-

The MacLean Publishing Co., Limited
Toronto, Ont.

Gentlemen;-

We wish to inform you that we have had quite satisfactory results from our advertisement in Canadian Machinery and Manufacturing News, which runs under the classified heading " Where to Buy your Castings ".

Yours Truly,
Brantford Brass Foundry Company.
per David M. Lobb

Canadian Machinery BUYERS DIRECTORY

If what you want is not here, write us, and we will tell you where to get it. Let us suggest that you consult also the advertisers' index— last page of book, after having secured advertisers' names from this directory. The information you desire may be found in the advertising pages. This department is maintained for the benefit and convenience of our readers. The insertion of our advertisers' names undr proper headings is gladly undertaken, but does not become part of an advertising contract.

ABRASIVE DISCS
J. R. Baxter & Co., Ltd., Montreal, Que.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John, London, S.E., Eng.

ABRASIVE MATERIALS
J. R. Baxter & Co., Ltd., Montreal, Que.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John, London, S.E., Eng.

ACETYLENE, DISSOLVED
Carter Welding Co, Ltd., Toronto.
Dominion Oxygen Co., Toronto.
Liquide Air Company, Toronto.

ANCHOR BELTS
Steel Co. of Can. Ltd., Hamilton, Ont

ANGLE BARS
Steel Co. of Can. Ltd., Hamilton, Ont.

ANVILS
Aikins & Co., Inc., E.C., Indianapolis, I.
Petrie, Ltd., H. W., Toronto, Ont.

ANCHOR BOLTS
Steel Co. of Can., Ltd., Hamilton, Ont.

ANGULAR HOLE DRILLING TOOL
Globe Engineering Co., Ltd., Hamilton, Ont.

ARBORS
Atkins & Co., Inc., E. C., Indianapolis,
Brown & Sharrpe Mfg.Co., Providence,R.I
Jacobs Mfg. Co., Hartford, Con.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.

BELLS, BRASS, BRONZE and STEEL
Canada Foundries & Forgings Co., Welland, Ont.
Canadian SKF Co., Toronto, Ont.

BARRELS, TUMBLING
McDougall Co., Ltd., R., Galt, Ont.

BARS, BORING
Armstrong Bros. Tool Co., Chicago, Ill.
Bertram & Son Co., td., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

BARS, BORING, PORTABLE
Underwood Corp., H. B., Philadelphia.

BARS, STEEL
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
British Empire Steel Corporation, Montreal, Que.

BEARINGS, BALL
Canadian SKF Co., Toronto, Ont.

BEARINGS, ROLLER
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

BELT CEMENT
D. K. McLaren Co., Ltd., Montreal, Que.
McLaren Belting Co., J. C., Montreal, Que.

BELT DRESSINGS AND FILLERS
Dom. Belting Co., Ltd., Hamilton, Ont.
D. K. McLaren Co., Ltd., Montreal, Que

BELT FASTENERS
Bristol Company, Waterbury, Conn.
D. K. McLaren Co., Ltd Montreal, Que
McLaren Belting Co., J.C., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

BELT HOOKS
Bristol Co., Waterbury, Conn.
D. K. McLaren Co., Ltd., Montreal, Que

BELT LACING
Bristol Company, Waterbury, Conn.
D. K. McLaren Co., Ltd., Montreal, Que.
McLaren Belting Co., J. C., Montreal,

BELT LACING, STEEL
Bristol Company, Waterbury, Conn.

BELT LACING MACHINES
D. K. McLaren Co., Ltd., Montreal, Que.
McLaren Belting Co., J. C., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

BELTING, CHAIN
Can. Link-Belt Co., Toronto, Ont.
Fittings, Limited, Oshawa, Ont.
Jones & Glassco, Montreal, Que.
Renold (Hans) of Canada, Ltd., Montreal, Que.

BELTING, FABRIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Dom. Belting Co., Ltd., Hamilton, Ont
D. K. McLaren Co., Ltd., Montreal, Que
McLaren Belting Co., J. C., Montreal, Que.

BELTING, LEATHER
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Can. Fairbanks-Morse Ltd., Montreal, Q.
D. K. McLaren Co., Ltd., Montreal, Que.
McLaren Belting Co., J. C., Montreal, Que.
Smith Belting Co., Toronto, Ont.

BELTS, ABRASIVE
Oakey & Sons, Ltd., John, London, S.E., Eng.

BENDING MACHINES, POWER
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bertrams Ltd., Edinburgh, Scotland.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

BILLETS, BLOOMS and SLABS
Steel Co., of Can. Ltd., Hamilton, Ont.

BLOCKS
Wright Mfg. Co., Lisbon, Ohio.

BLOCKS, CHAIN (See Hoists, Hand)
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

BLOCKS, DIE
Canada Foundries & Forgings Co., Welland, Ont.

BLOCKS, PILLOW
Can. Link-Belt Co., Toronto, Ont.

BLOWERS
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

BOILERS, LOCOMOTIVE
Goldie & McCulloch Co., Ltd., Galt,

BOLT AND NUT MACHINERY
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Montreal, Que.

BOLT AND NUT MACHINERY, Automatic
National Acme Co., Cleveland, Ohio.

BOLTS AND NUTS
British Empire Steel Corporation, Montreal, Que.
Fittings, Limited, Oshawa, Ont.
National Acme Co., Montreal, Que
Petrie, Ltd., H. W., Toronto, Ont

BOLT THREADING DIE HEADS
Landis Machine Co., Inc., Waynesboro Pa.

BOLTS, TRACK
Steel Co. of Canada, Ltd., Hamilton Ont.

BORING and TURNING MILLS, Vertical
Bertram & Sons Co., Ltd., The John Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

BORING, DRILLING and MILLING MACHINES, Horizontal.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
Landis Tool Co., Waynesboro, Pa.
Vertical
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
McDougall Co., Ltd., Galt, Ont
Petrie, Ltd., H. W., Toronto, Ont
Rockford Drilling Machine Co., Rockford.

BORING TOOLS
Armstrong Bros. Tool Co., Chicago, Ill
Gisholt Machine Co., Madison, Wis.

For list of Dealers see the last page of This Buyers Directory

BUCKET CARRIERS, Pivoted
Can. Link-Belt Co., Toronto, Ont.

BUFFERS
Prybil Machine Co., New York, N.Y

BUFFING OR POLISHING MACHINES
(See Polishing and Buffing Machines)
Blount Co., J. G., Everett, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Prybil Machine Co., New York, N.Y
U. S. Electrical Tool Co., Cincinnati, O.

BUILDING MATERIALS
Bertram & Son Co., Ltd., The John Dundas, Ont.

BURNERS, OIL AND GAS
Rockwell Co., W.S., New York City.

BURRS
Steel Co. of Can. Ltd., Hamilton, Ont.

CABINETS, OIL
S. F. Bowser & Co., Ltd., Toronto, Ont

CALIPERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Starrett Co., L. S., Athol, Mass.

CAMS
Canada Foundries & Forgings Co., Welland, Ont.

CAN-MAKING MACHINERY
(See Sheet Metal Working Machinery)
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Bliss Co., E. W., Brooklyn, N. Y
Smooth Mfg. Co., Jersey City, N. J.

CARBONIZING
Chapman Double Ball Bearing Co., Toronto.

CEMENTS, IRON
CENTERING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.

CHAINS (See Sprockets and Chains)
Reynold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

CHUCKS, DRILL
Jacobs Mfg. Co., Hartford, Conn.

CARD CLOTHING
D. K. McLaren Co., Ltd., Montreal, Que

CASTINGS, ALUMINUM, BRASS, BRONZE, COPPER, DIE-MOLDED, FERRO-ALLOY, IRON, SEMI-STEEL, STEEL.
See "Where to buy your castings" Section. Page number may be found by turning to Advertisers' Index.

CHAINS, DRIVING
Can. Link-Belt Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Glassco, Montreal, Que.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

CHASERS
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, a.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.

CHUCKING MACHINES
Acme Machine Tool Co., Cincinnati, O.
Brown & Sharpe Mfg Co., Providence, R. I.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

CHUCKS, DRILL AND TAP
Can Fairbanks-Morse Co., Ltd., Montreal.
Canadian SKF Co., Toronto, Ont.
Cushman Chuck Co., Hartford, Conn
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg., New Britain, Conn.

CHUCKS, LATHE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Cushman Chuck Co., Hartford, Conn.
Geometric Tool Co., New Haven, Conn
Gisholt Machine Co., Madison, Wis.
Ker & Goodwin Machine Co., Brantford Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Prybil Machine Co., New York, N.Y.
Skinner Chuck Co., New Britain, Conn
Union Mfg. Co., New Britain, Conn.

CHUCKS, MAGNETIC
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CHUCKS, PLANER
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cushman Chuck Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn
Union Mfg. Co., New Britain, Conn.

CHUCKS, TAPPING
William L. Procunier, Chicago, Ill

CHUCKS, VERTICAL BORING MILL
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Skinner Chuck Co., New Britain, Conn
Union Mfg Co., New Britain, Conn.

CLAMPS, MACHINISTS'
Brown & Sharpe Mfg Co., Providence.
Starrett Co., L. S., Athol, Mass.

CLEANERS, METAL, WASTE, GENERAL
Oakley Chemical Co., New York, N. Y.

CLOCKS
Chicago Watchman's Clock Co., Chicago.
Hardinge Bros., Limited, Toronto, Ont.

CLOCKS, TIME
Gisholt Machine Co., Madison, Wis.

CLOCKS, WATCHMEN'S
Chicago Watchman's Clock Co., Chicago, Ill.
Hardinge Bros., Limited, Toronto, Ont.

BUYERS' DIRECTORY

CLUTCHES, FRICTION
Can.-Link-Belt Co., Toronto, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.

COAL AND ASH HANDLING MACHINERY
Can.-Link Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

COAL-STORAGE SYSTEMS
Can. Link-Belt Co., Toronto, Ont.

COLLARS, SHAFT OR SET
Canada Foundries & Forgings Co., Welland, Ont.
Can. Link-Belt Co., Toronto, Ont.

COLLETS
Butterfield & Co., Inc., Rock Island, Que.
Hardinge Bros., Inc., Chicago, Ill.
Hendley Machine Co., Torrington Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

COMPOUNDS, CLEANING
Oakley Chemical Co., New York, N.Y.

COMPOUNDS—CUTTING, DRILLING, GRINDING, SCREW CUTTING
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Oakley Chemical Co., New York, N.Y.

COMPRESSORS, AIR AND GAS
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.

CONES, FRICTION
Norton Co., of Can. Ltd., Hamilton, Ont.

CONNECTING RODS AND STRAPS
Canada Foundries & Forgings Co., Welland, Ont.

CONTRACT WORK
Victoria Foundry Co., Ltd., Ottawa, Ont.

CONVEYORS AND ELEVATORS (SEE ELEVATORS)
Jones & Glassco, Montreal, Que.

COTTERS
Steel Co. of Canada, Ltd., Hamilton, Ont.

COUNTERBORES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

COUNTERS, REVOLUTION
Starrett Co., L. S., Athol, Mass.

COUNTERSHAFTS
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Johnson Machine Co., Carlyle, Man-
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

COUNTERSINKS
Butterfield & Co., Inc., Rock Island, Que.
Pratt &Whitney Co., of Canada, Ltd., Dundas, Ont.

COUPLERS, CAR AND LOCOMOTIVE
Can. Steel Foundries, Montreal, Que.

COUPLINGS
Steel Co. of Canada, Ltd., Hamilton, Ont.

COUPLINGS, PIPE
Fittings, Limited, Oshawa, Ont.

COUPLINGS, SHAFT
Can. Link-Belt Co., Toronto, Ont.

CRANES, ELECTRIC
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can.-Link-Belt Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

CRANES, LOCOMOTIVE
Can. Link-Belt Co., Toronto, Ont.

Bertram & Son Co., td., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

CRANK PIN TURNING MACHINE
Underwood Corp., H.B., Philadelphia, Pa.

CUTTERS, GEAR
Brown & Sharpe Mfg. Co., Providence, R. I.
Butterfield & Co., Inc., Rock Island, Q. Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CUTTERS, HIGH SPEED
Atkins & Co., Inc., E. C., Indianapolis.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CUTTERS, MILLING
Brown & Sharpe Mfg. Co., Providence, R. I.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.

CUTTERS, STAY BOLT
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.

CUTTING-OFF MACHINE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

CUTTING OFF MACHINES, PIPE (SEE PIPE-CUTTING AND THREADING MACHINES)
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.

CUTTING-OFF TOOLS
Armstrong Bros. Tool Co., Chicago, Ill.

CUTTING OIL FILTERS (SEE OIL FILTERING SYSTEMS
Bowser, S. F. & Co., Ltd., Toronto.

CUTTING, OXY-HYDROGEN
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Ltd., Toronto, Ont.

DEALERS, MACHINERY (SEE SEARCHLIGHT SECTION)
Petrie, Ltd., H. W., Toronto, Ont.

DETACHABLE CHAIN
International Malleable Iron Co., Guelph, Ont.

DIAMONDS, BLACK AND ROUGH
Can. Desmond-Stephan Mfg Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

DIAMOND TOOLS
Can. Desmond-Stephan Co., Hamilton,
Wheel Trueing Tool Co., Windsor, Ont.

DIAMOND CROSSINGS
Can. Steel Foundries, Montreal, Que.

DIAMONDS, IMPORTERS
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Co., Windsor, Ont.

DIES, SCREW AND THREAD CUTTING
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.

DIES, SHEET-METAL AND SUB-PRESS (See Tool Work)
Brown, Boggs & Co., Ltd., Hamilton, Ont.

DIES, FORGING
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

DIES, SELF-OPENING, ADJUSTABLE
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Landis Machine Co., Inc., Waynesboro,
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DIES, THREADING-OPENING
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford.
National Acme Co., Cleveland, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DIVIDING HEADS
Burke Machine Tool Co., Conneaut, Ohio.
Hendey Machine Co., Torrington, Conn.
Kearney & Treacker Co., Milwaukee, Wis.
Petrie, Ltd., H. W. Toronto, Ont.

DOGS, LATHE AND MILLING MACHINE
Armstrong Bros. Tool Co., Chicago, Ill.

DRAFTING MATERIALS
American Lead Pencil Co., New York City, N.Y.

DRESSERS, GRINDING WHEEL
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ont.
Norton Co., of Can., Ltd., Hamilton.
Wheel Trueing Co., Windsor, Ont.

DRESSING TOOLS
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Co., Windsor, Ont.

DRILL HOLDERS
Armstrong Bros. Tool Co., Chicago, Ill.

DRILLING MACHINES, BENCH
Burke Machine Tool Co., Conneaut, Ohio.
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Hardinge Bros., Inc., Chicago, Ill.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
U. S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, ELECTRIC AND HAND
Can. Fairbanks-Morse Co., Ltd, Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, GANG
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

DRILLING MACHINES, HEAVY DUTY
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
Rockford Drilling Machine Co., Rockford, Ill.

BORING, DRILLING AND MILLING MACHINES, (HORIZONTAL.)
Gisholt Machine Co., Madison, Wis.

DRILLING MACHINES, Multiple Spindle
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
National Acme Co., Cleveland, Ohio.

DRILLING MACHINES, Pneumatic
Cleveland Pneumatic Tool Co., Toronto. Ont.

DRILLING MACHINES, PORTABLE
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, RADIAL
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Wiliams Machinery Co., A. R., Toronto,

DRILLING MACHINES, SENSITIVE
Burke Machine Tool Co., Conneaut, O.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Williams Machinery Co., A. R., Toronto.
Wisconsin Electric Co., Racine, Wis

DRILLING MACHINES, TURRET
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wisconsin.
Williams Machinery Co., A. R., Toronto.

DRILLING MACHINES, VERTICAL
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

DRILLS, CENTRE
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DRILLS, HIGH SPEED TWIST
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Cleveland Twist Drill Co., Cleveland, O
Greenfield Tap & Die Corp., Galt, Ont
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DRILLS, RATCHET
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

DRILLS, TWIST AND FLAT
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt. Ont.

DROP FORGINGS
Steel Co. of Canada, Ltd., Hamilton.

DUST HANDLING EQUIPMENT
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

ELECTRICAL INSTRUMENTS
Bristol Co., Waterbury, Conn.

ELECTRICAL SUPPLIES
Atkins & Co., Inc., E. C., Indianapolis.
Diamond State Fibre Co., Toronto, Ont.
U.S. Electrical Tool Co., Cincinnati, O.

ELEVATING TRUCKS (See Trucks)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

ELEVATORS AND CONVEYORS
Can. Link-Belt C., Toronto, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q

EQUIPMENT, ELEVATOR SAFETY
Jones & Glassco, Montreal, Que.

EMERY WHEELS (See Grinding Wheels)
J. R. Baxter & Co., Ltd., Montreal, Que.
Atkins & Co., E. C., Indianapolis, I.
Norton Co., of Canada., Ltd., Hamilton.

ENGINES, CAPSTAN
Kennedy & Sons, Wm., Owen Sound, Ont.

ENGINE LATHE MANUFACTURERS
Oliver Machinery Co., Grand Rapids, Michigan.

ENGINEERS, MECHANICAL
Dominion Engineering Works, Limited, Montreal, Que.
Gisholt Machine Co., Madison, Wis.
Hamilton Gear & Machine Co., Toronto,

EXPANDERS, TUBE
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

FANS, ELECTRIC
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

FANS, EXHAUST
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Petrie Ltd., H. W., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass.

FANS, VENTILATING
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

FIBRE
Diamond State Fibre Co., of Can. Ltd., Toronto, Ont.

FILES AND RASPS
Nicholson File Co., Port Hope, Ont.
Simmons Canada Saw Co., Montreal, Que.

FILLER, IRON (See Cements, Iron)
Smooth Mfg Co., Jersey City, N.J.

FIRE ESCAPES
Roelofson Elevator Co., Galt, Ont.

FITTINGS, PIPE
International Malleable Iron Co., Guelph.
Fittings, Limited, Oshawa, Ont.

FLEXIBLE SHAFTS
Strand & Co., N. A., Chicago, Ill

FLUXES, WELDING
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd, Toronto
Liquide Air Company, Toronto, Ont.

FORGING MACHINERY
Acme Machinery Co., Cleveland, Ohio
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown Boggs & Co., Ltd., Montreal.
National Machinery Co., Tiffin, Ohio
Steel Co. of Canada, Ltd., Hamil.

BUYERS' DIRECTORY

FORGINGS, DROP
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Ltd., Toronto, Ont.

FORGINGS, HAMMER
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Hepburn Ltd., John T., Toronto, Ont.

FOUNDRY EQUIPMENT
McDougall Co., Ltd., R., Galt, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

FOUNDRY SUPPLIES
Rice Lewis & Son, Ltd., Toronto, Ont.

FROGS, SPRING OR RIGID
Can. Steel Foundries, Montreal, Que.

FURNACES, ELECTRIC
Rockwell Co., W. S. New York City.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

FURNACES, HEAT TREATING COAL
Rockwell Co., W. S., New York City.

FURNACES, HEAT TREATING OIL AND GAS
Bellevue Industrial Furnace Co., Detroit, Michigan.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Rockwell Co., W. R., New York City.

FURNACES TEMPERING AND ANNEALING
Bellevue Industrial Furnace Co., Detriot, Mich.
Brown & Sharpe Mfg., Co., Providence R. I.
Rockwell Co., W. S., New York City.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

FURNACES AND OVENS, ELECTRIC
Petrie, Ltd., H. W., Toronto, Ont.
Rockwell & Co., W. S., New York city.
Starrett Co., L. S. Athol, Mass.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

GAGES, MEASURING (See Tool Work)
Brown & Sharpe Mfg. Co, Providence, R. I.
Greenfield Tap & Die Corp., Galt, Ont.
Lufkin Rule Co., Windsor, Ont.
Starrett Co., L. S., Athol, Mass.

GAGES, RECORDING
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Pratt & Whitney Co, of Canada, Ltd., Dundas, Ont.

GAGES, SPECIAL MEASURING (See Tool Work)
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GAGES, THREAD
Brown & Sharpe Mfg. Co., Providence R. I.
Starrett Co. L S, Athol, Mass.

GALVANIZING
Fittings, Limited, Oshawa, Ont.

GAS, COAL COMPRESSED
L'Air Liquid Society, Toronto, Ont.

GAS, COMPRESSED
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

GASKETS
Diamond State Fibre Co. of Ca., Ltd., Toronto, Ont.
Smooth Mfg. Co., Jersey City, N. J.

GAUGES VACUUM AND PRESSURE
Taylor Instrument Co. Toronto, Ont.

GEAR BLANKS
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.
Dominion Engineering Works, Limited, Montreal, Que.

GEAR COUNTERS
Hart Mfg. Co., R. A., Battle Creek, Michigan.

GEAR-CUTTING MACHINES
Bertram & Sons Co., Ltd., The John Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Fellows Gear Shaper Co., Springfield, Vt.
Petrie, Ltd., H. W., Toronto, Ont.
Whiton Machine Co., D. E., New London, Conn.

GEAR TESTING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.

GEARS, CAST
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Hull Iron & Steel Foundries, Hull, Que.
Dominion Engineering Works, Limited, Montreal, Que.

GEARS, CUT
Brown & Sharpe Mfg. Co., Providence, R. I.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Gardner & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto, Ont.
Hepburn Ltd., John T. Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

GEARS, DRESSED
Kennedy & Sons, Wm., Owen Sound, Ontario.

GEARS, FORGED
Canada Foundries & Forgings Co., Welland, Ont.

GEARS, HERRINGBONE
Hamilton Gear & Machine Co., Toronto, Ont.

GEARS, RAWHIDE (See Gears, Cut)
Hamilton Gear & Machine Co., Toronto.

GEAR, SILENT CHAIN
Gardner & Son, Robt., Montreal, Que.
Can. Link-Belt Co., Ltd., Toronto, Can.
Hans Renold of Canada, Ltd., Montreal, Quebec.

GEARS, WORM
Hamilton Gear & Machine Co., Toronto

GENERATORS, ACETYLENE
L'Air Liquide Society, Toronto, Ont.

GLOVES, PROTECTIVE
Industrial Glove Co., Toronto, Ont.

GOGGLES, SAFETY
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

GRAB BUCKETS
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Cleveland Twist Drill Co., Cleveland, O.

GREASE CUPS, PRESSED STEEL AND BRASS
Can. Winkley Co., Ltd., Windsor, Ont.

GREASES, LUBRICATING
Canadian SKF Co., Toronto, Ont.

GRINDING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Norton Co., of Canada, Ltd., Hamilton.

GRINDING MACHINES, ABRASIVE BELT
Norton Co. of Can. Ltd., Hamilton, Ont.

GRINDING MACHINES, AUTOMATIC
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, BENCH
Blount Co., J. G., Everett, Mass.
Geometric Tool Co., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
McDougall Co., Ltd., R., Galt, Ont.
Norton Co. of Canada, Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, CENTER
U. S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES, CUTTER AND REAMER
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Petrie Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, CYLINDRICAL
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.
Norton Co., of Canada, Ltd., Hamilton.

GRINDING MACHINES, DIE
National Acme Co., Cleveland, O.
National Machinery Co., Tiffin, Ohio.

GRINDING MACHINES, DRILL
Bellevue Industrial Furnace Co., Detroit, Mich.
Bertram & Son Co., Ltd., The John, Dundas, Ont.

GRINDING MACHINES, ELECTRIC
Strand & Co., N. A., Chicago, Ill.

GRINDING MACHINES, FLOOR AND TOOL
Blount Co., J. G., Everett, Mass.
National Acme Co., Cleveland, Ohio.
Norton Co. of Canada, Ltd., Hamilton, Ontario.
Petrie, Ltd., H. W., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.

GRINDING MACHINES, INTERNAL
Garlock Machinery Ltd., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Wisconsin Electric Co, Racine, Wis.

GRINDING MACHINES PORTABLE
Strand & Co., N. A., Chicago, Ill.

GRINDING MACHINES, SNAGGING
Blount Co, J. G., Everett, Mass.
Norton Co., of Can. Ltd., Hamilton, Ont.

GRINDING MACHINES, SURFACE
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co, of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, THREAD
Pratt & Whitney Co., of Canada, Ltd.,

GRINDING MACHINERY, TOOL POST
Gisholt Machine Co, Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Wisconsin Electric Co, Racine, Wis.

GRINDING MACHINES, UNIVERSAL
Brown & Sharpe Mfg Co, Providence, Rhode Island.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Landis Tool Co, Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co, of Canada, Ltd, Hamilton, Ontario.
Petrie, Ltd., H. W., Toronto, Ont.

GRINDING WHEELS
J. R. Baxter & Co., Ltd., Montreal, Que.
Atkins & Co, Inc., E. C., Indianapolis, Indiana.
Can Fairbanks-Morse Co., Ltd., Montreal.
Norton Co. of Can., Ltd., Hamilton, Ont.

GUN-BARREL MACHINERY
Steinle Turret Machine Co., Madison, Wisconsin.

HACK SAWS, POWER
Atkins & Co., Inc., E C., Indianapolis, Indiana.
Petrie, Ltd., H W., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L S., Athol, Mass.

HAMMERS, CHIPPING
Cleveland Pneumatic Tool Co., Toronto, Ont.
High Speed Hammer Co, Rochester.

HAMMERS, DROP
Bertram & Son Co., Ltd., The John Dundas, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown Boggs & Co, Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

HAMMERS, ELECTRIC
Brown, Boggs & Co., Ltd., Hamilton, Ont.

HAMMERS, PNEUMATIC
Can. Steel Foundries, Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto Ont.

HANGERS, SHAFTING
Canadian SKF Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Hamilton Gear & Machine Co., Toronto,

HOBBING MACHINES
Shore Instrument Co., Jamaica, N.Y.

HARDENING, CASE-HARDENING AND TEMPERING
Barnes Company, Wallace, Hamilton.
Chapman Double Ball Bearing Co., Toronto.
Petrie, Ltd., H. W., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Cleveland Pneumatic Tool Co., Toronto Ont.

HAMMERS, POWER
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

HOBS
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

HOISTS, ELECTRIC
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

HOISTS, ELECTRIC
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

HOISTS, HAND
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio

HOISTS, PNEUMATIC
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

HOLDERS-ON, PNEUMATIC
Cleveland Pneumatic Tool Co, Toronto Ont.

HYDRAULIC MACHINERY
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

IGNITERS, GAS ENGINE
Canada Foundries & Forgings Co., Welland, Ont.
Burke Machine Tool Co., Conneaut, O.

INDICATORS, SPEED AND TEST
Brown & Sharpe Mfg Co, Providence, R.I.

INSULATION
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.

IRON BARS
Steel Co. of Canada, Ltd., Hamilton, Ont.

JACKS, HYDRAULIC
Norton, A. O., Boston, Mass.

JACKS, PLANER
Armstrong Bros. Tool Co., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

JAPANNING AND VARNISHING OVENS
Brantford Oven & Rack Co., Brantford, Ont.

JIGS AND FIXTURES (SEE TOOL WORK)
Fisher Motor Co, Ltd, Orillia, Ont.
Gisholt Machine Co, Madison, Wis.
Preston & Schwartz, Galt, Ont.

KEYSEATING MACHINES
Morton Mfg Co, Muskegon, Mich.

BUYERS' DIRECTORY

Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

KEYS, MACHINE
Can. Drawn Steel Co., Hamilton, Ont.
Morton Mfg. Co., Muskegon, Mich.

KNIVES, MACHINE
Atkins & Co., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

KNURL HOLDERS
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

LATHE ATTACHMENTS
Hendey Machine Co., Torrington, Conn.
Petrie, Ltd., H. W., Toronto, Ont.

LATHE TOOLS
Armstrong Bros. Tool Co. ,Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

LATHES, AUTOMATIC AND SEMI-AUTOMATIC
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, BENCH
Hardinge Bros., Inc., Chicago, Ill.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

LATHES, BORING
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, CHUCKING (SEE LATHES, HORIZONTAL TURRET, AND LATHES, VERTICAL TURRET)
Acme Machine Tool Co., Cincinnati, O.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, ENGINE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd. H. W., Toronto, Ont
Rockford Lathe & Drill Co., Rockford, Illinois.

LATHES, EXTENSION AND GAP
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, O.
Petrie, Ltd., H. W., Toronto, Ont.
Steinle Turret Machine Co., Madison, Wis.

LATHES, PRECISION
Hardinge Bros., Chicago.

LATHES, RELIEVING
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.

LATHE, UNIVERSAL HAND
Brown & Sharpe Mfg. Co., Providence, Rhode Island.

LATHE, SPEED AND HAND
Blount Co., J. G., Everett, Mass.

LATHES, SPINNING
Pryibil Machine Co., Torrington, Conn.

LATHES, VERTICAL TURRET
Bertram & Son, Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

LATHES, WOOD TURNING
Blount, Co., J. G., Everett, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.

LEAD PIPE
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

LEATHER FILLET
D. K. McLaren Co., Ltd., Montreal, Que.

LIGHTING AND GENERATING SETS
Beardmore & Co., Ltd., Wm., Montreal, Que.

LINOLEUM MILL MACHINERY
Bertrams, Ltd., Edinburgh, Scotland.

LIQUID AIR PLANTS
L'Air Liquide Society, Toronto, Ont.

LOCKERS, CLOTHES
Dennis Wire and Iron Works, London, Ont.

LUBRICANTS
Oakley Chemical Co., New York, N.Y.

LUBRICATING SYSTEMS
Bowser, S. F., & Co., Ltd., Toronto, Canada.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Ltd., Welland, Ont.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R. Toronto Ont.

MANGANESE STEEL
Can. Steel Foundries, Montreal, Que.

MANDRELS, EXPANDING
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MANDRELS, SOLID
Greenfield Tap & Die Corp., Galt, Ont.
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Pratt & Whitney Co., of Canada. Ltd., Dundas, Ont.

MEASURING MACHINES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MECHANICS' FINE TOOLS
Lufkin Rule Co., Windsor, Ont.

METALS, ALLOY
Canada Metal Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.

METAL WORKERS
Parker Co., Charles, Meriden, Conn.

MICROMETER CALIPERS
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Rice Lewis & Son, Ltd., Toronto, Ont.

MILLING ATTACHMENTS
Burke Machine Tool Co., Conneaut, O.
Hendey Machine Co., Torrington, Conn.
Hinckley Machine Works, Hinckley, Ill.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

MILLING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Burke Machine Tool Co., Conneaut, O

MILLING MACHINES, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence, R. I.
Hardinge Bros., Inc., Chicago, Ill.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

MILLING MACHINES, BENCH
Burke Machine Tool Co., Conneaut. O.
Hardinge Bros., Inc., Chicago, Ill.

MILLING MACHINES, HAND
Brown & Sharpe Mfg. Co., Providence
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MILLING MACHINES, HORIZONTAL PLANER TYPE.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Kearney & Trecker Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto.

MILLING MACHINES, PLAIN
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, O.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

MILLING MACHINES, THREAD
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MILLING MACHINES, UNIVERSAL
Brown & Sharpe Mfg. Co., Providence,
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

MILLING MACHINES, VERTICAL
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, O.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto.

MOTORS, ELECTRIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Roelofson Elevator Co., Galt, Ont.
Williams Machinery Co., A. R., Toronto,
Wisconsin Electric Co., Racine Wis.

NAILS AND STAPLES
Canada Metal Co., Ltd., Toronto, Ont.

NIPPLES
Canada Metal Co., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton.

NITROGEN
Carter Welding Co. Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

NUT TAPPERS
(See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
National Acme Co., Cleveland, Ohio.

NUTS, FINISHED and SEMI-FINISHED
Galt Macine Screw Co., Galt, Ont.
National Acme Co., Montreal, ue.

NUTS (Up to 4-in.)
Steel Co. of Canada, Ltd., Hamilton.

NUTS, S.A.E., PLAIN AND CASTELLATED
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

OIL FILTERING AND STORAGE SYSTEMS
Bowser, S. F., & Co., Ltd., Toronto,

OIL STORAGE ENGINEERS
Bowser, S. F., & Co., Ltd., Toronto,

OIL HOLE COVERS
Can. Whitney Co., Ltd., Windsor, Ont.

OILS, SOLUABLE
Brantford Oven & Rack Co., Brantford, Ontario.

OXYGEN
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

OXY-ACETYLENE APPARATUS
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Atlas Press Co., Kalamazoo, Mich.

PAPER MILL CONVEYORS
Bertram Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd., Montreal, Que.

PATTERNS, WOOD AND METAL
Fittings, Limited, Oshawa, Ont.
Victoria Foundry Co., Ltd., Ottawa.

PHOSPHOR TIN
Canada Metal Co., Ltd., Toronto, Ont.

PHOTOGRAPHIC DUPLICATING MACHINES
Photostat Corp., Providence, R. I.

PIPE BENDING MACHINES
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Underwood Corp., H. R., Philadelphia, Pa.
Williams Machinery Co., A. R., Toronto.

PIPE CUTTING AND THREADING MACHINES
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

PIPE
Canada Metal Co., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.

PIPE FITTINGS
Canada Metal Co., Toronto, Ont.
Fittings, Limited, Oshawa, Ont.
International Malleable Iron Co., Guelph Ont.

PIPE AND NIPPLE THREADING MACHINES
Landis Machine Co., Inc., Waynesboro, Pa.

PIPE FITTERS' TOOLS
Rice Lewis & Son, Ltd., Toronto, Ont.

PIPE THREADING DIE HEADS
Landis Machine Co., Inc., Waynesboro, Pa.

PISTON-RING MACHINES
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

PLANING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Williams Machinery Co., A. R., Toronto

PLANING MACHINES, ROTARY
Bertram & Son Co., Ltd., The John, Dundas, Ont.

PLATE ROLLS
Bertram & Son Co., Ltd., The John, Dundas, Ont.

PNEUMATIC TOOLS
Cleveland Pneumatic Tool Co., Toronto

POLISHING AND BUFFING MACHINES
J. R Baxter & Co., Ltd., Montreal, Q.
Blount Co., J. G. Everett, Mass.
Brown & Sharpe Mfg. Co., Providence.
Pryibil Machine Co., New York, N.Y.

PRESSED STEEL PARTS
American Pulley Co., Philadelphia, Pa.
Fisher Motor Co., Ltd., Orillia, Ont.

PRESSES, ARBOR
Atlas Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

PRESSES, DROP AND FORGING
Brown, Boggs & Co., Ltd., Hamilton.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

PRESSES, FOOT AND HAND
Brown, Boggs & Co., Ltd., Hamilton.

PRESSES, HYDRAULIC
Bertram & Son Co., Ltd., The John, Dunldas, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Perrin Ltd., W. R., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

PRESSES, POWER
Bliss Co., E. W., Prooklyn, N. Y.
Brown, Boggs, & Co., Ltd., Hamilton
Hepburn Ltd., John T., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Stoll Co., Inc., D. H., Buffalo, N.Y

PRESSES, SCREW
Brown, Boggs & Co., Ltd., Hamilton
Petrie, Ltd., H. W., Toronto, Ont

PROFILING MACHINES
Prtt & Whitney Co., of Canada, Ltd. Dundas, Ont.

PROTRACTORS
Brown & Sharpe Mfg. Co., Providence
Lufkin Rule Co., Windsor, Ont.

PROPELLERS
Kennedy & Sons, Wm., Owen Sound Ontario.

PULLEYS, CORK INSERT
American Pulley Co., Philadelphia, Pa

PULLEYS, METAL AND FIBRE
American Pulley Co., Philadelphia, Pa.
Can. Fairbanks-Morse Ltd., Montreal, Q
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.
D. K. McLaren Co., Ltd., Montreal, Que

PULP AND PAPER MILL EQUIPMENT
Dominion Engineering Works, Ltd., Montreal, Que.

PUMPS, HYDRAULIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Dominion Engineering Works, Ltd Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.

BUYERS' DIRECTORY

PUMPS, LUBRICANT AND OIL
Bowser, S. F., & Co., Ltd., Toronto.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Hepburn Ltd., John T., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.

PUMPS, POWER
Bowser, S. F., & Co., Ltd., Toronto.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hepburn Ltd., John T., Toronto, Ont.

PUNCHES, CENTER
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

PUNCHES, HAND
Brown Boggs & Co., Ltd., Hamilton.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Jardine & Co., A. B., Hespeler, Ont.

PUNCHES, POWER
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

PUNCHING MACHINES, HORIZONTAL
Bertrams Ltd., Edinburgh, Scotland.

PYROMETERS, ELECTRIC
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Hiram Walker & Sons Metal Products Co., Walkerville, Ont.

RACKS, CUT
Hamilton Gear & Machine Co., Toronto.

RACKS, STORAGE
(See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ontario.

REAMER HOLDERS
Simonds Canada Saw Co., Montreal, Q.

REAMERS, EXPANDING
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

REAMERS, SOLID
Butterfield & Co., Inc., Rock Island, Q.
Morse Twist Drill & Machine Co., New Bedford, Mass.

REAMERS, TAPER
Brown & Sharpe Mfg. Co., Providence, R. I.
Butterfield & Co., Inc., Rock Island, Q.
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canad, Ltd., Dundas, Ont.

RECORDERS, TEMPERATURE
Taylor Instrument Co., Rochester, N. Y.

RECORDERS, TIME
Gisholt Machine Co., Rochester, N. Y.
Taylor Instrument Co., Toronto, Ont.

REGULATORS, TEMPERATURE
Taylor Instrument Co., Toronto, Ont.

RIVETS AND BURRS
Parmenter & Bulloch Co., Gananoque, Ont.
Steel Co., of Canada, Ltd., Hamilton,

RIVETS, CHAIN
Pittings, Limited, Oshawa, Ont.

RIVET-MAKING MACHINERY
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

RIVETING MACHINES
Can. Fairbanks-Morse Ltd., Montreal, Q.
High Speed Hammer Co., Rochester, N.Y.
Parmenter & Bulloch Co., Gananoque Ont.
Petrie, Ltd., H. W., Toronto, Ont.

RUDDER FRAMES, STEEL
Can. Steel Foundries, Montreal, Que.

RUBBER MILL MACHINERY
Bertram Ltd., Edinburgh, Scotland.

RULES, STEEL AND WOOD
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Windsor, Ont.

RUST PREVENTATIVES
Oakley Chemical Co., New York, N. Y.

SAND EQUIPMENT
Can. Link-Belt Co., Toronto, Ont.

SAND RAMMERS, PNEUMATIC
Cleveland Pneumatic Tool Co., Toronto.

SAW FRAMES AND BLADES, HACK
Atkins & Co., Inc., E. C., Indianapolis,
Diamond Saw & Stamping Works, Buffalo, N. Y.
Rice Lewis & Sons, Ltd., Tornto, Ont.
Simonds Canada Saw Co., Montreal, Q

SAWING MACHINES, POWER HACK
Atkins & Co., Inc., E. C., Indianapolis,
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

SAW SHARPENING MACHINES
Atkins & Co., Inc., E. C., Indianapolis,
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

SAW SHARPENING MACHINES
Atkins & Co., Inc., E. C., Indianapolis

SAW TABLES, UNIVERSAL
Petrie, Ltd., H. W., Toronto, Ont.

SAWS, CIRCULAR METAL
Atkins & Co., Inc., E. C., Indianapolis.
Pryibil Machine Co., New York, N. Y.
Gisholt Machine Co., Madison, Wis.

SAWS, HAND
Atkins & Co., Inc., E. C., Indianapolis
Simonds Canada Saw Co., Montreal, Q.

SAWS, HOT AND COLD
Atkins & Co., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Q.

SAWS, HIGH SPEED STEEL
Atkins & Co., Inc., E.C., Indianapolis, I.
Butterfield & Co. Inc., Rock Island, Q
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWS, METAL BAND
Atkins & Co., E. C., Indianapolis, I.

SAWS, METAL CUTTING
Brown & Sharpe Mfg. Co., Providence,
Butterfield & Co., Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.
Starrett Co., L. S., Athol, Mass.

SAWS, SCREW SLOTTING
Atkins & Co., Inc., E., C., Indianapolis.
Butterfield & Co., Inc., Rock Island, Q
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canda, Ltd., Dundas, Ont.

SAWS, SCREW SLOTTING
Atkins & Co., Inc., E. C., Indianapolis
Butterfield & Co., Inc., Rock Island, Q.
Pratt & Whitney Co, of Canada, Ltd, Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q

SAWS, WOOD
E. C. Atkins & Co., Indianapolis, Ind

SCALES
Brown & Sharpe Mfg. Co., Providence
Can. Fairbanks-Morse Ltd., Montreal, Q.
Lufkin Rule Co., Windsor, Ont.

SCREENS
Dominion Engineering Works, Ltd., Montreal, Que.

SCREW DRIVERS, OPTICAL, JEWELRY AND NOVELTY
Strand & Co., N. A., Chicago, Ill.

SCREW MACHINE WORK
Cook Co., Asa S., Hartford, Conn
National Acme Co., Montreal, Que.

SCREW MACHINERY, WOOD AND LAG
Cook Co., Asa S., Hartford, Conn.

SCREW MACHINES
Brown & Sharpe Mfg. Co., Providence, Rhode Island.

SCREW MACHINES, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.

SCREW MACHINE PRODUCTS
National Acme Co., Montreal, Que.

SCREW PLATES
Butterfield & Co., Inc., Rock Island, Que.
Jardine & Co., A. B., Hespeler, Ont.

SCREWS, CAP AND SET
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

SCREWS, SAFETY, SET
Galt Machine Screw Co., Galt, Ont.

SECOND-HAND MACHINERY
See last page of directory.
Petrie, Ltd., H. W., Toronto, Ont.

SEPARATORS, MOISTURE AND OIL
Bowser, S. F., & Co., Ltd., Toronto, Canada.

SEPARATORS, OIL AND WASTE
Bowser, S. F., & Co., Ltd., Toronto.

SHAFTS, FLEXIBLE
Strand & Co., N. A., Chicago, Ill.

SHAFTING
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
Williams Machinery Co., A. R., Toronto.

SHAPES, COLD-DRAWN SPECIAL STEEL
Union Drawn Steel Co., Hamilton, Ont.

SHAPING MACHINES
Hendey Machine Co., Torrington, Conn.
Morton Mfg. Co., Muskegon, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Williams Machinery Co., A. R., Toronto.

SHEARS, HAND
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

SHEARS, POWER
Bliss Co., E. W., Brooklyn, N. Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Stoll Co., Inc., D. H., Buffalo, N. Y.
Williams Machinery Co., A. R., Toronto, Ont.

SHEARING MACHINES, ANGLE, IRON BAR AND GATE
Bertrams Ltd., Edinburgh, Scotland.

SHEET LEAD
Canada Metal Co., Ltd., Toronto, Ont.

SHEET METAL WORKING MACHINERY
Bliss Co., E. W., Brooklyn, N. Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Stoll Co., Inc., D. H., Buffalo, N. Y.

SHEETS, NICKEL, MONEL AND FIBRE
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.

SHEETS, O.P.C.R. & B. A. AND BLUE ANNEALED
Steel Co., of Canada, Ltd., Hamilton, Ont.

SIDE FRAMES, LOCOMOTIVE
Can. Steel Foundries, Montreal, Que.

SLOTTING ATTACHMENTS
Brown & Sharpe Mfg. Co., Providence, R.I.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio

SLOTTING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont

SOLDERS
Canada Metal Co., Ltd., Toronto, Ont.

SPECIAL MACHINERY AND TOOLS
Brown Engineering Corp., Ltd., Toronto
Gisholt Machine Co., Madison, Wis
National Acme Co., Cleveland, O

SPIKES, RAILWAY AND PRESSED
Steel Co. of Canada, Ltd., Hamilton, Ont.

SPINNING LATHES
Prybil Machine Co., P., New York City

SPRING, MILLED
Barnes & Co., Wallace, Hamilton, Ont

SPRINGS, SMALL SPIRAL HELICAL, COMPRESSION, EXTENSION, TORSION AND SPECIAL
Barnes Company, Wallace, Hamilton,

SPRINGS
Barnes Company, Wallace, Hamilton.
Cleveland Wire Spring Co., Clevleand, O.
Steele Ltd., James, Guelph, Ont.

SPRINGS, FLAT STEEL, BRUSH HOLDER, CLOCK, SMALL FLAT SPRINGS
Barnes Company, Wallace, Hamilton.

SPROCKETS AND CHAINS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Renold Hanson of Canada, Ltd., Montreal, Que.

SQUARES
Brown & Sharpe Mfg. Co., Providence, R.I.
Lufkin Rule Co., Windsor, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

STAMPING, METAL
American Pulley Co., Philadelphia, Pa.
Barnes Company, Wallace, Hamilton.
Diamond Saw & Stamping Works, Buffalo, N. Y.
Parmenter & Bulloch Co., Gananoque, Ont.

STAMPS, STEEL
Diamond Saw & Stamping Works, Buffalo, N. Y.

STEEL CONCRETE REINFORCEMENT
Steel Co. of Canada, Ltd., Hamilton.

STEEL PLATE
British Empire Steel Co., Montreal, Que.

STEEL AND IRON BARS
Steel Co. of Canada, Ltd., Hamilton

STEELS TOOL
British Empire Steel Co. Montreal Q.

STEEL, COLD-ROLLED STRIP
British Empire Steel Co., Montreal, Q.
Barnes Company, Wallace, Hamilton.

STEEL, CRUCIBLE, SPRING
Barnes, Company, Wallace, Hamilton
British Empire Steel Co., Montreal, Q.

SHEETS, OPEN HEARTH STEEL
Steel Co., of Canada, Ltd., Hamilton.

STEEL, SHAFTING AND FREE CUTTING SCREW
Union Drawn Steel Co., Hamilton, Ont

STEEL, SHEET
British Empire Steel Co., Montreal, Q
Rice Lewis & Son, Ltd., Toronto, Ont

STEEL, STAINLESS
Steel Co., of Can. Ltd., Hamilton, Ont

STEELS, ALLOY AND CARBON
Algoma Steel Corp., Ltd., Sault Ste Marie, Ont.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Can Steel Foundries, Montreal, Que
Rice Lewis & Son, Ltd., Toronto, Ont
Steel Co., of Canada, Ltd., Hamilton Ont.

STEELS, HIGH-SPEED
Armstrong Bros. Tool Co., Chicago, Ill
Atkins & Co., Ltd., Wm., Sheffield, England.
British Empire Steel Co., Montreal, Q
Rice Lewis & Son, Ltd., Toronto, Ont
Steel Co., of Canada, Ltd., Hamilton

STEEL TUBING, CLOSE JOINT AND WELDED
Standard Tube & Fence Co., Ltd., Woodstock, Ont.

STERN FRAMES, CAST STEEL
Can Steel Foundries, Montreal, Que

STRAIGHTENING MACHINERY
Bertram Ltd., Edinburgh, Scotland.
Williams & Co., J. H., Brooklyn, N.Y.

STUDS
Galt Machine Screw Co., Galt, Ont.

BUYERS' DIRECTORY

STUD SETTERS, SELF-OPENING
Geometric Tool Co., New Haven, Conn.

SWAGING MACHINES
Atkins & Co., Inc., E. C., Indianapolis, Indiana.

SWITCHES, RAILWAY
Can. Steel Foundries, Montreal, Que.

TACHOMETERS
Bristol Co., Waterbury, Conn.

TANKS AND PUMPS, OIL
Bowser, S. F., & Co., Ltd., Toronto.

TAP HOLDERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
William L. Procunier, Chicago, Ill.

TAPER PINS
Galt Machine Screw Co., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

TAPES, MEASURING
Starrett Co., L. S., Athol, Mass.
Lufkin, Rule Co., Windsor, Ont.

TAPPING MACHINES AND ATTACHMENTS
Burke Machine Tool Co., Conneaut, O.
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Wm. L. Procunier, Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

TAPS AND DIES
Butterfield & Co., Inc., Rock Island, Q
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

TAPS, COLLAPSING
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.

TEETH, DREDGE BUCKET
Kennedy & Sons, W., Owen Sound, Ont.

THERMOMETERS
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Greenfield Tap and Die Corp., Galt, Ontario.

THREAD-CUTTING TOOLS
Butterfield & Co., Inc., Rock Island, Q.
Greenfield Tap and Die Corp., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

THREAD CUTTING MACHINES
Landis Machine Co., Inc., Waynesboro, Pa.

THREADING MACHINES
Acme Machinery Co., Cleveland, Ohio.
Geometric Tool Co., New Haven, Conn.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Williams Tool Corp., of Can. Ltd., Brantford, Ont.

THREAD LEAD TESTING MACHINES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

THREAD-ROLLING MACHINES
Bliss Co., E. W., Brooklyn, N. Y.

TIE PLATES
Steel Co. of Canada, Ltd., Hamilton.

TIME RECORDERS
International Business Machine Co., Ltd., Toronto, Ont.

TONGS
Hepburn Ltd., John T., Toronto, Ont.

TOOL CASES
Rice Lewis & Son, Ltd., Toronto, Ont.

TOOL HOLDERS
Armstrong Bros., Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Bertrams Ltd., Edinburgh, Scotland.

TOOL POSTS, LATHE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Williams & Co., J. H., Brooklyn, N. Y.

TOOLS, SMALL
(See Machinists' Small Tools)
Armstrong Bros. Tool Co., Chicago, Ill.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Lufkin Rule Co., Windsor, Ont.
National Machine Tool Co., Racine, Wis.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S. Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A.R., Toronto,

TOOL WORK
Brown Engineering Corp., Ltd., Toronto, Ontario.

TORCHES, BLOW
Rice Lewis & Son, Ltd., Toronto, Ont.

TRACKWORK, RAILWAY
Can. Steel Foundries, Montreal, Que.

TRACKWORK, MANGANESE STEEL
Can. Steel Foundries, Montreal, Que.

TRANSMISSION MACHINERY
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound.
Petrie, Ltd., H. W., Toronto, Ont.
Renold, (Hans) of Canada, Ltd., Montreal, Que.

TROLLEYS AND TRAMWAYS
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Wright Mfg. Co., Lisbon, Ohio.

TROLLEY WHEELS
Langley & Austin, Galt, Ont.

TROWELS, PLASTERING
E. C. Atkins & Co., Indianapolis, Ind.

WRENCHES, MACHINISTS'
Armstrong Bros. Tool Co., Chicago, Ill.

TRUCKS
Can. Fairbanks-Morse Ltd., Montreal, Q.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

TUBING, SEAMLESS STEEL, BRASS AND COPPER AND FIBRE
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Goldstein Mfg. Co., Ltd., Toronto, Ont.

TURRET HEADS
Bertram & Son Co., Ltd., The John Dundas, Ont.

TURRET MACHINES
(See Lathes, Horizontal Turret)
Acme Machine Tool Co., Cincinnati, O.
Cook Co., Asa S., Hartford, Conn.
Gisholt Machine Co. Madison Wis.
National Acme Co. Cleveland O.
Pratt & Whitney Co. of Canada Ltd., Dundas, Ont.
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List of Directory of Dealers will be Found above Advertising Index

When answering advertisements kindly mention Canadian Machinery

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THE Buyers' Directory of CANADIAN MACHINERY was originally intended to contain information regarding lines actually manufactured by our advertisers. We now carry the advertising of leading machinery dealers, some of whom represent scores of manufacturers in addition to being manufacturers themselves in some cases. We recommend, therefore, if our subscribers cannot find what they want in our Directory that they communicate with the dealers whose names appear herewith.

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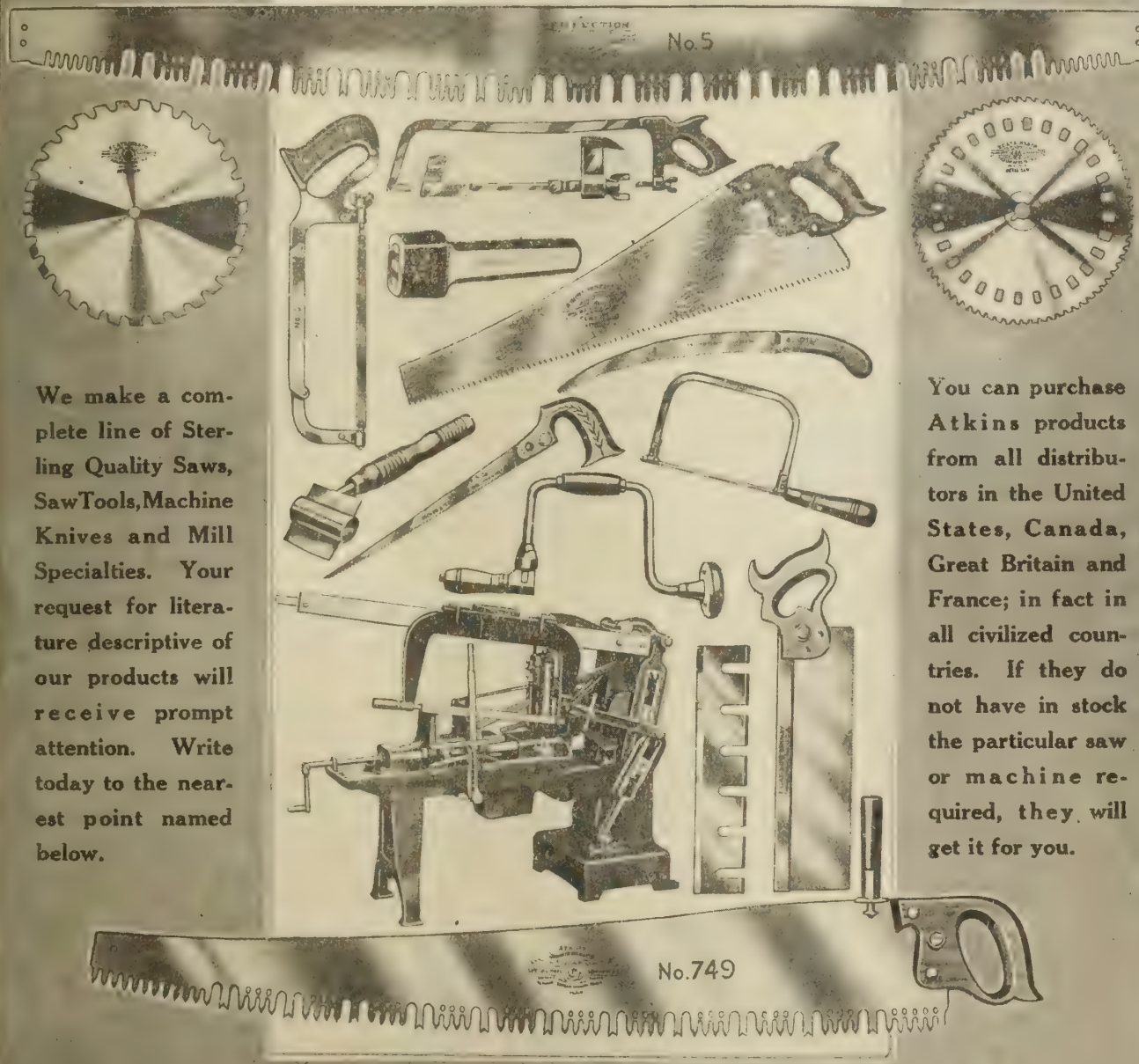

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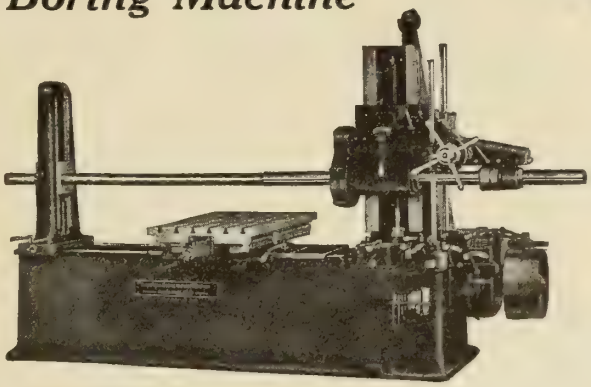

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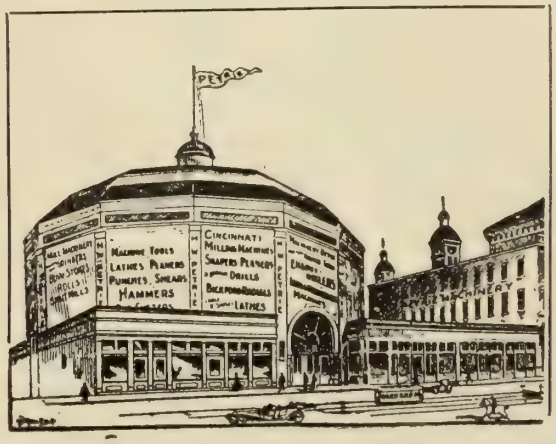

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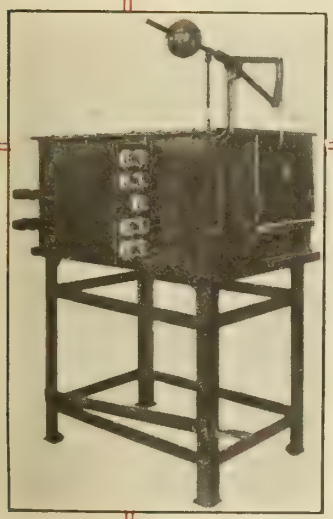

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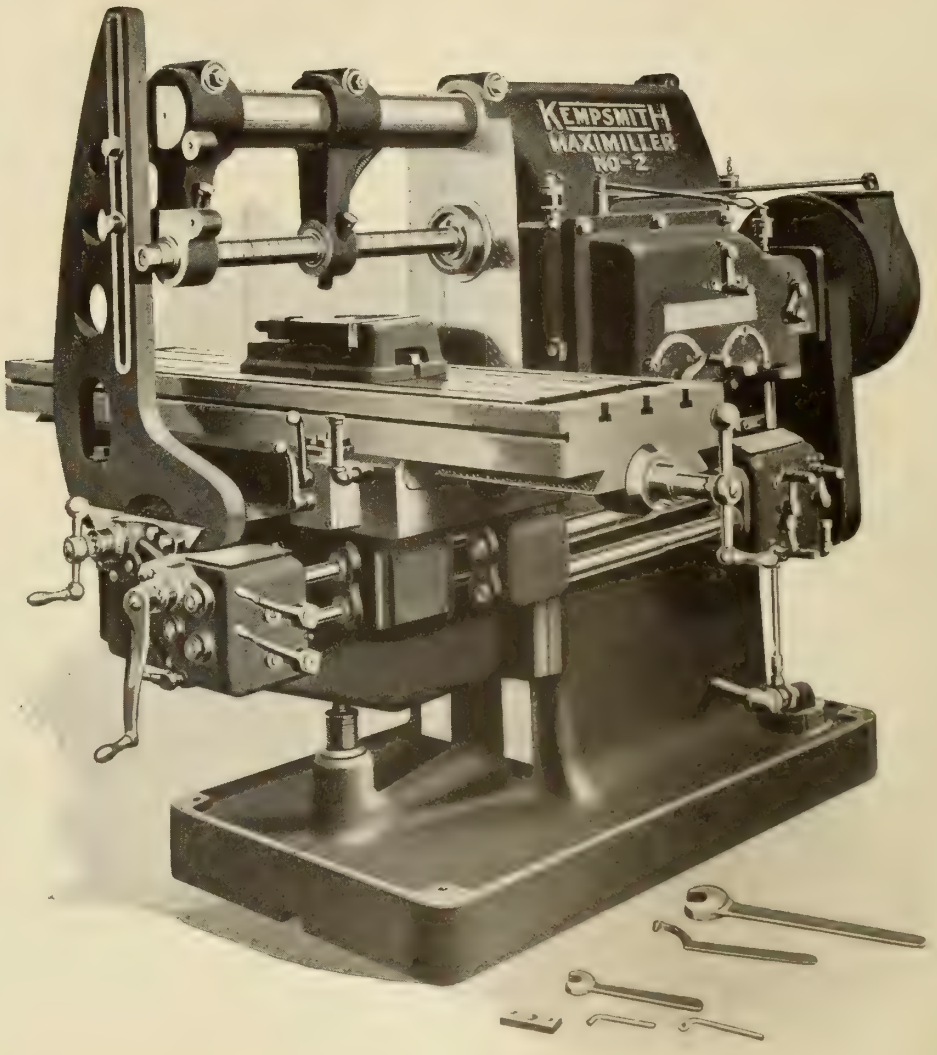

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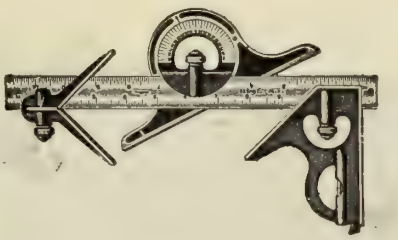

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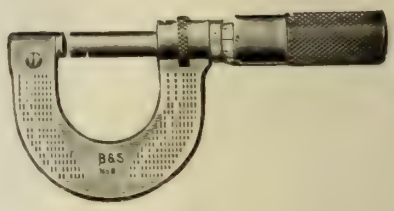

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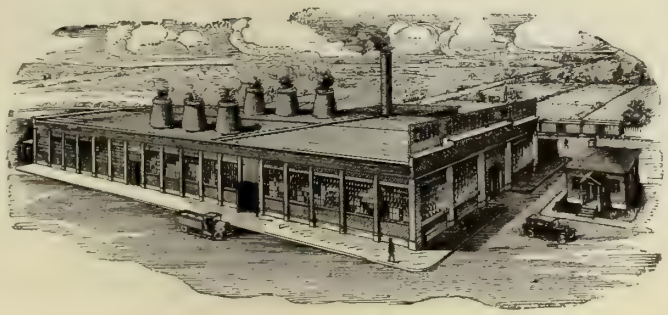

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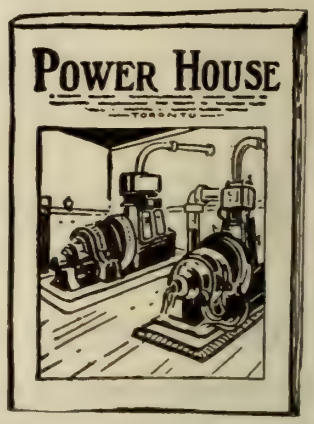

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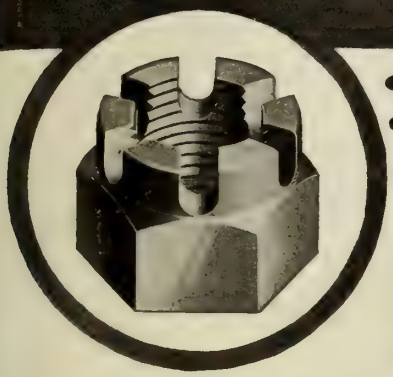

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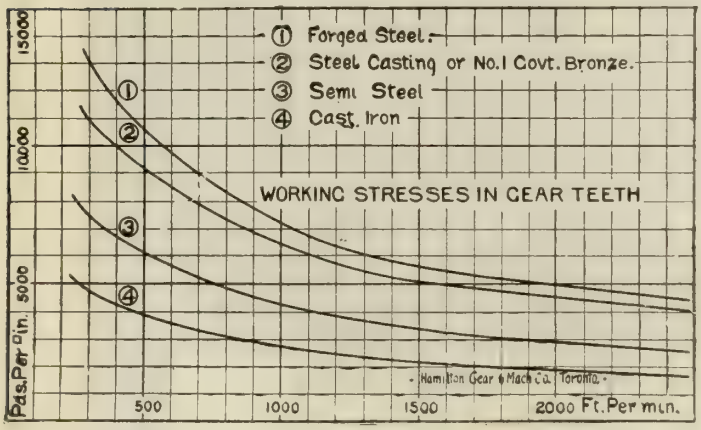

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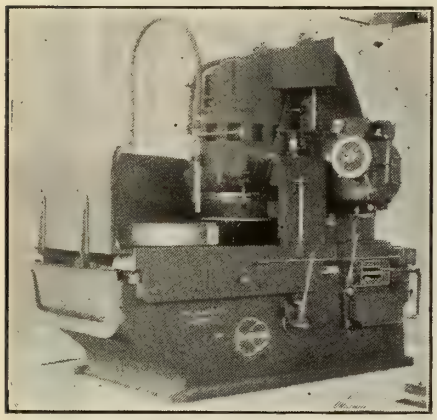

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Two No. 6 double clutches provide for rapid raising or lowering of the wheel.

One No. 10 single clutch is located in the gear box for rotating table.

The **AUTOMOTIVE INDUSTRY** demands reliable friction control—the Johnson Friction Clutch is the answer.

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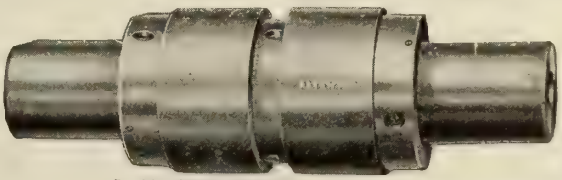

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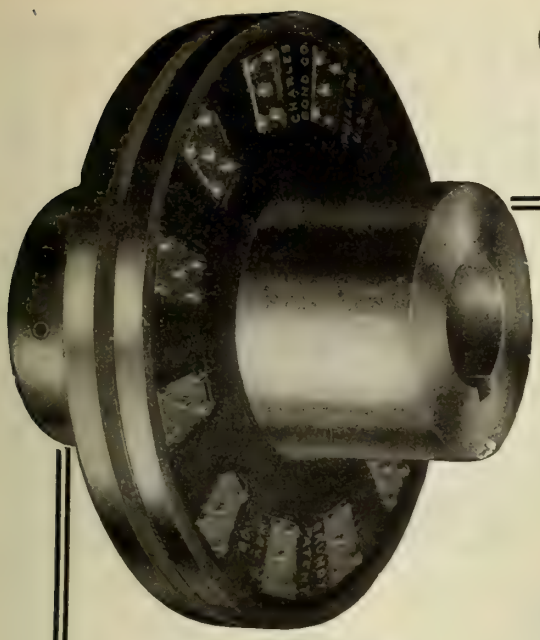

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Style PO: Parallel Valve has "waste port" to bleed the air from hose after valve is shut off, sizes ¼" ⅜" ½" ¾" 1" 1¼" 1½" and 2" Standard Pipe Thread Inlets and Outlets.

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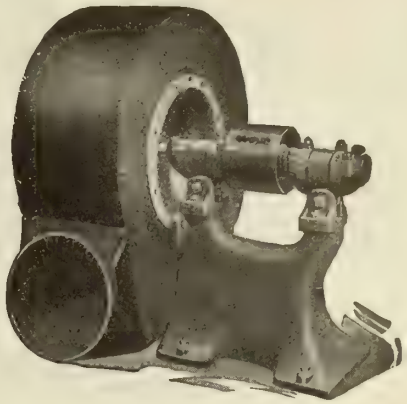

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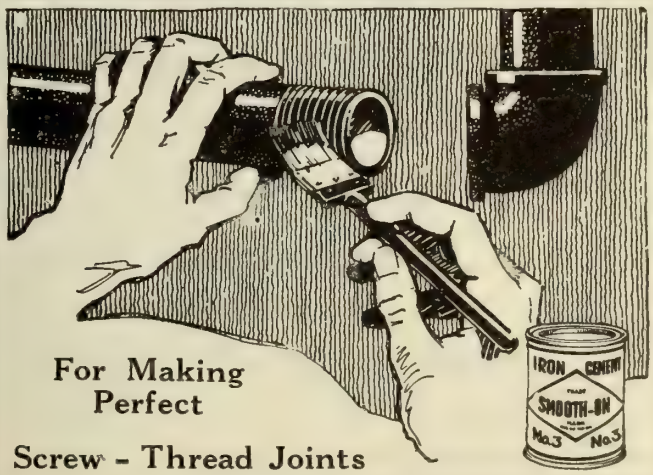

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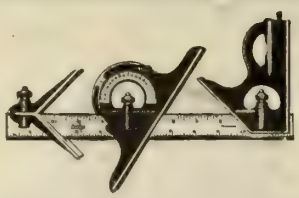

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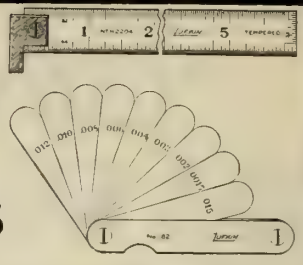

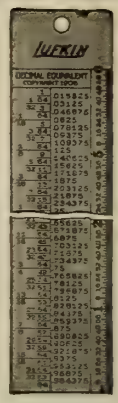

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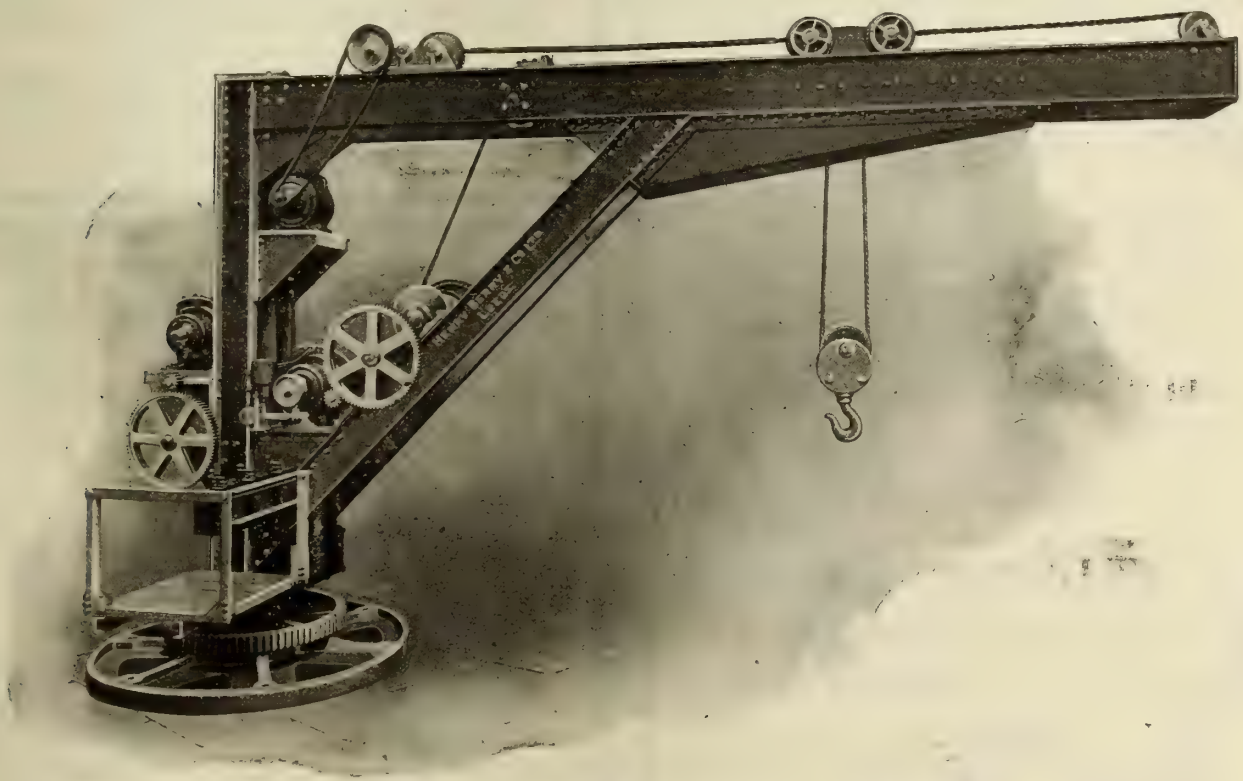

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Williams' perfectly balanced Hammers will grip the **body** of a nail and pull it, head and all, clear through a plank. All nails are trailers to Williams' hammers.

Heads on or heads off, for drive or pull, Williams' Superior Drop-Forged Hammers are the bosses in the nail world. Good workmen want them because they fit the hand, are perfectly balanced and are good all through.

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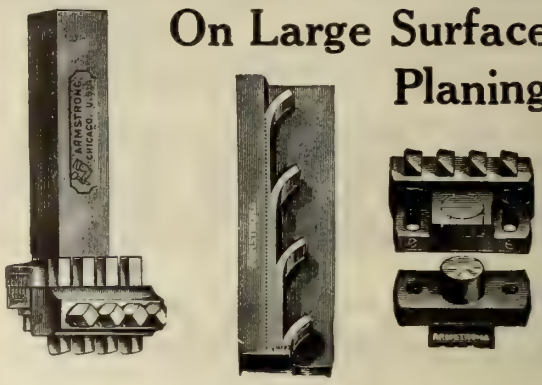

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is specially adapted for surfacing large castings. Its graduated head (which permits speed and ease in setting to any desired feed) makes possible the greatest speed on metals of varying degrees and hardness.

With this tool a planer will carry with ease a feed and depth of cut much greater than is possible with an ordinary tool and with less tendency to "break out" at the end of the cut.

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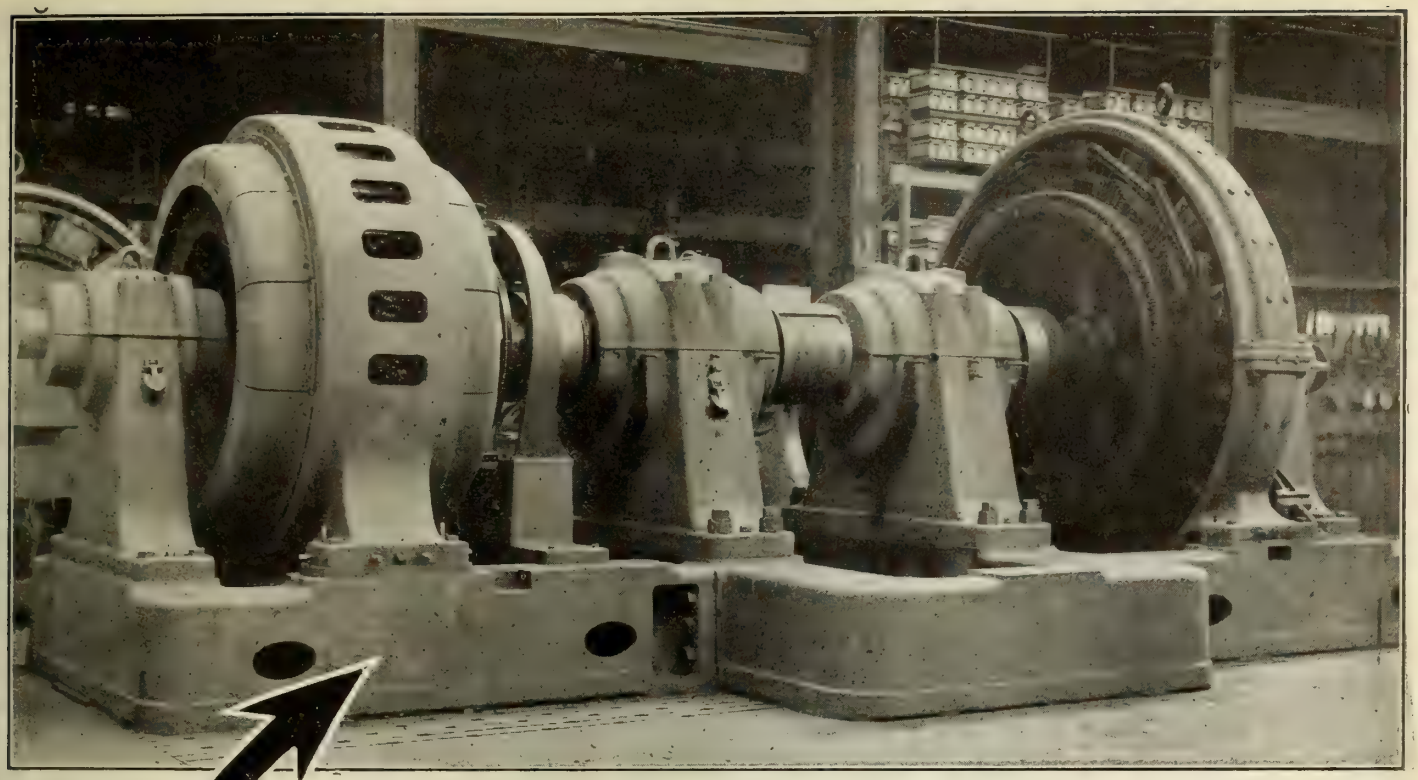

The Preferred Equipment for Strenuous Duty!

WHEN a manufacturer decides to install equipment of exceptional importance, he is certain to do a lot of investigating. When it is a matter of motors his decision as a rule favors Westinghouse. The high standard of reliability and efficient service of Westinghouse Motors has been proven time and again. A recent instance is illustrated above.

This is a 5,000 H.P. Reversing Westinghouse Motor of the compensating, commutating pole type in the plant of the Dominion Foundry and Steel Co., Hamilton, Ont. It is designed for use on their 72-inch universal plate mill. The duty is severe, and because it is severe a Westinghouse has been preferred for the work.

The correct type and size of motor to make good on your job will be pointed out by Westinghouse Engineers, on request.

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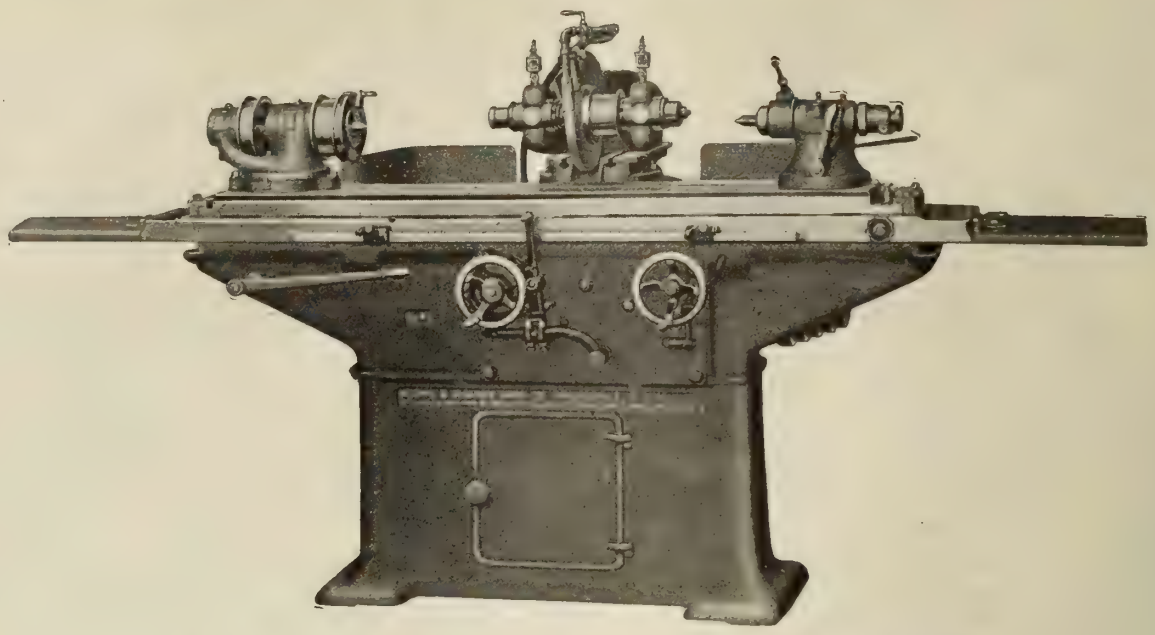

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In Constant Use Wherever Installed

For the Small Shop

The Small Shop with a varied assortment of work should consider the wide range of usefulness of Brown & Sharpe Universal Grinding Machines. In addition to ordinary straight or taper grinding, these machines do internal grinding, grind tools, cutters, and the sides of circular saws, etc. The adaptability of these accurate machines should appeal to the owner of the growing shop. The busy shop with a wide variety of grinding is just the place for one of these useful machines.

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The Large Shop will find the high quality and general usefulness of Brown & Sharpe Universal Grinding Machines warrant serious consideration. Their sturdy construction makes them suited to production work. During the intervals between production jobs their adaptability to all types of grinding keeps them constantly occupied. Add these machines to your grinding equipment. Their accuracy and durability make them investments of the highest value.

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CANADIAN MACHINERY
AND
MANUFACTURING NEWS

VOL. XXVIII, No. 4 JULY 27, 1922

Canada Rich in Electrical Power

IN CONSIDERING any phase of electrical development, it seems impossible to avoid a comparison of conditions at the present time with what they were, say thirty years ago. Street illumination by arc lamps then represented the extent to which it was known, in a general way, as a public utility. Its application to the hundred and one purposes by which it has become familiar to-day, was then quite a matter of theory, and it is even doubtful if those whose knowledge could then boast a certain amount of intimacy, were even inclined to prophesy as to the scope of its industrial objective.

The development as represented by the electrification of street and former steam railways, has of itself outstripped imagination while the almost universal use of the motor in all branches of industrial activity is one of the most wonderful illustrations of 20th century adaptability.

Electricity may be said to symbolize economy in a sense not formerly applicable to that word. It has contributed immeasurably to high efficiencies wherever introduced, has given increasing scope to enterprises of every kind so that industrial populations have benefited and standards of living much improved.

A Fortunate Position

Canada is in a fortunate position as regards electrical development. To-day approximately 3,200,000 developed horse power represents the extent to which the country's hydraulic resources have been converted for public utilities and varied industrial purposes. But even this does not represent the whole story. The limit of this wealth is not even within sight. There is some significance for Canada in the recent statement of an eminent scientist that "at some time more or less remote—long before the exhaustion of our coal—the population will gradually migrate to those countries where the natural resources of energy are most abundant."

With the single exception of Norway, Canada is the second nation of the world as regards horsepower available and horsepower actually developed per capita of population. It is estimated that this country has 19,000,000 available horsepower or 2.21 per capita and .26 developed. The figures for Norway are 55,000,000 available or 2.29 per capita and .54 developed. The United States has 30,000,000 available horsepower or .28 per capita and .07 developed. The completion of the gigantic work undertaken by the Ontario Hydro-Electric Commission is making available 500,000 horsepower of electric energy. Apart altogether from the benefits to be derived from the ultimate distribution of power the expenditure of something like sixty millions of dollars must benefit a large part of the community, from the farmer who sold the land through which the power canal passes, along to the laborers, artisans, mechanics, engineers and manufacturers of all kinds of equipment, electrical and otherwise. This is the outstanding example of such development in Canada, and it must make its appeal to industrial growth.

Boon to Industry

The flexibility and economy of electric power is the explanation of its demand, whether it be applied for transportation purposes, industrial operation or domestic services. It is immediately available at all times. Discoveries as to its varied uses are so frequent that none will be so venturesome as to measure its scope. Medical men declare that, as a factor in dealing with certain ailments, its possibilities are wonderful, while upon its potentiality have been built up great achievements in connection with wired and wireless communication. It has revolutionized certain tool room and heat-treating methods, it is being applied with great success in the smelting and treatment of metals, it has been so employed as to immeasurably improve working conditions in many industries, it is saving time, energy and money in countless ways. While contributing much to those things which make life worth living, those who know most about it declare that things electrical are still in their infancy. Already its triumphs have been stupendous: it is the electrical age.

Electric Steel Furnace Development in Canada

Proven in 1906 That Canada Ores Can Be Successfully Smelted —Initial Difficulties Ironed Out—Incentive to Production of Certain Alloy Steels—Recognized Part of Modern Steel Plant

By J. Young, Volta Mfg. Co.

THE advent of the first electric steel furnace in Canada might be traced from the time the Canadian Government named a commission to investigate the possibilities of using electric power for the reduction of our native ores. A furnace for this purpose was installed at the Canadian Soo in the year 1906, and the results obtained showed that Canadian ores could be successfully and economically smelted. Dr. Heroult and R. Turnbull were the designers of this furnace, and, immediately after completing this initial test for the Canadian Government, they designed and installed the first of the famous Heroult type electric steel furnaces—this first furnace being built and used in the States.

Early Difficulties

In the first furnaces built the designers were faced with many serious difficulties and had to be possessed with an abundance of courage and perseverance. Owing to the high temperatures at which electric steel furnaces operate, much of the standard equipment, at that time, was not suitable; refractories, which would stand up any length of time, were difficult to get, while the standard electrical insulations, used on furnaces at that time, were continually breaking down on account of the heat; mechanical parts, of standard design, were found unsuitable to stand the conditions peculiar to electric furnaces. Then, there were the electrodes to contend with. Electrodes of only a small size were made at that time, and a good deal of experimenting and research work had to be done before electrodes, that would stand up a reasonable length of time, could be obtained.

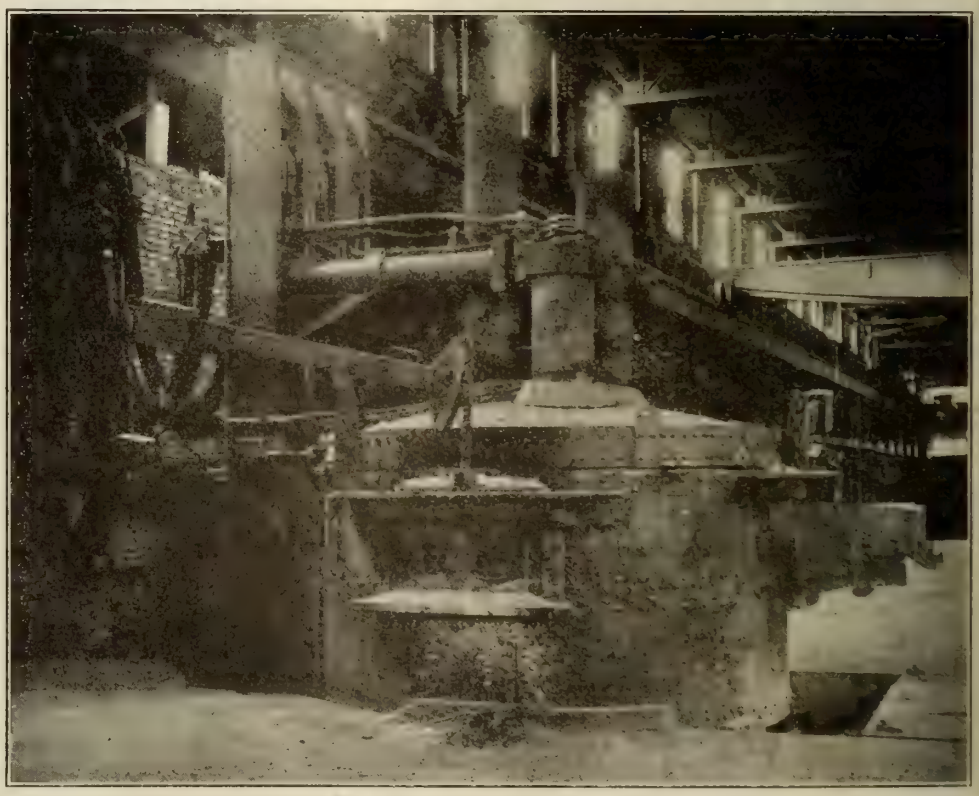
These initial difficulties, however, were gradually ironed out and the electric steel furnace then began to assert itself. The steel men became interested in it for several reasons. It had been proven, conclusively, that electric steel had properties which could not be got by the other methods of making steel; it could be produced economically, and it presented the only means of making the special alloy steels which were necessary in the automobile industry, with the result that installations began to appear in various parts of the country and these furnaces were giving highly satisfactory results when the war broke out and an added impulse was then given to their use. Canadian Steel Companies, whose limited market up to that time caused them to hold back, then began to instal electric furnaces with the result that by the year 1919 there were at least 40 electric steel furnaces in operation in Canada, capable of producing over 200,000 tons of steel per year. The British Forgings, Limited, of Toronto, Ont., had in operation a battery of ten 6-ton capacity Heroult type furnaces, which was, at that time, considered the largest installation of electric steel furnaces in the world. Since the termination of the war the number of electric furnace installations have been continually added to with the result that there are, as far as the writer's knowledge goes, approximately 50 furnaces installed in Canada at the present time.

Causes of Failure

As I have previously stated, the electric furnace, in the steel industry, is now a recognized part of a modern steel plant. There are, however, instances where the electric furnace has not been a success. These failures can, in many cases, be traced to an over-zealous salesman, who, in his ambition to make a sale, has not taken into full consideration the local conditions, or, again, it may be due to poor operation. The electric furnace cannot be operated, to give the best results, with any sort of mediocre operation—in fact, as in all other businesses, a man thoroughly acquainted with his work will give better service than the one who lacks experience. I heard the statement made that it just cost a certain party $10,000 to find out that electrical steel castings were not sound and could not be depended upon. To those conversant with electric steel furnaces such a statement would not be taken seriously, as it has been amply proven that electric steel castings are superior to either open hearth or converter castings. On the other hand, such statements tend to check bona fide sales.

I stated that during the war the electric steel furnaces established their place in the steel industry. In one forging plant, where a complete record was kept of the different steels used for shells, and where the blanks came from diversified sources, those made by the electric process showed less rejects and superior physical qualities in every way as well as more consistent chemical analysis. I do not mean to say that the electric furnace will take the place of other methods of making steel. It has its place as a steel producer, and, where installed with proper judgment and operated by efficient men, will give satisfactory and highly efficient service.

Of late, manufacturers of grey iron castings have turned their attention to the use of the electric furnace for mak-



Six-Ton Heroult Type Electric Furnace

ing grey iron in order to meet the ever-increasing demands for high quality grey iron castings, and several furnaces have been installed to produce grey iron for the making of cylinders, piston rings, etc., used extensively in the automobile business.

In Canada, however, where electric power is comparatively cheap in many localities, the electric furnace not only is a competitor with the cupola on a quality basis but also on a cost basis for ordinary castings and furnaces are in operation in Canada, producing electric grey iron for castings, continuously.

The electric furnace differs from the cupola in this respect, that it offers a larger range of products on account of the fact that the analysis of the finished article can be controlled within a very fine degree. Furthermore, a dual system is in use in some places—and is working out successfully—where steel and grey iron is produced from the same furnace.

A list of steel and pig iron electric furnaces installed in Canada follows:—

Quebec

Armstrong, Whitworth of Canada, Ltd., Montreal, one 3-ton and 3 6-ton "Heroult" type furnaces.

Canadian Electric Steel, Limited, Montreal, three 7-ton modified type "Heroult" three-phase furnaces.

Canadian Brakeshoe Company, Sherbrooke, Que., one 1-ton and 3 2-ton furnaces.

Canadian Steel Foundries, Ltd., Montreal, one 1-ton "Volta" Heroult type, 3-phase "quick-melting, or duplex voltage" furnace.

Thos. Davidson Mfg. Co., Ltd., Montreal, four 6-ton T. D. Mfg. Co. 1 2-ton T. D. Mfg. Co. and 1 1½-ton Snyder furnaces.

Hull Iron and Steel Foundries, Limited, Hull, one 6-ton Heroult type, three-phase tilting furnace.

Joliette Castings and Forgings, Limited, Joliette, one 2-ton Greaves-Etchell furnace.

Shawinigan Foundries, Limited, Shawinigan Falls, one 5-ton "Volta" Heroult type, 3-phase, stationary type furnace.

Ontario

Baldwins Canadian Steel Corporation, Ltd., Toronto, ten 6-ton Heroult furnaces.

Baldwins Canadian Steel Corporation, Ltd., Collingwood, one 3-ton Heroult, stationary furnace.

Bowmanville Foundry Co., Bowmanville, one 1¼-ton Cronwall-Dixon.

Canada Electric Castings Co., Limited, Orillia, one 1½-ton, two-phase, tilting furnace.

Electric Iron, Limited, Lakefield, one 6-ton "Volta" 3-phase, tilting furnace.

Dominion Foundries and Steel, Ltd., Hamilton, two 6-ton "Volta" Heroult type, 3-phase, tilting furnaces.

Electric Steel and Metals, Limited, Welland, one 6-ton Heroult, 1 7-ton Heroult.

Electro Foundries, Limited, Orillia, one 6-ton "Volta" 3-phase, pig iron furnace, one 6-ton "Volta" 3-phase, Ferro-alloy furnace.

Tivani Electric Steel Co., Limited, Belleville, one 2-ton; one ½-ton, and one 1/3 ton.

Turnbull Electro Metals, Limited, St. Catharines, one 6-ton "Volta" stationary, 3-phase, pig iron furnace.

Manitoba

Manitoba Steel Foundries, Ltd., Winnipeg, one 2-ton, single-phase, one 2-ton, three-phase, furnaces.

British Columbia

Port Moody Steel Works, Ltd., Port Moody, one 6-ton "Volta" 3-phase.

Lowox Steel Company, Ltd., Vancouver, one 6-ton, 3-phase "Volta" stationary type, furnace.

Opsal Steel Company, Vancouver, one 2½-ton, three-phase, tilting furnace.

Shipton Electric Pig Iron and Steel Smelting Co., Limited, Vancouver, one 1-ton furnace.

Vancouver Engineering Works, Limited, Vancouver, one 1-ton Greaves-Etchell furnace.

For Export

Union Electric Steel Company, Carnegie, Pa., two 6-ton "Volta" Heroult type, 3-phase, tilting furnaces.

T. Waddell & Sons Company, Limited, Christchurch, New Zealand, one 6-ton "Volta" Heroult type, 3-phase, tilting furnace.

Renton & Fisher, Limited, Hopetown Steel Works, Bathgate, Scotland, one 3-ton "Volta" Heroult type, 3-phase, tilting furnace.

Electric Furnaces for Non-Ferrous Metals

THE adoption of electric furnaces for melting non-ferrous metals has been a significant factor in Canadian non-ferrous foundry development during the past year. The list of installations of these furnaces in Canada now embraces practically all sizes from five hundred pounds up to two thousand pounds, while some Canadian foundries are already increasing their original installations by adding additional furnace units.

Greater ease and economy of operation are responsible for this change in furnace equipment. Foundries generally are seeking to better the quality of their castings and reduce the percentage of rejections, and so are turning to electricity as a sure method of producing non-ferrous castings entirely free from porosity and gas occlusions.

Installation at Dom. Steel Products Co., Brantford, Ont.

Electric melting also cuts the metal loss to less than one per cent. and there is a considerable labor saving over fuel furnaces, because one man can tend a whole battery of electric furnaces; and if but a single furnace is employed, he is available part of the time for other duties in the foundry.

Plenty of Power Available

Power rates in Canada also form a strong inducement, representing a saving which is not available to most brass melters in the United States, where hydro power is not available.

The chief type of electric furnace for non-ferrous work installed in Canada has been the Baily resistance type. Each furnace equipment consists of a transformer, switch and furnace proper, designed to work together upon a very simple and practical principle. The transformer takes current at any high tension voltage up to 22,000 volts and steps it down to the relatively low voltages required by the furnace. Nine low tension voltage taps are brought out from the transformer to a selective oil break switch. The current passes from the switch through two carbon troughs into a circular trough within the furnace.

(Continued on page 25)

Electric Trucks Help Solve Factory Costs

Reliable Utility Factor in Indoor Transportation—Development Suggested By Crude Methods in Handling Fruit—Easy of Operation—Reduces Cost From 50 to 75 Per Cent.

By R. F. HIBBARD

IT IS twelve years since the first industrial electric truck made its appearance and Buffalo is credited with being its birthplace. It was designed and built to aid indoor transportation of all kinds of merchandise heretofore handled by hand trucks. Its success was assured from the first, but its adoption for indoor use was immediately extended to any and all places where anything better than a corduroy road was available.

The industrial electric truck has been going through the development period. Experience has shown its few shortcomings and the necessary changes to produce efficiency under varying conditions. Each year has brought about such improvements as have placed this vehicle for indoor transportation on a par of perfection and utility with the automobile truck as a time and labor saver.

When W. H. Wright, of Phelps, N. Y., called on a friend who had charge of the Erie R. R. piers in Jersey City, some thirteen years ago, he had an opportunity to study the rather crude methods that were then in vogue in transportation on docks in general. Much fruit was spoiling because of lack of means to handle it quickly. The condition was so far regarded as beyond remedy that it was looked upon as a necessary evil. That is where the idea of an industrial truck had its birth.

Trucks Solved Problem

Returning to Buffalo, Mr. Wright secured a discarded motor, a differential link roller chain, silent chain and various other miscellaneous items and from these he built his first industrial electric truck. This was known as a carrying truck. It was necessary to place the load upon it for transportation purposes. It had chain drive, two-wheel steer, platform 6 feet long, height of platform 20 inches, width of truck 40 inches, 24-volt motor, speed, empty, 6 miles per hour, speed loaded, 4½ miles per hour, capacity 4,000 lbs.

The author is president of the Wright-Hibbard Industrial Electric Truck Co., Phelps, N. Y.

This truck, when completed, was sent down to the docks at Jersey City to be tried out. The result was that the truck solved a serious problem. Shortly after this the Erie placed an order for 20, and found in time that they would do the same work that had formerly required 130 men, and it was not long afterwards that they came into general use for this kind of work for railroads, steamship docks, warehouses, etc.

Loaded Truck Going Up an Incline

After the carrying truck was on the market for a matter of 2 years, further developments in the electric truck transportation, brought out the industrial electric truck, which is used for large docks, industrial plants, for pulling trailers loaded with merchandise, etc. As many as 6 or 8 trailers are pulled with these tractors at one time. Where these tractors have long pulls and can be kept reasonably busy the labor cost of transporting materials can very often be cut 50%.

Trucks Serve Entire Warehouse

Further developments in electric truck transportation, brought out what is known as the 2-ton industrial electric raised platform trucks. Users of these trucks were required to purchase or make up wooden or steel platforms themselves, 30 inches wide, 53 inches long and 11 inches high. These platforms were placed in different positions throughout their plants or warehouses, etc. The material which was to be transported was placed on these platforms. When loaded, the electric ran under same and elevated it off the floor, approximately 4 inches and transported it to the R. R. cars, stockroom, or wherever required.

Most of these raised platform trucks have 4 wheel steer and are worm driven, equipped with 2 motors, 24 volt, one motor for driving the truck and one for raising the platform. Battery equipment consists of 21 or 24 A-6 Edison cells or 12 cells of 15 or 17 plate lead battery, weight approximately 2,600 lbs.

About six years ago a raised platform industrial electric truck, similar to the one mentioned above was developed. In this it was necessary to use but one motor, which both drove the truck and raised the platform. In other words, they used but one unit instead of two, which meant a lighter truck with fewer parts. It was proved beyond a doubt that these raised platform industrial trucks showed a saving of at least 75% in transportation cost over old methods of transportation.

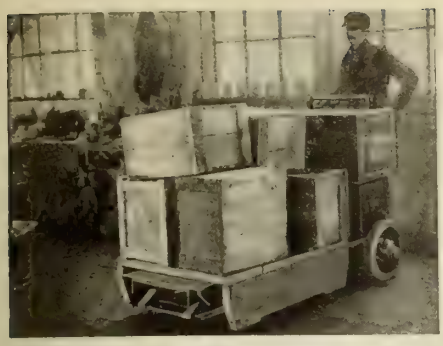
Efficient Small Trucks

The next development in electric trucks had to do with the idea that practically every firm in its infancy starts in with hand-lift trucks and small skids and at some time in its growth, it must change to the electrical unit in order to handle the volume and furnish the speed necessary to transport the product from one operating department to another. Such a change, it appeared, would involve, in some instances, thousands of dollars, but in response to the demand, such a truck made its appearance. It met the conditions as described and, as a matter of fact, does not require any more space in which to operate than does a hand-lift truck and at the same time uses all hand-lift truck equipment. This small truck will do anything that the larger ones would, and more, and sells for a great deal less. It is regarded as most efficient for all round work.

Taking Work from Drill Press

Operating in Store House

Taking a Load from Stock

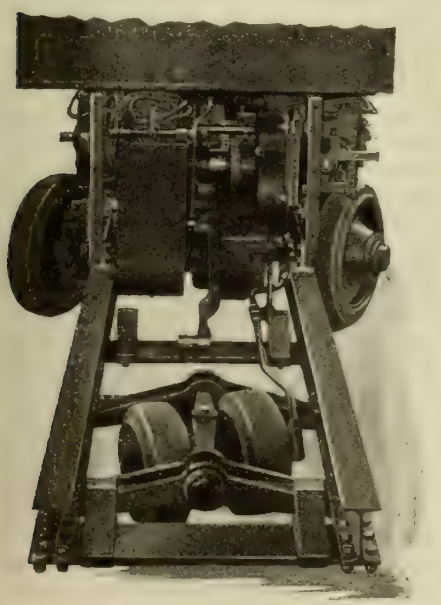


Transferring Loaded Cases

There are very few industrial plants that cannot use at least one of the above type of truck to good advantage, thus saving a considerable amount of labor cost in indoor transportation. As to what the amount of saving would be, depends entirely on the conditions under which the truck is operated. In some plants these trucks will do the work of 6 men and in many instances they are doing the work of 20 men.

Watch Transportation Costs

When the first industrial electric trucks were put on the market, it was necessary to demonstrate them in practically every plant that anticipated the use of same, for the reason that manufacturers did not as a rule know what their indoor transportation was costing them. They had always carried this important expense as miscellaneous or overhead expense; therefore they did not realize, that, if one of these trucks would do the work of only 2 men, this reduction of transportation expense would in itself pay for the truck in less than one year's time. However, manufacturers were quick to realize this important addition to their plant equipment and today these trucks are looked upon as an absolute necessity by the majority.



Constructional Features of the Truck

Adapt Direct Electric Drive to Various Production Needs

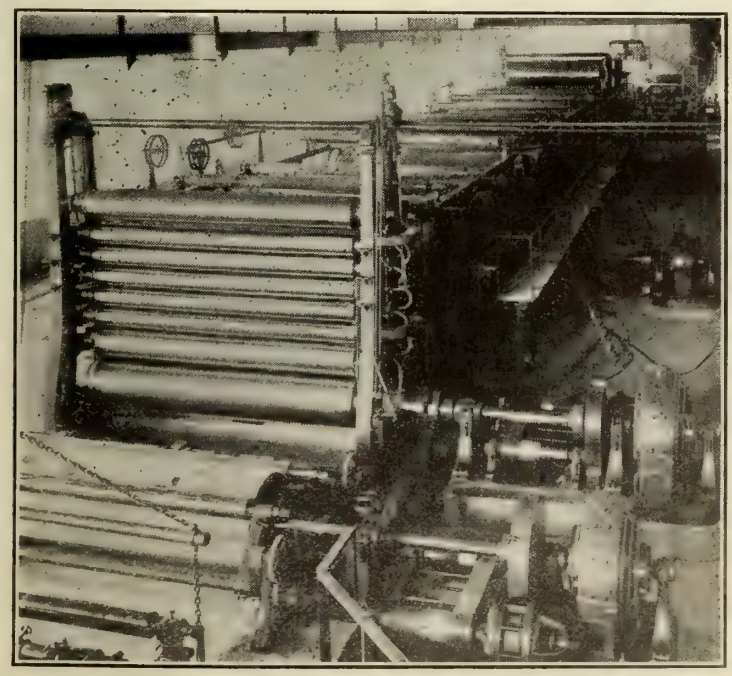
DIRECT electrical drive for various industrial purposes has claimed recognition because of its economy, reliability and efficiency. One advantage claimed for it is that the power plant, whether steam or water-driven, may be so placed as to obtain the greatest economy in the generation of power without regard to the location of the manufacturing plant or the equipment to be operated. The point of production may therefore be selected where most advantageous for receiving or shipping purposes. Building costs may be kept down by reductions in installations for mechanical drive. Handling of the product may be facilitated by location of motor-driven machinery to best suit requirements of routing, and where numerous motors are used any machine or group may be stopped without interfering with the remaining machinery. Defects in transmission are easily traceable and motors may be adjusted to speeds to give best results. The flexibility of electric drive is also illustrated by the fact that additions to plant may be made without interference with original equipment.

Whether alternating or direct current is used, depends upon the requirements of the equipment to be operated. A large percentage of machinery operates at constant speed and as the alternating current induction motor is designed primarily for constant speed, it should be chosen for such work. Where wide variations in speed are required, it will be found that a direct current motor will ensure ready control and a prompt variation of the speed.

In the application of electric drive, two general systems are now in vogue, namely, the operation of each individual machine by a single motor, commonly termed "individual drive," and the operation of machinery in groups by means of line shafting, which in turn is driven by a motor, this plan being generally designated as "group drive."

The relative values of the two methods must be determined in every instance by a careful analysis of the requirements of the installation, and while there are many successful examples of economical group drive, it is now the consensus of competent opinion that in a large majority of cases the highest efficiency, both for the machinery to be driven and for the electrical equipment, can be best obtained by the application of separate motors to each unit. This is especially true where the operation of the machines is intermittent, as in this case the cost of current, if obtained from an outside source, is entailed only during the actual operation of the machine.

If, on the other hand, the plant utilizing motor drive is provided with an isolated generating outfit, the size of the prime mover and generator, as well as the power factor in the case of alternating current plants, will be appreciably affected by the choice of group or individual drive. In the latter case, each machine can be equipped with a motor which will most nearly meet the exact requirements in regard to the maximum desirable speed and the amount of power delivered at the driving shaft.



An interesting example of direct electric drive—a nine-section newsprint machine operated by nine motors, direct connected to each section. The motors are of different sizes and operated at various speeds. One is of 100 h.p. running at 136 r.p.m., while another is 30 h.p., at 98.5 r.p.m. The prime mover is a 500 K.W. turbo generator.

Proper Care of Portable Electric Equipment

Small Tools Do Not Always Receive the Attention They Deserve —Reliable Service When Properly Cared for—Avoid Using Excessive Voltage—Suggestions for Avoiding Trouble

THERE are many points in connection with the use of electric drills and grinders which do not always receive the attention they deserve. The dissatisfaction occasionally expressed can invariably be traced to the lack of protection devices, which are indispensable if efficient service is to be obtained. Abuse in use is another cause of machines being out of service.

When carefully safeguarded and used electric tools will give the same satisfaction and be as reliable as any of the other tools in the machine shop. It is not expected, says the Machinery Tool Review, that every person who uses the machines will be fully posted concerning the electric motor part of the equipment. It therefore devolves upon those in authority to so protect the motor when in use that it is made as fool-proof as possible.

Guard Against Heavy Currents

The most common trouble is in the "burning-out" of the insulation of the armature and field magnet windings. This is caused by excessive currents being allowed to pass through the machine, which are more than the insulation was designed to withstand. The remedy is to fit other devices which will burn out, in the event of short circuit or overload, instead of the motor windings. It is cheaper and quicker to refit a few inches of fuse wire than to pay for the re-winding of the armature or field coils or both. Large electric motors are always well protected. Why not adequately protect the smaller ones, which are more in need of safeguards? The latter will not stand up to heavy overloads like the larger machines.

Claims are sometimes made that small electric tools can be run from any lamp socket. If a machine was so used, it would at times be entirely without protection. When all the lamps on that particular circuit were lighted, the circuit fuses would invariably safeguard an electric tool being used at the same time on that circuit, but when lights are out and the machine only is in use, it is possible to pass through that small motor the full current that the circuit fuse can carry. Small motors, used in this way, have often burned out, leaving the circuit fuse intact.

Protect the Motor

Much trouble and annoyance will be saved by providing a separate fuse and a separate plug and socket at intervals around the shop. The electric tools can then be used from these sources of current supply. It is also advisable to fit a type of wall plug which is equipped with an "earthing" terminal. This will carry away any leakage currents from the motor framing and also safeguard the operator from electric shock.

When machines of different capacities are in use in the same shop, it is advisable to definitely specify that certain machines should be used from certain wall plugs. Otherwise there is a possibility of the smaller machines being connected to a socket which is fitted with a gauge of fuse wire too large for the rated capacity of the smaller machine.

A method of overcoming this difficulty is to fit a different size of wall plug for each size of electric tool in use. The plug on the flexible wire will then only fit its mating socket. This arrangement should not restrict the area over which the machines can be used. They can be fitted with a longer flexible wire if necessary.

Use Drills Carefully

Lack of care when using electric drills is a common cause of machines being sent for repairs. Most of these machines are equipped with series wound motors, and attempts to start up the machine when pressed tightly against the work invariably results in an excessive current flowing through the standing machine.

Another cause of failure occurs when drilling through thin metal, angles, etc., the trouble commencing when the cutting edges of the twist drill break through on the other side. At this time, unless the pressure on the tool is momentarily released to enable the twist drill to clear itself, the cutting edge is liable to become locked, the machine stops with full current on, and the insulation fails.

Small electric motors must be kept clean, and it is advisable to instruct a competent person to take them apart regularly at short intervals. All dust should be cleaned away, new brushes fitted where necessary, and grease placed in the gear box casing. Any small repairs can be effected and the frayed flexible wire bound with insulating tape.

Use Armoured Wire

The fraying of the cotton cover of the flexible wire is a common cause of short circuits. This can be overcome by the use of armoured flexible wire. Something is sure to happen when a laden barrow is wheeled over unprotected wire lying on the floor.

Many of the electric drills can be used upon both a.c. and d.c. supply currents of the correct voltage. When used upon a.c. these are single-phase machines, and there is no difficulty in fitting them to two or three-phase supply. It is only necessary to connect the machine to one phase, as would be done when wiring for lights. When more than one machine is being fitted, they should be spread over the other phases to balance the system.

A word of caution is necessary regarding the very small high speed electric grinders on the market. Some of these grinders run at 10,000 r.p.m., and are listed to mount a 6 in. dia. grinding wheel. It is dangerous to use a 6-in. vitrified wheel at this speed. An elastic wheel of this size would also be running over the recognised safety limit of speed. A 4-in. dia. elastic wheel usually gives every satisfaction.

LARGE CRAWLER CRANE

An interesting development in the construction of cranes has recently been announced by the Link-Belt Co. of Chicago. This new machine, known as a crawler-crane, marks a forward step, from an engineering standpoint, in the art of building cranes of the caterpillar type. A severe preliminary test has demonstrated that this new Link-Belt crawler crane is mechanically perfect. The condition that this machine has been called upon to meet from the first day of its operation, in connection with the building of a new road through a swamp, consisting of unloading itself from the railroad car, traveling over very uneven country to lay down wooden platforms, in order to obtain sufficient bearing area to carry the weight, and starting the work of digging in several feet of water, put the machine through about as severe a test as it will ever be called upon to meet.

The following is a quotation from the report of the crane operator:

"This machine is working in a marsh on floats which weigh about 2½ tons each. The crane lifts them and the clam shell very easily. The material handled is marsh mud and sand. The crane is moving from 300 to 400 yards in 11 hours, with a light ¾ yard bucket. It uses about 25 gallons of gasoline in this time. This yardage does not include a considerable amount of mud overburden, which cannot be used on the road bed and is dumped back in the ditch. The oil added to the crank case is about 1 quart from the time the crane was started working. Water added in radiator was 1 gallon in three days. From the operating point it takes very little effort to handle the levers, and this makes the machine run smoothly and quickly. The hoist drum clutch is the only clutch that has been adjusted since the crane left the shop, June 7th."

Fibre Now Extensively Used in Electrical Work

Improved Methods of Manufacture—Tougher Than Horn, Lighter Than Aluminum and Almost As Hard as Iron—Applicable to a Large Range of Service

THE USE of fibre in the various industries has become quite widespread during the past few years, and in fact, many manufacturers are only now beginning to realize how varied are its uses. As far back as 1859, Thomas Taylor, an inventor and chemist, secured patents on vulcanized fibre, but of course since that time many improvements in the method of manufacture and quality of material have taken place.

The electrical, mechanical and transportation fields have especially benefited through the use of fibre, for many parts previously made of more exp sive material are now either stamped or machined from fibre. Through the courtesy of Mr. Webster, manager of the Diamond State Fibre Co., Carlaw Ave., Toronto, we are able to present some of the fields in which their product "Diamond Fibre" has been successfully used. These will give readers at least a brief idea of the variety of parts which can be made from such material.

First of all, what is fibre? Briefly it is a high grade of vulcanized fibre, a material which is said to be tougher than horn, almost as hard as iron, and yet lighter than aluminum. It does not crack, split or break with ordinary use, and is impervious to oil or grease. Its tensile strength (at least the product made by the above mentioned concern) is 12,000 to 15,000 lbs. per square inch; its resistance to compression is approximately 40,000 lbs. to the square inch, while tis dielectric strength is from 200 to 400 volts per mil of thickness. It is also non-corrosive, and does not deteriorate if subjected to moisture or submerged in water. If desired, it will take a high glossy finish, and can be secured in various colors.

The automotive industry make such parts as battery box linings, brake bands, bushings, conduits for wiring, gaskets, all sorts of insulators, speedometer gears, switch handles, washers, etc., etc., from fibre and the starting, lighting and ignition systems lend themselves admirably to this material.

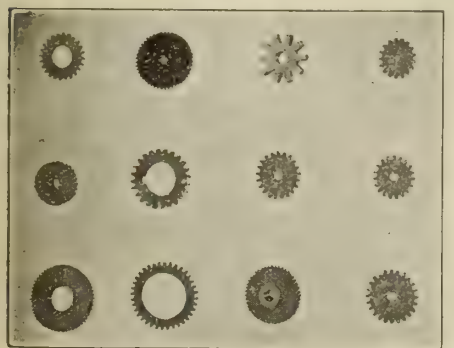


Fig. 1—Showing Some Gears Made from Condensite Celoron.

Electrical Field

In this field there are so many parts made of fibre that we will not even attempt to list them. However, here are a few parts: Bushings, cleats, commutator rings, fuse tubes, lightning arrestors, parts for dynamos and motors, switch bars and handles, etc., etc.

The mechanical field is another very large user of this material. Parts such as bearings, brake shoes, friction straps, gears, gibs, pinions, pulleys, pump valves, etc., are made, and in many cases considerable machining is performed. Then in the sheets, rods and tubes we find all sorts of stampings, bent shapes and so on. Quite a common practice is to make built up gears from steel washers and fibre washers placed one after another, this making a strong, smooth running, and practically noiseless gear.

In the transportation field we see fibre used in making braddock plates, engine box liners, ferrules, fishplates, head pieces, switch shims, etc., etc., and in the textile field such parts as bobbin boxes, bobbin heads, lacing combs, shuttles, spool heads, thrust washers, gears, etc., are made from this material. One of the two illustrations accompanying this article show a few examples of the variety of parts which can be made of fibre.

Another Material

The firm mentioned previously in this article also make another mater al known by the trade name of "Condensite Celeron" which is really hard fibre with the added quality of being waterproof. This feature of course opens up new uses, and as in the case of the regular fibre, this new material is available in sheets, tubes and rods. The product can be best described as vulcanized fibre thoroughly impregnated with Condensite and then hardened by heating. Condensite again is a product made from a combination of phenol and formaldehyde, and when hardened by heating it becomes an extremely water-resisting material, possessing high dielectric and mechanical strength.

Hot water or solvents such as alcohol, acetone, benzine, etc., will not hurt the product we are speaking of, and it is but little affected by hot solutions.

Hot water, or solvents such as alcohol, acetone, benzine, turpentine, etc., will nor hurt the product we are speaking of, and it is but little affected by even strong solutions of nitric, sulphuric, or hydrochloric acids. However, it will carbonize if brought into contact with hot solutions of these acids, and is affected by strong hot caustic solutions.

The new material is used very extensively in the electrical field, and is particularly adaptable to radio work. This is in fact one of its largest uses. Gears made of this material are well able to stand high speed, and will eliminate noise and vibration, according to the makers, and gears made from Condensite-Celeron are already in use on heavy duty equipment such as punch presses, planers, boring mills, lathes, milling machines, gear hobbers, etc.

Suggestions For Machining

In offering suggestions for machining, the makers say: Parts made from this material can be punched, shaved, sheared, turned, sawed, drilled, milled, planed, threaded, engraved, etc., in fact with the exception of the asbestos grade, can be reached in practically any manner possible to machine metal. It cannot be molded, but when in the uncured state, can be formed to special shapes.

It will also take a high polish, and successful machining depends chiefly upon keeping the tools sharp. Tools operate best at high speeds, except where the cut is large enough to heat the tool too much. Work should be turned to size wherever possible with one cut, but where two cuts are found to be desirable, the finishing cut should

(Continued on page 29)

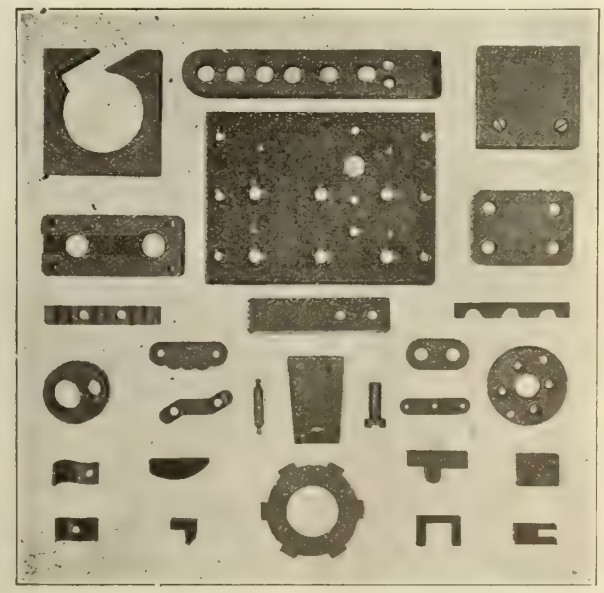


Fig. 2—Various Shaped Parts Made from Diamond Fibre.

Good Lighting Makes for Lower Plant Costs

Reduces Accidents and Spoilage and Increases Individual Production—Promotes Cheerful Surroundings—Poor Distribution of Light Not Only Dangerous But Costly—Lamp and Its Position, and Not the Ornaments That Count—A Satisfying Installation

By J. T. SCOTT

GOOD lighting is profitable. Production is needed and more of it at the minimum cost. For this reason, one of the most important contributing factors at the present time is that of good industrial lighting. Here are four of the more important reasons: 1. Reduced accidents. 2. Reduced spoilage. 3. Increasing individual production. 4. Promotion of more cheerful surroundings.

A short consideration of these reasons will prove helpful.

Accidents caused by insufficient lighting or not enough to see what one is doing. Deep shadows may hide dangerous objects and be deceiving. Glare from unshaded lights may cause momentary blindness and entanglement with moving parts of machinery. This is the result, not of insufficient illumination but of poor light distribution. A sequence of small accidents will quickly cost more than the sum required to secure adequate and proper illumination.

Spoilage.—Articles spoiled simply because a workman "didn't see"—make good production cost just so much more, makes it harder to complete, makes profits smaller.

Production.—Good lighting takes the brake off manufacturing effort. It eliminates delays. Tools are easily found; readings are made more accurately and in less time; it enables the operator to keep on at a more efficient rate of production.

Author is Illuminating Engineer in the Sunbeam Lamp Division, Canadian General Electric Co.

Morale.—The worker feels better under the influence of good lighting. There is less eye fatigue, less headache, and a more comfortable working atmosphere. It is readily agreed that a happier worker is a better producer. Then there is less chance for shirking, and no dirty places to breed carelessness.

Cost of Proper Lighting

Conditions vary so much that it is not possible to lay down a general rule applied to likely cost. It can be said, however, that the increased cost of better lighting totals but a fraction of the payroll cost—probably about one per cent.—and the return in increased production is easily measurable to five or ten per cent. A reference is made later to a point that might also be emphasized here. When getting plans or estimates for lighting, remember that you are buying light not ornamental fittings and equipment. It is the lamp and its position that count—not the ornaments that some contractors seem willing to sell.

What is Good Lighting?

Common sense is the best guide as to what is satisfactory lighting. Foundry work and stock room lighting is of lower intensity than that required for first class machine working.

You can readily find out whether your plant is up to standard by measuring its illumination value with a foot-candle meter. This is a handy little measuring instrument that can be carried around the shops, and it will give direct measurements of light values.

The foot-candle meter also enables you to test the efficiency of your electrical contractor and to get the job done right. In Figure 1 you see the superintendent checking up the shop illumination—seeing is believing.

The Units Used

A short table of the illumination values recommended is set out here. The intensities of lighting are defined by foot-candles.

TABLE OF FOOT CANDLES RECOMMENDED

Stores	5	f.c.
Stairways	3	"
Assembling Med.	8	"
Fine	12	"
Engine Rooms	4	"
Foundry	6	"
Forging and Welding	10	"
Inspecting	15	"
Machine Shop	10	"
Drafting Room	12	"
Office	10	"

The shops engaged in rough work will be well lighted with 4 or 5 foot-candles; if accurate work is being done then 8 to 10 f.c. would be required, or even more foot candles might be desirable. The work on dark objects of course will always require more light than operations on work easier to the eyes.

The unit of light used the foot-candle, might be briefly defined as the amount of light covering an area of one square foot with an intensity of one candle-power. Thus an illumination value of say 10 foot-candles, means an area of one square foot lighted to the equivalent intensity of ten candle-power.

Fig. 2—Well Distributed Lighting in Large Manufacturing Plant

MOUNTING HEIGHT OF UNIT

Above Plane of Work	Above Floor	Permissible Distance Between Outlets	Distance Between Outlets and Walls
4	6½	6	3
6	8½	9	4½
8	70½	12	6
10	12½	15	7½
11	13½	16½	8
12	14½	18	9
13	15½	19½	9½
14	16½	21	10½
15	17½	22½	11
16	18½	24	12
18	20½	27	13½
20	22½	30	15

Table of Spacing and Mounting Height.

Figures are for feet. Plane of work is assumed to be 2½ feet above floor. When work on a plane higher or lower than 2½ feet, then work from first column.

While the word "foot-candle" is used for intensity of illumination on areas, the word "lumen" is used to express light quantity. Thus all mazda lamps are rated as having an output of so many lumens. As a fairly near figure for reckoning, one may take 10 lumens per watt as a working basis. Then knowing the number of square feet to be illuminated, and the intensity of light required in foot-candles, you can choose a lamp having the required number of lumens.

The methods used in calculating the plans for installation of lighting equipment were given very fully in Canadian Machinery during April, 1922, during a course of articles by the writer, dealing with modern illumination.

The requirements of any satisfactory installation are:

1. Sufficient light on all parts of the working area.
2. Moderate light on adjacent areas and on the walls.
3. Freedom from glare and glaring reflections.
4. A system, simple, reliable, easy to maintain and of low operating cost.

With regard to the second point above, it should be remembered that the color of painted surfaces, walls and ceilings are a material factor. It is generally better and more economical to choose light colors wherever possible and thus obtain the benefit of the aid of such colors as white, light grey, buff and stone.

Effect of Cleaning

A large loss of light is allowed by not cleaning regularly all illumination equipment: lamps, shades, reflectors, etc. It is quite easy to lose 40% of the light paid for by a layer of dust and dirt. This is wasteful expenditure and could be saved by the periodical use of soap and water.

The reprint of Table 2 giving spacing and mounting distances will perhaps prove useful as a guide in checking up all installations that are being re-considered. A distribution of equipment that measures fairly close to the distances quoted, will give a very good average illumination provided that the correct size of lamp is used.

Finally, when you are considering any plans for increasing the values of your illumination, buy "lighting," not "lighting equipment." Good lamps of ample light giving capacity, properly spaced and shaded to eliminate glare. That is all there is to it. The cost will be very little and the gain will be considerable in satisfaction and production.

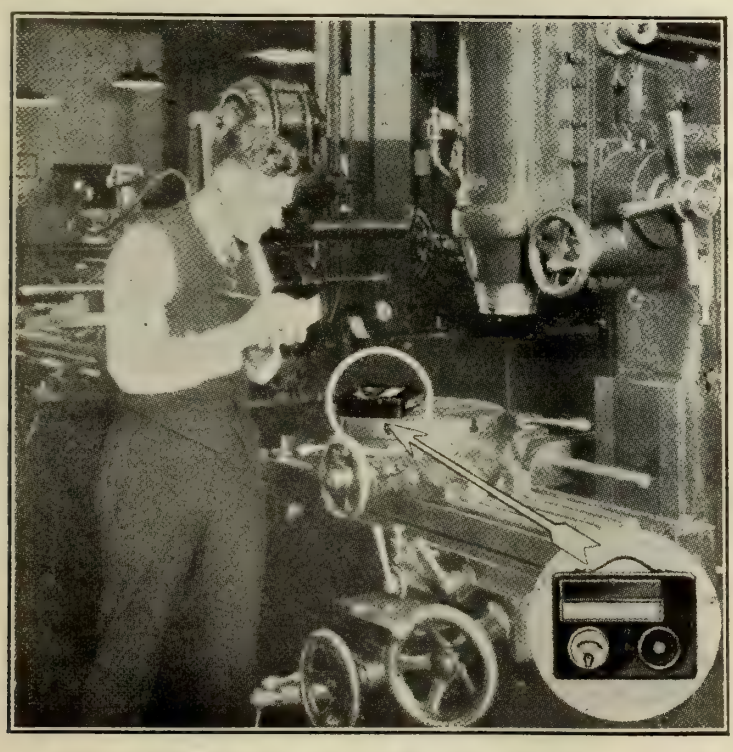


Fig. 1—Checking up Shop Illumination

ELECTRIC FURNACE FOR NON-FERROUS METALS

(Continued from page 19)

This trough of carborundum is packed with granular carbon material, and when the current passes into this material in the trough it brings it to incandescency, and the heat thus generated is radiated down upon the metal on the hearth of the furnace below. The switch may be closed into any one of nine positions, thus giving an easy and accurate method of control over the furnace voltages and hence exactly controlling the temperature within the furnace chamber.

After the switch has been closed and the metal charged into the furnace no further attention is required from the operator until it is time to pour the metal.

This construction entirely eliminates any complicated parts which might get out of order, increases production and forms as simple and accurate a method of melting non-ferrous metals as has so far been developed. These furnaces are built in a range of sizes from 200 pounds up to 2,000 pounds. A multiple of these units gives an extremely flexible arrangement for handling any tonnage or variety of alloys. In the United States there are more than 100 of these furnaces employed in various non-ferrous foundries.

Among the Canadian installations the following plants are typical of the modern foundries which are adopting electricity as a melting medium for their non-ferrous alloys:—

Dominion Steel Products Co., Brantford, uses a 50 K.W. furnace; 500 to 600 pounds hearth capacity; melting rate of 250 to 300 pounds per hour. This furnace is used chiefly for melting red brass and bronze for bushings.

Monarch Metal Company, Ltd., Hamilton, have installed a 75 K.W. furnace with 800 to 1,000 pound hearth capacity and a melting rate of 500 pounds per hour. This furnace is also used for red brass and bronze mixtures running high in lead. This furnace is used chiefly to produce railroad bearings.

Canada Metals Company, Ltd., Toronto, employ a 75 K.W. furnace, producing a wide variety of materials, among which are plumbers' supplies, valves and miscellaneous castings, also yellow and red brass ingot. They are able to melt a wide variety of alloys in the same furnace as with the Baily unit it is possible to change immediately from one alloy to another and it is never necessary to keep molten metal in the furnace as a priming charge.

Union Screen Plate Company, Sherbrooke, Que., use a 75 K.W. furnace for producing heavy castings. Their alloys are chiefly red brass run into screen plate casting molds.

Adapting a Portable Tool to a Variety of Uses

Makes Ideal Equipment for Garage and Service Station—Working Range Increased by Means of Attachments—Cradle of Stand Can Be Adjusted to Any Angle—Simple Construction

STARTING with the idea that the Hole Shooter, an electric portable drill, could be adapted to many other uses in addition to the drilling of holes, the A. H. Peterson Manufacturing Co. of Milwaukee, has developed a number of unusual attachments which make this tool a whole machine shop of usefulness. Practically all these devices have been designed particularly to meet various requirements of the garage and service station, and industrial plants. With these attachments, there are so many practical uses for an electric tool of this description, that it becomes infinitely more productive than a mere electric drill could ever be. Many garages have found it possible to do work with the Hole Shooter and its combinations, which heretofore required separate units of equipment costing many times the price of this unique combination.

Among these developments is a radial portable drill press stand, as illustrated here, remarkable for its simplicity. Other inventions include a battery terminal opener; end bristle wire brushes, of various grades and sizes which are mighty useful in removing carbon from cylinder heads, burnishing work, removing paint and varnish, etc.; a commutator saw-wheel on a flexible shaft; rotary taper files; special emery grinding wheels; special buffers, which are used to excellent advantage in simonizing bodies as well as for ordinary buffing work, and many other attachments.

The drill press stand is designed to hold the portable electric drill rigidly at any angle vertically or horizontally. When adjusted for use in a perpendicular position, the combination serves as a portable drill press. With the appliance adjusted in a horizontal position, the combination serves as an electric grinder, buffer or polisher. The spindle speed of the Hole Shooter is high enough to make this thoroughly practical. Machines of larger capacity will not do work of this sort because of their necessarily slower spindle speed. Several garages and shops have been able to eliminate the purchase of two distinct and expensive units by adapting this combination to their varied classes of work. The saving in most instances has been over 60 per cent. in initial cost. Operating cost is also reduced, so this equipment is a mighty profitable investment. The complete drill press stand weighs only 30 lbs. With the electric drill included, the total weight is only 34 lbs. Thus the whole outfit is easily portable.

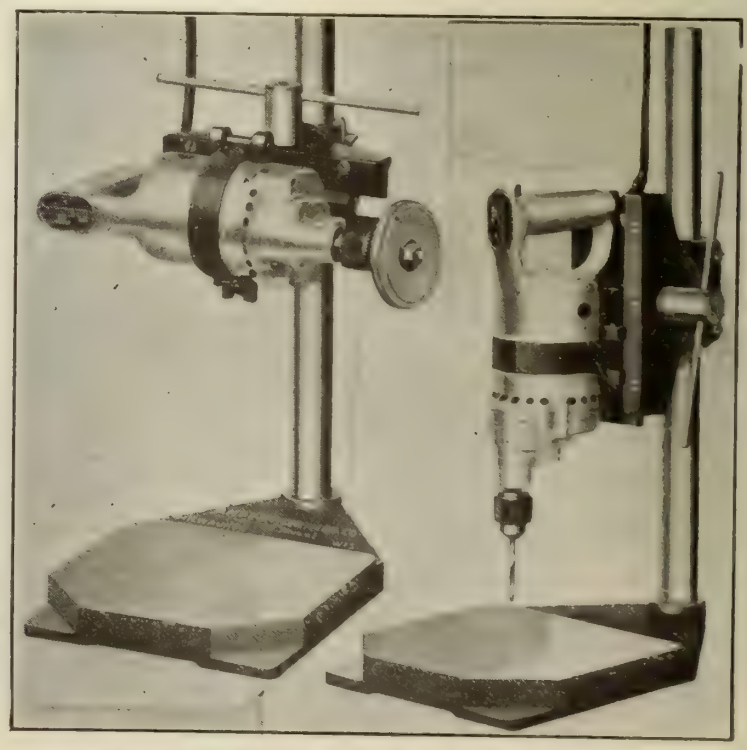
Simplicity of Design

The simplicity of its construction brings the cost low and eliminates possibilities of the outfit getting out of order. Sensitive and accurate control of the drill press rack is obtained without resorting to expensive and cumbersome counterweights, chains or spiral springs which are embodied in other small drill press stands. The fact that the cradle of this stand can be adjusted at any angle vertically or horizontally is also a unique and very practical feature.

The battery terminal opener is a simple, effective lead cutting drill bit, developed after extensive experiments. It cuts a hole 13/16 inch in diameter. The shank of this drill is turned down to fit the ¼ inch Jacobs chuck of the Hole Shooter.

The end bristle wire brushes are particularly desirable in various classes of garage work. The stiffer brushes are practical for cleaning carbon from cylinder heads. They are made in two sizes, suitable for getting into cylinders of large and small diameter. Other brushes are suited to removing rust and hard encrusted dirt from springs, wheels and under-castings of cars, burnishing metal parts before refinishing, removing paint and varnish, cleaning rough castings, polishing and sanding wood surfaces, etc.

The machine itself, used with regular drill points, is a valuable necessity in garages, service stations, machine shops, maintenance departments, etc. Its drilling capacity is up to ¼ inch in metal and up to 5/16 inch in wood. The new Hole Shooter has a motor that cannot be stalled on any work within its rated capacity—a motor that is a real achievement in the drill industry. Drilling oil holes, holes for fenders, snubbers, installing instruments on dash or cowl, making special wiring holes and many other uses are within the range of adaptability of this four-pound portable electric drill. These uses, together with those mentioned above make this tool a "whole machine shop of usefulness."



Showing the Adaptability of the Portable Electric Drill.

A STEEL FOUNDRY IN A GARDEN CITY

Almost the last place in which one would expect to find a steel foundry is one of those garden cities which enlightened town planners have constructed as a model. Nevertheless, in a garden city near London, Eng., there exists a steel foundry which is so well equipped and so well designed that it does not interfere in any way with the high standard of general well-being appropriate to a garden city. Normally this foundry employs about one thousand workers and its equipment includes a large electric furnace. The output of the foundry is about eight hundred tons of steel castings per month, and among its specialities is the casting of ships' davits which form an extremely difficult job. In spite of its remoteness from the large centres of raw materials this model steel foundry is very successful in competition with foundries in the orthodox steel districts.

Economies of Electricity in Foundry Practice

Magnetic Hoists Give Valuable Service in Handling Metals—Separators Help Eliminate Waste and Remove Particles of Iron and Steel From Brass Turnings—Charging the Cupola By Means of Magnet—Advantages in Many Industrial Operations

By F. H. BELL

ELECTRICITY and its adaptability to the various requirements of the foundry covers so large a field with such a variety of features that it could hardly be referred to as our subject, but rather as combination of subjects. Since its every day uses have been so thoroughly dissected and diagnosed as to be well known topics, I will omit mentioning the electric light, the electric crane, the electric melting furnace, the electric motor for driving the various machines which are used in and about the foundry, electric welding, signaling, etc., and will devote my attention to one branch of the science, that of the electro magnet.

The electro magnet, like everything electrical and everything magnetic, has the appearance of a phenomenon. We know some of the things it will do, because we have seen it do them but beyond this we know very little. We know, or at least we think we know, that magnetism is a product of electricity, while some electricians of note will argue that electricity is a product of magnetism. Howbeit, they work together.

The word "magnet" was, presumably, derived from Magnesia, a section of Thessaly, on account of a metal which was discovered there which looked like silver and was known as Magnesian stone. This stone had the characteristic of attracting other pieces of the same material as well as being attracted to the North pole. This led to the conclusion that stone of a similar nature was located in the extreme north. This was known as the Polar magnet. Later on a black stone was discovered which had the same characteristics only much more pronounced, this was known as lodestone.

For many years these minerals were used in making compasses and other instruments which required to be magnetized. This, of course, was before these stones or minerals were known as ores. These stones, or ores as we now call them, still exist, and still have these drawing characteristics. When refined and the metallic elements taken from the ore, the ore is known as magnesium while the other is magnetic iron. Magnets are now made artificially and known as electro magnets while the lodestone is known as natural magnet. While modern science has demonstrated that electricity will produce artificial magnetism, certain it is that natural magnetism was known long before electricity was discovered, but not necessarily before electricity existed. Both were probably in existence ever since the creation of the earth but it took time to discover them. Since both had to be discovered—not invented—and neither is understood, beyond knowing what can be done with them it is quite possible that electricity could not exist without the aid of magnetism and that magnetism could not be possible without the aid of electricity. While the name "magnet" owes its origin to the metal magnesium, this metal is not a very powerful magnet. The iron group which includes nickel and cobalt, are the most suited for magnets.

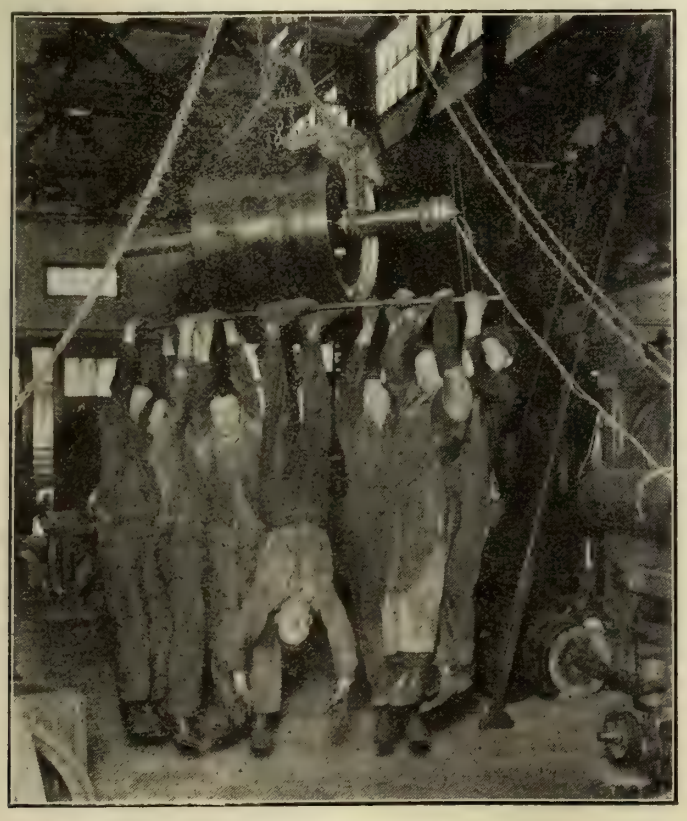
Queer characteristics of the phenomenon are that silver and copper which are the best conductors of electricity will positively repel the magnet. Steel, when magnetized, becomes a permanent magnet, while cast iron has an inclination that way but soft wrought iron which is equally as good a magnet while the current is on cease to be a magnet as soon as the current is off. This is what is known as a temporary magnet.

Were it not for this temporary feature the usefulness of the electro-magnet would be greatly reduced as it would be difficult to disconnect the magnet at will.

In his experiments with electricity Professor Orsted of Copenhagen discovered that if a current passed at right angles to an iron wire the wire would be magnetized so long as the current passed. This effect was easily multiplied by coiling the wire conveying the current round the iron rod or wire in the form of a helix, thus producing magnetism enormously more powerful than could be contained in any permanent magnet. Still later it was discovered that the wire helix alone possessed nearly all the properties of the magnet.

At a subsequent period, Faraday discovered the converse relative phenomena, that the production, or cessation, or any variation in the intensity of magnetism caused the production of an electric current, the developments of which are comprised in the subject of magneto electricity, which proves the contention that electricity may be the product of magnetism, while magnetism may be the product of electricity, and encourages the conclusion that it would be impossible to have either without the other.

The fact that the temporary magnet can be operated instantaneously makes it particularly useful in the foundry, while the fact that its strength can be increased to practically any desired volume makes it useful in lifting enormous weights of metal. As a demon-



Bar in contact with magnetic pulley supporting six men; one man suspended by nails in shoes

stration of what can be done with magnetism we will illustrate a little stunt which was performed at the works of the Dings Magnetic Separator Co., Milwaukee, Wis. A pulley from one of their standard separators was suspended from the ceiling of the shop on a short piece of rope. A wire was connected, carrying the current with which to magnetize the pulley. Against the bottom of this magnetized pulley an iron bar was placed. This bar being flat and the pulley being curved, there could be but a very small surface contact, yet that bar was held against the pulley with a tenacity sufficient to hold up the six men who are seen to be hanging from it, while the seventh one, who is hanging with his head down, is held suspended by the pegs in his shoes.

Knowing the convenience as well as the power of the electro magnet we will look into a few of its uses, and since we have the illustration of the separator drum we will begin with this.

Magnetic separators have two separate and distinct duties to perform in the foundry. One is to remove particles of iron and steel from brass turnings so as to leave the brass pure, while the other is to redeem good iron from waste refuse.

Eliminating Dangerous Nodules

That iron is a dangerous impurity in brass and copper alloys is a well established fact. Many attempts have been made to produce a good inexpensive bronze by combining iron with copper and its alloys, but all such experiments have resulted in proving that unless the carbon content of the iron is removed the results will be unsatisfactory, and since all iron contains carbon there is only one real solution and that is to keep the iron out. When iron or steel finds its way into the crucible with brass chips, it does not alloy but produces a dangerous mechanical mixture. The iron forms into small nodules and these nodules seem to absorb all the carbon in the surrounding metal, forming themselves into steel harder than the hardest chilled tool steel. These nodules vary in size from a small pin head to a pea, according to how much the metal has been stirred while in molten condition.

As far as the foundryman is concerned the castings would seem to be all right but it is from the machine shop standpoint that the trouble is expected. In machine brass castings, the edge of any steel tool will break when it strikes one of these nodules. This is one of the reasons why the presence of iron in brass castings is dangerous. Thousands of dollars worth of tools have been ruined, much valuable time lost and a great deal of annoyance has been caused by these troublesome nodules. They are especially dangerous to tools in automatic machines because the operator does not know for a considerable time that a tool has been damaged, and during this time a lot of good work may be spoiled.

In rolling brass containing these nodules into thin sheets the surfaces of chilled rolls are sometimes dented. In polished work, wherever these nodules do not come in contact with any tool but are close to the surface, rusty spots will appear upon the brass.

It has been fully demonstrated that with the utmost precaution, it is impossible to keep brass chips free from iron and steel. In shops where both brass and iron are machined, the brass chips always contain iron. No matter how carefully the lathes and machine tools are cleaned between operations on different metals, iron dust and small chips left in the crevices of the machine will contaminate the brass chips. Even in places where brass is worked exclusively, more or less iron and steel finds its way into the brass chips. Even the wear from the steel tool will do some mischief, and then there are washers and nuts and various other iron articles which manage to get in unobserved. If anyone of these happens to get into the melted metal, bad castings are to be expected. Flues of different kinds have been tried out but so far there is only one remedy and that is to either use a flux which will remove the carbon, or else eliminate the iron entirely, and the last mentioned is the one which is the real cure. All are agreed that it is not safe to melt brass or copper chips without first treating them with a reliable magnetic separator, and the question arises, "which is the best?" There is the permanent steel horse-shoe magnet which is still sometimes used, but the separator having the magnet energised by electric coils is much more efficient than this as it does not require brushes to scrape the chips off the drum but has all the advantages and conveniences which we have seen accompany the temporary soft iron magnet.

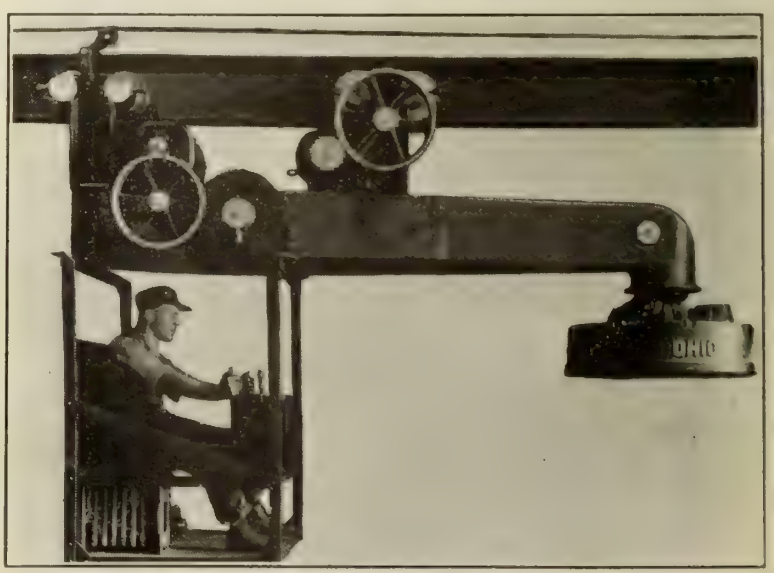
Reclaiming Good Metal

Magnetic separators are used in iron foundries for reclaiming good iron which would otherwise go to waste. Cinder mills will separate the iron from the cinder, but much of the finer particles of iron will pass through with the ground cinders and will be wasted. If this is passed through the magnetic separator it is surprising how much iron will be recovered. In some of the best foundries the molders' sand heaps are passed through magnetic separators to remove gaggers and scrap iron which would otherwise have to be picked out by hand and this not very effectively. This can be accomplished best by having a screen attachment so that the sand is first sifted out without going over the magnet, while the siftings go through and the magnet separates the iron from bits of brick or other undesirable material which is invariably in evidence.

Lifting Magnets

Lifting magnets are becoming quite common of late but are perhaps not as well known as they should be. Illustrations of these magnets are to be seen in most every technical paper but are passed over as though intended for some one else, but if properly understood they would be more popular. They are in no way connected with the mechanical work of the lifting machine, but simply take the place of hooks, chains, buckets, etc., for fastening the load to the crane or derrick. For instance in ordinary practice if pig iron is to be hoisted up to the charging floor it is usually placed on a barrow which is in turn wheeled to the elevator and raised to the proper level, where it is wheeled off and dumped in a heap, only to be rehandled and charged into the cupola.

With the magnet it can be attached to any kind of a crane in place of the hook and dropped down on top of a pile of pig iron. The pig iron will adhere to it when it is lifted away. When delivered to the proper place on the scaffold the current is turned off and the pig iron drops on the heap. In lifting scrap iron all the smallest pieces will be picked up and saved. Lifting pig and scrap iron are among the simplest op-



Roots Cupola Charging Hoist

erations. Where the magnet is most useful is in handling pieces which would require a lot of chains and hooks to secure them to the crane. The magnet only requires to touch the article and the crane can begin hoisting. These magnets may be attached to portable cranes or any other lifting machine and they will do the work.

One of the most useful occupations to which a magnet may be put is in connection with the cupola. This machine is operated by electric motors with the exception of the actual gripping of the metal which is done by a magnet. It is the latest thing in charging the cupola and has just recently been developed by the P. H. and F. M. Roots Co. of Connersville, Ind. It has all the conveniences of an electric crane and was designed to reduce fatiguing manual labor, with its accompanying cost. In addition it saves much in maintenance of cupola linings. It consists of a cantilever charging arm, with double swiveling four-wheel trucks. All four wheels of one truck are driven, while the trailing truck has an up-thrust roller to compensate for any cantilever action which may occur from overloading. This hoist covers more features than any hoist heretofore developed. The cantilever arm is run out to the yard, where the magnet is lowered down onto the pile or iron, which as we have already shown, adheres to the magnet and is raised to the charging floor level but instead of being deposited on the floor is charged right into the cupola by means of this cantilever arm which projects beyond the limits of the I beam on which the charger travels. Iron charged in this manner can be depended on to be properly placed, because by locating the magnet centrally in the cupola the iron is dropped to a position concentric with the centre line of the cupola, avoiding all contact with the brick lining, and in a position to melt more evenly. This is impossible where charges of materials are fed by hand, dumped from cars, or charged by chutes through charging doors of cupola. For lifting fuel and the fluxes, an automatic hook with drop bottom bucket is used in conjunction with the magnet.

ELECTRICAL INDUSTRY USES MANY FIBRE PARTS

(Continued from page 23)

remove at least ⅛ inch. If a lighter cut is taken it is not always possible to secure a uniform diameter. The turning tool should be ground to a diamond point and rounded off slightly and given plenty of clearance and rake.

As stated previously, this material lends itself particularly to the radio and electrical fields, and radio panels are very often made from this substance. To go into all the parts made from fibre and this latter mentioned product would take a volume in itself, but sufficient has been said to interest the reader and show the possibilities. Within a short time we can be sure of still further developments, for new uses are being discovered almost every day.

UNIVERSITY COURSES

The announcement made here last week that courses for export managers are to be held at Toronto and McGill Universities early next year should be of more than passing interest to every Canadian manufacturer. Every manufacturer catering to foreign markets employs an export manager who is in charge of this branch of the firm's output. The Federal Department of Trade and Commerce, recognizing this fact, and being desirous of assisting manufacturers to promote the export trade of the Dominion and to put same on a thoroughly sound basis, devised a scheme, in conjunction with the Commercial Intelligence branch of the department, to aid the manufacturers by equipping them with knowledge that will enable them to meet competitors in foreign markets on the best possible terms. The principal part of this scheme will be the courses.

The department, holding the opinion that the average export manager of Canadian manufacturing firms was not as well acquainted with the requirements of the foreign markets as he might be, concluded that no better method could be devised to correct this defect than by a course of instruction that, if taken, could not but help these export managers in the conduct of their trade to better comply with the demands of the foreign markets to which they were catering. Accordingly, Toronto and Montreal being the principal exporting circles, the Toronto and McGill Universities were approached and, these institutions having expressed their willingness to co-operate, it was decided to offer a course at each of these seats of learning. The courses will extend for two weeks, opening at Toronto on January 15 and at McGill on January 29. They will consist of lectures and demonstrations during the day and, possibly, a night course for local manufacturers, with a view to a thorough study of foreign markets, their requirements, and problems to be met and overcome.

No definite program has, as yet, been arranged, nor is one likely to be until late in the fall, but, as a basis from which to work, the Department has suggested the following ten subjects to be dealt with:—

1. Commercial geography; 2. problems of marketing; 3. transportation; 4. foreign tariffs; 5. Canadian Government services and, particularly, the functions of the Commercial Intelligence Service; 6. documentation; 7. financing foreign shipments and exchange; 8. correspondence; 9. marketing and packing, with practical demonstrations of the best methods of packing and experiments in testing the strength of packing; 10. general remarks on such subjects as the advantages of courtesy, address, etc.

It should be distinctly understood that these proposed subjects are purely tentative suggestions, the list may be much augmented or, when finally revised and adopted, some may be divided into subsubjects, while it is within the bounds of possibility that there may be eliminations. As at present proposed the lecturers and demonstrators will be drawn from the department, from the trade and from the universities.

Canadian Machinery has made arrangements that it will be in a position to announce the full definite program of the courses as soon as such is decided upon and available, which will probably be toward the end of November.

NEW BELTING SPECIFICATIONS

It will be of interest to Canadian manufacturers to know that the bureau of Standards, Washington, in co-operation with the U. S. Leather Belting Exchange have agreed upon specifications for leather belting in order to guarantee standards of quality on which competition can be fairly based. The belting manufacturers in the United States defined the elements of such quality with an assurance to industrial purchasers that they are receiving leather belting of a quality suitable for their work.

Dealing with the constitution of belting, the specifications require that, as to length, no sectional strip shall be more than 54 in. in length including the lap. The minimum length of any strip shall be 36 in. including the lap, excepting that in double belts one-eighth of the total number of pieces may be between 20 in. and 36 in., provided that these short pieces shall not occur consecutively. The minimum length shall not apply to the end pieces of rolls or cut length. In single belting the strips shall be joined shoulder end to shoulder end and butt end to butt end. In double belting the pieces shall be joined, backbone centre strips shall be used. The backbone mark shall appear running lengthwise approximately in the center of each strip. In all double belts from 8 in. up to 10 in. in width, backbone center strips shall be used in one ply and the backbone mark shall appear running lengthwise approximately in the centre of each strip. The other ply shall be cut from the location prescribed first quality stock. In all double belts 10 in. and over in width, both plies shall be made from backbone center strips and the backbone mark shall appear running lengthwise approximately in the center of each strip. The same quality of leather shall be used in both plies of all double belting.

Specifications further require that all leather shall have a minimum tensile strength of 3,000 lbs. per sq. in. of cross section and an average tensile strength for single belts of 3,750 lbs. per sq. in. and for double belts of 3,500 lbs. per sq. in. The average shall be determined from five test specimens selected at random from different parts of the sample being examined. Test specimens shall be cut with a metal die. The edges of the test specimen shall be cut perpendicularly. The minimum thickness inside the gage marks shall be used in determining the specimen.

Portable Outfit Widens Field of Electric Welding

Special Generators Required—Apparatus Fitted to Chassis Mounted on Large Pneumatic Tired Wheels—Reinforcing Seams on 30 Foot Tank—Welding of a Varied Character

By J. A. DUCHESNEAU

PORTABLE apparatus, which is used to generate electric current suitable for welding purposes, has widened the field of application of this particular branch of engineering. It is desirable to have voltages varying between 20 and 50, and, as all standard voltages are 110 volts or higher, it is easily understood that special generators and conductors used in connection with electric welding, must be able to take care of heavy amperages. Operators of electric welding outfits feel that the electrical apparatus is simpler to use than other types. After starting the generator there is only one major adjustment to take the attention of the operator, namely, the rheostat, the operation of which is simplicity itself. The field of electric welding overlaps, somewhat, the field of oxyacetylene welding, but then again, there are many repair jobs and manufacturing operations, that are more easily, and more economically, done with the electric apparatus.

Fig. 1 shows an electric welding generator, of the portable type, driven by a gasoline engine. The whole machine is mounted on a heavy steel frame, which maintains the alignment of the machine. This frame is mounted on the chassis shown. The apparatus is fully self-contained. It can be moved by hand around the shop and is towed behind a truck when it is necessary to do work at a distance from the shop. The apparatus can be entirely enclosed for such trips, preventing its exposure to the weather. The gasoline tank is below the engine crank case, and the fuel is fed to the carburetor through a Stewart vacuum feed apparatus. A governor is fitted to the engine, which keeps the speed, and therefore the generator voltage, constant. To the left, the panel board is seen. Here are located the electrical instruments, switches, rheostat, etc. This firm has several portable machines. This apparatus, is, in a general way, mounted on a similar chassis and has a housing which permits of entirely closing in the apparatus when traveling There are two or three standard a. c. motors kept for the machine so when it is necessary to do a job where only 550 volt current is available the corresponding motor can be placed on the apparatus. A 220 and 440 volt motor is also kept. As will be realized, this apparatus is used when it is required to do a job where there is electricity available. A direct current motor is also kept by the firm. Motors can be changed in 15 minutes. A fan will be noted between the motor and the generator. This fan was placed on the shaft as a safeguard for the generator, which at times showed a slight inclination to overheat.

This machine has been used on emergency jobs where no current was available, with the generator driven by a belt. The motor was removed and the pulley placed on the shaft extension. In using any of these portable apparatus it is a good precaution to ground the frame as it is well insulated from the ground on account of the rubber tires and static electricity is often present.

A large number of jobs in electric welding are done on boilers. There are limitations placed upon the application of this method of repairing boilers, and all major repair jobs must have the approval of the boiler inspector in whose territory the boiler to be repaired, is located.

Repairing Boiler Cracks

Probably the most common repair is a crack. This crack is chipped out as shown at B in Fig. 3. Then the "V" shaped groove is filled in, with the welding apparatus. The welding rod used, is, usually, specially manufactured soft steel. This firm use ⅛ in. and 5/32 in. diameters in most cases of small repairs. After the crack has been filled in as shown at C. a "rougher" is shown at Fig. 4, and is what might be called a caulking tool, and is used with hand or air hammers and close up any pin holes that might possibly exist. The tool is used any time after the weld is completed, either before or after the metal has cooled. In all welds the operator must be careful to build up at one time only that length of weld that he can keep hot, so that the built-up metal will not become unduly hard.

This firm undertook a very interesting job at the shops of the Dominion Bridge Co. A number of large tanks had been constructed for the Imperial

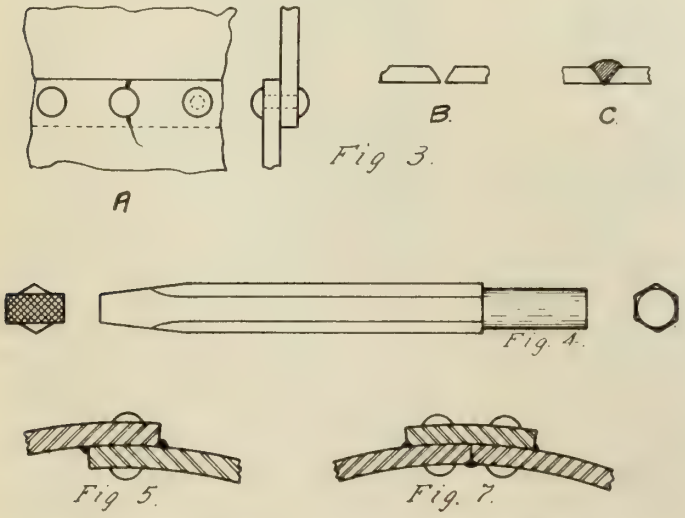
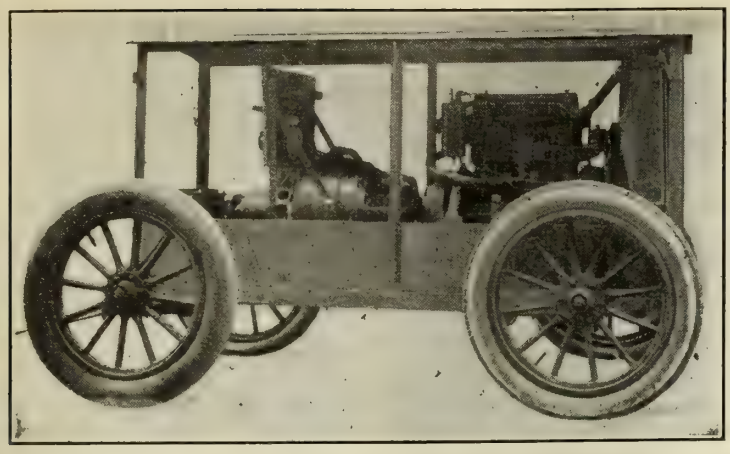


Fig. 3—Repairing Crack in Plate. Fig. 4—Caulking Tool. Fig. 5—Welding a Lap Joint. Fig. 7—Reinforcing Butt Joint.

Operator at Work on Bronze Runner



Portable Electric Welding Generator

Oil Co. These tanks were thirty feet long and ten feet in diameter, constructed from ⅞ in. plates. The joints had been lap-rivetted, and, as it was necessary for them to be tested at 200 lbs. cold water pressure, it was decided to weld the joints. This was done as shown at Fig. 5. The job was successfully accomplished.

A job that was somewhat unusual was undertaken at the power plant of one of the large aluminum companies at Shawinigan Falls. One of the bronze runners of a water turbine had become damaged through the breaking of the rack at the head gates. The cracks in the bronze were all welded and there were several pieces broken out that were "built in." Fig. 6 shows the operator at work on this job. Steel welding rod was used and a perfect job was apparently made. The turbine has been in operation since March last and has given entire satisfaction. Another job of interest that was done at Shawinigan Falls for the Shawinigan Engineering Co., Ltd., was the welding of the large new penstock 24 feet in diameter. The joints were butt rivetted and were welded as shown in Fig 7.

This firm has successfully accomplished many electric welding jobs in cast iron. Electric welding in this material has not reached the stages of perfection that it has in steel. This fact is due largely to the varying analyses of cast iron met with and that it is practically impossible to get a welding rod of that material that is entirely satisfactory over the wide varieties of iron met with.

The jobs undertaken are building up broken gear teeth, welding pulley arms, etc. Research and experiments are being continually carried on, and practical experience is growing wider every day. Thus, it is only reasonable to suppose, that in the course of a few years the field of application of electric welding will be very greatly widened.

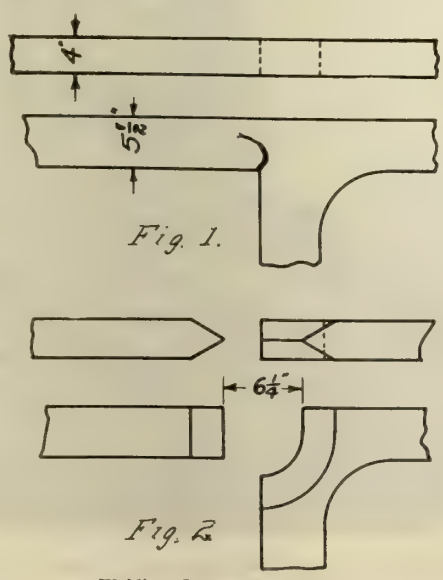
Electricity in Grand Trunk Pt. St. Charles Shop

IN A RAILWAY shop there are often many interesting special jobs that are undertaken and successfully executed, the details of which are only seen by those in charge of the work. It is further regrettable that there are rarely any photographic or other records kept of this class of machine shop work, which later could be worked up into shape for publication. It is not often the good fortune of Canadian Machinery's representatives to be present when some of these particularly interesting operations are being carried on.

A few days ago a very interesting electric weld was noted; in the case of a cracked locomotive frame. This locomotive was brought into the shops and partially dismantled. The crack in the frame is shown in Fig. I. The frame was cut away as shown in Fig. 2. The edges were bevelled at approximately thirty degrees and a piece of steel was machined to fit in the frame. There was no preheating required and only an allowance of 1/64 of an inch for contraction. The electric apparatus was used to amalgamate the inserted piece with the frame and thus one integral piece was made. The weld was entirely successful.

From time to time similar repair jobs are executed. Some months ago a spoke in one of the steel driving wheels of a yard locomotive was found cracked. Owing to the heavy section of the circular rim, no allowance for concentration could be provided. The weld was successfully accomplished by chipping a small "V" around the spoke following the course of the crack. A collar was built up around the spoke which proved to be a successful weld.

There are a large number of small shafts, pins, rods, etc., that enter into the construction of a locomotive. Some of the rods are forged to special shape and are fairly expensive to produce, and at the same time the wear occurs at only one or two points, where it operates in a bearing or guide. These parts are all inspected, upon the tearing down of a locomotive, and if worn, are sent over to the electric welding department. Here are located several operators' "stalls." When the welders are not working on the floor or in the yard, the welding foreman keeps them busy repairing these small parts. In the cases of the pieces mentioned above, these journal sections are built up, about one quarter inch being added to the diameter of those machined sections that are worn undersize. These pieces are then later machined to size and placed in commission once more. No preheating is used in these instances.



Welding Locomotive Frame

There are cases also of forgings that have holes in them that are worn "out of round" or "large." These holes are filled with a plug approximately the size and shape of the hole, and then the welding outfit is used to entirely close up the hole. The pieces are next smoothed up in a miller, shaper, lathe, or planer and the holes re-bored, or re-drilled, as the case may necessitate. In these instances again it is not necessary to preheat the work.

Patches are welded in boiler shells, fire-boxes, tender tanks, and in fact all plate work. There are a number of kinds of repair work where the electric welding process is more desirable than other methods. Preheating is not generally necessary as the net shrinkage or contraction is small, owing to the fact that only a very small section of the metal is heated at one time and contraction is taking place as the welding proceeds. The Board of Railway Commissioners have some rather strict regulations and will not permit the welding of car axles, the running gear of a locomotive, such as side rods, connecting-rods, etc., etc.

The electric welding of cast iron has not been attempted to any great extent in Montreal. Those close to the profession, state that there is not available locally the proper kind of flux or welding rod.

The cost of electric current used in operating a welding apparatus is low.

(Continued on page 37)

Points to Watch in Operating the Shaper

Care Should Be Taken to Have Ram Move Freely But Without Vibration—Undue Wear if Oiling is Neglected—Avoid Springing Work When Clamping in Position

THE thousand and one jobs that require to be surfaced on small areas demand the attention of a shaping machine, and next to the lathe it might be said to be the most desirable tool for the jobbing or repair shop. In the larger factories the range of equipment permits of better selection for the accomplishment of different classes of work, but when a shop must restrict itself to a few tools, the shaper will always meet with approval for the class of work generally handled in a limited way.

The character of the work that a shaper is called upon to perform demands the maximum amount of rigidity in construction, and yet with free movement of the reciprocating ram. This is obvious from the nature of the cut and the action of the ram when working on long pieces, or when the cut is made on work at the extreme forward position. For this reason it is necessary that careful attention be given to the lubrication of the forward end, as the overhang on long travel causes the ram to sag due to its weight and causes excessive downward pressure on the lower bearing surface. On the other hand, the action of the cut causes an upward thrust to the front end of ram that presses against the top gib. These two opposing factors will in time, if proper oiling is neglected, cause undue wear on the slide.

The writer remembers operating a shaper some time ago that was affected in this particular way. When the tool was entering the work it would lift up nearly a sixty-fourth before taking the cut. On very short pieces this fault could be overcome by adjusting the gib but this would not work on the longer cuts owing to the uneven wear on the ram and the frame slide, as it would be free in the back position but would jam when moved forward about eight inches. This state of affairs continued until we had a set of fine thread rolling dies to cut. Several attempts were made to complete this job but the result would always be the same—the threads breaking in places on the final cuts. Before this thread cutting job was finished it was necessary to put a day in on scraping and fitting the ram slide.

Keep Tool Rigid

In the operation of shapers, the principles governing the cutting of metals are similar to all other tools. Second only to the proper grinding of the tool is the need of rigidity to the tool support. The cutting point should not extend any lower than is necessary as the vibration and tendency to "dig in" is aggravated by the increased length. If it is imperative that a long tool be used the cutting point should be in a vertical line with the heel of the tool so that excessive resistance will cause the point to take a path away from the surface of the work. In this connection it might also be stated that the vertical side of the shaper head surface should be a snug fit and the back-lash entirely eliminated. If there is any play in the nut or end movement of the screw the possibility of spoiled work by the tool "digging in" is very great. When making vertical cuts care should be taken to have the clapper box tilted over to permit the tool to clear the return stroke of the ram.

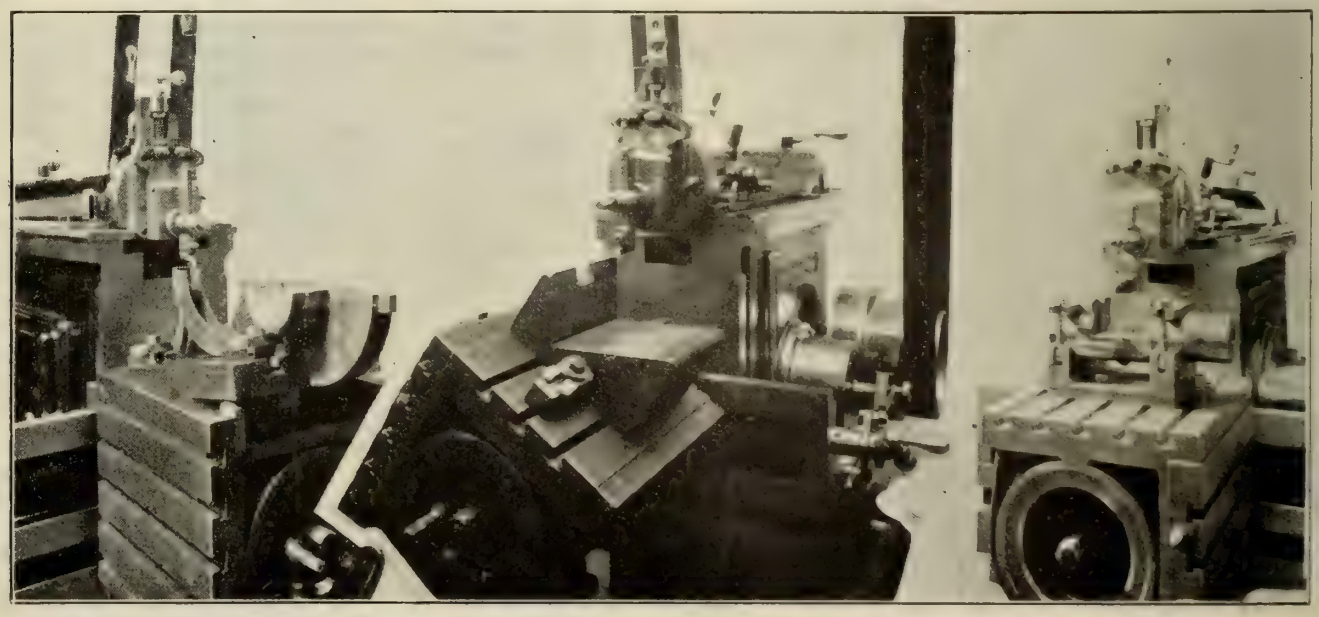
In order for any machine to do its best work it is necessary that the oiling of friction surfaces be carefully and systematically done. Lubrication to a machine is like food to a workman—both must be of the proper kind and suited to the particular needs. It should be neither a feast nor a famine. Too much oil may be as harmful as not enough. In many cases a heavy flow of oil is desirable but seldom in connection with machine tools. Where wells are provided to lubricate parts such as gears and worms, subjected to constant thrust, they should be adequately protected from dust and dirt. Oil running down the outside of a bearing or the frame of a machine is only so much waste. Feed and elevating screws on shapers should be kept clean and oiled sparingly, but frequently. The reason for this is to prevent the accumulation of dust on the thread which is drawn into the nut and causing wear, thus shortening the life of the screw.

Supporting the Work

Holding the work on a shaper is a very important point in connection with accuracy of finished product. Whether the piece is held in a vise, jig or clamped to the table, it must be secured in such a manner that all possibility of spring will be eliminated. When clamps are used care should be taken to see that a firm bearing is provided immediately beneath the clamp. Never attempt to use a clamp over a hollow portion. When using the vise see that the work is resting firmly on the parallel supports. After the vise jam is tightened a light blow should be sufficient to seat the work. If it does

(Continued on page 40)

Illustrations through courtesy of Potter & Johnston Co



Left—Showing the possibilities of the tilting table. Centre—Revolving table for angular cutting. Right—The use of jigs on shaper table.

Electric Furnaces for Many Industrial Purposes

Great Flexibility Indicated—Efficient and Economical—Makes for Better Working Conditions in Baking, Hardening, Enameling, Heat-Treating, Annealing, Melting and Forging—Application in Soldering, Heating Auto Rims, and Drying Lumber

GREAT is the variety of industrial utilities to which electricity is being applied. This has interesting illustration in the development of heat-treating furnaces for many different purposes. The scope of this field demonstrates the flexibility of electricity, and results actually obtained establish its merit as being economical in every department. It eliminates laborious operations and hence serves to reduce cost; it has been the means of saving valuable floor space by confining certain operations to smaller areas; in the matter of cleanliness, where such is an absolute necessity, it is beyond comparison with gas or oil; there are no offensive odors or excessive outside heat, and its efficiency has been established as beyond question. When it has been given a fair trial and wherever engineering skill has had an opportunity to adapt it to local conditions or particular purposes, results have been satisfactory, and electricity has won favor as a desirable heat-treating medium. Safety insulations and switches have been developed and designed whereby danger from high voltages has been reduced to a minimum and at the same time recording and indicating apparatus constructed whereby the power may be adjusted to the operation, automatic or otherwise, with absolute precision.

Scope of Heating Operations

The statement is made by an experienced electric-furnace engineer that electricity can be used for any heating operation requiring temperatures from 100 to 2,600 degrees Fahr., and for metal melting from 100 to 4,000 degrees Fahr. successfully and efficiently. Here are a few of the applications in Canada of the electric furnace to purposes that may be considered more or less exceptional:—

Baking 10,000 headache tablets per hour.

Baking corn flakes at the rate of 500 lbs. per hour.

Heating 120 auto rims per hour for shrinking on felloes, and also for drying truck bodies.

Electric lead pot, 12 ft. long by 2 ft. wide, heating 30 No. 10 iron wires to 1,550 degrees Fahr. traveling at the rate of 100 feet per minute.

Tinning 30 No. 22 iron wires traveling at the rate of 320 feet per minute.

Porcelain enameling 60 bath tubs per day, and 50 auto names plates per hour.

Hardening 30 planer knives, 2½ in. x ½ in. x 33 in. per hour at 2,350 Fahr.

As to the industrial scope of the electric oven or furnace the following outline is elucidating:—

Drying.—Varnish, lumber, paper, moulds, plastic forms.

Baking.—Bread, cereals, enamels, cores, transformers, motor windings.

Coloring.—Nails, wire, wire cloth, stampings and metal parts.

Annealing. — Wire, tools, machine parts, brass stampings, silverware, white metal stampings, castings and other metal parts.

Hardening.—Steel tools, bearings, wire, springs, drills, both high speed and carbon, reamers, milling cutters, lathe tools, taps, dies, saws, knives, etc.

Preheating.—All types of high-speed tools.

Porcelain enameling.—Bath tubs, kitchenware, stove parts, signs, lodge and fraternity pins, etc.

Heating.—Automobile rims for shrinking on felloes.

Burning.—Carbon electrodes, manufacture of graphite, china, porcelain and clay products, bank notes, parimutual tickets, general incineration and cremation.

Metal coating.—Tinning or galvanizing wire and other metal products.

Melting.—Solder, lead, soft metal alloys, zinc, tin, brass, copper, bronze, iron, steel nickel, chromium, vanadium, tungsten and other alloys.

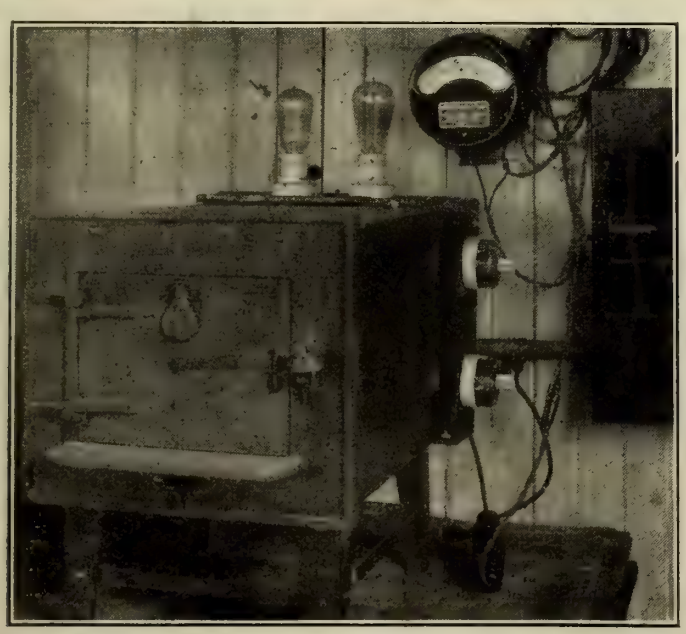
Forging.—Steel and tungsten.

Miscellaneous.—Soldering iron heaters, hot plates, plating and cleaning baths, water stills; laboratory furnaces and dental furnaces.

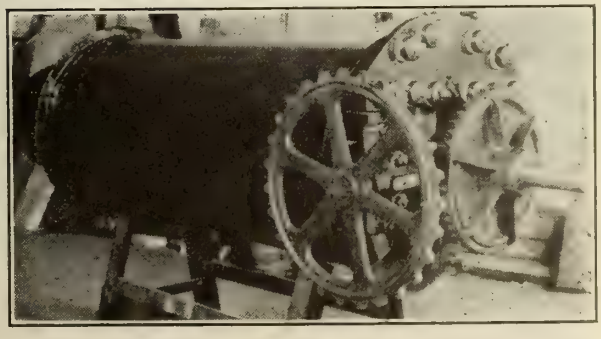
Application to Soldering

Electric soldering furnaces are among the most recent and useful applications. Here, again it has been demonstrated by actual test that the cost is less than gas. Records in one case show an hourly consumption of 840 watts. To bring the furnace up to a required temperature of 1,200 degrees Fahr., takes from ½ to ¾ of an hour, and a pair of 1½ inch coppers may be heated as desired in three minutes. The dressing and cleaning of coppers is no small item in extensive soldering operations, and with electricity it may be done in one half the time consumed where gas is used. Then, again, working conditions are greatly improved for there is no objectionable heat, and obnoxious fumes are eliminated. While the difference in operation costs, so far as actual consumption of electricity and gas is concerned, is slightly in favor of the form-

Illustrations courtesy R. H. Cunningham & Co., industrial furnace engineers, London, Ont.



Electric furnace used by manufacturing jeweler in enameling name plates, society pins, etc., and also for hardening dies and tools.



Automatic electric furnace for heat-treating small parts. These are fed in at one end, carried through by worm, and released at other end.

Left—Electric furnace equipment at plant of P. B. Yates Machine Co., Hamilton, used for hardening planer knives.
Right—View of electric furnace used by Hayes Wheel Co., Chatham, where 120 wheel rims per hour are heated for shrinking on felloes. To right of this picture is seen the furnace used in laborious former system.

er, other conditions give it a decided advantage.

An outstanding instance of economy has to do with the use of electricity for drying purposes in lumber mills, when they happen to be within a hydro zone. At night, while the mill is inactive, the available power may be used, say at 1/6 of a cent per kilowatt, in connection with the drying kilns, thus converting chargeable load to useful purpose and eliminating fuel costs otherwise necessary.

Electricity, it is found, has also its advantages in heat-treating dies and punches, as not only being economical but much cleaner than old methods. The product is practically free from scale of any kind and this is most desirable. Many large tool rooms are adopting the idea.

EXPANSION IN TRADE LOOKED FOR BETWEEN CANADA AND WEST INDIES

DISCUSSING, with Canadian Machinery, some aspects of the recent visit to the West Indies of the party of Canadian manufacturers, Sir Alexander Bertram (John Bertram & Sons Co., Ltd., Dundas), states that while the island of Jamaica is an agricultural one, and does not present a large field for the sale of iron and metal products, development has only started which should lead to a gradually widening trade with Canada along lines that are now more or less limited.

The only manufacturing activities are confined to a few sugar mills. These mills were built in England. When the mills were sent out a lathe, a planer, drilling machine and bolt cutter were sent out to each mill. The construction of the mills is such that very little maintenance work is required. Probably the babbitting of a bearing is all that is ever done. Thus the market for machine tools in this connection is practically nil.

Jamaica is about the only island in the British West Indies that has a railroad. This road is owned by the British Government and operated for them by a commission. Naturally as British capital constructed the road, the railway shops were equipped with British machine tools.

These two lines of endeavour represent the only markets for machine tools.

There is, of course, a certain amount of machinery in the hands of private owners, but it is relatively small. Throughout the island the Whitworth form of thread is used. The white population is the only section that uses iron stoves and ranges for cooking. Public utilities, as we know them, do not exist. The country is progressing rather rapidly and is interested in hydro-electric power development and in many other lines of engineering .

There is a fair market for sheet metal products, enamelled ware and such lines. In fact, Canadian goods in these lines are well known. As the population is largely colored, the bulk of the demand for any commodity comes from this portion of the people. In boots and shoes, textiles, etc., only a cheap quality is required. Everywhere there exists a keen desire to trade with Canada. Those lines such as potatoes, flour, fish, butter and cheese, etc., that it is necessary to import, are purchased largely in Canada.

Canadian banks control the finances of the country, but the denominations of currency are the English pounds, shillings and pence. The rate of exchange is practically the same as that of English funds.

The black population is of high intelligence and there is a movement on foot to establish one or more technical schools. General Bertram delivered a good many addresses in the Jamaican Legislature and on other public occasions, and brought to the attention of the authorities, the high class of Canadian machine tools and other apparatus that goes into the equipment of a technical school. The General feels confident that these schools will be equipped by Canadian firms. He also gave several lectures on Canada, describing the railways, canals, ports, hydro-electric developments and other Canadian engineering features from coast to coast. The interest taken in this subject was surprising, and the limited number of views available were studied carefully. The Canadian Trade Commissioner, Major Stephens, formerly a newspaper man, is doing excellent work for Canada. It is believed that the visit of the Canadian manufacturers did more to favourably advertise Canada than has been accomplished in this line for years.

The development of the country has only started, in many ways. If the trip of the manufacturers is followed up in the future with other efforts to foster trade, results will be felt in an increasing trade with Canada in ever widening lines. In the last two years, the trade with Canada has doubled, and the variety of imports is widening every year. General Bertram says that the future of this trade lies in the hands of Canadian business men and Canadian manufacturers. It cannot be built up faster than the colonies grow, but to maintain and develop the connection, these countries must be given more attention.

Tinning 22 wires traveling 320 feet per minute by electric furnace in plant of Laidlaw Bale Tie Co., Hamilton.

Practical Ideas From Practical Men

HOW TO CLEAN AN INDICATOR QUICKLY

By W. F. Schaphorst, M. E.

A short time ago I read an article on the care of ammonia refrigerating machine indicators. According to the author it is possible and permissible to use brass indicators on ammonia machines but they must be used continuously for not too prolonged a time, and after using must be carefully cleaned. After reading this article I was reminded of a cleaning kink that was taught me by a friend who was a chemist. He caught me one day while I was carefully wiping dirt and grease off of some small polished metal parts. He watched me for a while and asked, "What are you trying to do?" "Get this dirt off," I replied. "Why don't you put 'em in a pail of soap and water and boil 'em?" "They'll get wet," I said, "and then I'll have to dry them. After cleaning I want to grease them so that they won't rust." "Very simple," he informed me. "After boiling, rinse in plain hot water, and then dip in the purest alcohol you can get. The wetness will evaporate off in a jiffy and they will be ready for greasing almost immediately."

DRILL PRESS RECESSING TOOL

By I. N. B.

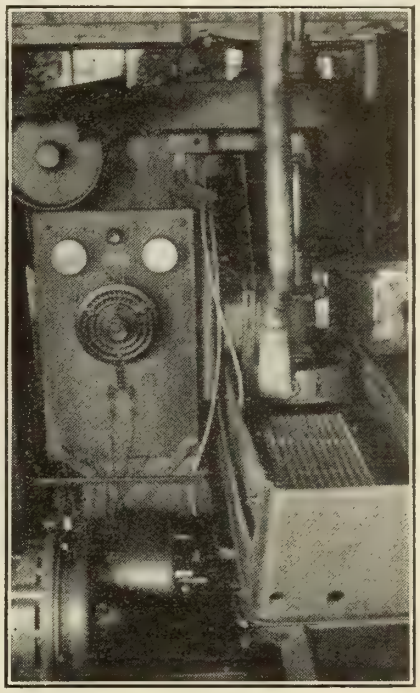
Having the occasion to recess the bottom of a number of ⅜ in. holes it was decided to do the operation in a drill press. The accompanying sketch shows the design of tool made for the purpose. The tool holder A is carried by the shank B, the latter being slotted to receive the holder which is pivoted on the driving pin C. The upper end of the tool holder is provided with an extension D that passes through a slot in the shank and bears on the taper portion of the bush E. This bush is forced down by the action of the spring F, pressing against the two washers G, and H. The handle I is hung from the piece J, that extends down from the collar K, the forked end being provided with pins that enter the groove L. When turning in a normal position the tool M revolves freely in the ⅜ in. hole, but when the lever I is pressed downwards the bush E moves upward and the taper causes the tool holder A to swivel on the pin C so that the cutting point of the tool cuts the required recess.

FEATURES OF A SURFACE GRINDER INSTALLATION

By D. A. Hampson

Shops in rural sections, and in many of the largest cities, are supplied with alternating current. Direct current has certain advantages not readily secured with "a c," among them being speed regulation and electro magnet usage. But day in and day out, the average shop does not miss these direct current advantages—it is only the occasional job and the special application that bring to mind the existence of them. In the slump days following the war, one shop bought some machinery from a defunct concern and among the tools was a Pratt & Whitney surface grinder. There was a Walker magnetic chuck on the machine but the intention was to remove this and apply mechanical clamping devices such as were already in use on less modern equipment in the shop. There was no direct current in the town anyway.

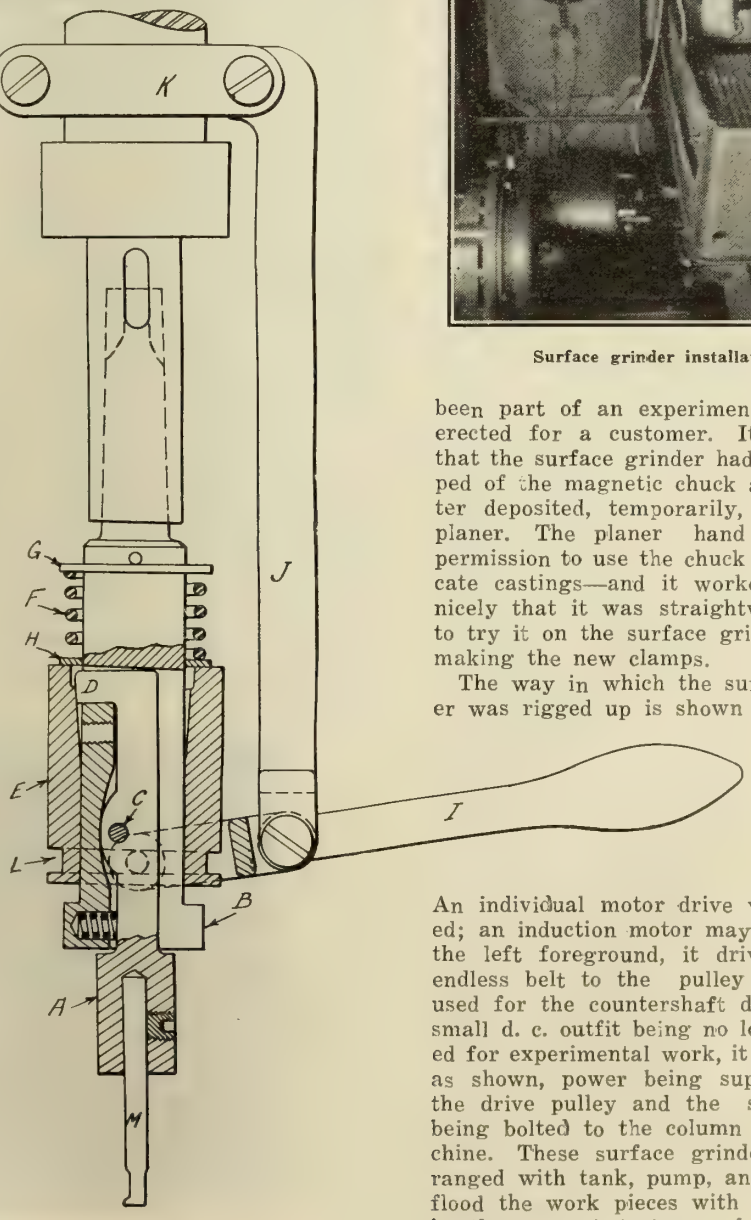
About that time, the shop ran into a planing job on some light cast iron pieces. This was to be done on the small planer which was near the assembling floor and which was near to a small dynamo and switchboard that had



Surface grinder installation.

been part of an experimental machine erected for a customer. It happened that the surface grinder had been stripped of the magnetic chuck and the latter deposited, temporarily, near the planer. The planer hand requested permission to use the chuck on his delicate castings—and it worked out so nicely that it was straightway decided to try it on the surface grinder before making the new clamps.

The way in which the surface grinder was rigged up is shown by the cut.



An individual motor drive was installed; an induction motor may be seen in the left foreground, it driving by an endless belt to the pulley ordinarily used for the countershaft drive. The small d. c. outfit being no longer needed for experimental work, it was set up as shown, power being supplied from the drive pulley and the switchboard being bolted to the column of the machine. These surface grinders are arranged with tank, pump, and piping to flood the work pieces with coolant but in the present instance, dry grinding

was imperative for several reasons. Advantage was taken of this to strip the back of the machine of these unused parts and to bolt rails across the top of the tank space for the electrical equipment to rest upon. The 7½ h. p. driving motor is on a sliding base which rests on these rails and the 1 h. p. dynamo is permanently fixed.

How well the machine produced may be stated when it is told that the other grinder—the one this was to "help out"—has been scrapped and the P. & W. machine with magnetic chuck now handles over twice the highest previous output and runs only part of the time to do it. No mechanical clamp could be as efficient as the chuck. In the photo, there may be seen a load of thirty pieces 1 in. x 10 in. on the chuck. There is a grinding rim one-quarter wide all around both sides and an ordinary helper has ground as high as 3,000 complete pieces in ten hours. For the comfort of the workman, the table shields are used, high all around, and a direct line to the exhaust blower is carried to the abrasive wheel. Surrounding the latter, in place of the usual light sheet metal splash band, is a welded ring of ¼ in. steel, riveted to stout brackets that are adjustable vertically. An oval opening is cut in the ring in the region where the most dust collects and here the 3 in. exhaust pipe is flanged and riveted tight.

X-RAYS AND THE FATIGUE OF STEEL

By E. C. MacCormac

Someone has said "an art is the practice of a science. The greater the art the more automatic its exercise. Engineering was originally defined 'as the art of directing the great Sources of Power in Nature for the use and convenience of man.' This is still an adequate definition of an art now so comprehensive in scope and related to so many activities and interests of mankind that it may be termed the art of arts in this civilization. No other department of human knowledge has advanced so rapidly during the last hundred years. It has transformed human environment in all countries, changed customs, altered international relationships and modified even the physiology and mentality of peoples. By the control and direction of the energies of nature external to man, engineering has developed."

Take for instance the fatigue of steel. Not infrequently serious machine tool and other accidents occur which result in heavy losses in limb and life because some of the metal parts used in the construction of the machine tools, etc., have become so tired that without warning or outward evidence of portending collapse, they have presented perplexing and puzzling problems to the engineering fraternity, which has resulted in a considerable amount of research work in order to reduce the risk connected with metal fatigue.

On investigating a broken crankshaft from a ten ton ammonia refrigerating machine it was found that the material proved to be inferior, in that it was decidedly porous and showed evidence of not having received sufficient reduction in forging. The break which occurred was in the nature of a fatigue failure, and had its origin in the angle between one of the throws and the bearing. A defect at this point had been filled in previously with arc-fused metal. Such a procedure would not necessarily lead to failure had the defect been located elsewhere, but at the point in question the stresses are much higher than at other points on the shaft, and the break once started would be propagated rapidly owing to the unsound character of the steel.

INTERESTING PLANER JOB

In all work-shops of the type which contract for the building of a multiplicity of sizes of machines, there occasionally comes along a job for machining beyond the capacity of the largest shop machine tool available. This situation common enough in its way is nevertheless one which calls into play all the latent initiative in the master mechanic, and its successful manipulation often means the difference between a profit and a loss on the particular piece being handled.

Such a case is the one illustrated by the accompanying photograph. The two halves of a long bed required machining to exact dimensions and as they eventually had to mate up into exact alignment it was desirable, if at all possible, to machine them side by side at the one operation. To secure this result the top portions of the two halves of the bed were first planed to size, and then carefully set up at right angles to the line of the planer travel on heavy box parallels bolted to the machine shop floor. The whole success of the job was of course dependent on the accuracy of this setting up, which, however, did not present many difficulties when checked with a good spirit level.

The tool box used was detached from the planer cross rail, and fitted to a spare chest iron column which was available from off an obsolete design of machine tool. This tool box column was set up at an exact 90 degrees to the finished portion of the bed being operated on, and on the table of the planing machine being set for the correct stroke the operation proceeded without any hitch, the machine attendant meanwhile standing on the planing machine table. The measure of the efficiency of all such rigs is of course the resultant accuracy obtained in a reasonable time, conditions which were adequately met under the circumstances above described.

BOOK REVIEW

Production Engineering and Cost Keeping is the title of a new book by Wm. R. Basset and Johnson Heywood, published by the McGraw-Hill Book Co. The treatise has been prepared especially for production managers, heads of planing departments, foremen and cost accountants; it takes the principles of scientific management and applies them in simple, every day language to the conduct of machine shop practice. The material contained in the book has been developed in the course of years of actual installation of production and cost keeping systems, and the principles and practice treated are highly recommended by the authors.

Two distinct but closely related fields—production engineering and cost accounting—are covered in the book. The first portion is devoted to production planning methods, and the machine shop executive will find the pages in this section full of practical suggestions that will aid him in checking up on manufacturing methods in use and in proposing improvements. The second part dealing with costing methods shows the close relation existing between profitable manufacturing and sound cost keeping. The authors show how properly prepared statements can be made to give an accurate picture of the business at all times, and how they can be used to obtain manufacturing economics and betterments. The book is 6 x 9 inches, 311 pages, and is illustrated with 117 forms and charts, Price $3.50.

Interesting planer job.

Some of the Factors Entering Into Power Cost

Charges Based Either on Cents Per Kilowatt Hour or Per H.P. —Comparison of the Different Systems—Measuring the Power Factor—Taking Peak Average

THE manufacturer's cost of power in many cases only amounts to the equivalent of petty cash, and has therefore during prosperous times received very little consideration. However, due to competition, the manufacturer to-day is watching very carefully the items of his petty cash and should in turn take a greater interest in his electric power bill and understand something of the factors which enter into its makeup.

A Canadian manufacturer's bill, generally speaking, is based on one of two methods. 1. A charge of so many cents per kilowatt hours only. 2. A charge per h. p. of demand, plus a charge per kilowatt hour.

Ten years ago, practically the only method in Canada was No. 1, but the power companies came to realize that there was a difference between the customer who used 24 kilowatt hours in one hour and the customer who used 24 kilowatt hours spread over 24 hours. The difference being that the first customer used 24 times the amount of machinery as was required for the second class of customer and in turn the fixed charges would be 24 times as much in the one case as in the other. An illustration with which we are all familiar, is the summer hotel. Their rates are always high in view of the service they actually give because they have to pay all the interest charges in a matter of one or two months, instead of spreading it over the whole twelve months as is the case with any hotel in the city.

Now let us consider for a moment what fixed charges represent to a distributor of power. These charges naturally cover the interest on investment on the building of the power station, the construction of canals or reservoirs, the installation of water wheels and generators or steam engines and generators, the building of transmission lines, transformers, etc.

It is an interesting fact that the interest on the building of a water power plant, including the items shown above, represents approximately 85 per cent. of the total cost of supplying the power; in the case of steam, approximately 45 per cent. of supplying the power.

Thus it is readily understood that if one customer requires 24 times the amount of fixed charges for the same number of kilowatt hours, his bill should be greater than the second class of customer mentioned.

The result of the realization by the suppliers of power, of the importance of this factor, led to the second method of charging, i. e. h.p. of demand plus kilowatt hours used. The only real difficulty was there was no instrument at a reasonable price available for the measuring of this factor. Therefore except on large customers (where valuable instruments were economically possible) the total h.p. of the machinery installed was adopted as the basis upon which to determine the h.p. of demand and this system which is fairly well known i. e. the "installed capacity" became quite general.

This system however, was not ideal for the folowing reasons. Some manufacturers will put in motors larger than necessary in order to provide for the future. Others have grown so rapidly that they have motors very considerably overloaded. The installed capacity basis penalizes the first class of manufacturer and gives the second class of manufacturer something for nothing.

Another difficulty is that the driving of individual machines is now considered the best practice from an engineering point of view, but if all the individual motors are totalled up, the installed capacity is quite high compared to the actual amount of power taken at any one time. Thus, although the manufacturer is adopting the best practice he will again be paying for more than he uses. Also the manufacturer would pay just the same, as far as the demand portion of this bill was concerned, whether he was busy or slack. Whether he had motors running or idle.

As a result of these conditions a very definite demand was created for instruments at a fair price which would measure the demand portion of a bill. Such instruments have been on the market for some considerable time and are coming into very general use and it may be of interest to give some of the characteristics of their operation. Such instruments take the average of the peak for say 10 or 15 minutes and are so arranged that they push a pointer upwards on the scale. If, for instance, the maximum to-day is 10 h.p. averaged over a 10 or 15 minute period, the pointer will read that amount. If next week the average increases for any 10 or 15 minute period to 15 h.p., the pointer will be pushed up and will remain at that point. An illustration of what is meant by the average over a 10 or 15 minute period makes this point quite clear. Your motor car may have reached for a few moments a speed of 35 miles an hour, but the average speed for a period of 15 minutes will be only 20 miles per hour. In electrical terms your motors may pull 35 h.p. for a few seconds, but the average load or demand over a 15 minute period is only 20 h. p. and 20 h.p. is what the bill would be based on for the demand portion.

ELECTRICITY IN G. T. R. SHOPS

(Continued from page 31)

Hydro-electric power is used largely in Montreal, and in the case of the Grand Trunk shops the cost of current necessary to operate one outfit for one hour is only a fraction over one and one-half cents. Voltages and amperages vary, but in this shop eighteen volts is considered standard while the current runs from one hundred to one hundred and twenty-five amperes.

One of the uses of electricity in the Grand Trunk shops, that has proved very efficient, is that of heating rivets. A rivet heater manufactured by the Humil Corporation of New York City is installed. Five rivets are heated at once. One boy operating the heater can supply two gangs of rivetters. Without undue effort three hundred and fifty to four hundred rivets an hour can be heated. There is no danger of burning rivets and perfect control is obtained with practically no attention. There are no delays due to dirty fires, poor control or other causes more or less common to coal, oil, or gas-fired heaters.

In round house work the Grand Trunk have usually operated their turn tables by air engines. Turn table centres are very inaccessible and dirt, water, and foreign matter usually find their way there, causing the table to be operated with more or less difficulty. When the pressure in the air line was low, due to any one of many reasons, the air engines often got hard usage and the result is that they did not stand up to the work as well as might be expected. Thus it was decided to apply an electric motor to the job. The first motor to be fitted up for this work was recently shipped from the Pointe St. Charles shops to Windsor. A fabroil spur pinion was placed on the armature shaft of the motor, which is a d. c. machine. This pinion runs into a cut tooth steel spur gear and thence through a train of spur gears. The motor was completely covered with a galvanized sheet metal housing which is weather proof, but yet provides for ventilation and has ample inspection facilities. A trolley car control was attached to the motor and it is believed that much better service will be had from this apparatus, than was had from the air engines.

In these shops new construction is handled as well as repair work, and the few uses of electricity mentioned are some of the more important. Portable tools such as grinders are used to a limited extent. At present the air lines are very complete, and there are more air-operated portable tools than electric operated.

New Things in Shop Equipment

DIE-MILLING MACHINE

A machine for milling dies and similar kinds of work of irregular outline and which contains many interesting features has recently been developed and placed on the market. The spindle of the machine operates at a speed of approximately 300 r.p.m. The speed change gear box provides four changes of spindle speeds ranging from 281 to 926 r.p.m. The spindle is provided with a lever operated collar that grips the cutters firmly and yet releases quickly and easily. A number of collars are provided with the machine, ranging from ⅜ inch to 1 inch in diam. The cutters may be held so as to permit of any degree of draft. The double sliding carriage has a traverse movement of 12 inches and a cross movement of 4¼ inches. Dies ranging from 3½ to 17½ inches in width and of any length may be clamped to the table. The slides of the table may be operated independently and in conjunction with each other. Graduated dials on the operating screws permit of very close adjustment. A force feed oiling system provide for the lubrication of all moving parts. These machines are manufactured by the Billings and Spencer Co., Hartford, Conn.

ELECTRIC INDUSTRIAL CRANE TRUCK

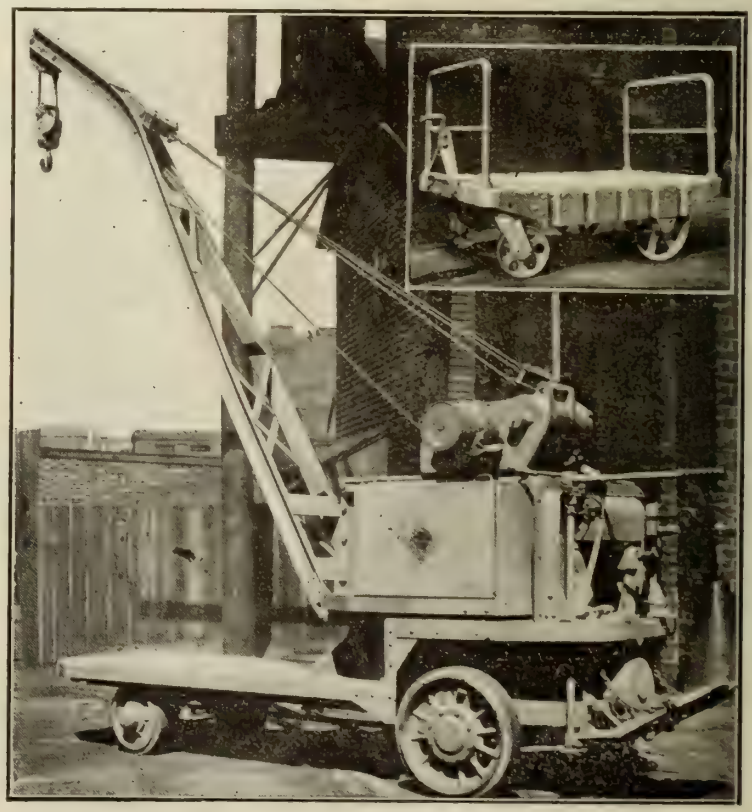
The latest unit added to a line of industrial trucks consists of a low revolving and luffing electric crane mounted on an electric load carrying truck. The capacity of this unit is just less than that of the industrial gas or steam locomotive crane, and on account of the size and flexibility of the unit, it is especially suited for inside, although it may be used for out-of-door service. Lift capacity 3,000 pounds at 6-foot and 1,000 pounds at 12-foot radius without outriggers. Stacks 12 feet high with boom set to lift 3,000 pounds at 6-foot radius. The truck itself is a complete new design of very heavy construction to provide stability and absorb the strains imposed when lifting. The same rugged construction assures satisfactory performance when carrying a ton and a half load, which with truck weight is 8,500 to 9,000 pounds.

An entirely new design of single motor double drum hoist unit handles a separate line to boom and hook. Motor hoist unit with battery in its compartment forms a counterbalance for twelve-foot boom with load. The crane column is supported on heavy, broad pillars and revolves on large ball and roller bearings. A geared revolving or slewing device swings crane through 180 degrees. Boom may be raised or lowered, or swung to right or left and locked in any desired position. With boom lowered, it will pass through a six-foot doorway. A single battery furnishes power to propel, as well as hoist motor. Both controllers are in front of operator. To avoid swinging or twisting of electric cables, they are brought up through crane column. There are but two motors on this equipment. Wide spread driving and trailing axles carry solid, press-on 22 inch x 4½ inch and 15 inch x 3½ inch tires respectively. All standard safety features, as crane trip switch, truck automatic control, worm drive, four-wheel steer and pressure lubrication system are incorporated in this new tool. This is one of the largest capacity electric industrial crane trucks built. It is manufactured by the Elwell-Parker Electric Co., Cleveland, Ohio.

WHEELED-PLATFORM-TRAILER

A wheeled-platform-trailer, designed especially for use interchangeably with Elwell-Parker electric elevating platform trucks and tractors, has recently been placed on the market. This trailer has load carrying capacity of 6,000 pounds and weighs 600 pounds, making it one of the lightest equipments for this capacity yet designed. The construction is extremely sturdy, and the very latest engineering practice has been incorporated in its design. The main top platform consists of a pressed, corrugated open hearth steel plate with deep aprons on either side, making a very substantial support for the load, and when considered together with the heavy 4 inch longitudinal channels all tied into malleable corner castings, a very light yet strong construction is the result. Two long steel caster fork pillars carry graphite bushed bearings at upper ends, ball swivel bearing and roller caster wheel bearings are retained in deep recesses in malleable corner casting. Fixed wheels on roller bearings are carried in forged steel yokes, riveted to top and side. All bearings are provided with pressure lubrication—casters are 10 inches in diameter and fixed wheels 15 inches in diameter. End or side standards with coupler are provided.

When used as trailers, the unit is furnished with hook or eye couplers or with "Y" or "X" chain couplers. When desired, the wheeled-platform will be equipped with 4 casters instead of 2 wheels with 2 casters. When required wheels may be equipped with 10 and 15-inch solid rubber tires of the press-on type; that is, the same as used on electric trucks and tractors. When the wheeled-platform is used with electric lift trucks, clearance has been provided between the wheels in order that the



Elwell-Parker industrial crane. Insert—Wheeled platform trailer.

lift truck platform may be driven beneath. When the lift truck lifts the load, the weight of same is supported on the truck platform by 2 longitudinal channels beneath the wheeled platform. These equipments are especially useful for the transport of materials at shops, warehouses, railway and steamship terminals. They are made by the Elwell-Parker Electric Co., Cleveland, Ohio.

BENCH GRINDER

In the construction of bench grinders it generally is necessary to incorporate a motor approximately as large in diameter as the grinding wheels to obtain the desired operating power. Such a motor sometimes interferes with the grinding operation, especially in handling work that must be fed past the wheel, or in grinding various types of tools. This difficulty has been overcome in the grinder shown in the accompanying illustration. It is equipped with a squirrel-cage, induction motor with the windings at the rear only,

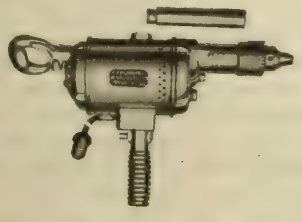
Forbes bench grinder.

which leaves ample space between the two grinding wheels for the easy manipulation of the work.

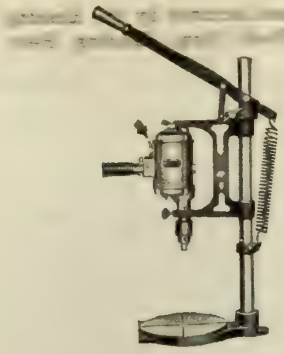
The machine accommodates 6-inch wheels which project 1¼-inch beyond the motor casing. Thus it is possible to utilize three-fourths of the material in the wheels before they are worn to a level with the motor. The design also makes it possible to grind on both sides of the wheel. The grinding wheels are protected by ample guards, while the tool rests are flat steel, adjustable in two directions. The spindle is ¾ in. in diameter, operating in ball bearings. The wheel flanges are of large size, while the motor and bearings are enclosed. The motor develops ½-horsepower at 3,600 revolutions per minute operating on two, on three-phase, 60-cycle current for 110, 220, 440 and 500 volts. The grinder is made by Forbes & Myers, Worcester, Mass.

BALL-BEARING PORTABLE ELECTRIC DRILL

A new light weight ball bearing portable electric drill designed for the particular use of garages and auto repair shops has recently been placed on the market. The new drill has a capacity



Portable electric drill.



Bench drilling stand.

of ½ inch in steel. It weighs only fourteen pounds and carries a universal motor for use on either direct or alternating current. The drill is equipped with a Jacobs chuck, an extra detachable side handle and 10 feet of cable with Hubbel attachment plug. A mandrel with a 3 inch x ½ inch grinding wheel to insert in chuck for light grinding, is furnished as an extra. The entire motor frame, switch handle and end handle are made of aluminum. The motor windings are fully enclosed, dirt and dustproof and all working parts are protected. The motor is air-cooled by means of a fan mounted on the armature shaft. High grade annular ball bearings support both ends of the armature shaft. A ball thrust bearing is provided for all end thrust. The chuck spindle is carried by a phosphor bronze bearing of ample size to withstand irregular drilling pressure. The switch is of special patented design of the quick make-and-break type, with 50 per cent. overload allowance. It is enclosed in the handle of the drill and is operated by means of a push button through the handle. Gears of special analysis steel, heat-treated and hardened, are carefully enclosed and operate in grease.

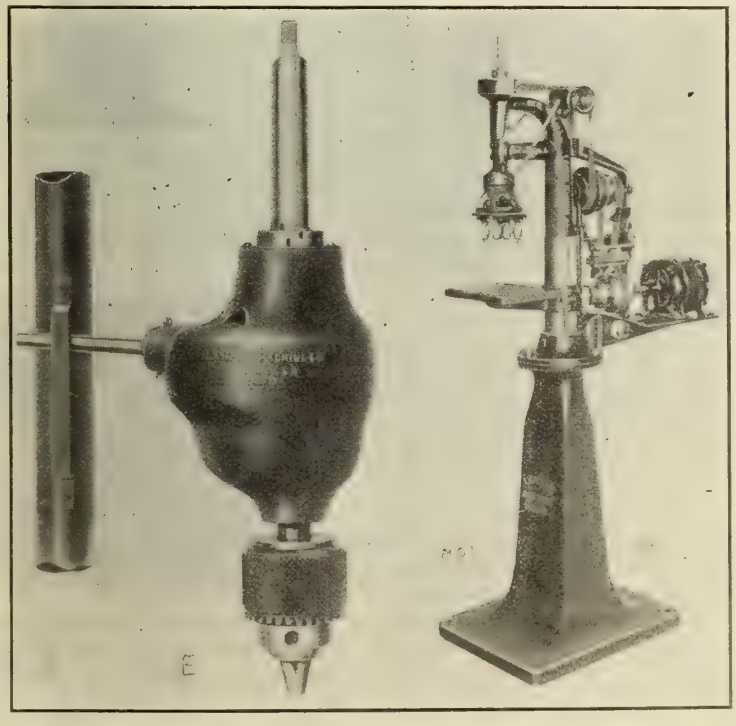
BENCH DRILLING STAND

A special bench drilling stand for use with the new "garage special" portable electric drill has just been placed on the market. The stand makes it possible to convert the drill into a bench drill press in a few seconds time. A cap and thumb screw locks or releases the drill. The stand has a column height of 24 inches, the maximum height from base to drill chuck being eight inches. The diameter of the base is 10 inches. The entire stand weighs 45 pounds. The drill bracket with the drill can be set at any point on the column and raised and lowered as desired. The weight of the drill and bracket is balanced by the spring in the rear of the column. The drill is kept in vertical alignment by means of a key on the bracket and keyway in the column. Depth of holes is regulated by an adjustable stop in the column. The stand is equipped with a lever feed with quick return. This portable electric drill and stand are manufactured by the Cincinnati Electric Tool Co. of Cincinnati, Ohio.

PLAIN AND BACK-GEARED TAPPING CHUCKS

A new line of tapping chucks has recently been offered to the trade. The chucks are designed with a simple friction device for holding taps, so as to prevent breakage, in case a hard spot is encountered in the work. The chucks are made in two styles, one having a tapered shank for use on drilling machines and lathes, while the other has straight shank with a reversing sleeve, so that the device can be used in a turret lathe.

The same firm has also developed a



Back-geared tapping chuck and sensitive multiple drilling machine.

single spindle tapping shank that can be driven directly from the main spindle of a drilling machine. It is fitted with ball bearings and the spindle reverses at higher speed than when feeding downwards. This chuck has a capacity of taps up to ¼ in.

Other models have been brought out where the speed control mechanism and the clutches operate to prevent breakage of the tap in case the movement is hindered by some obstruction in the work. The gearing is entirely enclosed in the housing which gives a perfectly smooth contour. The chucks are manufactured by the Landau Machine & Drill Press Co., of New York.

SENSITIVE MULTIPLE DRILLING MACHINE

A sensitive multiple drilling and tapping machine has recently been offered to the trade. It is of the quick-change type and provides both low and high speeds. Any desired speed can be quickly obtained while operating at full speed. Three drilling speeds are provided, namely 500, 900 and 1,800 r. p. m. Ball bearings are provided for one of the cone pulleys and the eccentricity of the shaft provides for the adjustment in the tension of the belt, while an idler roller is fitted to the machine to take up the slack of the lower belt when the speed is changed. The spindles can be instantly converted to drilling or tapping without adding to or removing any of the parts. Spindles may be operated independently or in conjunction if desired. The entire load of the head is taken by the main drive spindle which is mounted on ball bearings. Nickel-steel, hardened and ground is used for all operating parts, and the mechanism is protected by a ventilated hood which acts as a guard.

The head has a travel of 3½ in., and is operated by means of a rack and pinion. The table is 10 in. x 12 in. and has a vertical travel of 9 in. There is a distance of 8 in. between the spindle and the column. These machines are built by the Landau Machine & Drill Press Co., of New York.

"EVEREDY" ELECTRIC HOIST

An electric hoist especially intended to replace hand power chain hoists has recently been placed on the market. It is rugged in design, light in weight and operates at high speed. The applance is equipped with a mechanical motor brake which operates in conjunction with the control lever. The operating movement of the shifting device is regulated by means of an automatic limit stop that may be adjusted for any desired height of lift. By means of the balancing device lifting hook is always central with the point of suspension. The bearings are protected to prevent loss of oil from the gear casing. The hoist may be controlled by means of pendant cords or by a push button switch. These hoists are manufactured in various sizes ranging from 500 to 4,000 lbs. lifting capacity at high speed. They are manufactured by the Reading Chain and Block Corp., Reading, Penn.

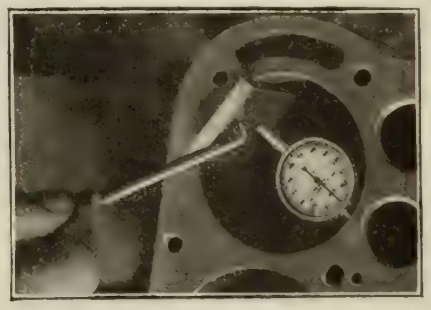
VERTICAL MILLING MACHINE

Recent changes have been made in the Becker No. 2 vertical milling machine. The improvement comprises an auxiliary ball bearing to take the belt pull thus permitting of speed 50% above that formerly employed. The main spindle bearing is of bronze with a babbitt lining. Hard steel thrust washers are used in the spindle. Change of spindle speed is maintained by means of two separate pulleys one three inches and the other five inches in diameter. The change of pulleys is obtained by simply removing one pulley from the speed and placing on the other. It is claimed that the machine operates successfully at a speed of over 6,000 revolutions per minute; this being made possible by means of ample oiling facilities and accurate balancing of the spindle and parts. When operating at the high speed a canvas belt is employed. These machines are manufactured by the Becker Milling Machine Co., Worcester, Mass.

MICROMETER INDICATOR

A combined micrometer and indicator dial for dirtct reading of dimensions within the range of the tool has recently been placed on the market. The Atlas micro-indicator piston gauge is an

adaptation of the dial indicator to a bench gauge for rapidly checking the diameter of pistons, piston pins and other cylindrical articles up to and including 6 inches. Variations are in-



stantly shown on the dial; larger dimensions appearing on the steel scale in inches, by sixteenths; smaller dimensions and variations on the dial in thousandths of an inch. When used in gauging cylinders or holes the device is provided with a saddle that assures the gauging points being kept exactly on the diameter in any position. These micro-indicator gauges are manufactured by George H. Wilkins Co., 180 North Market St., Chicago, Ill.

RADIAL DRILLING MACHINE

Some interesting features are incorporated in a new 4 ft. radial drill recently placed on the market. It is claimed that there is a saving of power from 20 to 25 per cent. due to the fact that the lower shaft, bevel gears in column, shaft in column, gears in column cap, outside vertical column shaft and the bevel gears in back of the arm are eliminated. There is also the advantage that in mounting the motor in this way it balances the arm permitting the arm to raise and lower on the column without exceptional strain on the elevating mechanism. An important feature in this radial drill is that the arm raising and lowering mechanism is mounted as a unit on the back of the arm near the motor drive gears and is only in operation when the arm is being raised and lowered. For this very reason this mechanism was removed from the column cap as this meant the constant running of a pair of bevel gears, a vertical shaft in back of the column and a few gears on the column cap as long as the machine is running or the mounting of an extra motor to raise and lower arm. On these machines the screw is stationary. The revolving unit is of bronze and mounted on a ball thrust bearing large enough to carry considerably more than the weight of the arm, head, motor and other details. A safety mechanism is provided to disengage the clutch that operates the arm raising and lowering mechanism at the extreme positions of the arm. The controller is mounted below the motor and on this size machine is within easy reach of the operator. The head has the same features as other styles of radials of the same make: that is the tapping attachment running in oil, back gears and clutches made of nickel steel, heat treated and hardened, helical spindle gears, and all bronze bearings with oil chamber, permitting ample lubrication. Spindle speeds are from 26 to 450 r.p.m. A 3½ horse power motor is required. These drills are manufactured by the Morris Machine Tool Co., of Court and Harriet Sts., Cincinnati, Ohio.

POINTS TO WATCH

(Continued from page 32)

not seat firmly with a few light taps, something is wrong. The practice of heavy blows must not be encouraged, as this tends to destroy the accuracy of the vise and parallels. It is often advisable when using the vise to apply a round bar between the work and the front of movable jaw as this often tends to give a better bearing on the lower supports.

By the use of special fixtures and attachments the shaper may be adapted to do a wide range of work.

CANADIAN MACHINERY
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Distribution of Fifty Millions

WHAT THE actual work of hydro-electric power development means to the community is strikingly illustrated in the expenditure of the fifty or sixty millions for the construction and completion of the Chippawa plant by the Hydro Electric Power Commission. Some of the beneficiaries of this undertaking may be given. First there is the farmer, who, for a good price, sold the land through which the canal passes; the engineers, mechanics, artizans and laborers in thousands who were engaged in the work; the stone quarries, brick yards, cement mills, steel mills, manufacturers of contractors' equipment, lumbermen and sawmill owners, makers of water-wheels, castings, overhead cranes, electric generators, switchboards, transformers and much other equipment, all of these and many others account for the huge expenditure, and this has no reference to the task involved in transmission of power and its ultimate distribution.

It was the late Senator Nicholls who declared early in 1921 that "after a careful survey of the situation and with some knowledge born of experience, I venture the opinion that in Canada the development of the electrical industry throughout its several branches will result in the expenditure of not less than one hundred million dollars per year for the next three years, which is as far ahead as I have any desire to prophesy."

Swinging in Right Direction

IT APPEARS to be a fact that prices in the iron and steel markets, while assuming an undoubted firmness, will reflect a cautious attitude toward any suggestion of exceptional upward swing. There seems to be an appreciation of the fact that business generally is struggling to a firm footing, and that any untoward factor would cause a return of over-conservatism. This should be guarded against.

Industry has had exceptional experience during the past few years. From unusual prosperity, it has skidded into reverse conditions, and has come out of it all with an ingrained feeling that, after all, it seems best to play safe. At the same time manufacturers have courageously faced the fact that the pendulum must swing back. From time to time there are signs that suggest it is moving smoothly enough, but when things are going well it is sometimes wise to see that the machinery is well served against impediment. That is just what the manufacturer is doing. He wants to be sure that the swing will make the full arc. That is one reason why business is being conducted largely on the basis of immediate prospect rather than future speculation. At that, there is a good foundation for aggressive work. Inquiries are good, showing that there is a mission for advertising with a punch behind it. Indications point to a fine crop, that the building industry in many centres is flourishing, that the growth of motor car demand indicates that an increasing number of people are confident of an ability to buy, large numbers of unemployed are being absorbed, and there are those who predict that the last quarter of the year will see personal work merging nicely into permanent employment. Many industries are taking on more men, even at this, generally the most indifferent period of the year, and it is worth observing that the market generally reports the first half of July as showing an activity that promises a record. From a business point of view the calendar seems to have lost some significance.

Advertising and the Selling Price

WHEN THE chairman of the Manchester Chamber of Commerce recently reviewed the state of trade he made the following interesting comment: "It is becoming a recognized fact that advertisements do not add to the selling price of an article, because overhead charges are reduced consequent on the increase of sales."

This observation presupposes, as a matter of course, that the advertising has been conducted in a thorough and systematic manner; that there has been concentration on the prospective field and that the advertising was used and developed as an active means to an end. Under these circumstances, the chairman merely gave utterance to what is coming to be regarded as part of the gospel of modern business.

The only kind of advertising that can be reliably applied in the offsetting of overhead charges is that which, on the whole, satisfies the management as to its merit as an indispensable adjunct of the sales force. A campaign may be made up of different phases. On the one hand, it may be more or less descriptive of the product and not overly solicitous as to sales. Then, relying upon the fact that through this medium the field should be well informed, the actual sales appeal is made and pushed to the limit.

It is all akin to the method employed in making individual sales for advertising is, after all, nothing but salesmanship in print. Someone has said that "the best place to print an advertisement is on the wagging tongue of a satisfied customer," and that "salesmanship is the power to persuade plenty of people to pleasurably purchase your product, whether it be planers, punches, printing presses, pears, prunes or peanuts, at a profit." When it is so worked out advertising reduces the overhead and helps to stabilize the selling price. The chairman was right.

Special courses for export managers are to be included in lectures at Toronto and McGill Universities, beginning Jan., 1923. Nothing like a well-trained outlook. At the same time what is to be done with the foreign buyer who addresses an inquiry: "Toronto, N. Y., via Erie Canal."

How Strikes Affect Steel Producer and Consumer

Curtailment in Output Now Apparent—Largely Result of Shopmen's Walkout—Some Companies Suffer Little—Consumer Anxious to Fill Book Orders—Producer Conservative With Regard to Future—Basis Prices Remain

PIG IRON ADVANCE IS NOW PREDICTED

THAT the railway shopmen's strike is the more serious factor to the steel industry is evident from the fact that the coal strike started April 1, and the shopmen's strike July 1. The latter, already, has had the effect of tying up the supply of coal from southern coal fields to steel producers. The iron and steel industry increases its output in May and June, the production being at the rate of 36½ million tons a year, while in December the rate was about 20 million tons.

Reports from steel centres in United States show that many furnaces are now being banked or blown out. It is predicted that, as a result of curtailment, steel ingot production will go below 30 million tons a year. Some companies, as yet, have suffered little. The Carnegie steel, for example, has blown out one furnace, leaving 38 in operation.

Who will be affected the more, producer or consumer? It is observed that there are more consumers seeking to buy for early mill shipment at premium prices and also buying from warehouses at the stiff extra over-mill shipment rates and on the other hand, consumers in general display little interest in deliveries for late in the year. This indicates that there will be an attempt made to fill certain book orders promptly. After that, consumers are not disposed to take a chance.

Producers are, on the other hand, show a reticence about taking on orders, and would probably be unwilling to consider fourth quarter business. Regular basis prices remain, but some premiums are being taken on early delivery.

Actual buying demand for pig iron may develop at any time and this would probably cause advances to fancy prices, owing to decreasing production. There is quite an apparent tendency, however, to keep within reasonable price basis, although it is difficult to predict what may happen should the situation become seriously aggravated.

In the Canadian market, at this vacation period, there are very few traces of what may be termed hectic excitement. For this time of year business is good, and once the vacation season is over, the hope is that it will come into a good stride. Construction materials show large tonnages and the prices are stable. Coal strike complications are developing and authorities predict that pig iron may advance $2.00 per ton, due to the coal and coke situation. It is not long since pig advanced $1.50 per ton. The prices, as advanced in iron and steel bars last week, are holding firm.. It may be said of the entire market, that it is showing some evidence of nervous strain, for there are, on one hand, prospects of much better business and on the other, the danger of paralysis due to strikes. There is an optimism apparent, however, largely rooted in the feeling that authorities will find a solution before great harm develops.

Turpentine prices, as previously announced, had a recession last week to $1.65 and in spite of a near famine in turps. this price still holds, though it is claimed new stocks will carry an advance.

Machine tool demand continues dull. It is a fact that some business is moving, representing absolute necessity and in small tools and supplies there continues to be a fair volume though it is quite below desired strength. The trading or exchanging factor is quite an important one to deal with at the present time. It is often the case that the prospective buyer has something to offer as exchange on a new deal, but it is evident that the proposition does not go through unless it has merit as dealers seem to be about fed up on anything that does not look like good, straight legitimate business.

Montreal reports a continuance of good business in galvanized sheets, merchant bars, structural steel, small steel products and miscellaneous lines. The fear that the coal and rail strike may drag along for some time without satisfactory settlement is causing some apprehension, for supplies are getting low and business seems inclined to quite an improvement. In fact, it is felt that July may be almost as good as June. Competition of Scotch pig iron with the Canadian product is said to be developing into a competitive factor in quarters adjacent to ocean shipping, and there are those who declare that it is a fixture on the Canadian market.

There has been very little doing in machine tools, while in machine shop supplies, a good amount of business is moving, though buying appears to be from hand to mouth.

Toronto

July 26

AGAIN there is a likelihood of an increase in pig iron. The cause is said to be the coal and coke situation and the fact that the industry is confronted by conditions over which it has little control. Furnaces are advising buyers of the likely development. A boost of $2 a ton is spoken of and the movement is but an indication of the way things are going in the United States. An announcement that the strike situation is well in hand, and that some drastic action is being taken to relieve the situation would have to be considered as a better price factor by the producers.

Non-ferrous metals are firmer, but the Canadian demand is said to apply mainly to small lots. The situation is one that may be described more or less as in the nature of a see-saw. Fluctuations have been frequent and insignificant and indicative of general conditions. It is interesting that one year or more ago, tin was cutting up some remarkable antics, advancing or rising pounds sterling per ton. This was also at a time when Canadian money had a larger buying power than at present in the English market, and the American exchange was around 12 per cent. To-day tin plates are about stationary, daily reports indicating very little tendency toward change. Prices follow:

Lake copper	17 00
Electrolytic copper	17 00
Castings, copper	16 75
Tin	34 00
Spelter	7 50
Lead	7 00
Antimony	7 40
Aluminum	21 00

Scrap metal markets remain quiet. The demand is not only light but the supply seems to be somewhat on the short side. American sources for certain grades are quite reticent following the general tendency, and this is not altogether regarded as an attempt to make the most out of the coal and rail strike situation. Business has been struggling too long to expect any branch of activity to hinge on opportunity for price manipulation upon the present labor crisis. Though there is little moving in old material, therefore, prices show a firmness, reflecting problems of supply. Prices follow:

	per 100 lbs.
Copper, light	8 50
Copper, crucible	11 00
Copper, heavy	11 00
Copper Wire	11 00
No. 1 composition	9 00
New brass cuttings	6 00
Red brass turnings	6 50
Yellow brass turnings	4 85
Light brass	3 50
Medium brass	4 50
Scrap zinc	4 00
Heavy lead	4 50
Tea lead	3 00
Aluminum	11 00
Boiler plate, per gross ton	9 00
Heavy melting steel	11 00
Axles (wrought iron)	16 00
Rails (scrap)	11 00
Malleable	11 00
No. 1 machine cast iron	16 00
Pipe, wrought	6 00
Car wheel	16 00
Steel axles	15 00

Iron and steel bar lists have now been generally revised in accordance with the recent advance of 10 cts. per 100 lb. The demand is still strong. The sheet situation also reflects the seasonable

activity in building and kindred industries and while prices are fairly stable, the supply of certain kinds is very short. Prices follow:

Iron bars	3 15 to 3 25
Steel bars	3 15 to 3 25
Reinforcing bars	3 15 to 3 25
Steel hoops	4 00
Tire steel	3 15
Spring steel	7 00
Band steel, No. 10 gauge and 3-16 in base	3 65 to 3 75
Small shapes	3 25
Sheets, black, No. 28	5 00
Sheets, blue ann., No. 10	4 00
Canada plates, dull, 52 sheets	4 90
Canada plates, all bright	6 00
Galvanized Sheets, No. 28	6 00

The turpentine situation promises interesting development. The barrel-lot figure of $1.65 as quoted last week, holds good, but there is said to be great scarcity. The prediction is that new supplies will see an advance.

Announcement is made of an advance of 25 cents per keg on cut nails.

Machine tools are showing a little life. Motor car districts such as Walkerville and Oshawa would be dull indeed if they did not occasionally require some new equipment for them and not only the car plants themselves but so-called subsidiaries which figure in demand. The volume is small, but as the saying goes "better than January." Supplies and small tools are still in fair demand.

Montreal

July 26

A VARIETY of conditions, some of them having conflicting influences, have caused an analysis of the local iron and steel market to be a rather complex problem. Last week mills advanced their quotations to the jobbers and large consumers ten cents per hundred pounds base. The jobbers anticipated this movement, and, influenced by the late deliveries from the mills, advanced their quotations two weeks ago. The advances made were somewhat higher than they have been able to obtain, except for small lots. The movement of iron and steel is about the same as last week. Galvanized sheets are the most active, while black and blue annealed sheets are always moving very well. Trading in merchant bars, structural steel, and small steel products, as well as in miscellaneous lines such as reinforcing bars, tire steel, etc., continues good. At the present moment, there is some apprehension felt as to what extent deliveries can be made, should the coal and railway strike assume a more threatening attitude. Pig iron sales continue to be encouraging with a tendency toward weakening in quotations. Machine tools are very quiet as also is the scrap market. Supplies continue to move freely. The non-ferrous metals are about holding their own as far as volume of trade is concerned. Quotations are firm.

Iron and steel—Last week the mills announced that their price to jobbers would be $2.60 base and to large consumers $2.40 base, per hundred pounds. This meant a ten-cent advance. For some time past deliveries have been getting worse from the United States mills. The threatening attitude of the coal strikers, and also the railwaymen, has led the jobbers and dealers to conscientiously believe that there was a real likelihood of their supplies being cut off. Thus quotations rose on the local market to $3, and in some cases for small orders, $3.15, base. But July and August are quiet months in these lines and business, which was very good up until the 10 inst., began to drop off a little. The result is that attractive specifications are getting somewhat lower quotations. Supplies are getting low, and most dealers are concerned greatly as to where they can replenish their stocks. Galvanized sheets continue to arrive from British mills, and are being consumed as fast as they arrive. Standard sizes and gauges are practically impossible to obtain from stock. Other classes of sheets are moving well. Merchant bars, structural steel, and small steel products are still in good demand. The call for tire steel, reinforcing bars, steel hoops, and other miscellaneous products, continues good. It is thought that the figures for July will be nearly as good as those of June, which was the best month so far this year. The local quotations are as follows:

Iron bars	3 15 to 3 25
Steel bars	3 15 to 3 25
Reinforcing bars	3 15 to 3 25
Steel hoops	4 00
Tire steel	3 15 to 3 25
Spring steel	6 00
Band steel, No. 10 gauge and 3-16" base	3 25
Small shapes	3 00

Pig Iron—Sales of pig iron are keeping up. Canadian pig iron is being disposed of very well indeed, in spite of the competition offered in the form of Summerlee iron. This latter iron is always moving nicely at a figure roughly one dollar a ton less than the local product. Summerlee iron cannot meet figures of the Canadian pig iron at inland points, thus the sales of the former are largely confined to points adjacent to river ports. Summerlee is quoted at $29.75 on docks while Canadian iron is quoted at $31.85 on tracks in car lots. It is however, weak at this figure. There is no doubt but that attractive business will get a slightly better figure. The competition from British furnaces is made possible through several conditions. Most ore that goes into British pig iron is imported. These ores are mined in countries where labor is cheap, such as Spain and Algeria. British shipping can obtain cargoes to many remote points and often can make attractive freight rates on the ore, and the pig, because of the fact that British imports are so great and of so wide a nature, that a return cargo is assured. Thus, unless conditions change greatly, British pig will be offered in Canadian markets, indefinitely. One large concern recently purchased a lot in excess of 1000 tons through brokers in New York. The iron was another grade of Scotch pig. The price is understood to be less than that asked for Summerlee. The foundries appear to be purchasing iron at a more satisfactory rate of late. In fact market conditions are gradually improving, and when compared to the tonnage moved at this period last year, are very good.

Machine Tools.—Little or no change has been reported in the machine tool market. Very few sales have been made except for an odd machine here and there. Most dealers feel that very little improvement can be looked for till after the first of September. Inquiries are coming in as much as usual but it is difficult to close orders. Staffs are more or less disorganized on account of vacations, and many executives are absent, so that the dealers feel that, in spite of inquiries they must mark time.

Machine Shop Supplies.—The jobbing and contract shops are enjoying a good share of business at this season, and are coming into the market in a small way, almost continuously for supplies. The railways are operating their shops at better than half capacity and they contribute, in a fair way to this business. Buying still continues to be practically from hand to mouth. The supply business came through the readjustment period much more quickly than other branches of the trade and there is a feeling that requisitions can be filled promptly, and for that reason no shop is covering its requirements except for immediate use. Prices are fairly stable, and the turnover quite satisfactory when all things are taken into account.

Non-Ferrous Metals—The non-ferrous metals are moving in about the same quantities as they were last week. Business is scattered, no large orders being received. Prices are tending toward firmness, and in the case of tin and spelter they have advanced one half and one quarter cent respectively. There has been no outstanding feature during the week, which has, in fact, been very quiet. The local quotations are as follows:

Lake Copper	17 75
Electrolytic Copper	17 50
Castings, Copper	17 25
Tin	35 00
Lead	6 75
Spelter	8 00
Antimony	6 50
Aluminum	23 00

Scrap Metals.—The scrap metal market has also had an uneventful week. No price changes have been noted, and sales have not been encouraging. Holdings by local dealers are small. Some outside business has been done, but the local demand has not increased. The following are the local quotations:

Copper, light per 100 lbs.	8 50
Copper, crucible	11 00
Copper, heavy	11 00
Copper Wire	11 00
No. 1 compositon	9 00
New brass cuttings	6 00
Red brass turnings	6 50
Yellow brass turnings	5 00
Light brass	4 00
Medium brass	5 50
Scrap zinc	3 50
Heavy lead	4 50
Tea lead	3 00
Aluminum	11 00
Boiler plate, per gross ton.	9 00
Heavy melting steel	10 00
Axles (wrought iron)	20 00
Rails (scrap)	11 00
Malleable	10 00
No. 1 machine cast iron	20 00
Pipe, wrought	7 00

Pittsburg

July 26

THE transportation situation has caused a material drop in pig iron and steel production, as foreshadowed in this report of a week ago. About the middle of June congestion reached considerable proportions on the railroads serving coal fields in West Virginia and Kentucky, on which the steel industry has been depending much more than usual, on account of the strike at the union coal mines and various non-union strikes, including those in the Connellsville region.

The general strike of railroad shopmen which started July 1 tied up the movement of southern coal almost completely, as to its coming north across the Ohio river, and slowed down various other roads, even including at least one that taps the Connellsville region. Of course, the coal strike is important, in making the iron and steel industry short of coal, but to get the perspective one must remember the coal strike started April 1 and the shopmen's strike July 1, so that the coal strike is between three and four months old while the shopmen's strike is between three and four weeks old

The later is the more important factor. The iron and steel industry got along fairly well the first three months of the coal strike, increasing its production, as in both May and June production of steel ingots was at a rate of about 36 1/2 million tons a year, while the rate at the end of March was about 35 million tons a year and the rate last December had been only 20 million tons.

Furnaces Blown or Banked

The Republic Iron & Steel Company had been operating three blast furnaces at Youngstown, and has had to bank two of these in the past week. It had started its Bessemer steel making department July 5, after an idleness since last September, and has had to close it. The open-hearth department continues as formerly. La Belle Iron Works has blown out the one furnace it was operating, and Trumbull-Cliffs at Warren, O., serving the Trumbull Steel Company, Cleveland, has banked a furnace. The McKinney Steel Company, Cleveland, has banked a furnace. Practically all of this is due to curtailment of supplies of coal at by-product plants that had been using Kentucky and West Virginia coal largely if not wholly. The by-product plants at Buffalo have been getting short of coal. Some of the furnaces in that district are running with slack draft and it is probably only a matter of days until some of them will have to bank or blow out. Cherry valley, a merchant furnace at Leetonia, O., (Mahoning valley) went out a few days ago.

The above sketch is representative, but probably does not cover all the curtailment that has occurred to date. Unless conditions change radically for the better there will be further curtailment. A good guess would be that steel ingot production will go below 30,000,000 tons a year before it goes above the 36½ million ton rate shown for May and June.

It chances that thus far the Carnegie Steel Company has suffered but little. It has blow out one furnace, leaving 38 in operation, but this is stated to have been for necessary relining. The Jones & Laughlin Steel Company is reported as not affected thus far in its furnace operations. The Carnegie Steel Company's ingot output, however, which has risen from about 70 per cent. of capacity in April to 80 per cent. at the end of June is down to about 75 per cent.

The condition of restricted transportation, with the continuance of the coal strike after President Harding's failure to get it settled by arbitration, with an immediate resumption of mining meanwhile, is so new that the reaction of the trade to the condition cannot be fully gauged. Steel shipments are decreased somewhat, with prospects of more decrease to follow, but on the other hand there is the factor that consumers may not have sufficient coal and transportation to operate at the rates they contemplated when they arranged for their steel deliveries. The point really is which will be affected the more, the production or the consumption of steel.

To Fill Orders

What can be observed now is this, that there are more consumers seeking to buy for early mill shipment, at premium prices, and buying from warehouse at the stiff extra over mill shipment prices, while on the other hand consumers in general have stopped showing any interest in deliveries late in the year. The position apparently is that they have certain orders on books which they wish to fill, and fill promptly, even if they have to pay delivery premiums, while they are disposed to take chances on their having business late in the year. As to producers, they are more reserved about taking on obligations and the majority probably would be unwilling to sell for fourth quarter even if buyers were anxious to close. Mills that can make early deliveries are in some cases asking for greater premiums, particularly in bars, shapes and plates, for which up to 1.90c has probably been paid. One mill, indeed, has an asking price of 2.00c on prompt bars. The regular basis price remains at 1.60c the price at which some conservative mills would accept desirable orders for late delivery, but an order must be very good to be considered desirable.

May Attempt to Operate

Since President Harding's plan for ending the coal strike by arbitration failed, through the miners rejecting arbitration, and the President "invited" the operators to go home and resume mining coal, plans have been under way for the attempt, both in the regular Pittsburg district, which has been union and in non-union fields, like Connellsville, where there have been sympathetic strikes. Two mines of the Pittsburg Coal Company, and one each of three other companies are scheduled, are to be formally opened as a test. In the Connellsville region the first effort will probably be by the H. C. Frick Coke Company of the Steel Corporation.

Connellsville coal has been in somewhat lighter supply on account of the fresh strike that followed the efforts at Washington to settle the strike and on account of railroad congestion, while demand has been much heavier, largely on account of consumers being shut off from West Virginia and Kentucky. The market has been advancing sharply, until Connellsville steam coal has reached $7.00, while Connellsville furnace coke is held at $13 and coke supposed to be of foundry grade has brought $14.

With pig iron production decreasing and with consumers presumably out of stocks by this time, pig iron would no doubt advance to fancy prices if there were any actual buying demand, and this may occur any time. A sale of 100 tons of malleable iron has just been made at $27, valley, which gives an idea of the trend. Prices formerly quoted, $25 on Bessemer and $24 on basic and foundry, at valley furnaces have become purely nominal.

RAPID MAKING OF GEARS

Nothing is more striking in recent engineering progress than the development of highly efficient gearing. This development has involved the construction of many wonderfud machines for cutting gears rapidly and with extreme accuracy. One of the difficulties of gear cutting is that so much time has to be occupied merely in cutting away large chunks of metal before the final and careful trimming of the gear is possible. In order to get over this difficulty British engineers have developed machines for gashing out, as it were, the main mass of metal between the teeth of the gear. Heavy cuts of metal are therefore made with great rapidity, and the final process of forming the gear is rendered both easy and swift. A British firm recently produced an improved machine on this system to deal with gear wheels up to three feet in diameter; and it is now constructing much larger machines. The special feature of these machines is the use of two cutters, one cutting on the front only and the other cutting on the sides. In this way three distinct and separate cuts are produced, and the metal comes away with exceptional freedom. The heavy roughing out cuts and the lighter gear-shaping cuts can, in fact, be performed at one and the same time.

BOOKLET

The Charles Parker Co., of Meriden, Conn., has recently issued a new catalog on their line of vises and ratchet drills. This booklet describes and illustrates the many improvements that have been made to their equipment during the past few years. A feature of the Parker vise is the solid steel strenthening bar that extends throughout the entire length of movable jaw.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Toronto price:—	
Silicon, 2.25% to 2.75%	$30 65
Grey forge, Pittsburgh	$25 27
Lake Superior, charcoal, Chicago	31 65
Standard low phos., Philadelphia	30 00
Bessemer, Pittsburgh	25 00
Basic, Valley furnace	24 00

IRON AND STEEL

Per 100 lbs. to Large Buyers	Cents
Iron bars, base, Toronto	$3 15 3 25
Steel bars, base, Toronto	3 15 3 25
Iron bars, base, Montreal	3 15 3 25
Steel bars, base, Montreal	3 15 3
Reinforcing bars, base	3 15 3 25
Steel hoops	4 00
Tire steel	3 15
Spring steel	7 00
Band steel, No. 10 gauge and 3-16 in. base	3 65 3 75
Chequered floor plate ¼" and heavier	6 00
Bessemer rails, heavy, at mill	2 35
Steel bars, Pittsburgh mill prices	1 80
Tank plates, Pittsburgh mill prices	1 80
Structural shapes, Pittsburgh mill prices	1 70
Steel hoops, Pittsburg	2 50
F. O. B., Toronto Warehouse	
Small shapes	3 25
F. O. B. Chicago Warehouse	
Steel bars	2 48
Structural shapes	2 58
Plates	2 58
Small shapes under 3-in.	2 48

FREIGHT RATES

	Per 100 lbs. C.L.	L.C.L.
Pittsburgh to Following Points		
Montreal	52	65½
St. John, N. B.	76	96
Halifax	77½	97
Toronto	34	48½
Guelph	34	48½
London	34	48½
Windsor	31½	45½
Kingston	48½	61

Current surcharge 1 per cent.

METALS

	Montreal	Toronto
Lake copper	$17 75	$17 00
Electrolytic Copper	17 50	17 00
Castings, copper	17 25	16 75
Tin	35 00	34 00
Spelter	8 00	7 50
Lead	6 75	7 00
Antimony	6 50	7 40
Aluminum	23 00	21 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$3 75	$3 50
Plates, ¼ up	3 40	3 25

PIPE—WROUGHT

Standard Buttweld Pipe S/C

Per 100 feet

	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
⅛ inch	$ 6.00	$ 8.00	$	$ ....
¼ inch	3.84	5.94	7.20	9.30
⅜ inch	3.84	5.94	7.20	9.30
½ inch	4.85	6 46	7.31	8 93
¾ inch	5.87	7.71	8 86	10.70
1 inch	8.16	11.05	12.58	15.30
1¼ inch	11.04	14.95	17.02	20.70
1½ inch	13.20	17.88	20.35	24.75
2 inch	17.76	24.05	27.38	30.30
2½ inch	28.08	38.03	.....	.....
3 inch	36.72	49.73	.....	.....
3½ inch	47.84	63.48	.....	.....
4 inch	56.68	75.21	.....	.....

Standard Lapweld Pipe S/C

Per 100 feet.

Below Dividing Line—Price Per Foot.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
2 inch	$21.46	$27.38	$31.08	$37.00
2½ inch	31.50	40.95	46.80	56.16
3 inch	41.31	53.55	61.20	73.44
3½ inch	48.76	65.32	72.68	89.24
4 inch	57.77	77.39	86.11	105.73
4½ inch	66.04	86.36	1.04	1.24
5 inch	76.96	100.64	1.21	1.45
6 inch	1.00	1.31	1.57	1.88
7 inch	1.30	1.76	2.02	2.45
8L inch	1.40	1.85	2.13	2.58
8 inch	1.61	2.13	2.45	2.97
9 inch	1.97	2.59	2.97	3.59
10L inch	1.82	2.40	2.75	3.33
10 inch	2.35	3.09	3.54	4.28

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4-in. and under 60 per cent.

4½-in. and larger, 50 per cent.

4-in. and under, running thread, 40%.

Standard couplings, 4-in. and under 30%

Do., 4½-in. and larger, 10%.

OLD MATERIAL

Dealers' Average Buying Prices

	Montreal	Toronto
Copper, light	$ 50	$ 8 50
Copper, crucible	11 00	11 00
Copper, heavy	11 00	11 00
Copper, wire	11 00	11 00
No. 1 machine composition	9 00	9 00
New brass cuttings	6 00	6 00
Red brass turnings	6 50	6 50
Yellow brass turnings	5 00	4 85
Light brass	4 00	3 50
Medium brass	5 50	4 50
Scrap zinc	3 50	4 00
Heavy lead	4 50	4 50
Tea lead	3 00	3 00
Aluminum	11 00	11 00
	Per Ton	Gross
Boiler plate	$ 9 00	$ 9 00
Heavy Melting Steel	10 00	11 00
Axles (wrought iron)	20 00	16 00
Rails (scrap)	11 00	11 00
Malleable scrap	10 00	11 00
No. I machine cast iron	20 00	16 00
Pipe, wrought	7 00	6 00
Car wheel	17 00	16 00
Steel axles	10 50	15 00
Mach. shop turnings	4 00	6 00
Stove plate	16 00	14 00
Cast boring	4 00	6 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, 7-16 and up	30
Carriage bolts, ⅜ in. and smaller 6 in. and shorter	40
Coach and lag screws	45
Stove bolts	72½
Wrought Washers	60
Do., corru. head	60
Machine bolts, 7-16 and over	35
Machine bolts, ⅜-in. and less	35
Blank bolts	35
Bolt ends	35
Machine screws, fl. and rd. hd., steel cut thread	37½ & 10
Machine screws, o. and fil. hd., steel cut thread	30
Machine screws, o, and fil. hd., brass cut thread	15
Standard couplings, 4-in. and under, brass cut thread	30% 30
Nuts, square, blank off net list	$1.00
Nuts, square, tapped off net list	50c.
Nuts, hex., blank off net list	50c.
Nuts, hex., tapped net list	
Copper rivets and burrs, list less	32c.
Burrs only, list plus	10%
Iron rivets and burrs	47%
Boiler rivets, base ¾ in and larger	$5.75
Structural rivets, as above	5 65
Wood screws, O. & R., bright	80
Wood screws, flat, bright	82½
Wood screws, flat brass	77½
Wood screws, O. & R., brass	75
Wood screws, flat, bronze	72½
Wood screws, O. & R., bronze	70

MILLED PRODUCTS

(Prices on unbroken packages)

Set screws	65
Square and hexagon head cap screws	60
Round head cap screws	20
Fillister head cap screws	35
Flat head screws	25
Button head cap screws	20
Studs	45
Semi-finished nuts up to and including 9/16 in.	70
Semi-finished nuts ⅝ to 1¼ in.	65
Semi-finished nuts 1⅜ to 2 in	35
Coupling bolts	35
Taper pins, No. 2 to No 5	65
Taper pin No. 6 and over	10
Planer bolts without fillet	10
Planer bolts with fillet	Net
Patch bolts	Plus 10%
Hollow set screws	20
Thumb screws	50
Thumb nuts	70

BILLETS

F. O. B. Pittsburgh

	Per gross ton
Bessemer billets, 4 in. x 4 in. and larger	$35 00
Open hearth billets	35 00
O. H. sheet bars	35 00
Forging billets	40 00
Bessemer rods	40 00

NAILS AND SPIKES

Wire nails, base	$3 65
Cut nails, base	4 35
Miscellaneous wire nails	72½%

ROPE AND PACKING

Plumbers' oakum, per cwt.	6 30
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 23
British Manila rope	0 20
New Zealand hemp	0 20

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	Net..

Solder, strictly	$0 22½
Solder, guaranteed	0 24
Soldering coppers, lb.	0 62½
White lead, pure, cwt.	13 20
Red dry lead, 100-lb. kegs, per cwt.	10 75
Wood alcohol, per gal.	1 75
Whiting, plain, per 100 lbs.	3 00

CARBON DRILLS AND REAMERS

S. S. drills, wire size	55
Can. carbon cutters	10
Standard drills, all sizes	60
3-fluted drills, plus	10
Jobbers and letter sizes	55
Bit stock	60
Ratchet drills	10
S. S. drills for wood	10
Wood boring brace drills	55
Electricians' bits	30
Sockets	30
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	Net
Bridge reamers, carbon	50
Centre reamers	5
Taps, machine screw	less 50-60
Taps, hand, under 1"	less 40-50
Chucking reamers	30 off
Hand reamers	25
High speed drills, list	30 to 40 off
Can. high speed cutters, less	10
American	plus 40

COLD ROLLED STEED

[At Warehouse]

Rounds and squares	$4.50 base
Hexagon and flats	$5.50 base

MALLEABLE FITTING LIST

1 in. elbow	.32	.53
2 in. elbow	1.05	1.70
1 in. tee	.43	.70
2 in. tee	1.45	2.40
1 in. coupling	.33	.53
1 in. locknut	.15	.23

Discount to dealers 70/5 off list.

SHEET

	Montreal	Toronto.
Sheets, black, No. 28	$5 40	$5 00
Sheets, blue ann., No. 10	4 05	4 00
Canada plates, dull, 52 sheets	5 50	4 90
Can. plates, all bright	7 00	6 00
Galvanized sheets, No. 28		6 00
Queen's Head, 28 B.W.G.	7 25	
Fleur de Lis, 28 B.W.G.	7 00	
Gorbal's best, No. 28	.....	.....
Colbornes Crown, No. 28	.....	.....
Premier	6 85	6 40
Premier 10£ oz.	6 85	6 40
Zinc sheets	9 00	10 00

PROOF COIL CHAIN
B. B. B. CHAIN

⅜ in., $16.45; 7-16 in., $14.00; ½ in., $12.95; 5-8 in., $13.15; ¾ in, $12.75; ⅞ in. $12.25; 1 in., $11.85; 1⅛ and 1¼ in, $10.55. Fire weld chain same sizes respectively are $14.00; $11.50; $10.40; $10.55; $10.15; $9.75; $9.35; and $8.25.

ELECTRIC WELD COIL CHAIN B.B.B

⅛ in. $20.00; 3-16 in. $16.50; ¼ in. $15.50; 5-16 in. $12.70.

FILES AND RASPS

Globe	60/5
Vulcan	50
P. H. and Imperial	60/5
Nicholson	40
Black Diamond	40
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	60
Great Western-American	50
Kearney & Foot, Arcade	60/5

BOILER TUBES

Size	Seamless	Lapweld
1 in.	19.00	
1¼ in.	20.00	
1½ in.	20.00	
1¾ in.	31.50	
2 in.	20.00	16.00
2¼ in.	22.00	20.00
2½ in.	23.00	20.00
3 in.	27.00	24.00
3½ in.	32.00	28.00
4 in.	41.00	35.00

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS

Castor Machine Oil, per lb.	34½
Royalite, per gal. bulk	21
Palacine	24
Machine oil, per gal.	33
Black oil, per gal. (Summer)	19
Cylinder oil, Capital	61½
Petroleum fuel oil bbls., net	10.80
Pure turp., single bbls., gal.	1.65
Linseed oil, raw, single bbls.	1.10
Premier Gasoline	35½

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	30%
Standard	30 and 10%
Cut leather lacing, No. 1	1.80
Leather in side, (Lacing)	1.60

TAPES

Chesterman Metallic, 50 ft.	$5 00
Lufkin Metallic, 603, 50 ft.	3 17
Admiral Steel Tape, 50 ft.	3 00
Admiral Steel Tape, 100 ft	4 50
Major Jun. Steel Tape, 50 ft.	3 75
Rival Steel Tape, 50 ft.	4 00
Rival Steel Tape, 100 ft.	8 75
Reliable Jun. Steel Tape, 50 ft	5 25

PLATING SUPPLIES

Polishing wheels, felt	$3 80
Polishing wheels, bull-neck	1 50
Emery in kegs, Turkish	08
Pumice, ground	05
Emery glue	25
Tripoli composition	08
Crocus composition	12
Emery composition	11
Rouge, silver	64
Rouge, powder, nickel	38

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	19
Brass sheets, 24 gauge and heavier base	21
Brass tubing, seamless	23

WASTE

XXX Extra	16	Atlas	18
Peerless	21	X Empire	13
XX Grand	15	Ideal	18
Superior	20	X Press	11½
X L C R	14		

Colored

Lion	12	Fancy	13½
Standard	10½	Popular	9
No. 1	13	Keen	7½

Wool Packing

Arrow	24	Anvil	16
Axle	20		

Washed Wipers

Select White	18	Dark colored.	13
Mixed Colored	14		

This list subject to trade discount

RUBBER BELTING

Standard 36 ....28% Best grades 28%

ANODES

Nickel	.55 to .60
Copper	.38 to .40
Tin	.70 to .70
Zinc	.16 to .17

COPPER PRODUCTS
Prices per lb.

	Montreal	Toronto.
Copper Bars, ½ to 2 in.	.29	.28
Brass Tube		.28
Plain sheets, 16 oz. in. 30 x 72	.30	.29
Copper sheet, tinned, 16 oz.	.37	.42
Copper sheet, planished, 16 oz. base	.42	.42
Braziers', in sheets, 6 x 4 base	.30	.29
Copper tubing, seamless		.32
Brass sheets		23
Brass Rods		.19

LEAD SHEETS
Roll Lot Prices

	Montreal	Toronto.
Sheets, 3 lbs. sq. ft.	$ 8 75	$ 9 25
Sheets, 3 1-2 lbs. sq. ft.	8 50	9 25
Sheets, 4 to 6 lbs. sq. ft.	8.25	8 50

Cut sheets, ¾c per lb. extra.
Cut sheets to size, 1c per lb. extra

PLATING CHEMICALS

Acid, boracic	.23
Acid, hydrochloric	.03¾
Acid, nitric	10¼
Acid, sulphuric	.03¼
Ammonia, aqua	.20
Ammonium, carbonate	.15
Ammonium, chloride	.18
Ammonium, hydrosulphuret	.75
Ammonium, sulphate	.10
Arsenic, white	.18
Copper, carbonate, anhy.	.32
Copper, sulphate	.08
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.14
Nickel carbonate	.32
Nickel sulphate	.14
Potassium sulphide (substitute)	.40
Silver chloride (per oz.)	.85
Silver nitrate (per oz.)	.65
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.35
Sodium hyposulphite per 100 lb.	6.50
Sodium phosphate	.15
Tin chloride	.30
Zinc chloride, C. P.	.30
Zinc sulphate	.06

Prices per lb. unless otherwise stated

News From the Industrial Field

Major R. Crowe, manager of the Crowe Iron Works, Guelph, is attending the Bisley meet in England, as a member of the Canadian rifle team.

National Castings, Limited, Brockville, are installing an electric furnace for both steel and grey iron production.

The private car "Eatonia" owned by the late Sir John Eaton, and which originally cost $100,000 has been sold to the C. P. R.

The Dominion Bridge Co., has secured the steel contract in connection with the $60,000 addition to the dairy buildings at Ottawa.

Toronto Board of Control fearing a coal shortage in that city next winter have recommended to the city council the expenditure of $100,000 on the importation of coal from Wales.

The E. B. Eddy Co., of Hull, Que., are having plans prepared for an addition to their plant; the cost of the building will be approximately $1,000,000.

Maple Leaf flour mills at Welland were gutted by fire July 21. The cause is supposed to have been spontaneous combustion. The loss is estimated at $150,000.

Alfred Herbert Ltd., are appointed sole Canadian selling agents for the mining machinery, air compressors, rock drills and pneumatic tools manufactured by Messrs Holman Bros. of Camborne, Cornwall, Eng.

Aluminum wire, such as used for power transmission purposes is composed of 99 per cent. pure aluminum. It has 62 per cent. conductivity as compared with copper, costs twice as much per pound, but its weight is only one-half that of copper.

Steps are being taken by the Canadian Government for the appointment of a Trade Commissioner and an assistant to investigate and report on the possibilities of opening trade in Mexico. The Order-in-Council containing the authority for the appointments says: "Mexico offers a field for organizing and extending healthy trade relations between that Republic and Canada."

A commutator is that part of an armature which reverses the direction of electric currents in any circuit. It consists of copper bars or segments, side by side, forming a cylinder and insulated from each other, ordinarily by sheets of mica. It rotates with the armature and the conductors of the latter are so connected with the segments of the commutator that the current taken off by the bushes bearing upon its surface are direct although an alternating current is generated by the armature itself.

In order that the conducting capacity of the rails in a trolley line may be preserved they are connected or bonded at their joints by short pieces of copper cable or wire rivetted or welded into the adjoining ends.

Chemical action, may be induced by a ray of light or invisible radiant energy known to science as the actinic ray. Most powerful in this classification are the violet and ultra violet rays of the spectrum.

Kingston.—Tenders are being asked by Stevens and Lee, architects for the new isolation building for the Kingston General Hospital. Plans may be seen at 62 Charles Street, Toronto, or at the office of J. C. Newlands, Kingston.

Alternating currents are described as those which, rising and falling in strength, flow alternately in opposite directions at regular intervals. The currents vary in intensity from a plus maximum to a negative maximum and are separated by points of zero pressure as distinguished from a direct or continuous current.

Kingston.—Another industry is in the offing for the city of Kingston. Stanley and Aylward, Toronto manufacturers of "Norman" silver plate, have laid a proposition before the City Industries Committee. They intend to float about $30,000 of stock in the city and the civic officials have been authorized to offer that amount to the people of Kingston. The new firm may use a building near the Locomotive plant.

Through lack of power industries at Belleville were completely tied up during the latter part of the week. The situation in Peterboro also threatened, when several factories were compelled to shut down. At the latter place the trouble is said to have been caused by restricting conserved waters, causing a difference in levels, but, on the other hand, the cause is attributed to evaporation. Some difference of opinion seems to exist as to water rental per horsepower and the matter is one that has to be threshed out between the Hydro Commission and Ottawa Government. The Department of Railways and Canals ask a rental of $3.50 per horse power, which is claimed to be exhorbitant, and had cut down the supply at hydro stations. As a result industries in several towns are crippled. Formerly, the rates had averaged $1 and $2 and it was claimed that some power concessions in other provinces were securing water from the Dominion free of charge. The Province of Ontario is charging a maximum of 50 cents per horse power.

A manufacturer of machine screw products states: "Business conditions in our line are slowly improving, particularly in special pieces and automobile works. Standard or general lines are gradually increasing as confidence returns, although, as you know the machinery men are not very busy, consequently we cannot expect to be. However there is a general improvement and we hope it will continue."

Dominion Fabrics Limited, is a new corporation, capitalized at $250,000 to work in collaboration with the Dominion Hammock Co., Dunnville, Ont., but under a separate charter. The Campbellford interests which own the entire stock of the Hammock works, are big holders in the new venture. The new structure, which is nearing completion, is of steel built in with brick, 130 feet in length and 58 feet wide, four stories high including the basement. It is the intention to employ an additional 150 hands. The output will include dress goods, curtains, table spreads, etc.

Indicative of the come-back in the motor industry is the report of General Motors Corporation for the six months ending June. Net sales are reported as $218,490,887; net earnings before Federal taxes and interest as $35,116,481; net earnings after all charges as $29,997,391; net amount earned on the common stock $26,839,391.

The indicated production of 271,022 motor vehicles in June established a monthly record. It is estimated that of this number about 10 per cent., or 27,000 were trucks, leaving 244,000 passenger cars, a gain of six per cent. over 231,619 in May, the previous record month. Production of passenger vehicles for the six months to June 30 was 1,016,742, as against 1,514,000 in the full year 1921.

Australia has stolen a march on Canada by entering into an agreement with the British Government under the Empire Settlement scheme. Canadian parliament has prorogued without passing the necessary legislation. The plan as proposed will be operative until March, 1923 and will cost £400,000. There will be a grant to desirable immigrants of one-third of cost of passage, another third will be loaned at a low rate of interest, and even the remainder may be advanced if necessary. Initial allowances may also be granted. Australia, owning its own steamers, will make the expenditures and will be refunded one-half by the British Government. Only immigrants proceeding under settlement or development scheme, or assured of other employment in Australia will be eligible for these assisted provisions

Kingston may use coal from the Maritime provinces for the manufacture of gas.

Fire did $30,0000 damage to the leather goods plant of A. R. Clarke, Carlaw Ave., Toronto. Explosion of a gasoline tank during the fire made control difficult.

Authority to construct a bridge across the Niagara river to replace the old cantilever bridge built in 1882, over which the Michigan Central now operates, has been granted from Ottawa.

Toronto, Ont.—During the month of June construction contracts awarded in Canada amounted to $25,620,400, creating a record month for building in Canada since June, 1914.

Welsh coal may be used to relieve any coal shortage in Canada. Despatchers from Montreal indicate that cargoes are already on their way. Anthracite will be delivered at about $17 a ton.

Carpenters working on the Welland ship canal may strike for an increase of from five to fifteen cents an hour. The men claim that an order from the Minister of Railways and Canals justifies their claim.

In order to investigate openings in Russia for Canadian trade, the Dominion Government has authorized the appointment of a permanent trade commissioner, with an assistant, to that country. Russia may establish a trade agency here.

Fire prevention day has been set by the Government for October 9. Inspection of factories, public buildings, warehouses, theatres, hospitals, and private residences will be required, as well as removal of conditions likely to cause fire.

Saulte Ste. Marie, Ont.—The Algoma Steel Corporation has secured a 48,000 ton rail order from the Canadian Pacific Railway. This means that the rail mill will be re-opened immediately and put in full operation. The work will give employment to 2,000 men and will result in a general stimulation of business locally.

Windsor, Ont.—Wallace A. Campbell, vice-president and treasurer of the Ford Motor Co. of Canada, has officially announced that his company will begin in the near future the erection of a huge motor plant immediately adjacent to the present factory in Ford City. The new plant will cover approximately 125 acres and will cost in the neighborhood of $6,000,000, according to Mr. Campbell's announcement. The new property extends for 2,000 feet along the river front. It is expected that the production of the Canadian Ford will be doubled immediately the new plant starts to operate, and the plans are to turn out 500 cars a day in place of the 250 made at present. This will not represent the entire capacity, however, as the plant will allow a production of 1,000 cars a day, as soon as the market warrants the output.

Calgary, Alberta.—It is proposed to construct a hydro-electric plant on the Bow River, east of the city, to consist of four dams, the first of which will cost half a million dollars. The project is that of the Alberta Hydro-Electric Company, Ltd., of this city.

Vancouver, British Columbia.—Ocean borne lumber exports from British Columbia mainland for the first six months of the year show an increase of 21,737,-745 feet over same period last year. Shipments totalled: shingles 128,934,-500, box shooks 164,948 bundles, lath 12,220 bundles and lumber 94,552,742 feet.

Vancouver, British Columbia.—Tenders are being called for the superstructure of the new pier the Canadian Pacific Railway is constructing here for the accommodation of its ocean liners. The new work, which is the largest the Canadian Pacific has undertaken locally for some time, will give employment to several hundred men for approximately twelve months. The pier is to be 850 feet long and 330 feet wide, and is estimated to cost about $2,000,000.

St. John, New Brunswick.—it is reported that a Canadian engineer working for a St. John syndicate has made a number of valuable mineral discoveries in North Cumberland County, which include gold quartz, sheet mica, graphite. and clay or paint. The gold, it is claimed, should assay one ounce to the ton the deposit being only about 200 yards from the railway. Samples of true sheet mica from one foot to three feet square were brought out. A fine clay or paint was uncovered running in a deposit over one and a half miles long in layers of blue, light and dark yellow, bright scarlet, Indian red and pink, pure white and jet black. This deposit is seven miles from the railroad.

LITTLE COAL ARRIVES AT LAKE HEAD

Fort William.—The serious aspect of the fuel situation in the United States, and its resultant effect upon Canadian industry, is becoming apparent here. Usually at this time of the year coal cargoes are arriving from Lake Erie ports at the rate of almost a dozen a week but since the opening of navigation this year only two cargoes, comprising a total of 10,000 tons of soft coal have been unloaded. Dealers here state that the stocks of hard coal on hand are utterly inadquate to meet demands and that stocks of soft coal will be exhausted by the middle of October. Some hope was held out by Cleveland exporters of shipments of coal mined in non-union mines but since the start of the railroad strike in the United States, carloads have ceased to come forward and storage yards at Cleveland are practically empty. Vessel owners will be forced to tie-up their ships unless a change for the better occurs.

Klompf and Hardy, Fort William, have been awarded the contract for construction of a new oil warehouse for the Canadian Oil company here. The building will cost $4,000.

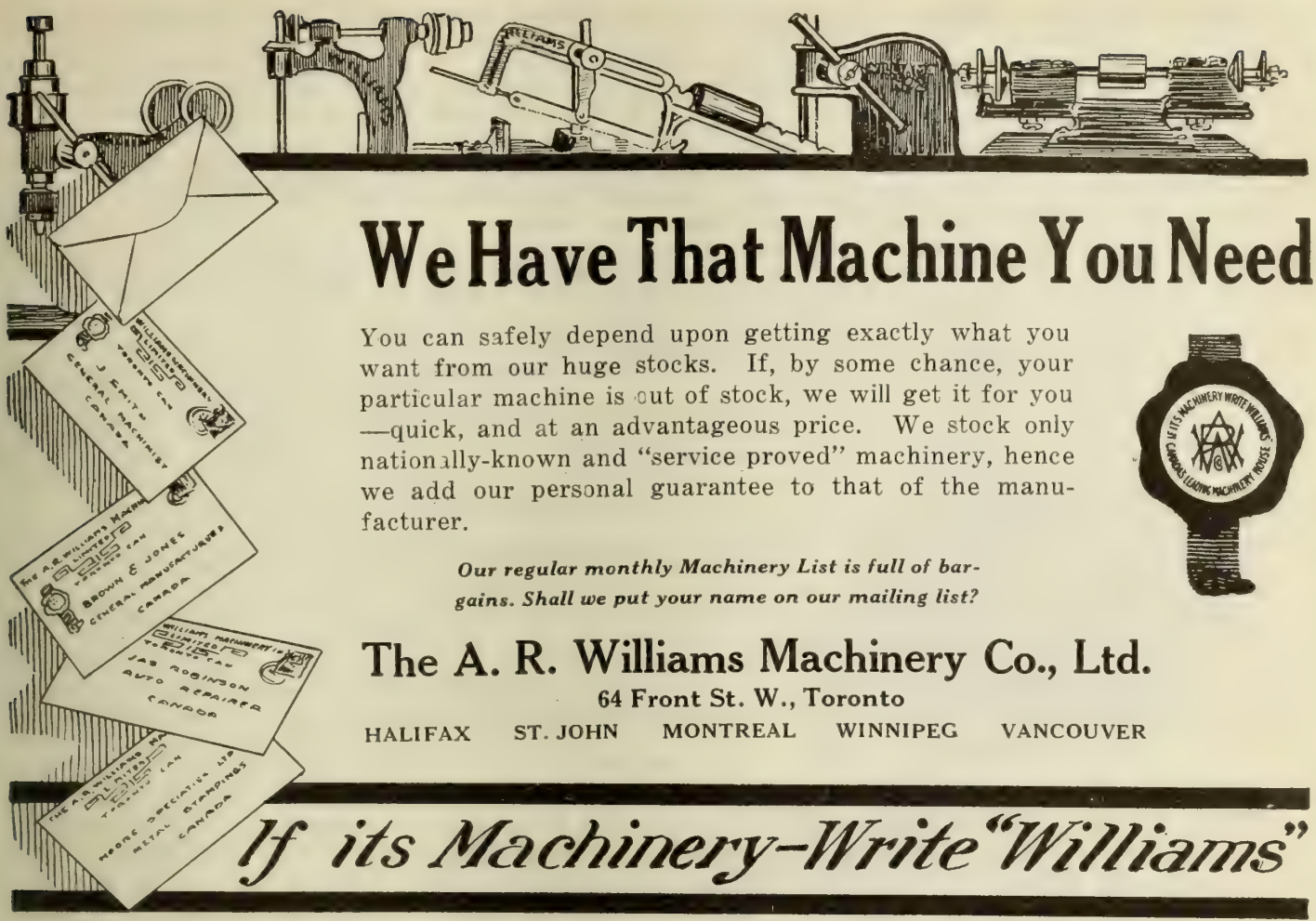
A vacancy will probably occur during the next few weeks in the board of grain commissioners of Canada, due to the resignation of Commissioner J. P. Jones, Fort Willian, whose term of office will expire early next year, but who is likely to have his resignation accepted a few months early in order that he may take a position with a Western grain firm. Word from Ottawa intimates that mention has been made of James Robinson, a director of the Saskatchewan Co-operative Grain company, for the position.

According to plans, the enlargement of the Port Arthur plant of the Consolidated Water Power and Paper company will be proceeded with at once. The capacity of the present pulpmill will be doubled and a one hundred ton daily capacity paper mill will be constructed. The entire plant when completed will use 10,000 horse-power electric energy instead of 1,500 as at present. The name of the Port Arthur plant has been changed to the Thunder Bay Paper mills.

Progress is being made in the construction of the new sorting, transferring and storage yards being established by the Canadian National railways upon two hundred and fifty acres of land just west of the westerly limits of Fort William. The new yards besides containing many miles of tracks will contain a roundhouse and offices. The plant when completed will represent an outlay of over two million dollars of which the sum of $470,000 has been appropriated by the government in this year's estimates. The yard is part of the government objective to co-ordinate the old Canadian Northern and the Grand Trunk Pacific railroads.

A MODEL FACTORY

One of the most admirably equipped factories in the world has recently been erected near London, England, for the manufacture of confectionery and for the packing of tea. In the tea department the whole of the work is done by machinery, the tea not being touched by hand from beginning to end. The tea chests are brought in barges to a canal dock and lifted out of the barges by means of an electric transporter which carries them into the factory. They are then raised by an electric conveyor to an upper floor where a sample is taken for tasting purposes The tea is then emptied down chutes leading to automatic machines which weigh out the tea in pounds, half pounds, or quarter pounds, as required, shape a package out of sheets of paper, fill the package with the exact weight of tea, and then close the packet. This packing operation is done at the rate of one complete package per second. The packages are then made up in parcels of one dozen or more and placed on electric trucks which convey them to the despatch department.



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64 Front St. W., Toronto

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STEADY RETURN TO NORMAL

London, Eng.—The outlook in the machinery and engineering trades has, naturally, been very materially improved by the favorable result of the ballot taken by the union on the question of a return to work. Although it may be a question of some time before the industry is once more in full swing, there is now nothing to look forward to other than a steady return towards normal conditions—a prospect which affects not only these allied industries, but a very large section of the country's trades. Order books are, of course, fuller than they would have been had the men been working, but firms are particularly desirous of securing long term contracts. For this, for countries where conditions are stable and risks are small, particularly attractive prices can be quoted. Enquiries have somewhat fallen off again more recently, probably owing to the trade dispute, but the work of regaining pre-war markets, particularly in heavy standard types of machinery, is not likely to receive any serious check from outside.

As to machinery developments, Messrs. H. G. L. Young have recently brought out some small woodworking machines, which should be very suitable where large woodworking machinery is not suitable for the work to be performed. For example, a thicknesser has been designed to meet the needs of woodworkers in a small way of business. Although small and cheap these machines will plane wood up to 6 ins. wide and 4 in. thick. The dimensions are 22⅛ ins. by 19 in. by 14 ins., and its weight is ¾ cwt. The machines can be driven from a ¾ h.p. electric motor or from a counter shaft. A circular saw bench has also been designed in which the table measures 24 ins. by 14 ins. and it is fitted with a 12 in. circular saw. This machine measures only 27 ins. in 19 ins. by 16 ins. and weighs 1¾ cwts. It will run normally at a speed of 1,500 r.p.m., and can be driven by a 1 h.p. motor. Other products of this maker include a bench spindle milling machine and a band saw. All these machines, although quite small, are well designed and efficient.

In welding and cutting, the past few years have seen a great deal of progress in the development, and both the electrical and gaseous methods of welding appear to have established themselves for various types of operation with great success. In one particular field the welding process has been of the utmost value, viz., for repair work on broken or damaged castings, or forgings. Not only have these been repaired with great ease and low cost, but the period of delay, during which the machinery has been out of operation owing to the damage in the first place, has been enormously reduced. As an example of this a recent case was quoted in which a large steamship fractured the three cylinder castings of her triple expansion engine. The cost of replacement would have been £50,000, and it would have been necessary for the ship to be laid up for six months. A firm of welding specialists undertook the repair, and the steamship was returned to service in five days. Lloyd's surveyor subsequently passed her A. 1. It is obvious also that apart from the saving in the delay while the ship was held up for the repair the cost of the welding itself was merely a fraction of that charged for the new cylinders. In this case the total length of the fractures was 14½ feet in metal 3 inches thick.

So much has the oxy-acetylene process developed, that profiling to exceedingly fine limits and with speed as well as accuracy is now quite possible, and is not difficult. At recent exhibitions workmen have been seen demonstrating the process by which a gear wheel has been cut out with the teeth accurately formed to within one-twentieth of an inch, in plate half an inch thick. The time required is merely one-tenth of that necessary by the older machine methods and the subsequent machining operation in the case of a piece of work such as a gear wheel is enormously reduced, owing to the very small amount of material which it is necessary to remove after the blow pipe has done its work.

OXYGEN PRODUCERS CONSOLIDATE

The consolidation recently of the manufacturing and distributing resources of the Dominion Oxygen Company, Limited, and the National Electro Products, Limited, gives to Canada one of the largest organizations of its kind on the continent. The business is henceforth to be conducted under the name of the Dominion Oxygen Company, Limited, now operating oxygen plants at Montreal and Toronto, and acetylene plants at Merriton, Winnipeg and Shawinigan Falls. In addition the company conducts oxygen and acetylene distributing stations at Hamilton, Windsor and Quebec. It is claimed that the union of the two companies will be of material advantage to all Canadian oxygen users through stabilization of the product, assurance of steady supply and certain improvements in service that enlarged facilities will make possible. It is understood that Mr. W. J. Cluff and associates, of Toronto and Montreal, who founded the National Electro Products, Limited, several years ago, will retain their relationship with the oxygen industry through their interest in the consolidated companies.

STRIKES AND BETTER BUSINESS

Delay in reaching settlements of present labor troubles will temporarily delay expansion, but it will not affect the fundamental causes which for more than a year have been making for better business, declares a New York authority on the situation in the United States.

Conditions at the close of the first half of 1922 indicate that business will expand moderately during the autumn and winter months. It is now one year since the definite beginning of recovery from the depression of 1920-1. Progress was slow until the close of 1921, but since the beginning of 1922 improvement has been rapid. Money is cheap. The crop outlook is excellent. With few exceptions, stocks of raw materials and of manufactured products are not larger than necessary to bridge the normal period between production and consumption. Commodity prices are rising. The movement at present seems to be primarily one of adjustment between the different classes of commodities, and as long as the upward tendency does not assume a speculative character, it is a favorable factor. Except for strikes, there is little idleness. Production has expanded steadily since the beginning of the year, and as yet the usual mid-summer dullness has been little felt.

FIGHTING FOR A CONTRACT

In the consideration of tenders for a four million gallon centrifugal pump for the Toronto Island pumping station, Commissioner Harris, before Toronto Board of Control, was disinclined to award the contract to the John Inglis Co., Toronto, claiming that they were not equipped. He seemed to have lost sight of the fact that the Inglis people have installed pumps to the capacity of two hundred millions of gallons in Toronto services. They have put in a tender of $10,791, which, after some show of a fight in the Board, was accepted. The Toronto plants having Inglis equipment are the main station, twenty million gallons, electrically driven; filtration plant, seventy-five million gallons, steam; sewage plant, twenty, seven, and one and one-half million gallons electric; main station, fifteen million gallons. Corliss steam; high level, six million gallons, Corliss steam; filtration plant, two million gallons, duplex steam.

"It's pretty tough when a Toronto man can't get a job in his own city," Mr. Inglis told the Board.

"The other pump is a better pump, that's all," remarked Commissioner Harris.

"That makes it a serious matter when the Toronto firm says it will build a pump according to your specifications and with a guarantee," said the mayor.

"What's the use of calling for tenders?" asked another controller, who moved that the local firm get the contract. The motion was carried four to one.

IMPROVEMENT IN GALT

All indications point to improvement industrially in Galt. While conditions in many branches could be much better, there is a more optimistic feeling among manufacturers generally. It is gratifying to learn that several of the large plants producing iron and steel report an increase in the number of working hours, more hands being taken on and good prospects for the future.

Cowan and Company, Limited, wood working machinery, are now working five and a half days a week and a number of the hands who were laid off during the slack period are back at work again.

Shurly-Dietrich Co., Limited, saw manufacturers, have lately taken on some more men and are working five days a week. Reports from the lumbering districts in the north say that the lumber companies are putting men into the bush now, which is earlier than usual, thus creating a greater demand for saws.

The Canada Machinery Corporation, Limited, wood and iron working machine tools, say business is now on the up grade. More hands are being taken on and the total number of employees at the present time is greater than at any time during the past year. They are now working five and a half days a week.

The R. McDougall Co., Limited, are very busy in their pump department and are working full time.

Conditions at the Galt Stove and Furnace Company, Limited, have been steadily improving since the middle of April. The moulders are now working four days and other employees five and a half days a week.

The Galt Art Metal Co., Limited, are very busy and were it not for the fact that supplies of material are slow in arriving, the factory could be working ten hours a day instead of eight as at present.

The Greenfield Tap and Die Corporation, Limited, the Galt Knife Company, Ltd., both report business as improving.

The Dominion Tack and Nail Co., Limited, are fairly busy and are working full time.

Galt Brass Co., Limited, report "exceptionally busy," and the prospects for future business "very good."

The C. Turnbull Co., Limited, knitted underwear manufacturers, have, through the recent purchase of the oatmeal mill adjoining their factory on North Water street, added another 8,000 feet to their floor space, which is good evidence of progress in their particular line.

Stauffer-Dobbie, Limited, report business good, employees working five and a half days a week.

P. W. Gardiner & Son, sash and door manufacturerss, say business in June, both wholesale and retail, was very good and on account of so much building going on at the present time in large centres, future prospects were bright. The firm is employing a normal number of hands who are working fifty hours a week.

HEATING AND VENTILATING ENGINEERS

A Canadian Chapter has been formed of the American Association of Heating and Ventilating Engineers, to be known as the "Canadian Division, Ontario Chapter," with a membership of about 35. The first meeting was held on June 2nd and the following officers appointed:

M. F. Thomas, president; H. H. Angus, vice-president; A. S. Leitch, secretary; A. J. Dickey, treasurer.

Monthly meetings will be held in Toronto.

RURAL POPULATION LEADS

The final figure issued from Ottawa of the sixth census, as of June 1st, gives Canada a population of 8,788,483, an increase of 1,581,840 over 1911 or 21.95 per cent. The census figures show 4,439,505 of the total population residing in rural districts as compared with 4,348,978 living in urban centres. Ontario is leading the way among the Provinces both as to total population and in the number living in the country. Ontario's total population is 2,933,662, of whom 1,226,292 live in rural districts. Quebec is second with a total population of 2,361,199, of whom 1,038,128 reside in the country.

For recording degrees of heat above those possible of indication by the mercurial thermometer, a pyrometer is used. This registers or measures by means of multiplying levers and a scale, the effect of heat upon some expansive substance such as a metallic rod when exposed to the heat to be measured.

Geometric

Screw Cutting Tools

Do the Work and Stand Up Through Long and Constant Service.

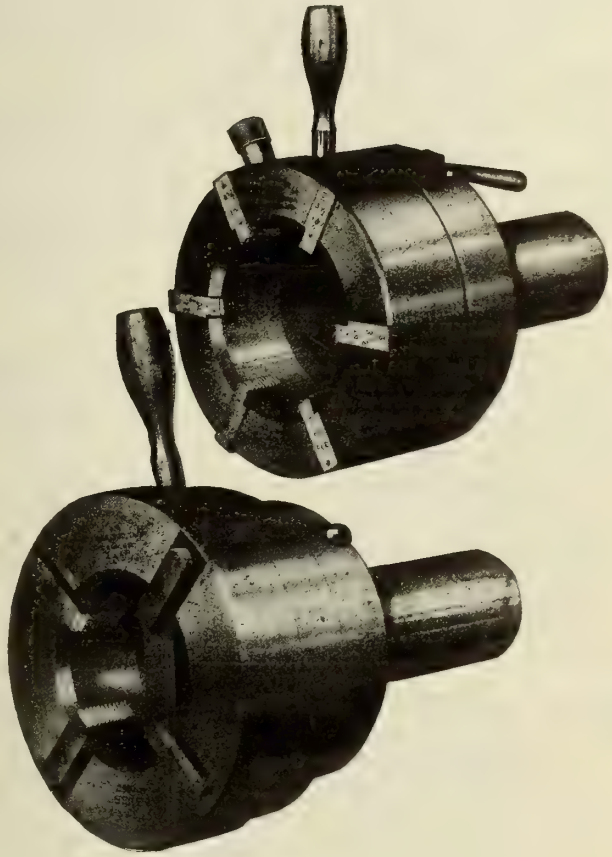
Men long experienced in Screw Thread Cutting affirm they were the losers where they had been induced to try substitutes.

A Geometric Self-Opening Die Head of just the right construction for your work, and a set of Geometric Milled Chasers—

Did you ever try to beat that combination on your Screw Machine or Turret Lathe?

A Geometric Collapsing Tap on your Screw Machine, Turret Lathe or live Spindle will prove if it is not the best possible investment.

Geometrics Give Highest Production and Maintain Quality



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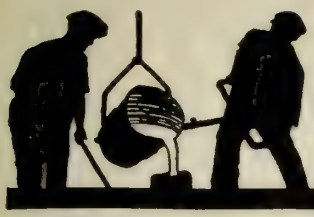
TWEED - ONT.

CLOSING TIME

Advertisements for this section must be in our composing room Tuesday morning prior to day of issue.

In order that the announcements of your wants, machinery for sale, etc., etc., shall not be delayed, please try to have them in our office with the Tuesday morning mail.

Canadian Machinery



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Steel, Malleable and Heavy Grey Iron.
See Advertisement Page 8

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Canadian Machinery & Mfg. News
143 University Avenue,
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BRANTFORD, ONTARIO

FOUNDRY AND OFFICE
63 LEONARD ST

June 27th., 1922

The MacLean Publishing Co., Limited.
Toronto, Ont.

Gentlemen;-

We wish to inform you that we have had quite satisfactory results from our advertisement in Canadian Machinery and Manufacturing News, which runs under the classified heading " Where to Buy your Castings ".

Yours Truly,
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per David Mitchell

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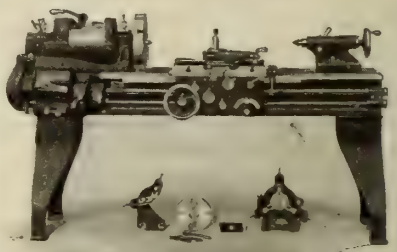

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THE PYROSCOPE

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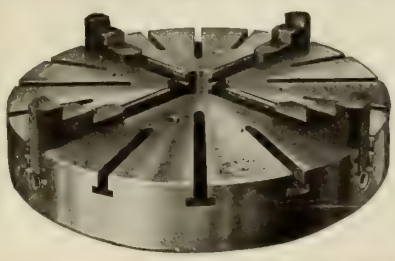

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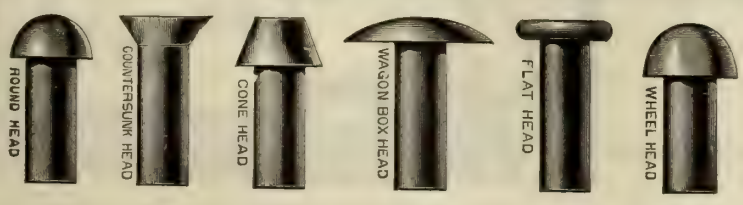

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All Fiction Number

BY WAY of an innovation, the August 1st issue of MACLEAN'S MAGAZINE has been produced as a Mid-Summer All-Fiction Number. The cover is by C. H. Taffs, the noted English artist who made such a hit with the cover of our January 1st issue this year.

There will be the usual Review of Reviews section, the Woman's Department, the Scoutmasters' and the Financial Departments; but, for this one issue, there will be no other serious original articles.

The chief feature of this issue will be a 42,000 word novel,

"THE JADE GOD," by Alan Sullivan

Never before has a complete novel been published in one issue of a Canadian periodical. In fact, there are few magazines in United States which have ever done it. There will be ten full pages of this novel at the front, well illustrated, as well as a generous turnover at the back of the magazine. In book form this one novel would sell for $1.75.

$1.75 Novel — **August 1st** — For Only 20c

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"CHEESE," by Henry Holt, is the story of a business man who has spent his life manufacturing cheese —and made a big success of it. He suddenly gives way to an impulse which his wife cannot curb and which leads him through many ventures, New York, Paris, Monte Carlo—in all of which he learns to "take a chance."

"THE PINK PAGODA" is from the pen of Isabel Ecclestone McKay, that charming Canadian novelist who looks out on the world from her comfortable Vancouver home and who has achieved such a recent success with her book, "The Window Gazer."

"THE GUEST OF TRADITION" is a newspaper yarn by J. L. Rutledge. George Wilcox was a tradition around the old "Examiner" office and whenever cub reporters came on the staff they were urged to write like Wilcox. But Wilcox met a dainty little bit of femininity from the stage and the criss-crossing of their lives, and the wrecking of his ambition, are woven into an extraordinarily gripping tale.

"PER AGREEMENT" is by Archie McKishnie and is a mystery story told in this Canadian writer's best vein.

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"THE TRYST OF THE WHITE LADY," by L. M. Montgomery. This is a delightful little love story with a very unusual turn to it, a story which measures up to the high standard which you expect from the author of "Anne of Green Gables."

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See "Where to buy your castings" Section. Page number may be found by turning to Advertisers' Index.

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Brown & Sharpe Mfg. Co., Providence, R. I.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

CHUCKS, DRILL AND TAP
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canadian SKF Co., Toronto, Ont.
Cushman Chuck Co., Hartford, Conn
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg., New Britain, Conn.

CHUCKS, LATHE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Cushman Chuck Co., Hartford, Conn.
Geometric Tool Co., New Haven, Conn.
Gisholt Machine Co., Madison, Wis.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pryibil Machine Co., New York, N.Y.
Skinner Chuck Co., New Britain, Conn
Union Mfg. Co., New Britain, Conn.

CHUCKS, MAGNETIC
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CHUCKS, PLANER
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cushman Chuck Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

CHUCKS, TAPPING
William L. Procunier, Chicago, Ill.

CHUCKS, VERTICAL BORING MILL
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

CLAMPS, MACHINISTS'
Brown & Sharpe Mfg. Co., Providence.
Starrett Co., L. S., Athol, Mass.

CLEANERS, METAL, WASTE, GENERAL
Oakley Chemical Co., New York, N. Y.

CLOCKS
Chicago Watchman's Clock Co., Chicago.
Hardinge Bros., Limited, Toronto, Ont.

CLOCKS, TIME
Gisholt Machine Co., Madison, Wis.

CLOCKS, WATCHMEN'S
Chicago Watchman's Clock Co., Chicago, Ill.
Hardinge Bros., Limited, Toronto, Ont.

For list of Dealers see the last page of This Buyers Directory

BELTS, ABRASIVE
Oakey & Sons, Ltd., John, London, S.E., Eng.

BENDING MACHINES, POWER
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bertrams Ltd., Edinburgh, Scotland.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

BILLETS, BLOOMS and SLABS
Steel Co., of Can. Ltd., Hamilton, Ont.

BLOCKS
Wright Mfg. Co., Lisbon, Ohio.

BLOCKS, CHAIN (See Hoists, Hand)
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

BLOCKS, DIE
Canada Foundries & Forgings Co., Welland, Ont.

BLOCKS, PILLOW
Can. Link-Belt Co., Toronto, Ont.

BLOWERS
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

BOILERS, LOCOMOTIVE
Goldie & McCulloch Co., Ltd., Galt,

BOLT AND NUT MACHINERY
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Montreal, Que.

BOLT AND NUT MACHINERY, Automatic
National Acme Co., Cleveland, Ohio.

BUCKET CARRIERS, Pivoted
Can. Link-Belt Co., Toronto, Ont.

BUFFERS
Pryibil Machine Co., New York, N.Y.

BUFFING OR POLISHING MACHINES (See Polishing and Buffing Machines)
Blount Co., J. G., Everett, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Pryibil Machine Co., New York, N.Y.
U. S. Electrical Tool Co., Cincinnati, O.

BUILDING MATERIALS
Bertram & Son Co., Ltd., The John Dundas, Ont.

BURNERS, OIL AND GAS
Rockwell Co., W.S., New York City.

BURRS
Steel Co. of Can. Ltd., Hamilton, Ont.

CABINETS, OIL
S. F. Bowser & Co., Ltd., Toronto, Ont

CALIPERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Starrett Co., L. S., Athol, Mass.

CAMS
Canada Foundries & Forgings Co., Welland, Ont.

CAN-MAKING MACHINERY (See Sheet Metal Working Machinery)
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Bliss Co., E. W., Brooklyn, N. Y.
Smooth Mfg. Co., Jersey City, N. J.

CARBONIZING
Chapman Double Ball Bearing Co., Toronto.

CEMENTS, IRON

CENTERING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.

CHAINS (See Sprockets and Chains)
Reynold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg Co., Lisbon, Ohio.

CHUCKS, DRILL
Jacobs Mfg. Co., Hartford, Conn.

CARD CLOTHING
D. K. McLaren Co., Ltd., Montreal, Que

BUYERS' DIRECTORY

CLUTCHES, FRICTION
Can.-Link-Belt Co., Toronto, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.

COAL AND ASH HANDLING MACHINERY
Can.-Link Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

COAL-STORAGE SYSTEMS
Can. Link-Belt Co., Toronto, Ont.

COLLARS, SHAFT OR SET
Canada Foundries & Forgings Co., Welland, Ont.
Can. Link-Belt Co., Toronto, Ont.

COLLETS
Butterfield & Co.. Inc., Rock Island, Que.
Hardinge Bros., Inc., Chicago, Ill.
Hendley Machine Co., Torrington Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

COMPOUNDS, CLEANING
Oakley Chemical Co., New York, N.Y.

COMPOUNDS—CUTTING, DRILLING, GRINDING, SCREW CUTTING
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Oakley Chemical Co., New York, N.Y.

COMPRESSORS, AIR AND GAS
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.

CONES, FRICTION
Norton Co., of Can. Ltd., Hamilton, Ont.

CONNECTING RODS AND STRAPS
Canada Foundries & Forgings Co., Welland, Ont.

CONTRACT WORK
Victoria Foundry Co., Ltd., Ottawa, Ont.

CONVEYORS AND ELEVATORS (SEE ELEVATORS)
Jones & Glassco, Montreal, Que.

COTTERS
Steel Co. of Canada, Ltd., Hamilton, Ont.

COUNTERBORES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

COUNTERS, REVOLUTION
Starrett Co., L. S., Athol, Mass.

COUNTERSHAFTS
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Johnson Machine Co., Carlyle, Man-
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

COUNTERSINKS
Butterfield & Co., Inc., Rock Island. Que.
Pratt &Whitney Co., of Canada, Ltd., Dundas, Ont.

COUPLERS, CAR AND LOCOMOTIVE
Can. Steel Foundries, Montreal, Que.

COUPLINGS
Steel Co. of Canada, Ltd., Hamilton, Ont.

COUPLINGS, PIPE
Fittings, Limited, Oshawa, Ont.

COUPLINGS, SHAFT
Can. Link-Belt Co., Toronto, Ont.

CRANES, ELECTRIC
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can.-Link-Belt Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

CRANES, LOCOMOTIVE
Can. Link-Belt Co., Toronto, Ont.

Bertram & Son Co., td., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

CRANK PIN TURNING MACHINE
Underwood Corp., H.B., Philadelphia, Pa.

CUTTERS, GEAR
Brown & Sharpe Mfg. Co., Providence. R. I.
Butterfield & Co., Inc., Rock Island, Q. Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CUTTERS, HIGH SPEED
Atkins & Co., Inc., E. C., Indianapolis.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CUTTERS, MILLING
Brown & Sharpe Mfg. Co., Providence, R. I.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.

CUTTERS, STAY BOLT
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.

CUTTING-OFF MACHINE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

CUTTING OFF MACHINES, PIPE (SEE PIPE-CUTTING AND THREADING MACHINES)
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.

CUTTING-OFF TOOLS
Armstrong Bros. Tool Co., Chicago, Ill.

CUTTING OIL FILTERS (SEE OIL FILTERING SYSTEMS
Bowser, S. F. & Co., Ltd., Toronto.

CUTTING, OXY-HYDROGEN
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Ltd., Toronto, Ont.

DEALERS, MACHINERY (SEE SEARCHLIGHT SECTION)
Petrie, Ltd., H. W., Toronto, Ont.

DETACHABLE CHAIN
International Malleable Iron Co., Guelph, Ont.

DIAMONDS, BLACK AND ROUGH
Can. Desmond-Stephan Mfg Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

DIAMOND TOOLS
Can. Desmond-Stephan Co., Hamilton,
Wheel Trueing Tool Co., Windsor, Ont.

DIAMOND CROSSINGS
Can. Steel Foundries, Montreal, Que.

DIAMONDS, IMPORTERS
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Co., Windsor, Ont.

DIES, SCREW AND THREAD CUTTING
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.

DIES, SHEET-METAL AND SUB-PRESS (See Tool Work)
Brown, Boggs & Co., Ltd., Hamilton, Ont.

DIES, FORGING
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

DIES, SELF-OPENING, ADJUSTABLE
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Landis Machine Co., Inc., Waynesboro,
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DIES, THREADING-OPENING
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DIVIDING HEADS
Burke Machine Tool Co., Conneaut, Ohio.
Hendey Machine Co., Torrington, Conn.
Kearney & Treacker Co., Milwaukee, Wis.
Petrie, Ltd., H. W. Toronto, Ont.

DOGS, LATHE AND MILLING MACHINE
Armstrong Bros. Tool Co., Chicago, Ill.

DRAFTING MATERIALS
American Lead Pencil Co., New York City, N.Y.

DRESSERS, GRINDING WHEEL
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ont.
Norton Co., of Can., Ltd., Hamilton.
Wheel Trueing Co., Windsor, Ont.

DRESSING TOOLS
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Co., Windsor, Ont.

DRILL HOLDERS
Armstrong Bros. Tool Co., Chicago, Ill.

DRILLING MACHINES. BENCH
Burke Machine Tool Co., Conneaut,, Ohio.
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Hardinge Bros., Inc., Chicago, Ill.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
U. S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, ELECTRIC AND HAND
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, GANG
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

DRILLING MACHINES, HEAVY DUTY
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
Rockford Drilling Machine Co., Rockford, Ill.

BORING, DRILLING AND MILLING MACHINES, (HORIZONTAL.)
Gisholt Machine Co., Madison, Wis.

DRILLING MACHINES, Multiple Spindle
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
National Acme Co., Cleveland, Ohio.

DRILLING MACHINES, Pneumatic
Cleveland Pneumatic Tool Co., Toronto. Ont.

DRILLING MACHINES, PORTABLE
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, RADIAL
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto,

DRILLING MACHINES, SENSITIVE
Burke Machine Tool Co., Conneaut, O.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Williams Machinery Co., A. R., Toronto.
Wisconsin Electric Co., Racine, Wis

DRILLING MACHINES, TURRET
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wisconsin.
Williams Machinery Co., A. R., Toronto.

DRILLING MACHINES, VERTICAL
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

DRILLS, CENTRE
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DRILLS, HIGH SPEED TWIST
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Cleveland Twist Drill Co., Cleveland, O.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DRILLS, RATCHET
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

DRILLS, TWIST AND FLAT
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.

DROP FORGINGS
Steel Co. of Canada, Ltd., Hamilton.

DUST HANDLING EQUIPMENT
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

ELECTRICAL INSTRUMENTS
Bristol Co., Waterbury, Conn.

ELECTRICAL SUPPLIES
Atkins & Co., Inc., E. C., Indianapolis.
Diamond State Fibre Co., Toronto, Ont.
U.S. Electrical Tool Co., Cincinnati, O.

ELEVATING TRUCKS (See Trucks)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

ELEVATORS AND CONVEYORS
Can. Link-Belt C., Toronto, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.

EQUIPMENT, ELEVATOR SAFETY
Jones & Glassco, Montreal, Que.

EMERY WHEELS (See Grinding Wheels)
J. R. Baxter & Co., Ltd., Montreal, Que.
Atkins & Co., E. C., Indianapolis. I.
Norton Co., of Canada., Ltd., Hamilton.

ENGINES, CAPSTAN
Kennedy & Sons, Wm., Owen Sound, Ont.

ENGINE LATHE MANUFACTURERS
Oliver Machinery Co., Grand Rapids, Michigan.

ENGINEERS, MECHANICAL
Dominion Engineering Works, Limited, Montreal, Que.
Gisholt Machine Co., Madison, Wis.
Hamilton Gear & Machine Co., Toronto,

EXPANDERS, TUBE
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

FANS, ELECTRIC
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

FANS, EXHAUST
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Petrie Ltd., H. W., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass.

FANS, VENTILATING
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

FIBRE
Diamond State Fibre Co., of Can. Ltd., Toronto, Ont.

FILES AND RASPS
Nicholson File Co., Port Hope, Ont.
Simmons Canada Saw Co., Montreal, Que.

FILLER, IRON (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J.

FIRE ESCAPES
Roelofson Elevator Co.. Galt, Ont.

FITTINGS, PIPE
International Malleable Iron Co., Guelph.
Fittings, Limited, Oshawa, Ont.

FLEXIBLE SHAFTS
Strand & Co., N. A., Chicago, Ill

FLUXES, WELDING
Carter Welding Co., Ltd , Toronto, Ont.
Dominion Oxygen Co., Ltd, Toronto
Liquide Air Company, Toronto, Ont.

FORGING MACHINERY
Acme Machinery Co., Cleveland, Ohio
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown Boggs & Co., Ltd., Montreal.
National Machinery Co., Tiffin, Ohio
Steel Co. of Canada, Ltd., Hamilton.

BUYERS' DIRECTORY

FORGINGS, DROP
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Ltd., Toronto, Ont.

FORGINGS, HAMMER
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Hepburn Ltd., John T., Toronto, Ont.

FOUNDRY EQUIPMENT
McDougall Co., Ltd., R. Galt, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

FOUNDRY SUPPLIES
Rice Lewis & Son, Ltd., Toronto, Ont.

FROGS, SPRING OR RIGID
Can. Steel Foundries, Montreal, Que.

FURNACES, ELECTRIC
Rockwell Co., W. S. New York City.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

FURNACES, HEAT TREATING COAL
Rockwell Co., W. S., New York City.

FURNACES, HEAT TREATING OIL AND GAS
Bellevue Industrial Furnace Co., Detroit, Michigan.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Rockwell Co., W. R., New York City.

FURNACES TEMPERING AND ANNEALING
Bellevue Industrial Furnace Co., Detriot, Mich.
Brown & Sharpe Mfg., Co., Providence R. I.
Rockwell Co., W. S., New York City.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

FURNACES AND OVENS, ELECTRIC
Petrie, Ltd., H. W., Toronto, Ont.
Rockwell & Co., W. S., New York city.
Starrett Co., L. S., Athol, Mass.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

GAGES, MEASURING (See Tool Work)
Brown & Sharpe Mfg. Co., Providence, R. I.
Greenfield Tap & Die Corp., Galt, Ont.
Lufkin Rule Co., Windsor, Ont.
Starrett Co., L. S., Athol, Mass.

GAGES, RECORDING
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GAGES, SPECIAL MEASURING (See Tool Work)
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GAGES, THREAD
Brown & Sharpe Mfg. Co., Providence R. I.
Starrett Co., L. S., Athol, Mass.

GALVANIZING
Fittings, Limited, Oshawa, Ont.

GAS, COAL COMPRESSED
L'Air Liquid Society, Toronto, Ont.

GAS, COMPRESSED
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

GASKETS
Diamond State Fibre Co. of Ca., Ltd., Toronto, Ont.
Smooth Mfg. Co., Jersey City, N. J.

GAUGES VACUUM AND PRESSURE
Taylor Instrument Co. Toronto, Ont.

GEAR BLANKS
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co, of Can., Ltd., Toronto, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.
Dominion Engineering Works, Limited, Montreal, Que.

GEAR COUNTERS
Hart Mfg. Co., R. A., Battle Creek, Michigan.

GEAR-CUTTING MACHINES
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Fellows Gear Shaper Co., Springfield, Vt.
Petrie, Ltd., H. W., Toronto, Ont.
Whiton Machine Co., D. E., New London, Conn.

GEAR TESTING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.

GEARS, CAST
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Hull Iron & Steel Foundries, Hull, Que.
Dominion Engineering Works, Limited, Montreal, Que.

GEARS, CUT
Brown & Sharpe Mfg. Co., Providence, R. I.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Gardner & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto, Ont.
Hepburn Ltd., John T. Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

GEARS, DRESSED
Kennedy & Sons, Wm., Owen Sound, Ontario.

GEARS, FORGED
Canada Foundries & Forgings Co., Welland, Ont.

GEARS, HERRINGBONE
Hamilton Gear & Machine Co., Toronto, Ont.

GEARS, RAWHIDE (See Gears, Cut)
Hamilton Gear & Machine Co., Toronto.

GEAR, SILENT CHAIN
Gardner & Son, Robt., Montreal, Que.
Can. Link-Belt Co., Ltd., Toronto, Can.
Hans Renold of Canada, Ltd., Montreal, Quebec.

GEARS, WORM
Hamilton Gear & Machine Co., Toronto.

GENERATORS, ACETYLENE
L'Air Liquide Society, Toronto, Ont.

GLOVES, PROTECTIVE
Industrial Glove Co., Toronto, Ont.

GOGGLES, SAFETY
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

GRAB BUCKETS
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Cleveland Twist Drill Co., Cleveland, O.

GREASE CUPS, PRESSED STEEL AND BRASS
Can. Winkley Co., Ltd., Windsor, Ont.

GREASES, LUBRICATING
Canadian SKF Co., Toronto, Ont.

GRINDING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Norton Co., of Canada, Ltd., Hamilton.

GRINDING MACHINES, ABRASIVE BELT
Norton Co. of Can. Ltd., Hamilton, Ont.

GRINDING MACHINES, AUTOMATIC
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, BENCH
Blount Co., J. G., Everett, Mass.
Geometric Tool Co., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
McDougall Co., Ltd., R., Galt, Ont.
Norton Co. of Canada, Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, CENTER
U. S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES, CUTTER AND REAMER
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Petrie Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, CYLINDRICAL
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.
Norton Co., of Canada, Ltd., Hamilton.

GRINDING MACHINES, DIE
National Acme Co., Cleveland, O.
National Machinery Co., Tiffin, Ohio.

GRINDING MACHINES, DRILL
Bellevue Industrial Furnace Co., Detroit, Mich.
Bertram & Son Co., Ltd., The John, Dundas, Ont.

GRINDING MACHINES, ELECTRIC
Strand & Co., N. A., Chicago, Ill.

GRINDING MACHINES, FLOOR AND TOOL
Blount Co., J. G., Everett, Mass.
National Acme Co., Cleveland, Ohio.
Norton Co. of Canada, Ltd., Hamilton, Ontario.
Petrie, Ltd., H. W., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.

GRINDING MACHINES, INTERNAL
Garlock Machinery Ltd., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES PORTABLE
Strand & Co., N. A., Chicago, Ill.

GRINDING MACHINES, SNAGGING
Blount Co., J. G., Everett, Mass.
Norton Co., of Can. Ltd., Hamilton, Ont.

GRINDING MACHINES, SURFACE
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, THREAD
Pratt & Whitney Co., of Canada, Ltd.,

GRINDING MACHINERY, TOOL POST
Gisholt Machine Co., Madison, Wis.
Grenfield Tap & Die Corp., Galt, Ont.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES, UNIVERSAL
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co., of Canada, Ltd, Hamilton, Ontario.
Petrie, Ltd., H. W., Toronto, Ont.

GRINDING WHEELS
J. R. Baxter & Co., Ltd., Montreal, Que.
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Norton Co. of Can., Ltd., Hamilton, Ont.

GUN-BARREL MACHINERY
Steinle Turret Machine Co., Madison, Wisconsin.

HACK SAWS, POWER
Atkins & Co., Inc., E.C., Indianapolis, Indiana.
Petrie, Ltd., H. W., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.

HAMMERS, CHIPPING
Cleveland Pneumatic Tool Co., Toronto, Ont.
High Speed Hammer Co., Rochester.

HAMMERS, DROP
Bertram & Son Co., Ltd., The John Dundas, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

HAMMERS, ELECTRIC
Brown, Boggs & Co., Ltd., Hamilton, Ont.

HAMMERS, PNEUMATIC
Can. Steel Foundries, Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto Ont.

HANGERS, SHAFTING
Canadian SKF Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Hamilton Gear & Machine Co., Toronto,

HOBBING MACHINES
Shore Instrument Co., Jamaica, N.Y.

HARDENING, CASE-HARDENING AND TEMPERING
Barnes Company, Wallace, Hamilton.
Chapman Double Ball Bearing Co., Toronto.
Petrie, Ltd., H. W., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Cleveland Pneumatic Tool Co., Toronto Ont.

HAMMERS, POWER
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

HOBS
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

HOISTS, ELECTRIC
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

HOISTS, ELECTRIC
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

HOISTS, HAND
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

HOISTS, PNEUMATIC
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

HOLDERS-ON, PNEUMATIC
Cleveland Pneumatic Tool Co., Toronto Ont.

HYDRAULIC MACHINERY
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

IGNITERS, GAS ENGINE
Canada Foundries & Forgings Co., Welland, Ont.
Burke Machine Tool Co., Conneaut, O.

INDICATORS, SPEED AND TEST
Brown & Sharpe Mfg. Co., Providence, R.I.

INSULATION
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.

IRON BARS
Steel Co. of Canada, Ltd., Hamilton, Ont.

JACKS, HYDRAULIC
Norton, A. O., Boston, Mass.

JACKS, PLANER
Armstrong Bros. Tool Co., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

JAPANNING AND VARNISHING OVENS
Brantford Oven & Rack Co., Brantford, Ont.

JIGS AND FIXTURES (SEE TOOL WORK)
Fisher Motor Co., Ltd., Orillia, Ont.
Gisholt Machine Co., Madison, Wis.
Preston & Schwartz, Galt, Ont.

KEYSEATING MACHINES
Morton Mfg. Co., Muskegon, Mich

Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

KEYS, MACHINE
Can. Drawn Steel Co., Hamilton, Ont.
Morton Mfg. Co., Muskegon, Mich.

KNIVES, MACHINE
Atkins & Co., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

KNURL HOLDERS
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

LATHE ATTACHMENTS
Hendey Machine Co., Torrington, Conn.
Petrie, Ltd., H. W., Toronto, Ont.

LATHE TOOLS
Armstrong Bros. Tool Co. ,Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

LATHES, AUTOMATIC AND SEMI-AUTOMATIC
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, BENCH
Hardinge Bros., Inc., Chicago, Ill.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

LATHES, BORING
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, CHUCKING (SEE LATHES, HORIZONTAL TURRET, AND LATHES, VERTICAL TURRET)
Acme Machine Tool Co., Cincinnati, O.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, ENGINE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd, H. W., Toronto, Ont
Rockford Lathe & Drill Co., Rockford, Illinois.

LATHES, EXTENSION AND GAP
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, O.
Petrie, Ltd., H. W., Toronto, Ont.
Steinle Turret Machine Co., Madison, Wis.

LATHES, PRECISION
Hardinge Bros., Chicago.

LATHES, RELIEVING
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.

LATHE, UNIVERSAL HAND
Brown & Sharpe Mfg. Co., Providence, Rhode Island.

LATHE, SPEED AND HAND
Plount Co., J. G., Everett, Mass.

LATHES, SPINNING
Pryibil Machine Co., Torrington, Conn.

LATHES, VERTICAL TURRET
Bertram & Son, Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

LATHES, WOOD TURNING
Blount, Co., J. G., Everett, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.

LEAD PIPE
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

LEATHER FILLET
D. K. McLaren Co., Ltd., Montreal, Que.

LIGHTING AND GENERATING SETS
Beardmore & Co., Ltd., Wm., Montreal, Que.

LINOLEUM MILL MACHINERY
Bertrams, Ltd., Edinburgh, Scotland.

LIQUID AIR PLANTS
L'Air Liquide Society, Toronto, Ont.

LOCKERS, CLOTHES
Dennis Wire and Iron Works, London, Ont.

BUYERS' DIRECTORY

LUBRICANTS
Oakley Chemical Co., New York, N.Y.

LUBRICATING SYSTEMS
Bowser, S. F., & Co., Ltd., Toronto, Canada.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Ltd., Welland, Ont.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R. Toronto Ont.

MANGANESE STEEL
Can. Steel Foundries, Montreal, Que.

MANDRELS, EXPANDING
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MANDRELS, SOLID
Greenfield Tap & Die Corp., Galt, Ont.
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Pratt & Whitney Co., of Canada. Ltd., Dundas, Ont.

MEASURING MACHINES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MECHANICS' FINE TOOLS
Lufkin Rule Co., Windsor, Ont.

METALS, ALLOY
Canada Metal Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.

METAL WORKERS
Parker Co., Charles, Meriden, Conn.

MICROMETER CALIPERS
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Rice Lewis & Son, Ltd., Toronto, Ont.

MILLING ATTACHMENTS
Purke Machine Tool Co., Conneaut, O.
Hendey Machine Co., Torrington, Conn.
Hinckley Machine Works, Hinckley, Ill.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

MILLING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Burke Machine Tool Co., Conneaut, O.

MILLING MACHINES, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence, R. I.
Hardinge Bros., Inc., Chicago, Ill.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

MILLING MACHINES, BENCH
Burke Machine Tool Co., Conneaut. O.
Hardinge Bros., Inc., Chicago, Ill.

MILLING MACHINES, HAND
Brown & Sharpe Mfg. Co., Providence
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MILLING MACHINES, HORIZONTAL PLANER TYPE.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Kearney & Trecker Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto.

MILLING MACHINES, PLAIN
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, O.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

MILLING MACHINES, THREAD
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MILLING MACHINES, UNIVERSAL
Brown & Sharpe Mfg. Co., Providence,
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

MILLING MACHINES, VERTICAL
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, O.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto.

MOTORS, ELECTRIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Roelofson Elevator Co., Galt, Ont.
Williams Machinery Co., A. R., Toronto,
Wisconsin Electric Co., Racine Wis.

NAILS AND STAPLES
Canada Metal Co., Ltd., Toronto, Ont.

NIPPLES
Canada Metal Co., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton,

NITROGEN
Carter Welding Co. Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

NUT TAPPERS
(See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
National Acme Co., Cleveland, Ohio.

NUTS, FINISHED and SEMI-FINISHED
Galt Macine Screw Co., Galt, Ont.
National Acme Co., Montreal, ue.

NUTS (Up to 4-in.)
Steel Co. of Canada, Ltd., Hamilton.

NUTS, S.A.E., PLAIN AND CASTELLATED
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

OIL FILTERING AND STORAGE SYSTEMS
Bowser, S. F., & Co., Ltd., Toronto,

OIL STORAGE ENGINEERS
Bowser, S. F., & Co., Ltd., Toronto,

OIL HOLE COVERS
Can. Whitney Co., Ltd., Windsor, Ont.

OILS, SOLUABLE
Brantford Oven & Rack Co., Brantford, Ontario.

OXYGEN
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

OXY-ACETYLENE APPARATUS
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Atlas Press Co., Kalamazoo, Mich.

PAPER MILL CONVEYORS
Bertram Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd., Montreal, Que.

PATTERNS, WOOD AND METAL
Fittings, Limited, Oshawa, Ont.
Victoria Foundry Co., Ltd., Ottawa.

PHOSPHOR TIN
Canada Metal Co., Ltd., Toronto, Ont.

PHOTOGRAPHIC DUPLICATING MACHINES
Photostat Corp., Providence, R. I.

PIPE BENDING MACHINES
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Underwood Corp., H. R., Philadelphia, Pa.
Williams Machinery Co., A. R., Toronto.

PIPE CUTTING AND THREADING MACHINES
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

PIPE
Canada Metal Co., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.

PIPE FITTINGS
Canada Metal Co., Toronto, Ont.
Fittings, Limited, Oshawa, Ont.
International Malleable Iron Co., Guelph Ont.

PIPE AND NIPPLE THREADING MACHINES
Landis Machine Co., Inc., Waynesboro, Pa.

PIPE FITTERS' TOOLS
Rice Lewis & Son, Ltd., Toronto, Ont.

PIPE THREADING DIE HEADS
Landis Machine Co., Inc., Waynesboro, Pa.

PISTON-RING MACHINES
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

PLANING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Williams Machinery Co., A. R., Toronto

PLANING MACHINES, ROTARY
Bertram & Son Co., Ltd., The John, Dundas, Ont.

PLATE ROLLS
Bertram & Son Co., Ltd., The John, Dundas, Ont.

PNEUMATIC TOOLS
Cleveland Pneumatic Tool Co., Toronto

POLISHING AND BUFFING MACHINES
J. R Baxter & Co., Ltd., Montreal, Q.
Blount Co., J. G. Everett, Mass.
Brown & Sharpe Mfg. Co., Providence.
Pryibil Machine Co., New York, N.Y.

PRESSED STEEL PARTS
American Pulley Co., Philadelphia, Pa.
Fisher Motor Co., Ltd., Orillia, Ont.

PRESSES, ARBOR
Atlas Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

PRESSES, DROP AND FORGING
Brown, Boggs & Co., Ltd., Hamilton.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

PRESSES, FOOT AND HAND
Brown, Boggs & Co., Ltd., Hamilton.

PRESSES, HYDRAULIC
Bertram & Son Co., Ltd., The John, Dunidas, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Perrin Ltd., W. R., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

PRESSES, POWER
Bliss Co., E. W., Prooklyn, N. Y.
Brown, Boggs, & Co., Ltd., Hamilton,
Hepburn Ltd., John T., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Stoll Co., Inc., D. H., Buffalo, N.Y.

PRESSES, SCREW
Brown, Boggs & Co., Ltd., Hamilton.
Petrie, Ltd., H. W., Toronto, Ont.

PROFILING MACHINES
Prtt & Whitney Co., of Canada, Ltd., Dundas, Ont.

PROTRACTORS
Brown & Sharpe Mfg. Co., Providence
Lufkin Rule Co., Windsor, Ont.

PROPELLERS
Kennedy & Sons, Wm., Owen Sound Ontario.

PULLEYS, CORK INSERT
American Pulley Co., Philadelphia, Pa.

PULLEYS, METAL AND FIBRE
American Pulley Co., Philadelphia, Pa.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.
D. K. McLaren Co., Ltd., Montreal, Que

PULP AND PAPER MILL EQUIPMENT
Dominion Engineering Works, Ltd., Montreal, Que.

PUMPS, HYDRAULIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Dominion Engineering Works, Ltd Montreal, Que.
Hepburn Ltd., John T., Toronto Ont.

BUYERS' DIRECTORY

PUMPS, LUBRICANT AND OIL
Bowser, S. F., & Co., Ltd., Toronto.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Hepburn Ltd., John T., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.

PUMPS, POWER
Bowser, S. F., & Co., Ltd., Toronto.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hepburn Ltd., John T., Toronto, Ont.

PUNCHES, CENTER
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

PUNCHES, HAND
Brown Boggs & Co., Ltd., Hamilton.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Jardine & Co., A. B., Hespeler, Ont.

PUNCHES, POWER
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

PUNCHING MACHINES, HORIZONTAL
Bertrams Ltd., Edinburgh, Scotland.

PYROMETERS, ELECTRIC
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Hiram Walker & Sons Metal Products Co., Walkerville, Ont.

RACKS, CUT
Hamilton Gear & Machine Co., Toronto.

RACKS, STORAGE
(See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ontario.

REAMER HOLDERS
Simonds Canada Saw Co., Montreal, Q.

REAMERS, EXPANDING
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

REAMERS, SOLID
Butterfield & Co., Inc., Rock Island, Q.
Morse Twist Drill & Machine Co., New Bedford, Mass.

REAMERS, TAPER
Brown & Sharpe Mfg. Co., Providence, R. I.
Butterfield & Co., Inc., Rock Island, Q.
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canad, Ltd., Dundas, Ont.

RECORDERS, TEMPERATURE
Taylor Instrument Co., Rochester, N. Y.

RECORDERS, TIME
Gisholt Machine Co., Rochester, N. Y.
Taylor Instrument Co., Toronto, Ont.

REGULATORS, TEMPERATURE
Taylor Instrument Co., Toronto, Ont.

RIVETS AND BURRS
Parmenter & Bulloch Co., Gananoque, Ont.
Steel Co., of Canada, Ltd., Hamilton,

RIVETS, CHAIN
Pittings, Limited, Oshawa, Ont.

RIVET-MAKING MACHINERY
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

RIVETING MACHINES
Can. Fairbanks-Morse Ltd., Montreal Q.
High Speed Hammer Co., Rochester, N.Y.
Parmenter & Bulloch Co., Gananoque Ont.
Petrie, Ltd., H. W., Toronto, Ont.

RUDDER FRAMES, STEEL
Can. Steel Foundries, Montreal, Que.

RUBBER MILL MACHINERY
Bertram Ltd., Edinburgh, Scotland.

RULES, STEEL AND WOOD
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Windsor, Ont.

RUST PREVENTATIVES
Oakley Chemical Co., New York, N. Y.

SAND EQUIPMENT
Can. Link-Belt Co., Toronto, Ont.

SAND RAMMERS, PNEUMATIC
Cleveland Pneumatic Tool Co., Toronto.

SAW FRAMES AND BLADES, HACK
Atkins & Co., Inc., E. C., Indianapolis,
Diamond Saw & Stamping Works, Buffalo, N. Y.
Rice Lewis & Sons, Ltd., Tornto, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWING MACHINES, POWER HACK
Atkins & Co., Inc., E. C., Indianapolis,
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

SAW SHARPENING MACHINES
Atkins & Co., Inc., E. C., Indianapolis,
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

SAW SHARPENING MACHINES
Atkins & Co., Inc., E. C., Indianapolis.

SAW TABLES, UNIVERSAL
Petrie, Ltd., H. W., Toronto, Ont.

SAWS, CIRCULAR METAL
Atkins & Co., Inc., E. C., Indianapolis.
Pryibil Machine Co., New York, N. Y.
Gisholt Machine Co., Madison, Wis.

SAWS, HAND
Atkins & Co., Inc., E. C., Indianapolis
Simonds Canada Saw Co., Montreal, Q.

SAWS, HOT AND COLD
Atkins & Co., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Q.

SAWS, HIGH SPEED STEEL
Atkins & Co., Inc., E.C., Indianapolis, I.
Butterfield & Co. Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWS, METAL BAND
Atkins & Co., E. C., Indianapolis, I.

SAWS, METAL CUTTING
Brown & Sharpe Mfg. Co., Providence,
Butterfield & Co., Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.
Starrett Co., L. S., Athol, Mass.

SAWS, SCREW SLOTTING
Atkins & Co., Inc., E., C., Indianapolis.
Butterfield & Co., Inc., Rock Island, Q.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canda, Ltd., Dundas, Ont.

SAWS, SCREW SLOTTING
Atkins & Co., Inc., E. C., Indianapolis.
Butterfield & Co., Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWS, WOOD
E. C. Atkins & Co., Indianapolis, Ind.

SCALES
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Lufkin Rule Co., Windsor, Ont.

SCREENS
Dominion Engineering Works, Ltd., Montreal, Que.

SCREW DRIVERS, OPTICAL, JEWELRY AND NOVELTY
Strand & Co., N. A., Chicago, Ill.

SCREW MACHINE WORK
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Montreal, Que.

SCREW MACHINERY, WOOD AND LAG
Cook Co., Asa S., Hartford, Conn.

SCREW MACHINES
Brown & Sharpe Mfg. Co., Providence, Rhode Island.

SCREW MACHINES, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.

SCREW MACHINE PRODUCTS
National Acme Co., Montreal, Que.

SCREW PLATES
Butterfield & Co., Inc., Rock Island. Que.
Jardine & Co., A. B., Hespeler, Ont.

SCREWS, CAP AND SET
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

SCREWS, SAFETY, SET
Galt Machine Screw Co., Galt, Ont.

SECOND-HAND MACHINERY
See last page of directory.
Petrie, Ltd., H. W., Toronto, Ont.

SEPARATORS, MOISTURE AND OIL
Bowser, S. F., & Co., Ltd., Toronto, Canada.

SEPARATORS, OIL AND WASTE
Bowser, S. F., & Co., Ltd., Toronto.

SHAFTS, FLEXIBLE
Strand & Co., N. A., Chicago, Ill.

SHAFTING
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
Williams Machinery Co., A. R., Toronto.

SHAPES, COLD-DRAWN SPECIAL STEEL
Union Drawn Steel Co., Hamilton, Ont.

SHAPING MACHINES
Hendey Machine Co., Torrington, Conn.
Morton Mfg. Co., Muskegon, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Williams Machinery Co., A. R. Toronto.

SHEARS HAND
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

SHEARS, POWER
Bliss Co., E. W., Brooklyn, N. Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Stoll Co., Inc., D. H., Buffalo, N. Y.
Williams Machinery Co., A. R., Toronto, Ont.

SHEARING MACHINES, ANGLE, IRON BAR AND GATE
Bertrams Ltd., Edinburgh, Scotland.

SHEET LEAD
Canada Metal Co., Ltd., Toronto, Ont.

SHEET METAL WORKING MACHINERY
Bliss Co., E. W., Brooklyn, N. Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Stoll Co., Inc., D. H, Buffalo, N.Y.

SHEETS, NICKEL, MONEL AND FIBRE
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.

SHEETS, O.P.C.R. & B. A. AND BLUE ANNEALED
Steel Co., of Canada, Ltd., Hamilton, Ont.

SIDE FRAMES, LOCOMOTIVE
Can. Steel Foundries, Montreal, Que.

SLOTTING ATTACHMENTS
Brown & Sharpe Mfg. Co., Providence, R.I.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

SLOTTING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.

SOLDERS
Canada Metal Co., Ltd., Toronto, Ont.

SPECIAL MACHINERY AND TOOLS
Brown Engineering Corp., Ltd., Toronto.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Cleveland, O.

SPIKES, RAILWAY AND PRESSED
Steel Co of Canada, Ltd., Hamilton, Ont.

SPINNING LATHES
Prybil Machine Co., P., New York City.

SPRING, MILLED
Barnes & Co., Wallace, Hamilton, Ont.

SPRINGS, SMALL SPIRAL HELICAL, COMPRESSION, EXTENSION, TORSION AND SPECIAL
Barnes Company, Wallace, Hamilton,

SPRINGS
Barnes Company, Wallace, Hamilton.
Cleveland Wire Spring Co., Clevleand, O.
Steele Ltd., James, Guelph, Ont.

SPRINGS, FLAT STEEL, BRUSH HOLDER, CLOCK, SMALL FLAT SPRINGS
Barnes Company, Wallace, Hamilton.

SPROCKETS AND CHAINS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Renold Hanson of Canada, Ltd., Montreal, Que.

SQUARES
Brown & Sharpe Mfg. Co., Providence, R.I.
Lufkin Rule Co., Windsor, Ont.
Steel Co. of Canada, Ltd., Hamilton. Ont.

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American Pulley Co., Philadelphia, Pa.
Barnes Company, Wallace, Hamilton.
Diamond Saw & Stamping Works, Buffalo, N. Y.
Parmenter & Bulloch Co., Gananoque, Ont.

STAMPS, STEEL
Diamond Saw & Stamping Works, Buffalo, N. Y.

STEEL CONCRETE REINFORCEMENT
Steel Co. of Canada, Ltd., Hamilton.

STEEL PLATE
British Empire Steel Co., Montreal, Que.

STEEL AND IRON BARS
Steel Co. of Canada, Ltd., Hamilton.

STEELS TOOL
British Empire Steel Co. Montreal Q.

STEEL, COLD-ROLLED STRIP
British Empire Steel Co., Montreal, Q.
Barnes Company, Wallace, Hamilton.

STEEL, CRUCIBLE, SPRING
Barnes, Company, Wallace, Hamilton.
British Empire Steel Co., Montreal, Q.

SHEETS, OPEN HEARTH STEEL
Steel Co., of Canada, Ltd., Hamilton.

STEEL, SHAFTING AND FREE CUTTING SCREW
Union Drawn Steel Co., Hamilton, Ont.

STEEL, SHEET
British Empire Steel Co., Montreal, Q.
Rice Lewis & Son, Ltd., Toronto, Ont.

STEEL, STAINLESS
Steel Co., of Can. Ltd., Hamilton, Ont.

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Atkins & Co., Ltd., Wm., Sheffield, Eng.
Can. Steel Foundries, Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton. Ont.

STEELS, HIGH-SPEED
Armstrong Bros. Tool Co., Chicago, Ill.
Atkins & Co., Ltd., Wm., Sheffield, England.
British Empire Steel Co., Montreal, Q.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton.

STEEL TUBING, CLOSE JOINT AND WELDED
Standard Tube & Fence Co., Ltd., Woodstock, Ont.

STERN FRAMES, CAST STEEL
Can. Steel Foundries, Montreal, Que.

STRAIGHTENING MACHINERY
Bertram Ltd., Edinburgh, Scotland.
Williams & Co., J. H., Brooklyn, N.Y.

STUDS
Galt Machine Screw Co., Galt, Ont.

BUYERS' DIRECTORY

STUD SETTERS, SELF-OPENING
Geometric Tool Co., New Haven, Conn.

SWAGING MACHINES
Atkins & Co., Inc., E. C., Indianapolis, Indiana.

SWITCHES, RAILWAY
Can. Steel Foundries, Montreal, Que.

TACHOMETERS
Bristol Co., Waterbury, Conn.

TANKS AND PUMPS, OIL
Bowser, S. F., & Co., Ltd., Toronto.

TAP HOLDERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
William L. Procunier, Chicago, Ill.

TAPER PINS
Galt Machine Screw Co., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

TAPES, MEASURING
Starrett Co., L. S., Athol, Mass.
Lufkin, Rule Co., Windsor, Ont.

TAPPING MACHINES AND ATTACHMENTS
Burke Machine Tool Co., Conneaut, O.
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Wm. L. Procunier, Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

TAPS AND DIES
Butterfield & Co., Inc., Rock Island, Q.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

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Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.

TEETH: DREDGE BUCKET
Kennedy & Sons, W., Owen Sound, Ont.

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Taylor Instrument Co., Toronto, Ont.
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Greenfield Tap and Die Corp., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

THREAD CUTTING MACHINES
Landis Machine Co., Inc., Waynesboro, Pa.

THREADING MACHINES
Acme Machinery Co., Cleveland, Ohio.
Geometric Tool Co., New Haven, Conn.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Williams Tool Corp., of Can. Ltd., Brantford, Ont.

THREAD LEAD TESTING MACHINES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

THREAD-ROLLING MACHINES
Bliss Co., E. W., Brooklyn, N. Y.

TIE PLATES
Steel Co. of Canada, Ltd., Hamilton.

TIME RECORDERS
International Business Machine Co., Ltd., Toronto, Ont.

TONGS
Hepburn Ltd., John T., Toronto. Ont.

TOOL CASES
Rice Lewis & Son, Ltd., Toronto, Ont.

TOOL HOLDERS
Armstrong Bros., Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Bertrams Ltd., Edinburgh, Scotland.

TOOL POSTS, LATHE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Williams & Co., J. H., Brooklyn, N. Y.

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(See Machinists' Small Tools)
Armstrong Bros. Tool Co., Chicago, Ill.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Lufkin Rule Co., Windsor, Ont.
National Machine Tool Co., Racine, Wis.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S. Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A.B., Toronto,

TOOL WORK
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TORCHES, BLOW
Rice Lewis & Son, Ltd., Toronto, Ont.

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Can. Steel Foundries, Montreal, Que.

TRACKWORK, MANGANESE STEEL
Can. Steel Foundries, Montreal, Que.

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Jones & Glassco, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound.
Petrie, Ltd., H. W., Toronto, Ont.
Renold, (Hans) of Canada, Ltd., Montreal, Que.

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Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
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Wright Mfg. Co., Lisbon, Ohio.

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Langley & Austin, Galt, Ont.

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E. C. Atkins & Co., Indianapolis, Ind.

WRENCHES, MACHINISTS'
Armstrong Bros. Tool Co., Chicago, Ill.

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Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

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Dominion Engineering Works, Limited, Montreal, Que.
Goldstein Mfg. Co., Ltd., Toronto, Ont.

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Bertram & Son Co., Ltd., The John Dundas, Ont.

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(See Lathes, Horizontal Turret)
Acme Machine Tool Co., Cincinnati, O.
Cook Co., Asa S., Hartford, Conn.
Gisholt Machine Co. Madison Wis.
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Pratt & Whitney Co. of Canada Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin

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Gisholt Machine Co. Madison, Wis.

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Fittings, Limited, Oshawa, Ont.

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Canada Metal Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Mon-
Dominion Engineering Works, Limited, Montreal, Que.

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Cleveland Pneumatic Tool Co., Toronto, Ontario.
Kempsmith Mfg Co., Milwaukee, Wis.

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Charles Parker Co., Meriden, Conn.

VISES, PLANER AND SHAPER
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Philip Gies Foundry, Kitchener, Ont.
Hendley Machine Co., Torrington, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

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Parmenter & Bulloch Co., Gananoque, Ontario.

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Bristol Co., Waterbury, Conn.

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Can. Link-Belt Co., Toronto, Ont.

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L'Air Liquide Society, Toronto, Ont.
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto, Ont.

WELDING APPARATUS
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.

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Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.

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Steel Co. of Canada, Ltd., Hamilton.

WELDING ROD, TOBIN, MANGANESE, BRONZE AND ALUMINUM
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Liquide Air Company, Toronto, Ont.

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Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.

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Hull Iron & Steel Foundries, Hull, Que.
Kennedy & Sons, Wm., Owen Sound, Ontario.

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Kennedy & Sons, Wm. Owen Sound, Ontario.

WINCHES, STOPLOG
Kennedy & Sons, Wm., Owen Sound, Ontario.

WIRE
Barnes Company, Wallace, Hamilton.
Canada Metal Co., Ltd., Toronto, Ont.
Dennis Wire & Iron Works, London, Ontario.
Greening Wire Co., B., Hamilton, Ont.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

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Barnes Company, Wallace, Hamilton.

WIRE, COPPER AND BRASS, FINE AND HEAVY
Steel Co., of Canada, Ltd., Hamilton, Ontario.

WIRE STRAIGHTENING AND CUTTING MACHINERY
Brown, Boggs & Co., Ltd., Hamilton, Ontario.

WIRE, WELDING
L'Air Liquide Society, Toronto, Ont.
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.

WIRES, SPECIAL
Dennis Wire & Iron Works, London, Ontario.
Greening Wire Co., B., Hamilton, Ont.

WOODWORKING MACHINERY
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Williams Machinery Co., A. R., Toronto, Ontario.

WRENCHES, DROP FORGED
Armstrong Bros. Tool Co., Chicago, Ill.
Canada Foundries & Forgings Co., Welland, Ont.

List of Directory of Dealers will be Found above Advertising Index

When answering advertisements kindly mention Canadian Machinery

DIRECTORY OF DEALERS

THE Buyers' Directory of CANADIAN MACHINERY was originally intended to contain information regarding lines actually manufactured by our advertisers. We now carry the advertising of leading machinery dealers, some of whom represent scores of manufacturers in addition to being manufacturers themselves in some cases. We recommend, therefore, if our subscribers cannot find what they want in our Directory that they communicate with the dealers whose names appear herewith.

MACHINE TOOLS, ETC.

Bertram & Sons, Ltd., John, Dundas, Ont.

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Garlock Machinery Ltd., Toronto.

H. W. Petrie, Ltd., Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

Yeates Machinery Co., London, Ont.

SHOP and FACTORY SUPPLIES

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Garlock Machinery Ltd., Toronto.

H. W. Petrie Ltd., Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

Yeates Machinery Co, London, Ont.

POWER EQUIPMENT, ETC.

The Canadian Fairbanks-Morse Co., Montreal, Que.

H. W. Petrie, Ltd., Toronto, Ont.

WOODWORKING MACHINERY

The Canadian Fairbanks-Morse Co., Montreal, Que.

Garlock Machinery Ltd., Toronto.

H. W. Petrie Ltd., Toronto, Ont

A. R. Williams Machinery Co, Toronto, Ont.

Yeates Machinery Co., London, Ont.

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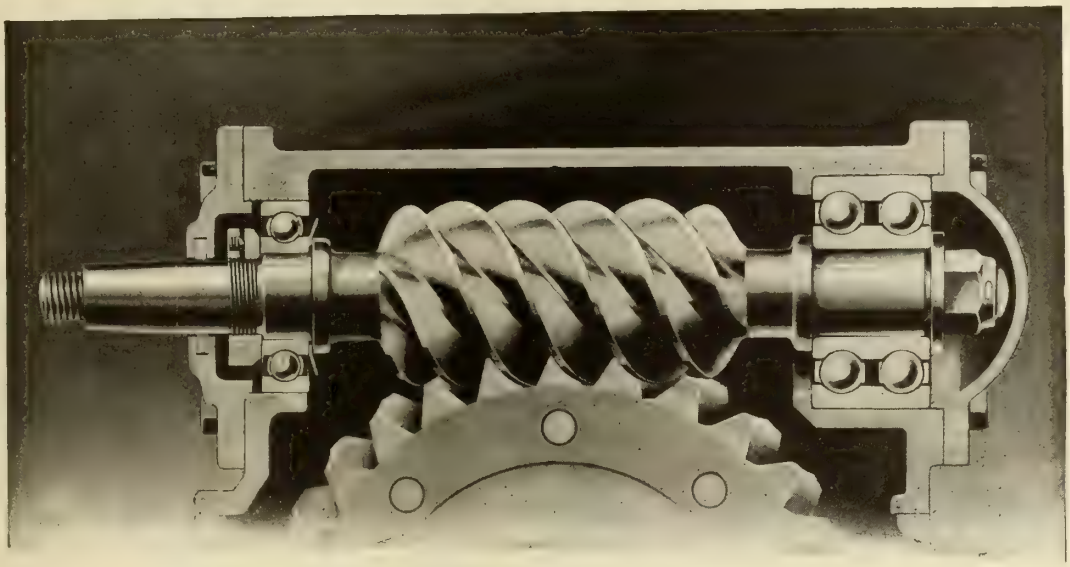

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CANADIAN **SKF** COMPANY, LIMITED

TORONTO AND MONTREAL

708

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The new Starrett Pistol Grip Adjustable Hacksaw Frame

The frame you would make if you were designing a hack saw for your own personal use. Substantially built and beautifully finished—checked hard rubber handle and stream line design.

This new Hack Saw Frame has several features not found on any other frame on the market. Constant spring tension on the bolts that hold the blade and a positive adjustment on the tubular back, make blade changing a quick and easy operation. Without removing the wing nut, the blade can be set to cut four ways and any length from 8 to 12 inches can be used.

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Write for Catalog No. 223 and the Supplement describing the new Starrett Tools.

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The World's Greatest Toolmakers
Manufacturers of Hacksaws Unexcelled
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42-303

STARRETT TOOLS — STARRETT HACK SAWS CUT QUICKER LAST LONGER

Starrett Hack Saws

CANADIAN MACHINERY AND MANUFACTURING NEWS

Vol. XXVIII. No. 5 Published Weekly by the MacLean Publishing Company, Limited, Toronto, Ont. August 3, 1922 $4.00 a Year Subscription Price

READ AND PASS TO	Check	See Page	READ AND PASS TO	Check	See Page

These Are Important Dates

One problem, sometimes clouding the industrial perspective under conditions such as exist to-day is that which has to do with definite objective. There is so much sameness in the average outlook, manufacturers declare, that there is danger of it becoming deceptive.

That is why positive plans have the advantage over negative attitude. They act as a guide to future action. That is why we submit to our advertisers the following list of feature articles and numbers, selected from our program for the next three months. They represent special advertising values calculated to give particular emphasis to your campaign.

Feature Numbers

SEPTEMBER 28—Do It Pneumatically—Describing and illustrating the application of pneumatic tools and other equipment in modern production.
OCTOBER 19—Do It Automatically. This will deal with a large and important field—the automatic tools and machinery in their relation to industrial achievement.

Feature Articles

AUGUST 24—Production Drilling—Examples of Work Performed.
SEPTEMBER 7—The Value of Die Casting to Industry.
OCTOBER 5—Making the Repair Shop PAY Its Way.
OCTOBER 12—Securing Production by Means of the Turret Lathe.
OCTOBER 26—Are You Losing Money on YOUR Benches?

The above articles and numbers, valuable to the manufacturer desiring to develop the interest of his market, will also have their appeal to the man who would post himself upon best developments in engineering and mechanical enterprise. They are selected from a program comprising a wide range of important subjects. They constitute a message of co-operation from

CANADIAN MACHINERY AND MANUFACTURING NEWS

143-153 University Avenue, Toronto, Ontario

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The BERTRAM Page

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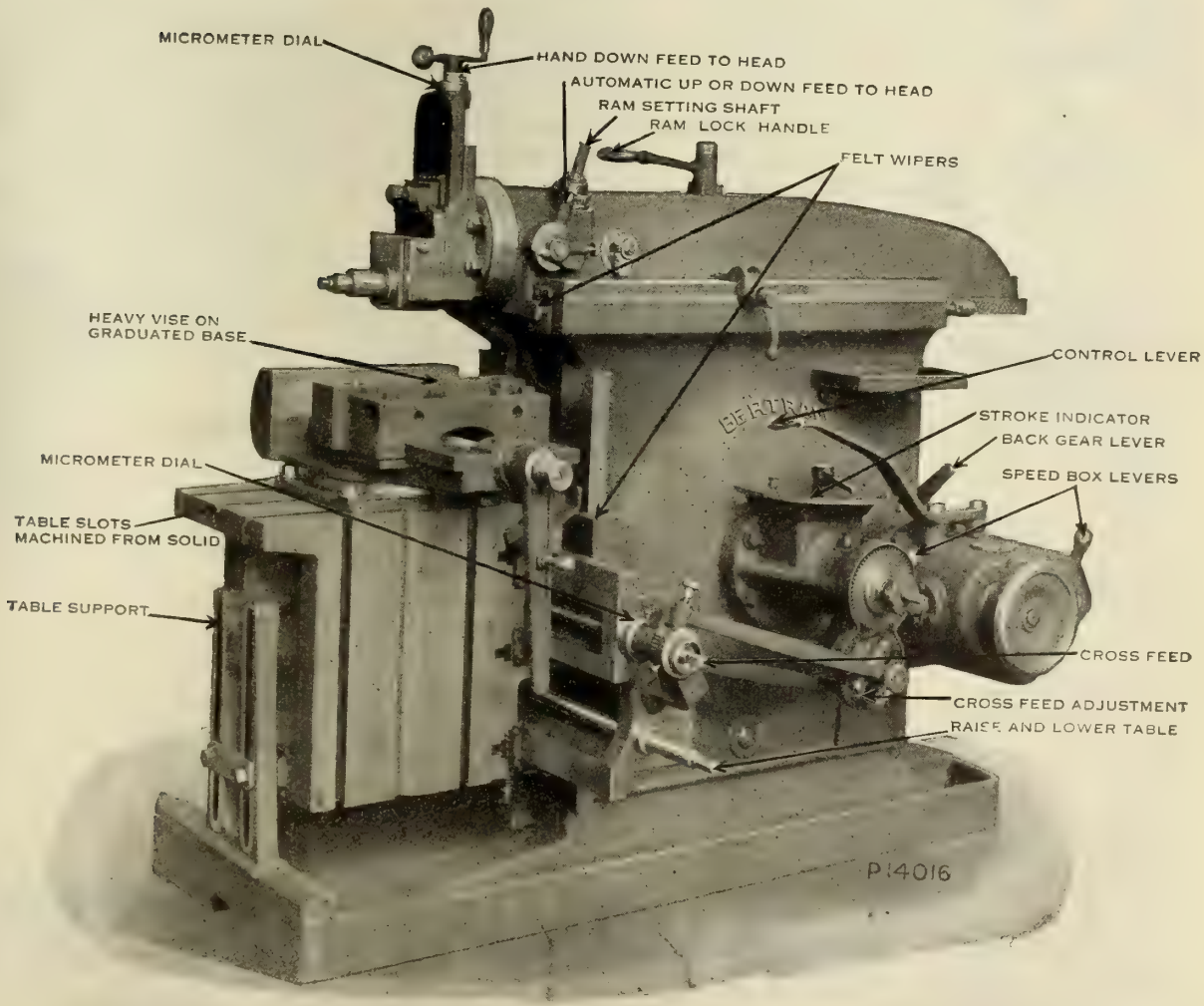
A Sturdy and Convenient Tool



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Esterbrook-Allcard High Speed Drills
Norton Grinding Wheels
Dick's Balata Belting
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ATHOL, MASS.

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Starrett Tools

42-351

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BILLETS SLABS
STRUCTURAL STEEL
MERCHANT BARS
CONCRETE REINFORCING BARS
IRON, BRASS AND BRONZE CASTINGS

Prompt Shipments from Stock

SULPHURIC ACID
NITRE CAKE

ALGOMA STEEL CORPORATION, LTD.

SAULT STE. MARIE, ONTARIO

SALES OFFICES:

Montreal: 606 McGill Building

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Genuine Bitisrh Oak Tanned Belting

YOU cannot afford to use belting that is cheaply made—of poor leather and by slipshod methods. Under-cut prices may appeal—at first, but pretty soon you run into belt-slippage and that's where you start in to add to the first cost.

Every foot of D. K. McLaren's Belting is made from the backs of choicest hides and is subjected to the Genuine **British Oak Tanning Process**. It is this that gives it a toughness, flexibility and gripping power that reduces belt-slippage to a positive minimum.

D. K. McLAREN LIMITED

Head Office and Factory
351 St. James St., Montreal, P. Q.

Calgary, Gormans, Ltd. Edmonton—Gormans, Ltd. Toronto, 194 King St West

St. John, N.B., 90 Germain St. Vancouver, Gormans Limited, 1158 Homer St

Carbons for Electric Arc Welding

THE electric welding industry has been tremendously advanced by the high development of arc carbons for specific purposes. We manufacture the following grades, named in the order of their current carrying capacities:—

Plain Welding Carbon:
A hard carbon for Ordinary service.

Columbia Welding Carbon:
Very hard. It can also be furnished copper coated, making it suitable for use as a cutting electrode as well as for heavy welding work.

Special Graphite Welding Carbon:
Rather soft and graphitic. High conductivity. Used where a high amperage is required. Used with excellent results on general work.

CANADIAN NATIONAL CARBON CO. LIMITED

TORONTO - CANADA

C N C

2062

BURKE Millers

Handling big jobs with speed and accuracy is the purpose of this little machine. Small in size but substantially built, it is a space-saver and cost-saver combined. Slotting and vertical milling attachments; index centres—either stationary or tilting heads and other features recommend the Burke No. 3 for every shop.

BURKE

Supplied in both Bench and Pedestal types.

PRICE BENCH TYPE $155

WITH FLOOR COLUMN $171

Write for circular and prices quotations.

THE BURKE MACHINE TOOL CO.
520 Sandusky St., Conneaut, Ohio, U.S.A.

Canadian Dealers:—H. W. Petrie, Ltd., National Machinery & Supply Co., A. R. Williams Machinery & Supply Co., Canadian Fairbanks-Morse Co., Williams & Wilson, Garlock-Walker Machinery Co., Yeates Machinery Co., Cope & Sons.

Buried in the Work and Broke!

Next time a tap breaks below the surface of a large casting, don't let some makeshift method of removing it injure the thread and waste half an hour of valuable production time. Instead—

Walton it Out in a Jiffy

And save the casting.

Special analysis steel fingers of the Walton Extractor drop into the flutes of the broken tap—and grip. Then a few turns of a wrench applied to the squared end of the Extractor backs out the buried tap.

Sixty-day trial offer proves the Walton Extractor pays for itself. Write.

The Walton Co.
Hartford, Conn.

Shall cleaning room capacity be increased by employing a more efficient cleaning material?

OR?

or—shall capacity be increased by spending more money for equipment and labor?

More work from the same cleaning tanks— or more equipment and more men?

"This Advertisement is one of a series based on actual occurrences."

AS production increases, the cleaning of work in process of manufacture must keep pace. This often results in a condition where it apparently becomes necessary to provide for increased equipment and labor in order to keep up with the growing volume of cleaning work.

But many plants and shops have found that there is another way to solve this problem. They have found that by using Oakite materials and methods they could avoid the expense of extra equipment and would not have to put more men on the job. The reason is that Oakite cleans *faster* than the materials they have been using and cleans with absolute thoroughness.

Write for our booklet "Modern Metal Cleaning"

This fact is well emphasized by the experience of a large electrical equipment plant. Increasing demand for its products created a cleaning problem. Based on the equipment and materials in use it was evident that the capacity of the cleaning room had to be doubled.

The situation was met most satisfactorily, not by spending money for new tank equipment, nor by adding to the payroll, but by using Oakite cleaning materials and by making a few changes in the method of handling the cleaning job. They report they are handling their cleaning work faster and better than they believed was possible, and they are having no trouble in keeping up with the demand.

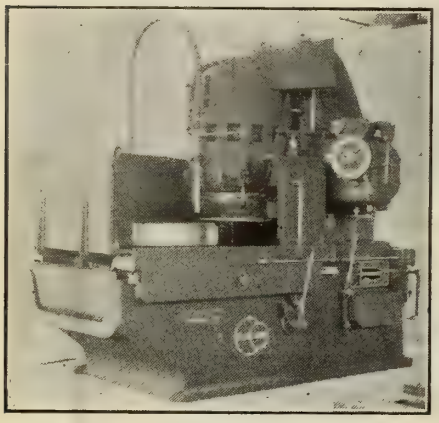
If you have need for faster, better cleaning we can help you. It incurs no obligation to have a friendly talk with one of our experienced Service Men. Out of his broad experience and ability you are sure to get some useful ideas that are worth while. Drop us a postal card—it is a little thing to do but a big step in the right direction.

OAKITE

MANUFACTURED BY OAKLEY CHEMICAL CO. 44 THAMES ST. NEW YORK

Resident Canadian Representatives: MR. C. BURGIN, Montreal; MR. C. P. MURPHY, Toronto

THE JOHNSON FRICTION CLUTCH
AS USED ON THE
NEW No. 27-R, BLANCHARD VERTICAL SURFACE GRINDER



Courtesy The Blanchard Machine Co., Cambridge, Mass.

Another advance of progress in abrasive engineering is the use of Johnson friction clutches on this *NEW* machine.

Two No. 6 double clutches provide for rapid raising or lowering of the wheel.

One No. 10 single clutch is located in the gear box for rotating table.

The **AUTOMOTIVE INDUSTRY** demands reliable friction control—the Johnson Friction Clutch is the answer.

Write for Stock List and Yellow Catalog

Double Clutch-Exterior

THE CARLYLE JOHNSON MACHINE CO. MANCHESTER-CONN

STEEL CASTINGS

QUICK DELIVERIES

High Carbon Steel
Manganese Steel
Chrome Steel
Mild Steel

QUALITY GUARANTEED

Sizes—½lb. to 5,000 lbs.

THE WILLIAM KENNEDY & SONS
LIMITED
OWEN SOUND, ONTARIO
ESTABLISHED 1860

WRIGHT HOIST

WHY take a chance in hoisting when you are guaranteed absolute safety in the Wright High Speed Hoist

It's a one man hoist adapted to every type of hoisting operation.

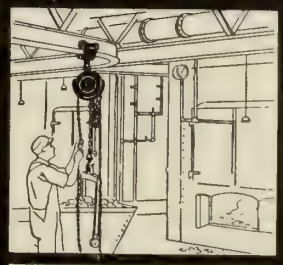
All steel — ruggedly built—easily operated —speedy and safe.

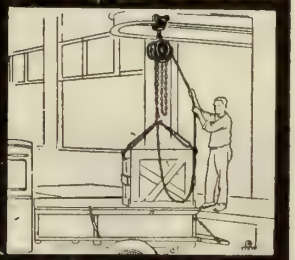
It will cut your hoisting costs.

Do you want all the facts? Write us

WRIGHT MANUFACTURING COMPANY

CANADIAN DISTRIBUTORS:
The A. R. Williams Machinery Co., St. John, Halifax, Toronto, Winnipeg, Vancouver, Montreal.

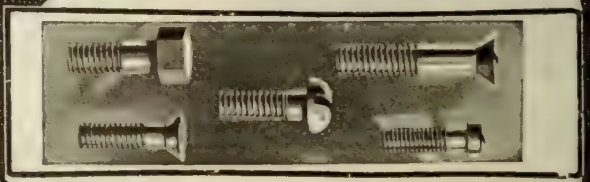




WRIGHT HOIST

Wood Screw Making Machinery

SEND FOR CATALOGUE



For sixty years we have constantly manufactured machinery for making screws, always studying to improve and refine our product.

Write or Wire us.

Cable address: "Cook,"
Hartford, U.S.A.
Codes: Liebers
Western Union

Asa S. Cook Co.
Hartford, Conn.

TRACKWORK

FOR STEAM AND ELECTRIC RAILWAYS OF ANY STANDARD SECTION

MANGANESE-STEEL SPECIAL WORK

Frogs, Diamond Crossings, Crosses, Switches, Mates and Complete Intersections to meet any traffic requirements.

Makers of Balkwill Articulated Manganese-Steel Crossings

CANADIAN STEEL FOUNDRIES LIMITED

Transportaton Building - Montreal

METAL WORKERS' CRAYONS

Sawed from the Purest Talc

These crayons are medium hard and *guaranteed* free from grit. Every crayon is uniform—made from absolutely pure talc. Equal to the best imported products—but lower in price.

Send coupon for free sample. Fill in, clip and mail the coupon to-day.

H. H. Wood Talc Company

Head Office and Factory

MINE CENTRE, ONT.

TORONTO
82 Richmond St. E.

MONTREAL
131 St. Paul St. W.

WINNIPEG
259-261 Stanley St.

H. H. WOOD
TALC COMPANY
Mine Centre, Ont.

Gentlemen:—

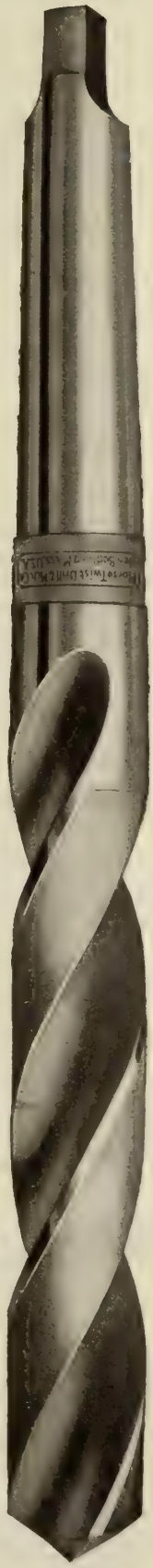
Kindly send me by return mail, free of charge, one metal worker's crayon that I may test its real quality on my work.

NAME .....

FIRM NAME .....

ADDRESS .....

This High Speed Drill is designed for Speed and Accuracy—Which means True Economy in the long run



Morse Twist Drill & Machine Co.
New Bedford, Mass., U.S.A.

GENUINE EMERY

Sizes 180, 160, 140, 120, 110, 100, 90, 80, 70, 60, 54, 46, 40, 36, 30, 24, 20, 18, 16, 14, 12, 10, 9, 8, hole.

EMERY FLOUR AND WASHED FLOUR

Emery
Glass
Flint
Garnet
Corundum
Carborundum

Paper and Cloth

In Sheets, Rolls, Discs, Bands, Strips and Tapes, &c.

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LIMITED
WELLINGTON MILLS
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Pyrometer Tubes
Protecting Tubes
Combustion Tubes
HEAT-RESISTING CASTINGS

UNUSUAL SHAPES OUR SPECIALTY

Made in Canada

Hiram Walker & Sons Metal Products
WALKERVILLE, ONTARIO. Limited

BROWN-BOGGS

B B

Service You Can Depend Upon

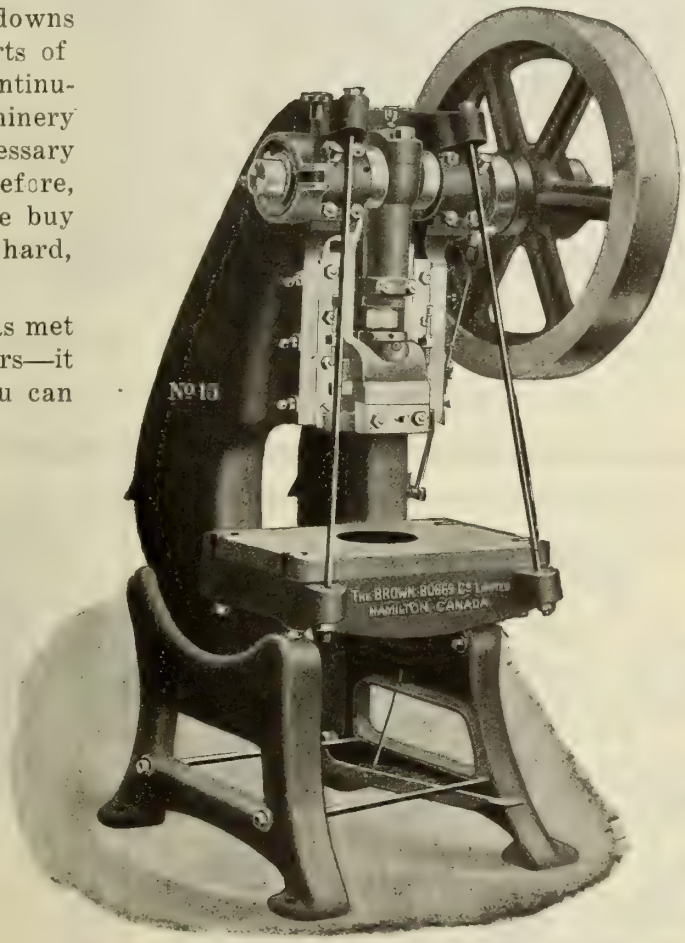
OUTPUT lost through breakdowns cannot be made up by spurts of speed. Only by the steady continuous operation of efficient machinery is it possible to maintain the necessary volume of production. Therefore, when you are buying a machine buy one which will give you long, hard, continuous and efficient service.

For half a century "B-B" line has met the approval of particular buyers—it has a reputation for service you can depend upon.

The "B-B" Line

The "B-B" line comprises tinsmiths' tools and sheet metal working machines of all kinds; canners' and evaporators' machinery; shears of every description; power presses for punching, forming, embossing, blanking.

We shall be glad to send you catalogs containing full descriptions of the machines and tools in which you are interested.



No. 15—Power Press

TORONTO OFFICE:
Holbrook Building

A. B. WALKER,
Representative

THE BROWN-BOGGS CO. LIMITED
HAMILTON, CANADA.

Tapping 1,200 Control Rod Clevices Per Day

And doing it regularly WITHOUT BROKEN TAPS is an achievement possible only with the

"Procunier" Safety Tapping Attachment

the only device on the market having a **balanced** reversing mechanism, which eliminates all side pull or torsion.

Its positive grip on the tap gives steady production; automatic reverse as the drill press spindle is raised saves time and prevents damage to tap or work in backing out; reversing at twice the forward speed increases rate of output.

WILLIAM L. PROCUNIER THE PROCUNIER LINE CHICAGO ILL.

Ask us for actual facts and figures as proof that Procunier Tapping Attachments will increase your production without increased costs.

WILLIAM L. PROCUNIER, 18 South Clinton St., CHICAGO, ILL.

Ontario Distributor: H. A. HARRISON, 220 King St. West, Toronto, Ontario

Suitable for Every Purpose

Whatever the requirement, there is an Armstrong Dog or Clamp that, in design, quality of material and expert workmanship, is best suited to that particular purpose.

Write for Catalogue

ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"

306 N. Francisco Ave., Chicago, U.S.A.

Canadian Agents:

A. R. Williams Machinery Company, Toronto, Halifax, St. John.
Williams & Wilson, Montreal.

One of These Gauges is Saving a Firm $1,200 a Month !

The same combination of circumstances may never occur in relation to your own gas supply, but this situation which is vouched for by the firm's own figures, actually exists. It may serve to suggest some place in your own plant where a reliable

TRADE MARK
BRISTOL'S
REG. U.S. PAT. OFFICE

Pressure Gauge

can save you money. Gas, air, steam and many liquids are being accurately measured and continuously recorded by one and another of the Bristol pressure gauges.

Full details will be found in Bulletin 1-1005.

THE BRISTOL CO., Waterbury, Conn.

Canadian Distributor

A. H. WINTER JOYNER

TORONTO MONTREAL

"Bristolize for '22"

HENDEY

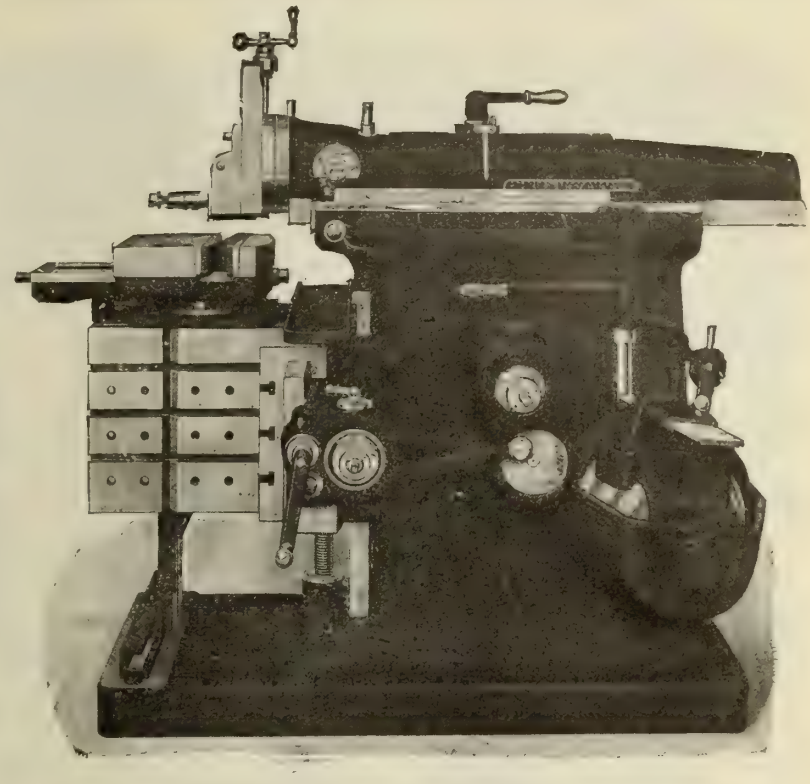
You Need It
For Those Particular Jobs

WHEN you are up against a particular job that requires careful machining and the time set for finishing is short, you naturally look about for a machine tool that has an ability record.

Hendey Shapers produce to the closest limits and exert a power behind the tool that appreciably reduces operating time. For keeping the volume and accuracy of your products up and the producing cost down, you need Hendey Shapers.

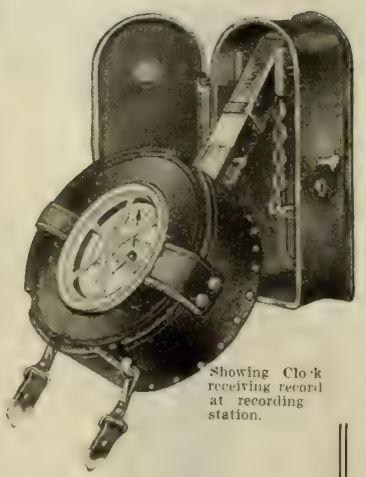
The Hendey Machine Co.
Torrington, Conn., U.S.A.

Canadian Agents:
A. R. Williams Machinery Co., Toronto, St. John, N.B., Winnipeg and Vancouver.
Williams & Wilson, Montreal.



Hendey 20-in. Crank Shaper

Your Watchman Is Only Human



Showing Clock receiving record at recording station.

What proof have you that your watchman is "on the job" all the time? How can you be sure he'll be on hand to notice any small blaze that might occur—one of those small blazes that often mean ruin if not caught in time? He's only human, you know. He may mean to do right but—supposing you **knew** he "slipped a round" once in a while—would you sleep easy?

Sure, you'd get your insurance in case of fire, you might even re-build; but what about loss of production and disorganization in the meantime? Worth a few minutes thought, isn't it?

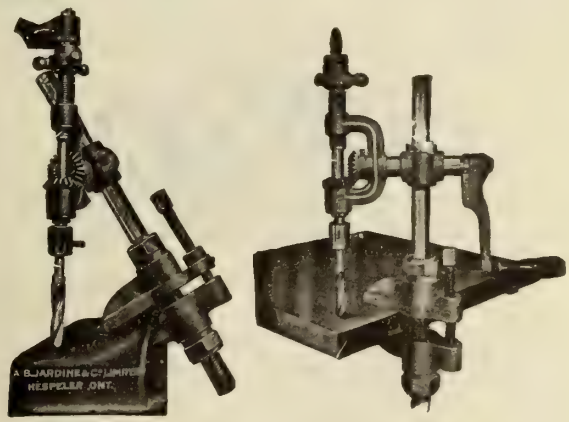
Let us tell you just how the Hardinge System will **protect** you absolutely. No wiring or other complications, the only tool needed is a screw-driver. It's ridiculously inexpensive too.

This is what we'll do. We will install the system in your plant for 30 days' trial without suggestion or prompting from us. If it doesn't convince you it's something you can't do without, there's no harm done—all the charges are on us. How about it?

Hardinge Bros. of Canada, Ltd.
47 Wellington St. E. TORONTO 50 Front St. E.

Jardine Universal Ratchet Drill

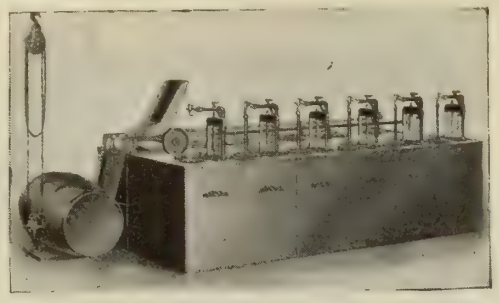
Time is expensive when a machine is standing idle, waiting for repairs.



On the average repair job, this machine completes the drilling in less than the time required to set an ordinary ratchet to begin.

Weight, 40 lbs. Price, $26.50 net.
Sold by all Machinery and Supply Houses.

A. B. JARDINE & CO., Limited
HESPELER, ONTARIO



Save Money and Machinery by Correct Storage

Save labor, be sure of clean oil, eliminate fire hazards—and buy less oil—by using Bowser Piston-Type Measuring Pump for handling oils.

Accurate measurement saves oil; Bowsers are accurate. Oil-tight construction eliminates losses—Bowsers are oil-tight. Spillage means waste—Bowsers prevent spillage. And such a battery of oil tanks as is shown saves hand labor—cuts down operating costs and overhead.

Full details, as to exactly how much money you can save per year, and how soon the Bowser equipment will pay for itself, will be supplied by our engineering division. Ask for illustrated Folder C-13, and state your problem briefly.

Bowser equipment is MADE IN CANADA by

S. F. BOWSER & CO., LTD.

Toronto - - - Canada

Branch Offices and Service Departments throughout Canada and in principal cities abroad.

BOWSER ESTABLISHED 1885

ACCURATE MEASURING PUMPS

Bowser Products

For Handling Gasoline and Oils Wherever Sold or Used

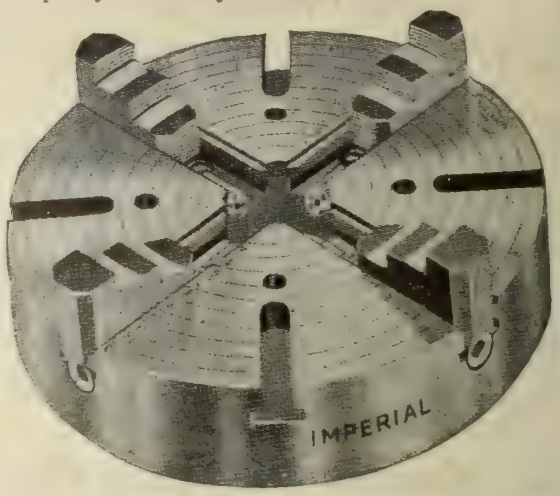
Filling Station Pumps and Tanks for Gasoline.
Portable Tanks for Oil and Gasoline.
Storage and Measuring Outfits for Paint Oils, Kerosene and Lubricating Oils.
Carload Oil Storage Tanks.
Power Pumps.
Dry Cleaners' Underground Naphtha Clarifying Systems.
Richardson-Phenix Oil Circulating and Filtering Systems and Force Feed Lubricators.

Write for Booklets

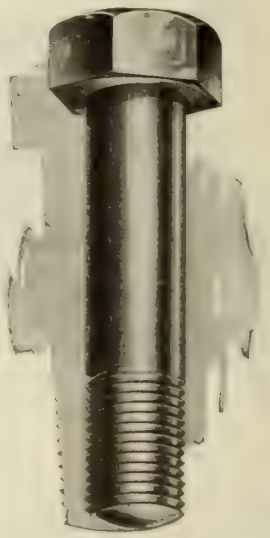
IMPERIAL LATHE CHUCKS

Highly Endorsed by Canada's Best Manufacturers

Sturdy long-wearing "Made-in-Canada" Chucks that are making good everywhere. Specify them in your next order.



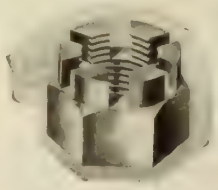
Ker & Goodwin Machinery Co.
BRANTFORD, Ont. LIMITED



ACCURACY

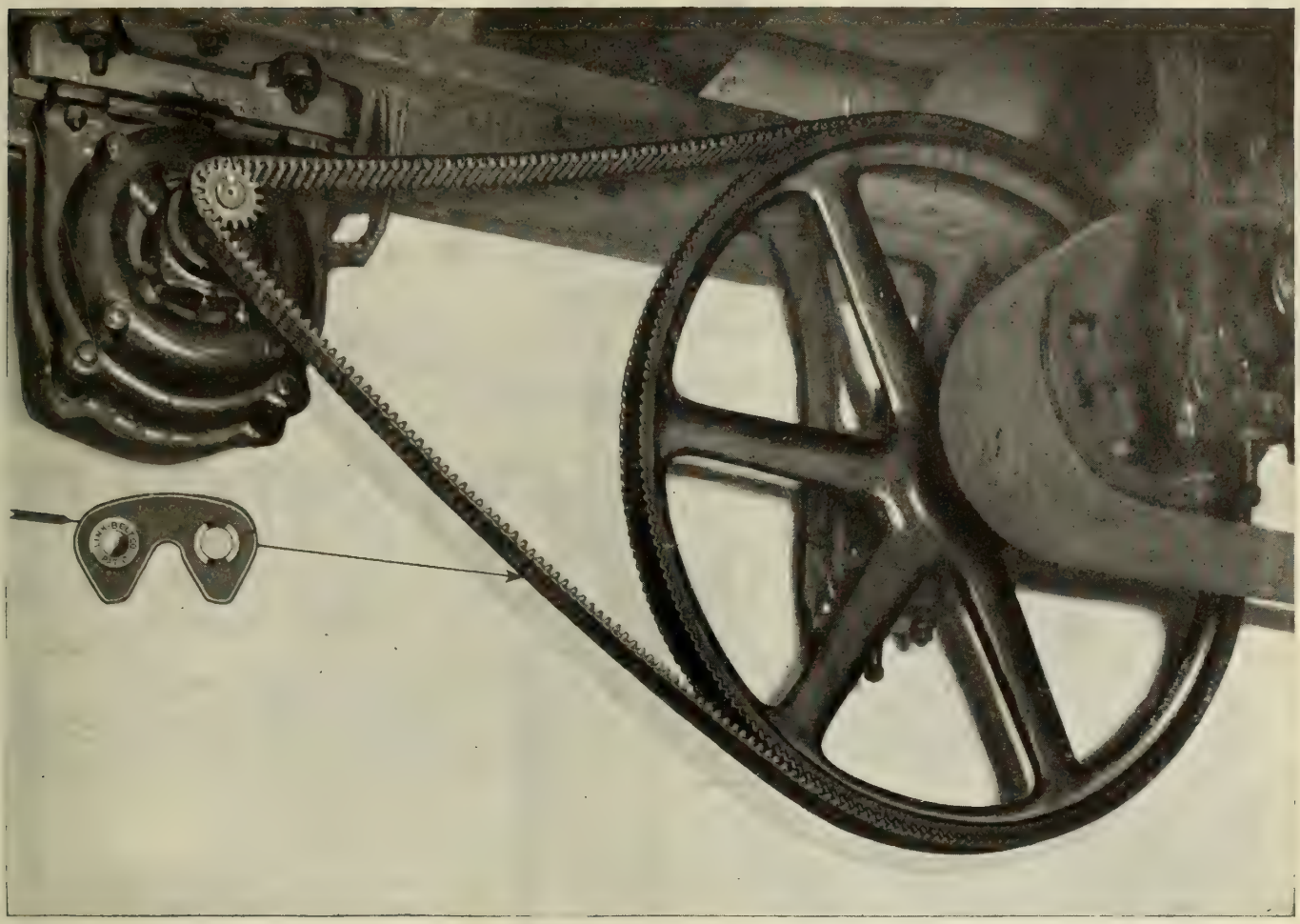
Just now all jobbers should have a complete stock of SAE Cap Screws, Plain and Castellated Nuts and Taper Pins to meet the automobile repair trade requirements.

Your rush orders filled promptly by



The Galt Machine Screw Co., Limited
GALT, ONTARIO

Eastern Representatives:
Messrs. F. BACON & COMPANY
131 St. Paul Street West, Montreal, Que.
Western Representative:
Mr. D. PHILIP
138 Portage Avenue, Winnipeg, Man.



Flexible as a Belt—
Positive as a Gear—
More Efficient than either.

THE LINESHAFT DRIVE

THE efficient method of driving lineshafting and machinery of every character, in every industry, is through Link-Belt Silent Chain.

The motor is thus chained to the machine or shaft There can be no slippage. The "flow" of power is always uniform.

When encased in a Link-Belt dust-proof, oil-retaining casing this drive forms the ideal method of transmitting power, requiring the least attention and inspection and making for safety-first conditions in the plant or factory.

Send for Link-Belt Silent Chain Data Book No. 125.

CANADIAN LINK-BELT COMPANY LIMITED

TORONTO-Wellington & Peter Streets **Montreal-10 St. Micheal's Lane**

LINK-BELT

CUT GEARS

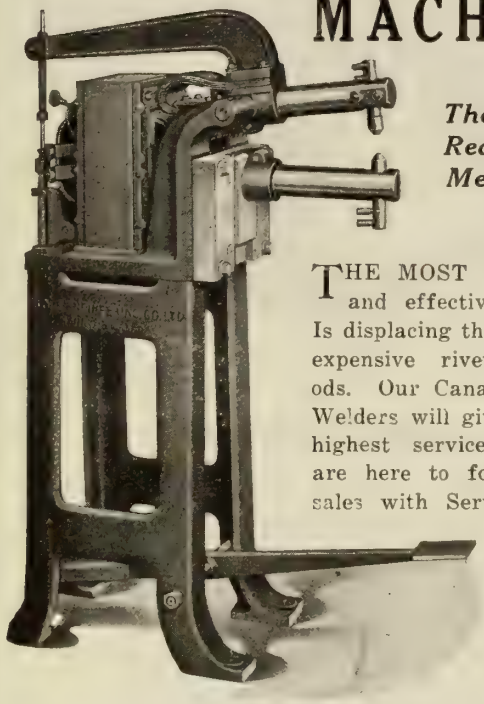
Theoretically Correct

PROMPT SERVICE

ROBERT GARDNER & SON
LIMITED
52 NAZARETH ST., MONTREAL, P. Q.

RAWHIDE OR METAL

ELECTRIC WELDING MACHINES



The Cost-Reducing Method

THE MOST economical and effective method. Is displacing the slow and expensive riveting methods. Our Canadian-made Welders will give you the highest service, for we are here to follow our sales with Service.

Illustration Shows our standard Spot Welder, adaptable for all classes of Spot and Lap welding up to ⅜ in. thick.

GLOBE ENGINEERING CO., LTD.
125 MARY ST. - HAMILTON, ONT.

GISHOLT

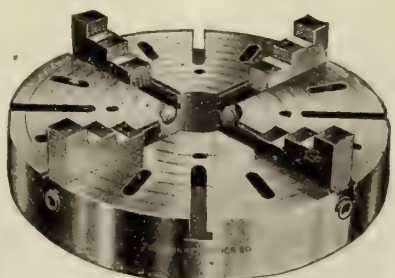
LABOR SAVING EQUIPMENT

TURRET LATHES
Hand Operated
For Chucking and Bar Work
AUTOMATIC TURRET LATHES
For Chucking Work
VERTICAL BORING and TURNING MILLS
UNIVERSAL TOOL GRINDERS
HORIZONTAL BORING and DRILLING MACHINES
CYLINDER GRINDERS
TOOL-POST TOOL HOLDERS
REAMERS, "SOLID ADJUSTABLE"
Shell and Chucking
BORING BARS
With Adjustable Cutters
PERIODOGRAPH
For Time Recording in Factories
Separate Catalogs on each Product
Send for the ones you want

GISHOLT MACHINE CO.
1207 E. Washington Avenue
Madison, Wisconsin, U. S. A.

SKINNER STEEL BODY INDEPENDENT CHUCK

Trade Mark



POWERFUL--STURDY--DEPENDABLE--ACCURATE

For production, where exceptional gripping power is required, where heavy cuts are often necessary and large pieces are held, this type of chuck will render most satisfactory service.

Although the Skinner Steel Body Chuck has been in use for years, we have never known of one breaking in service. It is the heaviest, strongest Independent Chuck made.

Body—Cast Steel. Jaws—Extra wide. Adjusting screws—Large diameter.
Illustrated literature and catalogue on request.

THE SKINNER CHUCK COMPANY
NEW BRITAIN CONN., U.S.A.
Established 1887

New York Office: 94 Reade Street.
San Francisco Office: Rialto Building
Chicago Office: 552 W. Washington Blvd.
London Office: 139 Queen Victoria St., E. C. 4.

THE MORSE CHAIN CO.

are the

Largest Manufacturers in the world

of

High Speed Silent Chains

The superiority of Morse Rocker Joint Silent Chain has never been seriously questioned.

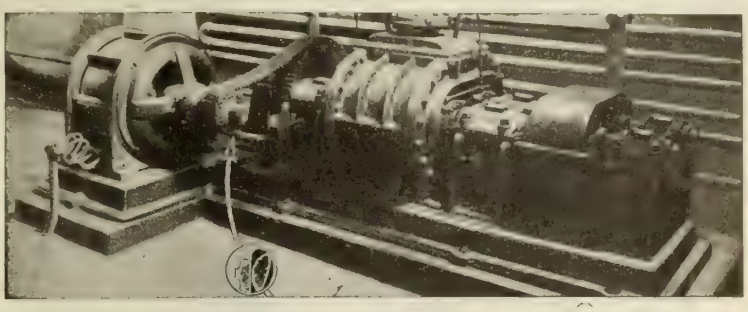
They speed up production, cut belt expense and overtime wages.

Catalogue Free.

Jones & Glassco (Reg'd)

Canadian Agents

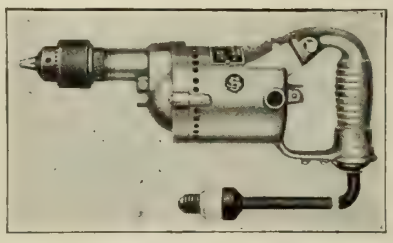
Montreal - - Toronto

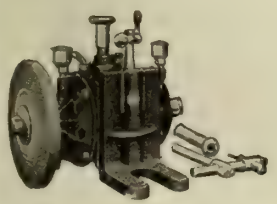


25 H.P. Morse Silent Chain to Positive Blower.

U. S. ELECTRIC
Drills and Grinders
Can be Attached to any Lamp Socket

For drilling in metal these drills are the superior of every other kind of portable drill. Their operating cost is only half that of air drills. And they can be attached to any lamp socket.





Made in several sizes from 3-16″ to 1¼″. Motors wound for alternating or direct current, or both, 110 or 220 volts.

A trial will prove that our drills and grinders will save you time, labor, and expense. Order a few today.

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THE UNITED STATES ELECTRICAL TOOL CO.

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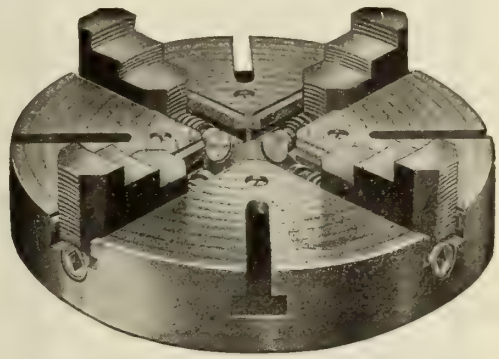
are not an experiment—they have come to stay. They are a necessity with the modern machinery and high-speed steel cutting tools.



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are well designed and have all the elements of strength and durability for which they are designed. We make other types in steel also, including the Geared Scroll Chucks and the Geared Scroll Combination—all designed for heavy work and hard usage.

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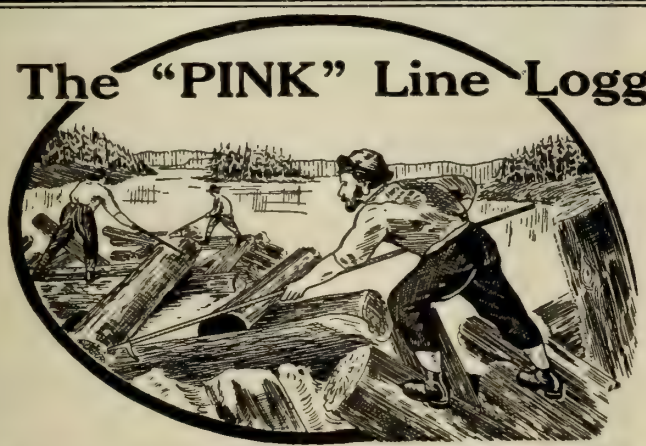
The "PINK" Line Logging Tools and Handles



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We export the same good quality of lumbering tools that have made PINK'S TOOLS a by-word in the matter of good tools in all Canadian lumber camps. Enquiries cordially solicited.

Thomas Pink Co., Limited

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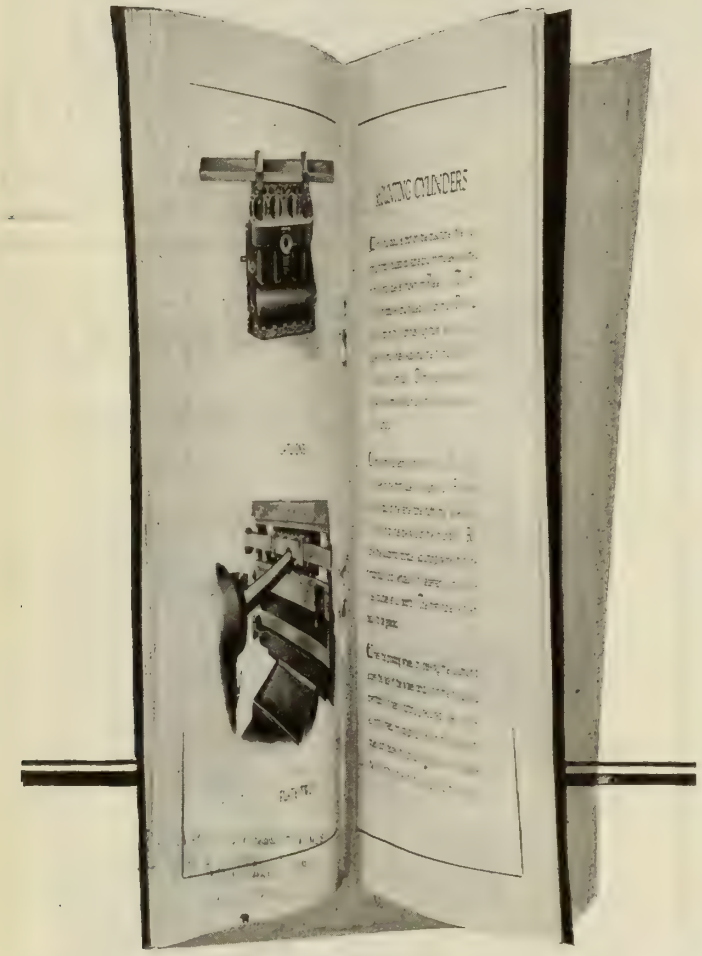

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1800 Staybolt Holes

THAT is the number of staybolt holes tapped with ONE GTD Maxi Staybolt Tap in a large eastern railroad shop (name on request). This is by no means an unusual Maxitap performance, for due to the uniform quality of material and workmanship which distinguishes GTD products we expect every

GTD Maxi Staybolt Tap

which we sell to do equally well under similar conditions. It is a typical example of GTD service in railroad shops, which is measured not by the number of taps sold but by the number of holes tapped per tap.

Designed and tempered to meet the exacting requirements of railroad repair work, as well as new work, Maxitaps stand up under the worst conditions encountered—the retapping of old sheets through rust, mud and water scale.

Maxitaps thread more holes, do better work and cut tapping cost wherever used—because of special design and heat treatment. One treatment for new, another for repair work. This "personality" is one reason for the "Maxitap's" production records.

The GTD organization is ready to consult with you on your threading and tapping work.

Write to-day for detailed information.

Ask for Bulletin 129C.

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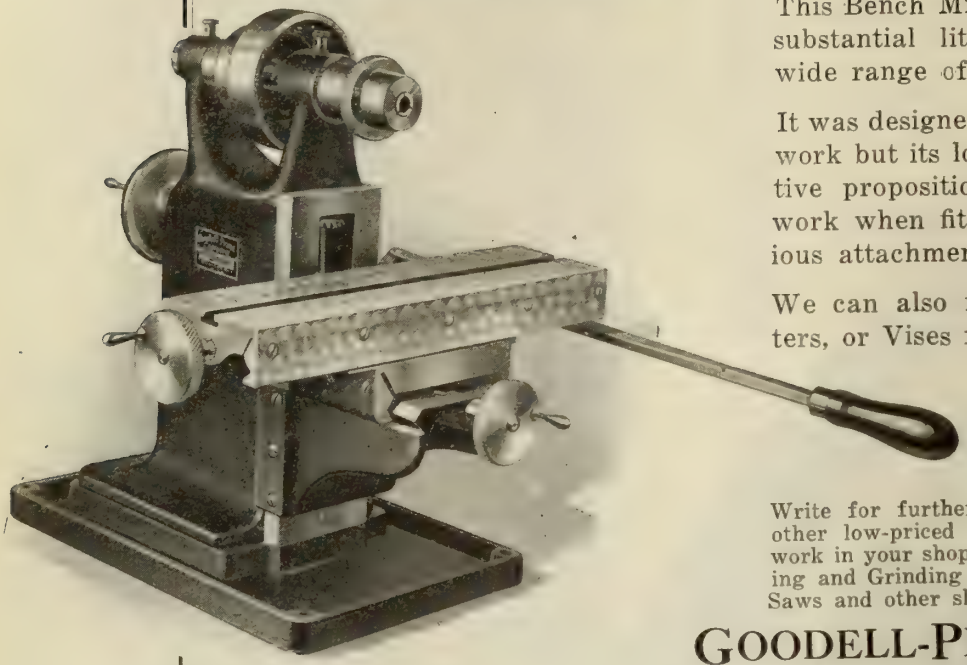

BENCH MILLING MACHINE No. 644

For Experimental Work and Light Manufacturing

This Bench Milling Machine is a solid and substantial little machine capable of a wide range of work.

It was designed primarily for experimental work but its low price makes it an attractive proposition for light manufacturing work when fitted by the owner with various attachments for special purposes.

We can also furnish Arbors, Index Centers, or Vises for this machine.

List Price
$150.00
with liberal discount.

Write for further particulars regarding this and other low-priced Goodell-Pratt machines for light work in your shop. We make Bench Lathes, Polishing and Grinding Heads, Drill Chucks, Vises, Hack Saws and other shop equipment.

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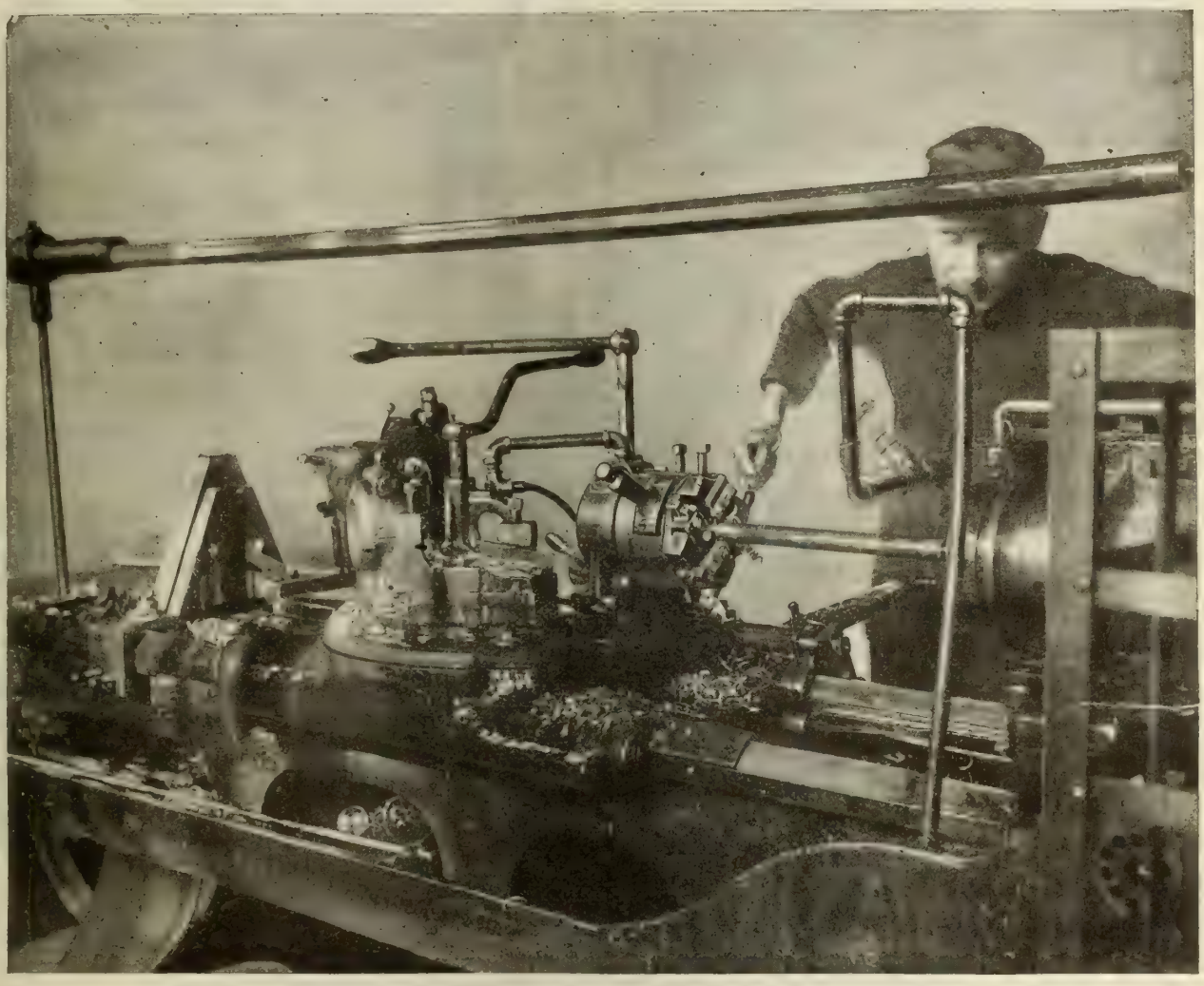
You Take No Risk When You Install the New Type Landis Automatic Die Head



This photograph shows a New Type Landis Automatic Die Head working in a large Canadian plant. Our customer writes: "We are well satisfied with the working of this tool and also the economy in the chasers."

They knew this head would be satisfactory because they have long used the Landis Rotary Head and realized the savings which the Landis Chaser made in their thread cutting.

Landis Automatic Die Heads are similar in design to the rotary type and embody all the features which made the latter a complete success. Furthermore, it employs the Landis chaser, which gives the advantages of the variable cutting angle, the tangential disposition of the chaser to the stock, the interchangeability feature, the simple grinding feature and the fact that annealing, hobbing and retempering are eliminated. These features make for good threads, high production, low chaser cost and dependability.

Would you be interested in trying a New Type Landis Automatic Die Head?

Write at once.

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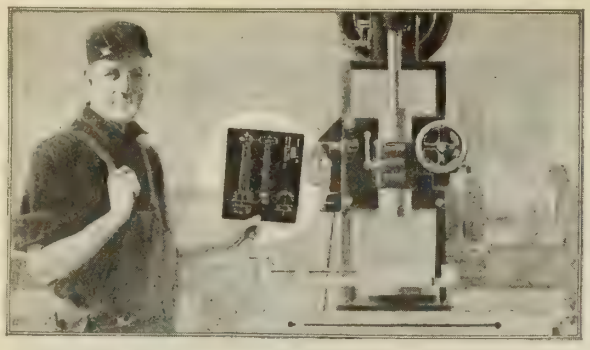

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Even your most conscientious machinist doesn't have to "make sure" about any figures or lines on a PHOTOSTAT print. He knows that the print was made directly from the original drawing, not from a tracing, and

The PHOTOSTAT makes no mistake. It makes photographic facsimiles.

There is always the possibility of errors in blue prints made from tracings. PHOTOSTAT prints are absolutely accurate.

It takes hours and in some cases even days to make tracings and blue prints. PHOTOSTAT prints are produced in a few minutes.

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A range of sizes from 15 to 60-inch swing. Illustration is 22-inch Ball Bearing Lathe with 6-inch Oval Chuck and Compound Rest.

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BECAUSE they are made by experts—with expert heat-treating facilities; because they are put to the severest tests before leaving our up-to-date Laboratory; and because every detail of their manufacture is carried out on a quality basis—are reasons why Raymond Springs "stay on the job."

Write for catalogue, also free engineering service on your spring problems.

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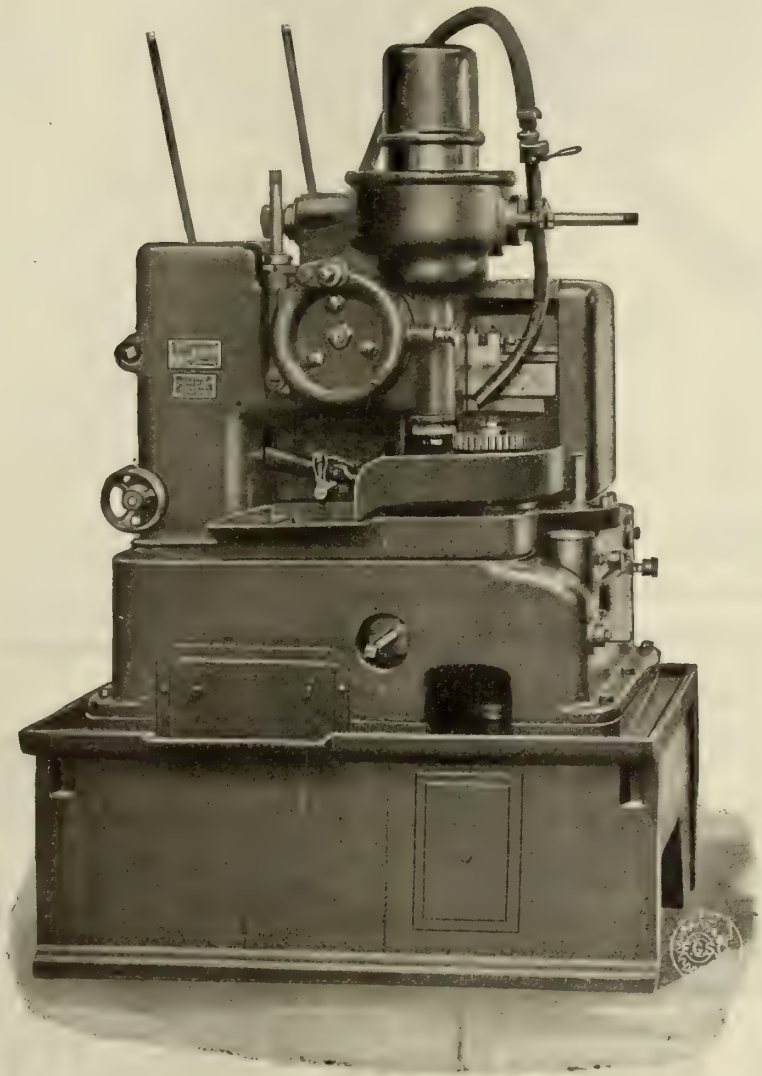
CUT GEAR COSTS
WITH THE
New Production Gear Shaper



The new production Gear Shaper, illustrated, has been designed to cut gear costs. It incorporates every feature necessary in a gear cutting machine to obtain this result, and still one of the outstanding features of the Gear Shaper principle—accuracy—has been maintained.
It is designed to cut one gear at a time and at a speed which eclipses all other methods.
All operating levers are at the front of the machine, permitting a number to be bolted together and operated as a unit, one 6 H.P. motor furnishing ample power for 10 machines
It incorporates to the fullest extent the three principal requirements of production—high speed, accuracy and simplicity of operation.
See illustrated article in all technical magazines
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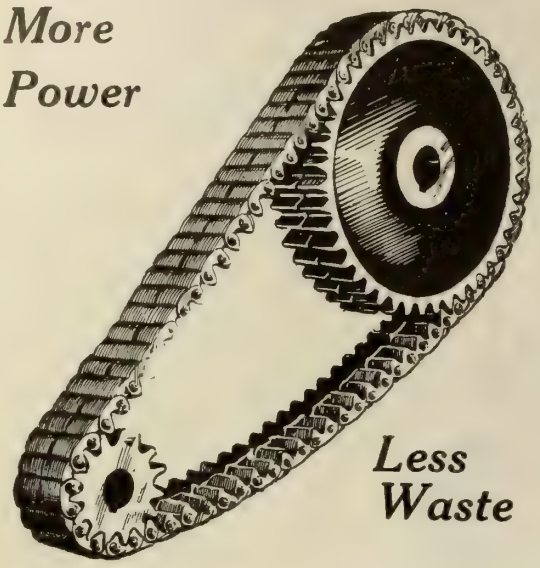

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The Recognized Standard for Efficient Power Transmission

Twenty-six years' highly efficient performance in the finest plants in the country has built up an enviable reputation for Renold Silent Chain Drives. Absolute reliability in service with maximum efficiency and minimum maintenance costs has made "Renold" the universal name for power transmission chains. Renold Silent Chain Drives are applicable to any powers, no matter how small or large and not only are they silent in operation, but also unaffected by heat, cold or moisture.

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Machine Bolts **Blank Bolts** **End Spring Bolts**
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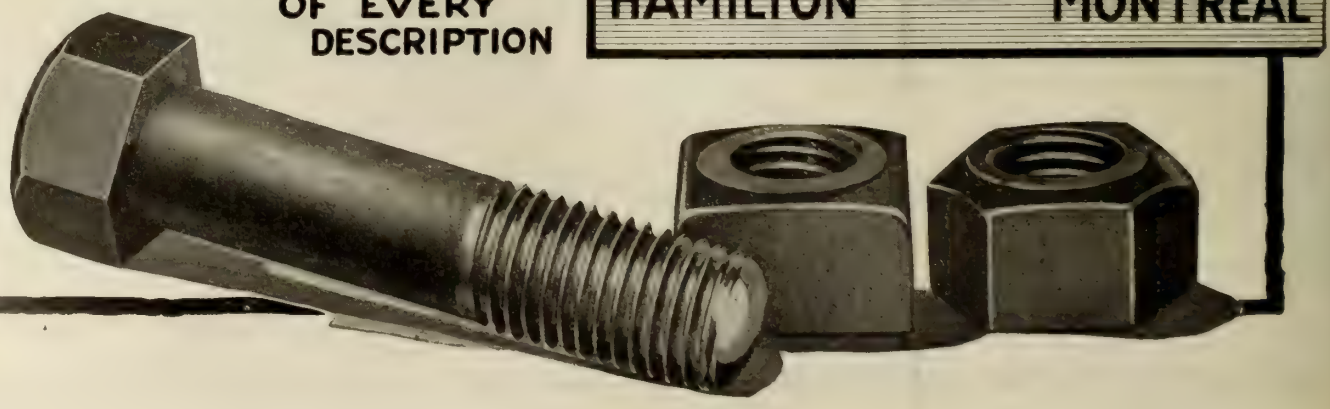

ONE SHEPARD ELECTRIC LIFTABOUT —that's all

Lifting, Carrying, and putting down portable garages may be an unusual job—but it has proved simple and easy for a LIFTABOUT.

SPEED—SAFETY—LOW COST were the requirements of this manufacturer: and they were provided when the LIFTABOUT was installed.

(1) The LIFTABOUT picks up a complete garage section; (2) conveys it on I-Beam track over to edge of one story building; and (4) lowers it safely (5) into waiting truck.

This is but one example of the adaptability of a LIFTABOUT.

It really is a hoist for everybody's load-moving and lifting jobs, and is being used in practically every industry and business.

It has lowered production and distribution costs for hundreds. The same economies are possible for you.

The LIFTABOUT story is told comprehensively in our bulletin. Send for it.

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MEMBER ELECTRIC HOIST MANUFACTURERS' ASSN.

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Ready To-day--MacLean's Mid-Summer

All Fiction Number

BY WAY of an innovation, the August 1st issue of MACLEAN'S MAGAZINE has been produced as a Mid-Summer All-Fiction Number. The cover is by C. H. Taffs, the noted English artist who made such a hit with the cover of our January 1st issue this year.

There will be the usual Review of Reviews section, the Woman's Department, the Scoutmasters' and the Financial Departments; but, for this one issue, there will be no other serious original articles.

The chief feature of this issue will be a 42,000 word novel,

"THE JADE GOD," by Alan Sullivan

Never before has a complete novel been published in one issue of a Canadian periodical. In fact, there are few magazines in United States which have ever done it. There will be ten full pages of this novel at the front, well illustrated, as well as a generous turnover at the back of the magazine. In book form this one novel would sell for $1.75.

$1.75 Novel **August 1st** **For Only 20c**

Other big fiction features in the August 1st issue include—

"CHEESE," by Henry Holt, is the story of a business man who has spent his life manufacturing cheese —and made a big success of it. He suddenly gives way to an impulse which his wife cannot curb and which leads him through many ventures, New York, Paris, Monte Carlo—in all of which he learns to "take a chance."

"THE PINK PAGODA" is from the pen of Isabel Ecclestone McKay, that charming Canadian novelist who looks out on the world from her comfortable Vancouver home and who has achieved such a recent success with her book, "The Window Gazer."

"THE GUEST OF TRADITION" is a newspaper yarn by J. L. Rutledge. George Wilcox was a tradition around the old "Examiner" office and whenever cub reporters came on the staff they were urged to write like Wilcox. But Wilcox met a dainty little bit of femininity from the stage and the criss-crossing of their lives, and the wrecking of his ambition, are woven into an extraordinarily gripping tale.

"PER AGREEMENT" is by Archie McKishnie and is a mystery story told in this Canadian writer's best vein.

"HOOKS AND EYES," by Lloyd Roberts. Something is bound to happen when a bunch of New York chorus girls decide to venture into the Canadian wilds during the off-season (speaking theatrically), in order to get into condition for the rigors of their winter performances.

"THE TRYST OF THE WHITE LADY," by L. M. Montgomery. This is a delightful little love story with a very unusual turn to it, a story which measures up to the high standard which you expect from the author of "Anne of Green Gables."

"OVINGTON'S BANK," by Stanley J. Weyman. This is the next to the concluding instalment of this most popular serial.

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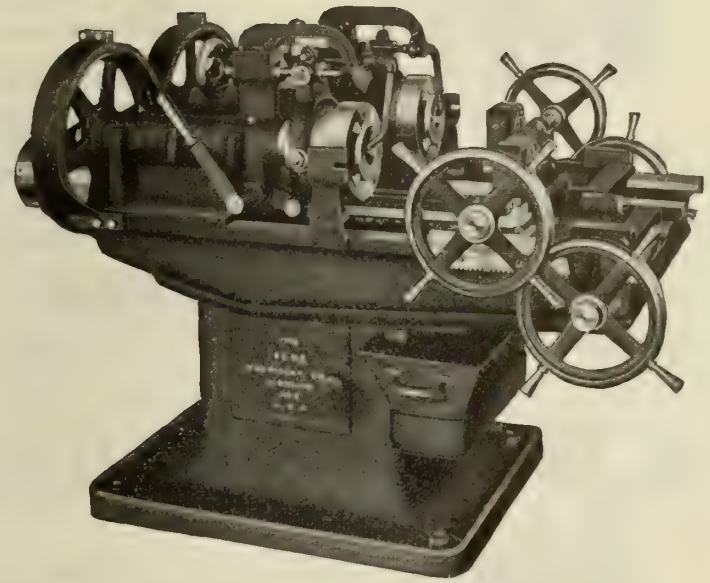
What Are Your Bolts Costing You?



Acme 1½ Inch Double Bolt Cutter--Class A

For Threading and Tapping ⅜ to 1½ inch, either right or left hand. Furnished with motor drive for either direct or alternating current.

IF YOU have never stopped to consider this item of costs it will pay you to do so, particularly if you are buying the bolts you need.

The "ACME" line of Bolt Cutters were designed to meet the demand for cheaper bolt production. That they are now considered standard equipment in progressive shops in all parts of the country is due to the fact that they produce clean, accurate and highly finished threads at a speed that spells certain economy.

All "ACME" Bolt Cutters are equipped with our latest improved micrometer die adjustment, located above the die head within easy reach of the operator, by which means the dies can be finely adjusted to size even while the machine is in motion. Die Heads are automatically opened and closed by the forward and backward motion of the carriages. The Vise Hand Lever is adjustable on the vise screw for all diameters of bolts.

All these features facilitate the rapid feeding of the machine and are particularly appreciated when the pieces are small and speed essential.

Our catalogue gives complete details of "ACME" Bolt, Nut, Rivet, Upsetting and Forging Machinery. Write for a copy.

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4530 St. Clair Avenue, Cleveland, Ohio

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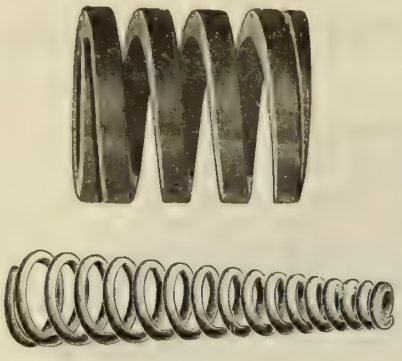

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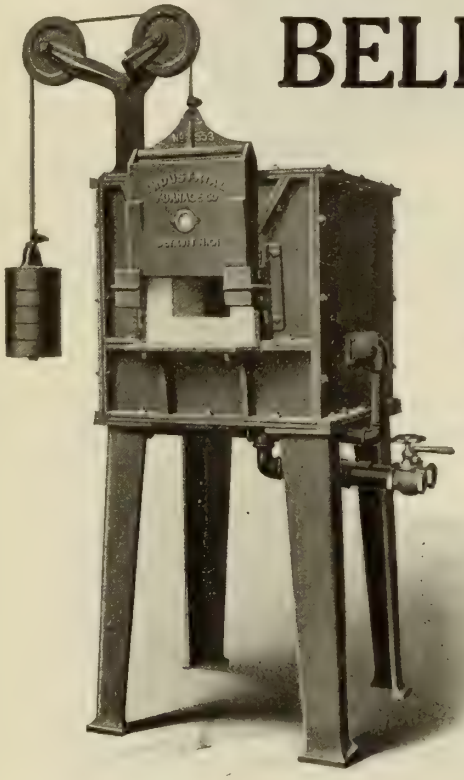

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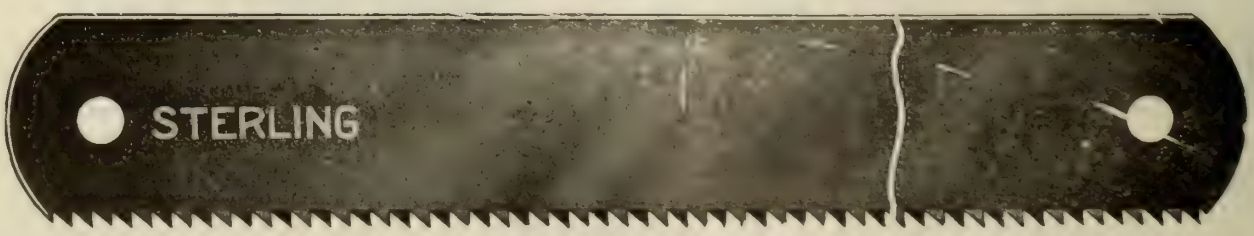

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which every one should know who buys Machinery and Supplies.

In our Toronto warehouse we have over 130,000 feet of floor space filled to capacity with machine tools and supplies of every description required in machine shops. Our lines include the best makes on the market. From our immense stock we are always able to meet requirements and our splendid shipping facilities enable us to fill all orders promptly. Our experience extends over half a century. You can always depend upon securing satisfaction when you order from us. Get in the habit of ordering from PETRIE — it pays.

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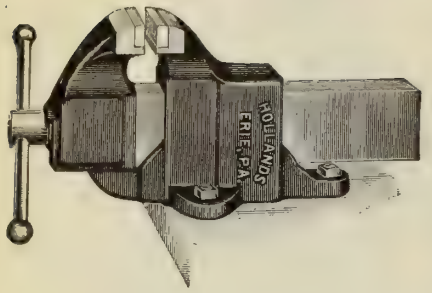

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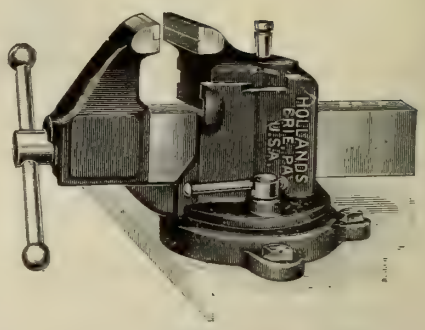

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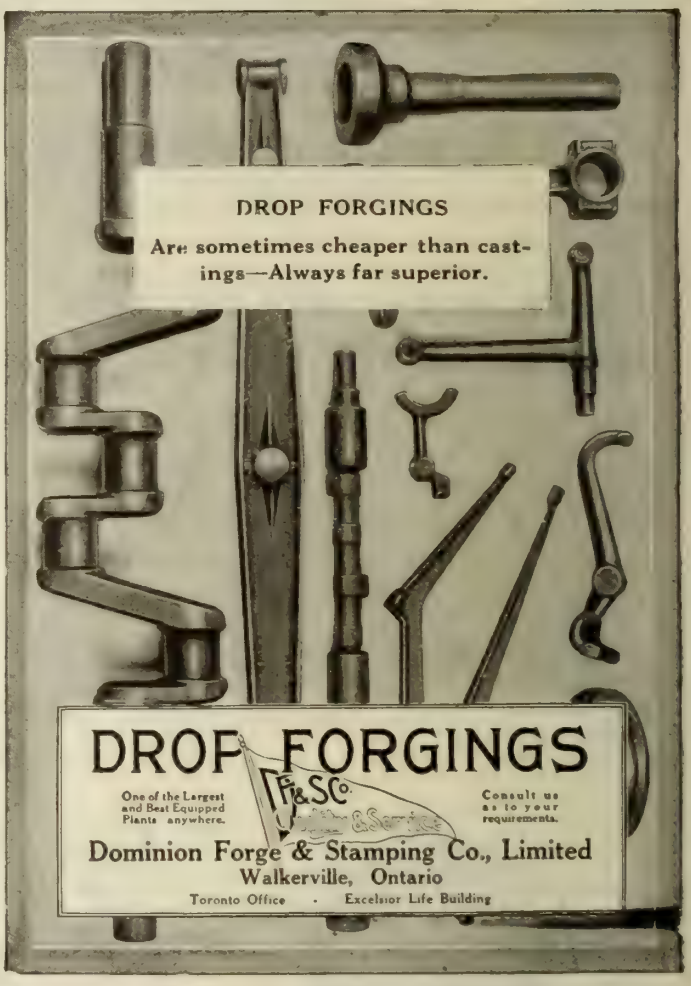

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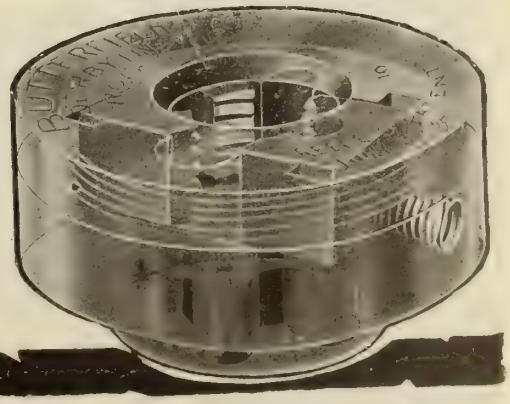

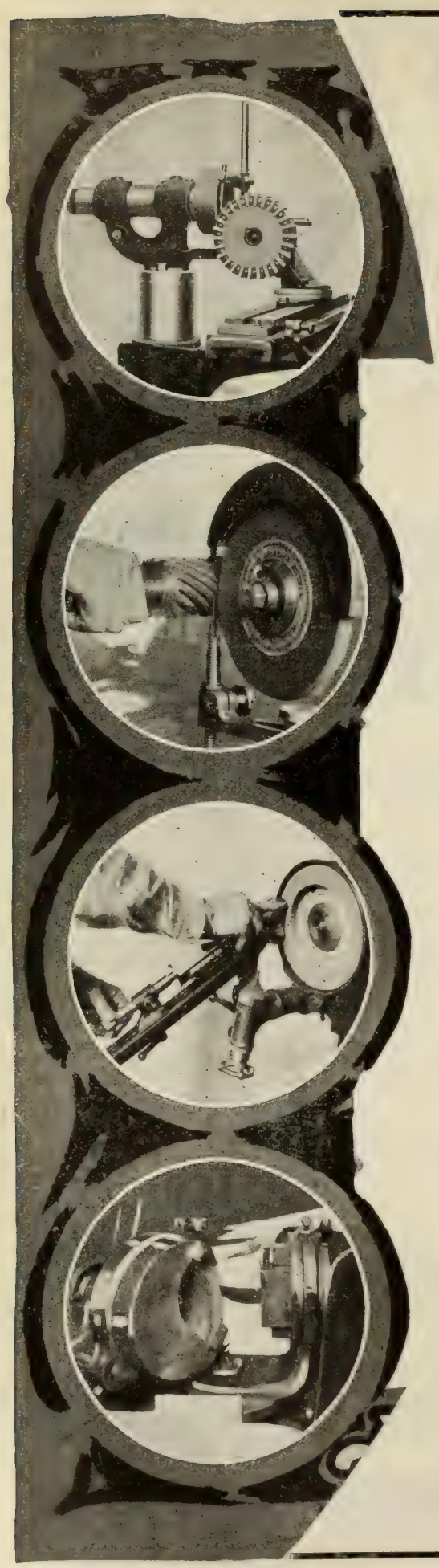

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CANADIAN MACHINERY
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Efficiency Secured by Proper Hoisting Equipment

Methods of Handling Material, and in Smooth Routing of Work, Figure in Industrial Economy—Description of Modern Facilities That Are Paying Their Way and Are Essential Under Competitive Conditions

ECONOMY in present day production hinges largely on the methods of handling the material rather than on the practice adopted in the actual machining of the work. This is especially true as regards engineering works where the operations of making the parts vary but little in many plants. The rapidity of moving the material to and from machines, stock rooms and different departments, is the factor that governs the value of the ultimate result of a multiplicity of conditions.

The demand in recent years for a better system of handling rapidly and economically all classes of material in and about manufacturing plants—both large and small—is becoming more and more insistent. Competition is so keen that it is becoming increasingly difficult to make a profitable showing and still retain the old fashioned hand operated equipment that the other fellow has discarded. The high labor cost makes it almost imperative for the manufacturer to adopt every means of facilitating production by mechanical means. The conservation of human energy is also an important point in deciding whether it is advisable to install better hoisting and conveying equipment. If a man's effort is expended in lifting a heavy casting or pushing a truck load of material, he cannot use it to the best advantage in other and more essential work.

Equipment for Fuel Handling

In every large manufacturing or office building, where the boiler room is below grade level, and where coal is used for fuel, the removal of ashes is a daily hoisting problem. The wheel-barrow method of handling this class of refuse is fast becoming obsolete, the modern practice being to remove the ashes by the means of hoisting equipment. An interesting and economical device for this purpose is shown in Fig. 1. With this appliance it is an easy matter for two men to take care of the entire work of a large establishment with a small amount of effort. The electrically operated hoists will raise loaded cans at a speed of 60 ft. per min., from the boiler room to a point high enough to be discharged directly into a box truck.

The normal position of the hoist when not in use is just below the sidewalk doors, which lie flush with the grade. A condensation gutter, tapped for plumber's drain pipe, which is connected to the sewer, insures a dry area. The first act of the operator is to turn the telescoping handle, which raises head into working position, automatically opening the doors, ringing a four inch electric warning gong for pedestrians on the sidewalk and bringing the guard gates into proper position, so as to protect persons from the dangers of an open hoistway.

Tests for current consumption have shown that at an installation when the boiler room is 12 feet below grade, 78 filled cans of ashes were raised to wagon height and the empties returned to the boiler room, consuming only 1 K.W.H. of electricity. At that plant the cost is $ .03 per K.W.H., which means that 26 cans are raised and lowered for 1 cent. The average time consumed in 1 round trip was 30 seconds. The basic principle of construction naturally divides the hoisting heads into two classes, one of which raises cans to grade level, the other raises can high enough that the ashes may be emptied directly into the cart without rehandling at street level.

For use in buildings where it is not possible for a truck to drive alongside of the opening a type is provided which raises the load to grade level electrically at a speed of 60 feet a minute and lowers by gravity as fast as one can drop a stone. This type of hoist is shown in Fig. 2. In one of the principal buildings of the Bell Telephone System, where the boiler room is 16 feet 8 inches below grade, 296 cans of ashes were raised and the empties lowered using only 1 K.W.

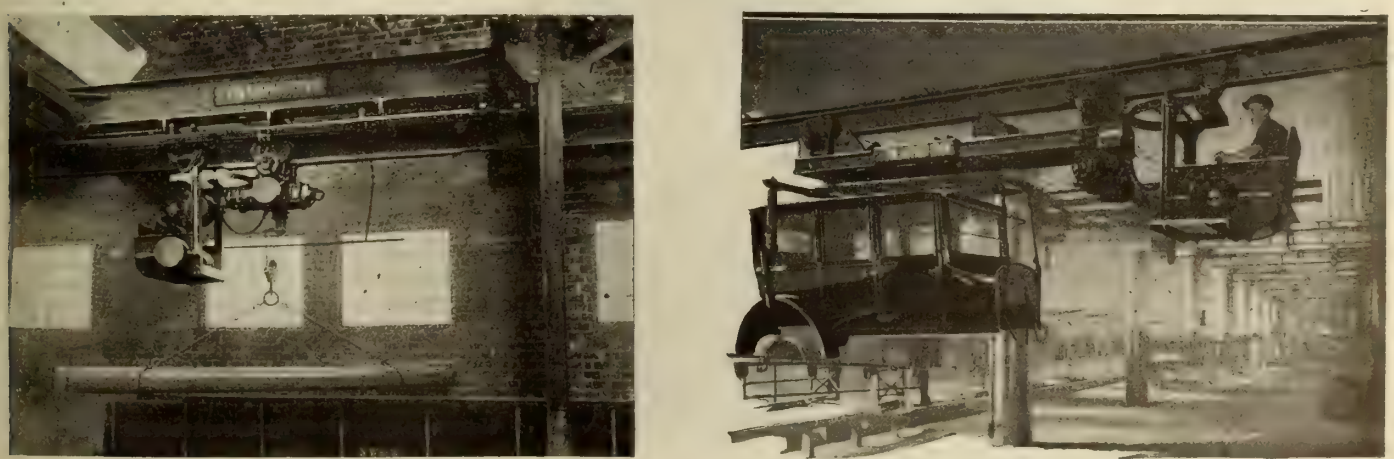


Fig. 4.—On left, hoist handling steel bars. On right, transferring a car body. Overhead track is used here and conveyor has wide range of utility.

H. of current. At the cost of $ .0348 per K.W.H., 85 cans are raised and lowered for 1 cent. The average time raising was 12 seconds, for lowering 1 second.

Pneumatic Hoists

Where compressed air is used in the plant the installation of small direct lift pneumatic hoists provides a convenient

Fig. 3.—Pneumatic motor hoist.

means of handling material around machines. This type of crane is largely used in manufacturing shops for lifting loads from trucks to machines, jib cranes often being provided to serve several tools within its radius.

A pneumatic motor hoist is shown in Fig. 3. These are equipped with a large and powerful worm gear drive. The worm is cut to a pitch that insures locking of the drum and holds the load at any point, even when air is turned off, or when the air line breaks. A particular feature of this type of air hoist is the fact that the load can be raised, and the air line disconnected, after which the trolley may be run to a distant department, another line connected and the load lowered to the desired location.

The throttle valve of the motor has a graduated opening, making it easy to control the speed of the motor and start and stop it gradually. The cylinders are double-acting, placed at right angles and use a single-throw balanced crank shaft, which is connected with the worm.

Great Saving of Floor Space

One of the advantages of the overhead conveying system is the great saving of floor space that is effected and the possibility of piling material to considerable height. Many types of cranes are now in use, each especially adapted to different needs. A hoist that is particularly well suited where material is transferred over a wide area is illustrated in Fig. 4.

The view at the left shows the hoist handling a load of long bars in a large warehouse. The illustration on the right was taken in an automobile plant and shows a hoist with extension arm lifting and transferring the body of a car. A system of overhead track enables a load to be picked up at one end of the plant, convey it to the other—transport it from one building to another—carry it indoors or out—send it any place—without change. It is possible to make it as flexible as a switch engine.

These hoists are employed by many large plants for rehandling coal. Overhead rails are erected over the car tracks and storage piles, carrying hoists with automatic buckets which unload cars and store coal.

This type of combination crane and conveyor can be made a highly efficient and economical means of rapid, interdepartment transportation for any business or industry.

Makes for Efficiency

There are many types of cranes and conveyors in use, from the useful portable floor crane, to the high-tonnage travelling conveyors used in large manufacturing plants. Pneumatic and electrical equipment has been brought to a high state of efficiency and its value in the general scheme of things may be calculated to a nicety. A pneumatic cylinder hoist may be used portably by being suspended from an I-beam trolley running on an overhead rail or it may be mounted in a fixed position. The cost of operation will figure considerably under 1-1000 of a cent per foot of lift per hundred pounds. Another instance of economical operation may be cited in the portable floor hoist. In handling work the overhead crane cannot reach,

Fig. 1.—No rehandling of cans at the grade with this hoist.

this is a useful piece of equipment. Picture five men straining to lift by hand a piece of work which such a machine could handle in a few minutes—meaning, probably, four machines standing idle and thus forty minutes spent on a ten-minute job. Such facilities enable each man to handle his own work with-

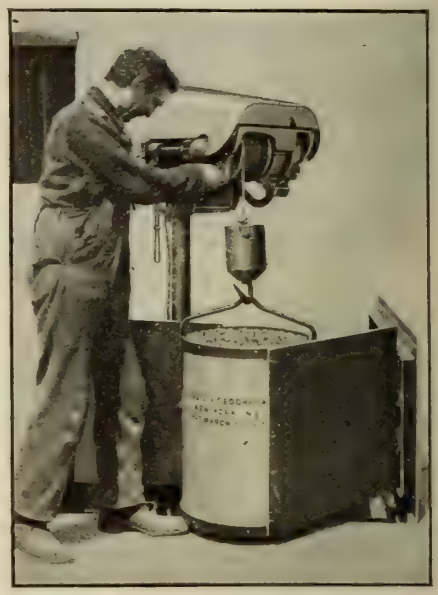


Fig. 2.—With this telescopic hoist one man can raise cans to the grade level faster than two others can empty them into the wagon.

out calling others from their jobs to assist. Each machine is kept at production and heavy work is handled more easily and quickly.

Any consideration of hoisting or conveying equipment must not overlook the importance of the elevator. Installations of this kind have been brought to a high degree of efficiency, and for transferring heavy loads from floor to floor in any scheme of routing the industrial or freight elevator, as it is called, is practically indispensable. It figures in plant economies to such an extent that it is difficult to conceive a plant of any dimensions trying to compete under modern conditions without one. Still, cases are known where industries of some proportions are struggling along in four or five storey buildings without hoisting equipment of any kind. These may be regarded, not as examples of rigid economy, but as exceptions, proving the absolute force of the rule that modern time and labor saving equipment contribute largely to efficiency in capital employed, in time, labor and the competitive power of the product.

Reports that anthracite coal had been discovered near Sudbury are not regarded seriously by the Department of Mines, Toronto. The mineral may be found to be anthraxolite, similar in appearance to anthracite, but of brighter lustre and of lower specific gravity. When it occurs without admixture, it makes a good fuel; but ordinarily it is found mixed with quartz and calcite. In the pure form it has not been found in Canada in commercial quantities.

Careful Handling of Materials Will Show a Profit

Methods Adopted Differ According to Nature of Product—Minimizing Labor Cost—Conveyors Facilitate Inter-Department Transportation—Progressive Routing of Material Aids Production

AT A RECENT meeting of the Worcester Chapter, American Society of Mechanical Engineers held about a month ago, many interesting points were discussed relating to the handling of stock and materials in manufacturing plants. E. C. Evans, of the Wyman-Gordon Co., in speaking on the question, stated that prior to 1915 no serious thought had been given to the handling of goods on a modern efficient basis. The company had no separate heat treating department. The furnaces were set up wherever there might be an available space, and the runways, such as they were, were of dirt, which at places was 3 to 4 in. thick.

Prior to that year the routing was as follows: After the bars of steel were cut to length at the bar shear, they were placed on steel trucks and pulled by four or five men through the dirt of the forge shop to the heat furnaces. The trucks were then unloaded, one bar at a time, and the material placed on the charging table. The bars varied in weight from 30 to 90 lb. each. After a truck was unloaded it was pulled back to the shear and reloaded. The labor turnover on this class of work was great, for two or three days was about as long as a new man would stay on the job.

After the steel was forged, the forgings were thrown on the ground, which required their being picked up again and placed on trucks to be moved to the next department. As no one man was in charge of the routing of material, there resulted a piling up of work around some machines, which greatly hampered efficient operation and reduced production in some departments, caused by waiting for material in process.

Congestion Forces Reforms

In the summer of 1915, with orders piling up on the books, it became apparent that a radical step must be taken to relieve congestion and to rout material properly in the various stages of progress. After investigation it was apparent the problem did not involve traffic alone; with the old arrangement of departments, progressive routing of material was impossible. A new building resulted. All heat treating furnaces were placed in this building, independent of the forge shop. It was then possible to route material in orderly sequence, as follows:

Bar steel is cut to length at the stock yard shear and placed on steel racks. Storage battery trucks move the loaded racks to the forging furnaces, where they are used as charging tables.

From the hammers, all forgings are placed directly on a steel rack, which is carried by an electric truck to the heat treating department. Here all forgings are taken from the racks, when charging the furnaces, and again placed on the racks after they have been heat treated. From the heat treating department, the forgings are taken to the balancing and centering department, then through the pickling room into the inspection and shipping departments.

In the cycle of process, nowhere are the forgings allowed to be thrown on the ground. The principal features of our system for progressive and economical handling of material are nine elevating platform trucks, two charging panels, and 400 specially designed steel racks. No material is allowed to be piled anywhere other than on these racks. One man, in charge of the trucks and operators, is held responsible both for the truck activities and for the maintenance of the equipment. It is a very poor investment to use cheap labor for operators.

Aisleways, of concrete, are kept clear at all times. In the different departments spaces are provided where rack loads of material can be stored ahead of operations. In the finishing, inspection and shipping departments hand operated trucks with elevating platforms are used, to move the racks from one machine to another. All equipment requires instant and efficient attention. Repairs to the equipment should be done in one department and one man be held responsible. All machinists are not expert truck or crane repairmen. All hand trucks which carry loads of a ton or more should be equipped with roller-bearing wheels. A company owes this much to its workmen. Too much thought cannot be given to the purchasing or building of equipment for intra-department transportation, whether it be cranes, trucks or conveyors of any type.

Handling of Gas Coal

Our large forging furnaces are fired with gas coal and over each furnace is mounted a waste-heat boiler. In the yard the coal is dumped by means of a motor driven loader into steel buggies, which hold about one ton, have hinged sides, are mounted on roller-bearing wheels, and are drawn into the shop by a horse. The buggies serve as a coal bin at the furnace, the coal being shoveled from the buggy directly into the fire box. As soon as one buggy is emptied another is rolled into place, and by this method minimum space is used for the storage of coal within the shop.

In conclusion, the industrial executive usually knows how much per piece it costs to produce a given article, but rarely knows what it costs per unit to handle the materials entering into the manufacture of the article, or the cost of handling the finished article. As a usual thing, indirect or non-productive labor is charged to factory burden. A very large percentage of this labor is used in picking up and transporting material.

Any engineer wanting a good talking point in presenting to his management a new system of transportation should separate his old transportation costs from the general factory burden. Too much thought and time cannot be given to the selection of equipment that not only will show a saving, but fits into the general operating conditions of the plant, and, at the same time, permits future extension and development.

Function of a Factory

C. J. Simeon's paper read, in part, as follows:

The function of a factory is to convert materials from one condition to some other condition, which usually includes the assembling of two or more pieces together. In order that these various operations can be performed, the raw or semi-finished material must be handled and stored during the various stages. This introduces a problem which requires a different solution in every plant (or at least in every industry), as it is mainly dependent on the kinds of materials used, and to a less extent on local conditions. The two extremes of this problem are illustrated by a mill producing a bulk product and a jobbing shop.

Differences in Character of Output

In the case of a mill producing material in bulk, such as a flour or steel mill, the work is of such a repetitive nature that it pays to use highly specialized equipment for handling the material in process. As a result, a large proportion of the total equipment is merely for moving and storing the material and, as a matter of fact, in both of these industries the material is not touched by the hand of the man during the entire manufacturing process.

In a jobbing shop the reverse is found. In this case it is seldom that two jobs are exactly alike, although similar jobs may follow each other with

varying frequency. It obviously, therefore, would not pay to spend much money in special handling equipment, and we find even the most up-to-date plants, that are engaged in work of an irregular or special nature, are almost without any special equipment for handling their material. On the other hand, and for the same reasons, such plants require a more highly developed system for keeping track of materials, both in process and storage.

The Morgan Construction Co. more nearly approximates the second than the first example given above. The product is entirely custom-made, designed to order and consequently is very diverse in character and limited in quantity of any kind of article at a time. For this reason the equipment for handling and storing material is of the simplest and most general kind.

Since the nature of the work prevents us from using conveyors to move material from one operation to another, it follows that every move must be made individually. This introduces the danger of a congestion or shortage of material at any one of perhaps several hundred points, unless each move is carefully planned and followed up. The manufacturing portion of the shop is divided as follows:

(a) Ground floor, consisting of bays 1 to 7, all approximately at street level. This contains the heavy machines and main assembling department.

(b) Bays 8 to 10, a few feet above the main shop level, contain machines and light assembling.

(c) The small machine and blacksmith departments are on the second floor, although not over either (a) or (b).

(d) The store room for finished small manufactured and purchased parts is located at the ground floor level, under (c)).

All materials entering the plant are moved as follows, in every case a record of their disposition being sent to the shop office:

(a) If stores or purchased parts, they are taken to the finished store room.

(b) If small castings or forgings, they are placed in the casting storage.

(c) If castings or forgings of large size, requiring a crane to handle a single piece, they are stored under one of the crane runways in Bay 3, 4 or 5, on the right side of the main gangway.

In the shop office are the production records and planning board, from which all movements of material within the factory are controlled. When the planning board finds that certain material will shortly be required to feed a given machine, a "move ticket" is made out and handed to the "move man," giving him particulars of the material and its present location, together with its destination. After making the desired move, this man signs the ticket and returns it to the planning board. The same process is repeated after each operation, until the completed work is finnaly delivered to the store room, if small in size, and to the assembly floor, if too large to be accommodated in the store room.

Owing to the diverse nature of our product, orderly methods of handling material are of greater importance than special equipment. We have practically no special equipment, in the sense of appliances intended to handle some particular piece in quantities, as for example: conveyors, elevators or special trucks. On the other hand, we are unusually well equipped with implements which because of their simplicity, are well adapted to handling material which shows great variety in size, shape and weight. Every one of the ten bays has one, two or three overhead electric cranes. These, together with ordinary rope or chain slings and a few hand trucks, represent about all our handling equipment on the main floor. On the second floor, where the work is all rather small, there are a few light hand cranes, a few tote boxes and lifting platform trucks.

BUSINESS CONDITIONS SHOW IMPROVEMENT

SPEAKING on the industrial outlook in Western Canada, John Sweting, industrial agent of the Canadian Pacific Railway at Winnipeg, says: "Better business has to-day become a fact. During the last few months there has been a gradually growing feeling that the period was arriving when some dependency might be had in price levels, and while there are yet some deflations in rents, wages and fuel, the majority of articles may show a slightly upward movement before a definite level is reached. It may be assumed, however, that trading can be carried on at prices now existing without any great fear of a sufficiently great variation to cause further economic disturbance.

"We have emerged from a period of considerable anxiety with better results than at one time anticipated, and can now promise a very considerable volume of business for the year which will in itself create the foundation for some years of active development and prosperity.

"Perhaps one of the most striking features is the development in building operations. A few weeks ago the outlook was not promising and it seemed to stabilize wages and cost; there is now a very distinct change and while individual buildings of hundred thousand dollars or more class are likely to be small in number, there will be many thousands of smaller buildings, residences, stores, barns, etc., erected throughout the west.

"One noticeable fact is the number of buildings being, and to be, erected in country villages and towns. Every point has its quota, in addition to which farmers are erecting new barns, silos and making other improvements, some of which have undoubtedly been held up pending a return of what may be classified as normal times. While the actual cash value of buildings erected and required for immediate use will, in the aggregate, run into a considerable figure, it is not likely, so far as can be seen at present, that any construction work of magnitude will take place.

EXTEND OPERATIONS IN WESTERN CANADA

MONTREAL.—Thomas McMillan, president Can. Fairbanks-Morse Co. Ltd., recently returned from western Canada, having made an inspection tour of the company's western branches. The agricultural outlook in the west is excellent, and as this factor is more essentially the barometer of conditions in that country than anywhere else, Mr. McMillan feels that prospects for improved general conditions are good, and that his firm will participate in the better trend of matters.

Already his firm has experienced better business in the Maritimes and in the province of Ontario. The latter improvement was due largely to the prosperity of the automotive industry. Better business conditions originated in the east, and moved westward. The large manufacturing firms in Montreal and vicinity were somewhat slower to get under way than the smaller plants in Ontario. For that reason, his firm was getting, at the moment, more business in Ontario. Another factor that handicapped, for the time being, business in Montreal, was the fact that the railways were keeping out of the market.

Mr. McMillan believes that by the time the western crops are harvested, business will have greatly improved. The western farmer, of late, has not been so free to gamble on the future and now waits until his crop is harvested before he goes into the market for his requirements. His company have planned to extend to a considerable extent, their operations in the West. The rate at which these plans of extension will be consummated would, of course, depend upon general conditions, but the expansion would be carried out just as fast as the demands of the country required.

Although confident that the worst of the depression has been passed, Mr. McMillan does not feel that there will be any spectacular recovery overnight, or that the volume of business enjoyed in the war years will be reached for a decade, at least.

The American associate company report business very good, and improving every week, and as these reports originate from offices located in all of the larger centres of the States, they truly reflect conditions across the border. This situation is bound to show itself in Canada from ninety to one hundred days later, according to Mr. McMillan's opinion which is based on many years close observance.

Varied Practice of Producing Gear Teeth Profiles

Defining the Base Circle—Helical Cutting Controlled By Suitable Guides—Hobbing of Gears and Worms—Tangential Feed of Hob—Minimizing Effect of Hob Warpage

By CHESTER B. HAMILTON, JR., B.A.Sc., M.E.

THE following is the continuation of the treatise on gear cutting that has been running for some months past; the last article appeared in the June 1st issue.

Moulding Practice

The Moulding Generating process is the main and might well be the only generating process. That is the gear industry, of this continent at least, would not notice the omission of the Odontograph and describing generating processes. The principle of this process, as well as the methods of production, depend on the fact that the pure involute system of gear teeth is a theoretically correct interchangeable system so far as the tooth curves are concerned. If the length of the teeth is not carried to excess to cause interference, any involute gear will run with any other involute gear of the same pitch, of any number of teeth. This holds true up to the rack, which is a gear of infinite radius, and also equally true for a spur meshing with an internal gear, which may be considered as beyond the rack, being a gear of negative radius, the teeth turning inwards.

Methods of cutting involute teeth by the moulding generating process consist in principle in replacing one number of a pair with a cutting tool which has the same cross section as the gear or rack it replaces. Its edges will then mesh with the second gear, and if this second gear be now replaced by a blank, the tool will cut its teeth in identically the same way. This process is adapted to practically all kinds of gears, spurs, bevels, helicals and worm wheels being correctly produced, though of course with different tools and machines. The Fellows' gear shaper system for spurs and helicals with shafts parallel, uses a cutter which resembles a pinion, that is, its cutting edges are involute curves. This cutter is itself made by the moulding generating process, its edges being ground after hardening by rolling in a constraining mechanism so that it meshes with an emery wheel. The edge of the emery wheel is shaped and located so that it corresponds to the edge of one tooth of an imaginary rack supposed to mesh with the cutter as it rolls. Said in another way—the grinding face of the wheel is straight and lies at an angle equal the pressure angle to the path or tangent on which the base circle of the cutter rolls. In the actual machine the straight grinding face is maintained by frequently dressing with a diamond mounted in a straight slide of suitable angle.

The Base Circle

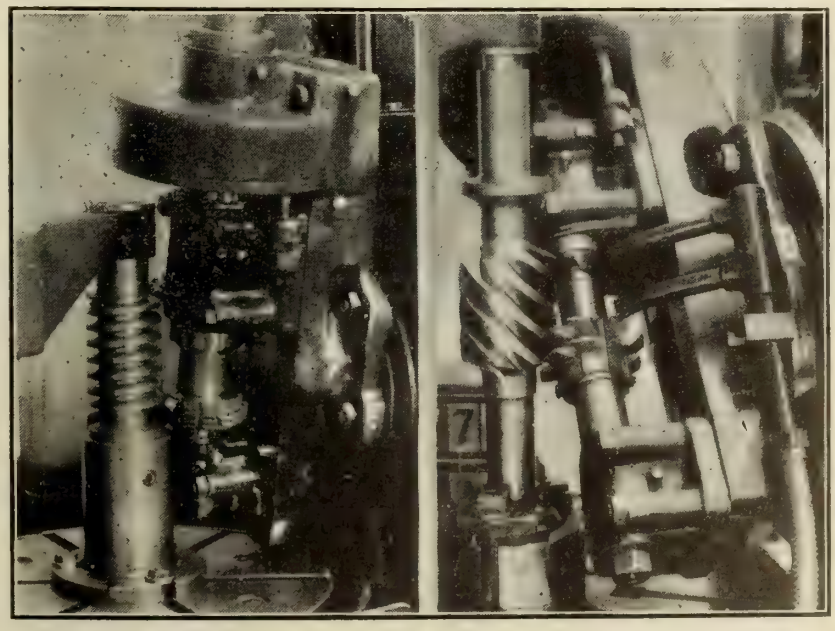
To define the base circle of the cutter, an accurate cylindrical drum is filed adjacent to, and revolving with the cutter, rolling on a straight plane surface, and prevented from slipping or having any other motion than pure rolling by a pair of steel tapes. One of these unrolls as the other rolls up, and they constitute in fact the unwrapping tangents of the theory of the involute. The Fellows cutters are made with teeth parallel the axis for cutting spur gears, and with teeth at an angle for helical and double helical. In the gear cutting machine the cutter is mounted at the lower end of a vertical shaper ram, and reciprocated to plane out the teeth. The cutter on its arbor within the ram is revolved by trains of change gears in ratio with the gear being cut, which is mounted horizontally. In starting to cut the gear the cutter is first fed radially into the work to the desired depth, and then at constant depth revolved in mesh till the work has made one complete revolution. The gear is then complete unless a finish cut is to be taken in a second revolution, in which case the cutter was not fed to full depth the first time, by uually five one-thousandths of an inch.

In the case of helicals the shaper ram is provided with angling guides which give it a partially revolving motion and return, as it reciprocates up and down, this angle corresponding to the angle of the teeth of the helical cutter. The motion is independent of the slowly continuous revolution of the generating motion. Both the spur and helical machines can cut internals, and the helical machine is of course arranged to work on both right and left hand angles. The standard angles of helix are fifteen and twenty-three degrees reckoned from the axis.

It may be mentioned in passing, as a sidelight on the generating process, that a machine working on this process can cut cams and a great variety of peculiar shapes, both internal and external, by using a cutter which was itself generated from a master tool, a duplicate of the work to be produced.

Rack Shape Cutters

Practically all other systems of gear tooth generation use the rack as their basis. In the case of bevel gear generators the rack is in circular form, that is, it is a flat crown gear of 90 degrees pitch angle. The Gleason and Bilgram machines both work on this principle. The Gleason generator for straight tooth gears has two tools working alternately on the two sides of the tooth being cut. Their cutting edges represent the two sides of a tooth space in an imaginary crown gear which would mesh with the gear being cut, when controlled by an actual crown gear which is part of the



Method of generating teeth

Author is President of the Hamilton Gear and Machine Co., and a member of the American Society Mechanical Engineers; Engineering Institute of Canada; Society of Automotive Engineers; American Gear Manufacturers' Association, Steel Treating Research Society; Standardization Committee of A.G.M.A.; Member of Canadian Engineering Standards Association.

machine. The gear and the tools are compelled to roll in mesh without slipping, by a master segment, selected to suit the pitch angle of the job, and held in mesh with the crown gear segment which controls the shaper mechanism. The action is exactly similar to the two steel tapes in the Fellows cutter generating grinder.

In the case of the Gleason "spiral" bevel generator the construction is more obscure, but the principle is similar. While the tooth is curved in profile, a line at any point along the tooth would show a true involute curve. The cutter section, taken perpendicular to the cone is a side mill, somewhat of rotary planer style, with inserted teeth ground to the required gear tooth pressure angle, and with tip flattened for the width of gear tooth space at the root of small end of teeth. This cutter being set with its face parallel the root angle of the gear to be cut, is fed axially into the blank to the required depth and then gears and cutter are rolled in mesh, the action being that of a gear rolling in mesh with a flat crown gear which occupies the same plane as the cutter, which is generating the teeth.

The literal use of the rack itself as a cutting tool is seen in the Sunderland gear planer used in England for spur and helical gears. On account of the special construction of some of these machines which allow the shaper guides to be swiveled about at any angle it is possible to cut helicals of high tooth angle and therefore of any shaft angle. The Fellows is limited to angles not too far from parallel the shaft, and of course to the standard angles for which the machine is equipped. Both the Fellows and Sunderland will cut close up a shoulder, which is impossible with a rotary cutter or hob, but they also require a chip space turned in the metal between the gear and the shoulder, down to root diameter. There are other machines in use on the continent of Europe based on the same principle, and Bilgram has made a spur generator using a tool to correspond with a rack tooth. None of these are in general use in North America, nor can they compare with the Fellows or the hobbing process for general and practical efficiency.

Hobbing Process

The hobbing generating process is adapted to the spur, helical and worm gears, and in special machines to worms. The hob is of the general form of a worm, made of tool steel, gashed to provide cutting edges, relieved back of the cutting edge, hardened, and ground on the face of the tooth. By reason of the relief, or reduction in diameter back of the cutting edge, which is made by a formed tool controlled by a cam in finish turning the hob, the form of cutting edge is unchanged by repeated grinding on the radial face. Also by reason of this same reduction of diameter, the helix angle of an old hob is materially different from a new one, and a correction must be made by setting the hob axis in the machine at a different angle to the tooth to be cut.

A hob cuts gears by two methods. First, it may cut a worm gear by impression, that is, by sinking the hob the required depth into the rim of the gear blank, using only the one feeding motion in addition to revolution. Here the hob simulates the worm which is to operate with the gear when finished, and must closely resemble it in external dimensions. The direction of feed may be either radial or tangential to the gear blank. The former is the common way, but the latter is the more accurate and rapid, but requires special machines.

Tangential Feed of Hob

The tangential feeding of the hob is not a simple traversing, but is accomplished by a special train of gears connected through a set of differential gears with a train that revolves the work table, so as to impress upon the revolving work an increment of rotary motion equivalent to the tangential feeding motion of the hob, said equivalency being reckoned at the pitch line. If this were not so, the feeding of the hob tangentially to the work would merely mill out a concave groove. In other words, the hob is not fed in a simple lateral movement, but is screwed along its own helix. Hobs for this work are usually made tapered at one end as to outside diameter so as to start cutting gradually on a number of teeth, resembling somewhat a taper tap. The taper is not applied to the pitch and root circles. These special machines, equipped with differential gears for tangential feeding of hobs will also generate perfect worm wheels without any hob at all, by the use of a fly cutter, shaped to the thread cross section and radius of the worm. As the cutting proceeds the tool is fed tangentially to the work with a motion of being screwed along the helix of the imaginary worm. If the worm is of multiple thread there are two alternatives: either the cutter arbor may carry two or more tool points, suitably spaced, or after one series of tooth spaces have been generated, either the work or the cutter may be rotated by hand one tooth space and the next series generated. Like all fly tool work, this is a slow method and only used in the absence of a suitable hob.

Another Hobbing Method

The second method by which a hob may generate teeth is by simulating a rack, with its cutting edges, and being fed to the work in a direction parallel the work axis. The rack which it simulates is not perfectly straight but really an arc of very long radius, but the generating action is the same. This is because the hob must have its thread parallel the teeth being cut in the work and obviously the plane of generation is perpendicular to both. This plane then cuts the pitch cylinder of the hob in a long ellipse, whose minor axis is the pitch diameter of the hob, and whose major axis is a function of the diameter and the helix angle of hob thread.

In cutting a gear the hob is placed with its axis at such an angle that its thread is parallel the teeth to be cut. The radial depth to be cut is a matter of preliminary adjustment, there being no feeding in this direction. The feeding is all parallel the work axis, not directly along the tooth being cut except in the case of spur gears, thus preserving the cylindrical form of the gear. Straight line feeding along an angling tooth would produce an hyperboloid of revolution, which is referred to elsewhere under "Skew Bevels." In the case of helical gears it is, however, necessary that there should be a virtual feed along the helix of the gear tooth. This is accomplished by modifying the gear ratio of the machine. In cutting spur gears the gearing is simple and direct. The work is revolved in direct ratio to the hob, based on the number of teeth in the gear and number of threads in the hob. In the case of helical gears the advance of the work will be greater or less than 360 degrees of arc at the end of each complete cycle of tooth cutting, by an amount dependent on the tangent of the helix angle of the gear tooth, and the distance the hob has been fed parallel the work axis. This advance increment is provided for in one of two ways. The feed that is to be used on the job may be assumed and the increment calculated and the gearing in the train that drives the work modified from the simple ratio to the ratio which will give the new advance. This is difficult, and it is not always exactly possible within the mechanical limitations of the machine and the change gears available,—and in any case a change of feed means a complete recalculation of the set-up of change gears.

Differential Gear Method

The other way is to use the differential gear method, somewhat in the same way as mentioned above for tangential feeding of worm hobs. In this case, for helical gears the hob feed, which is parallel the work axis, is connected through a differential to the gears that rotate the work. Thus the work, in addition to being given a rotation by a train from the shaft that drives the hob, is also given a small increment of rotation from the feed mechanism. The differential method is much the better, as the feed can be changed at any time, and both the calculation and the setting up are easier. Unfortunately, it has been controlled in the United States by Schuchardt and Schutte patents, which, due to peculiarities of United State's patent law, they have not been compelled to work. The result is that American hobbing machines use the awkward and roundabout method.

The hobbing process is a rapid one, and good hobbing machines are fast

(Continued on page 43)

Machining Engine Parts for R-S. Motorcycles

Jigs and Fixtures Used in Various Operations—Method of Resisting Strains—Locating Work by Sliding Wedges—Machining the Gear Box—Jigs of Compact Construction

By ROBERT MAWSON

THE Reading-Standard motorcycle is manufactured in Reading, Penn., and in this article will be shown the special tools and their use described when machining the cylinders, 3-speed gear box, connecting rods and cams used in the making of this motorcycle. The R-S motor is of the high speed, long stroke, four cycle type, having a 4 inch stroke, cylinder bore of 3⅜ inches, with a piston displacement of 71.57 cu. inches developing 16 actual horsepower. The cylinders are made of high-grade gray iron of the sloping head type with the spark plug placed in the side of the valve chamber, one of the finish machined elements being illustrated in Fig. 1, this being the front cylinder for a machine.

The first machining operation on the cylinder is performed with the set up as shown in Fig. 2. The casting is located and held in the special fixture A, being located by means of vee-blocks which come against the round section of the piece with the swinging cover B fastened down to the stationary or fixed portion with the bolt as shown. Four set screws C, 90 deg. apart are then tightened against the cylinder to hold it firmly in the fixture, the casting having been pushed back against a stop at the rear of the fixture which assists in resisting the strains during the machining operation and also enables the man to machine all the pieces to the same length over all. With the cylinder as shown it is bored and reamed to 3⅜ ins. leaving 12 thousandths of an inch for a later grinding operation; both sides of the flange are faced and the register projecting from the flange turned to 3⅝ inches. The tool for boring may be seen at D, the reamer E, and the combination tool F which faces the two sides of flange and turns the register. This last tool is made so that the operator feeds in from the outer edge and a cutter faces one side and another cutter the other side of the flange to the desired thickness and as the cutter head is fed in further the register is turned to the proper diameter.

Machining Valve, Plug and Flange Holes

The half tone shows the jig for the next operation. In this tool the cylinder is located by the turned register on its flange which fits into a machined recess in the base of the jig, and also by sliding wedges which are tapped in lightly against the sides of the flange to bring it into the desired and proper position, the wedges also tending to hold the part securely in the jig. The following holes are then machined, two 1¾ inch bored and reamed in the position as shown for the valve seats, one to suit a ⅝ inch S. A. E. thread for the spark plug through the bushing B, one for ¾ inch S.A.E. thread for the cylinder plug through the bushing C, and two 9/16 inch and four ⅜ inch in the flange, the jig of course being moved to the different positions on the table to suit the machining of these various holes.

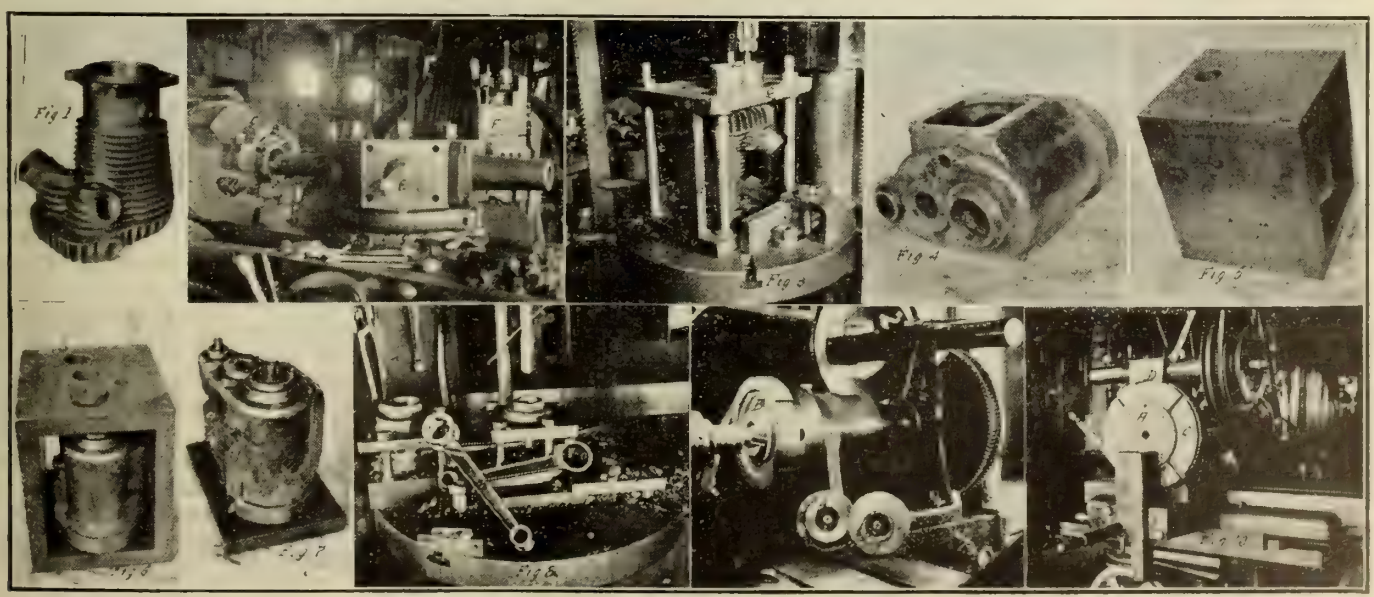
Machining the 3-Speed Gear Box

A view of a finish machined 3-speed gear box is shown in Fig. 4. This unit is of the sliding gear type, the main shaft is mounted on over-size ball bearings and carries the high, sliding and low speed gears. The secondary gears are made of one-piece drop forgings, the three speeds being integral. The gear ratio in the transmission are for high, 3.91 to 1; intermediate, 6 to 1; low, 9.20 to 1 and in the case oil leakage is eliminated by the use of heavy felt washers. Figs. 5 and 6 show the jig for drilling the 3-speed gear box, the casting is located by a large pin that fits into one of the large cored holes and the piece is then swung around against a stop.

The following holes are then machined, all four sides of the jig having bushings to guide the various tools—drills and reamers. Six No. 11 for the high speed ball bearing housing, four holes to suit ⅜ inch studs, one ¼ inch drain plug hole, one 9/16 inch, two 1 inch drill and ream, one 1-1/16 drill and ream, one ½ inch ream, and two 13/64 inch drill. It will be noticed that the jig is quite compact, the piece being held in from the ends, two of which are open so that the chips can fall away from the casting so that they will not interfere with the accurate setting of the part in the tool.

The illustration Fig. 7 shows a fixture used to hold the gear box when performing certain spot facing operations. The piece is located by two plugs A. and B. which fit into a one inch and a half inch reamed holes machined in the previous operation. The following work is then performed: spot facing for the lock shaft, spot facing the counter shaft flange, and also spot facing for the kick

(Concluded on Page 40)



Jigs and Fixtures Used in Machining Motorcycle Parts

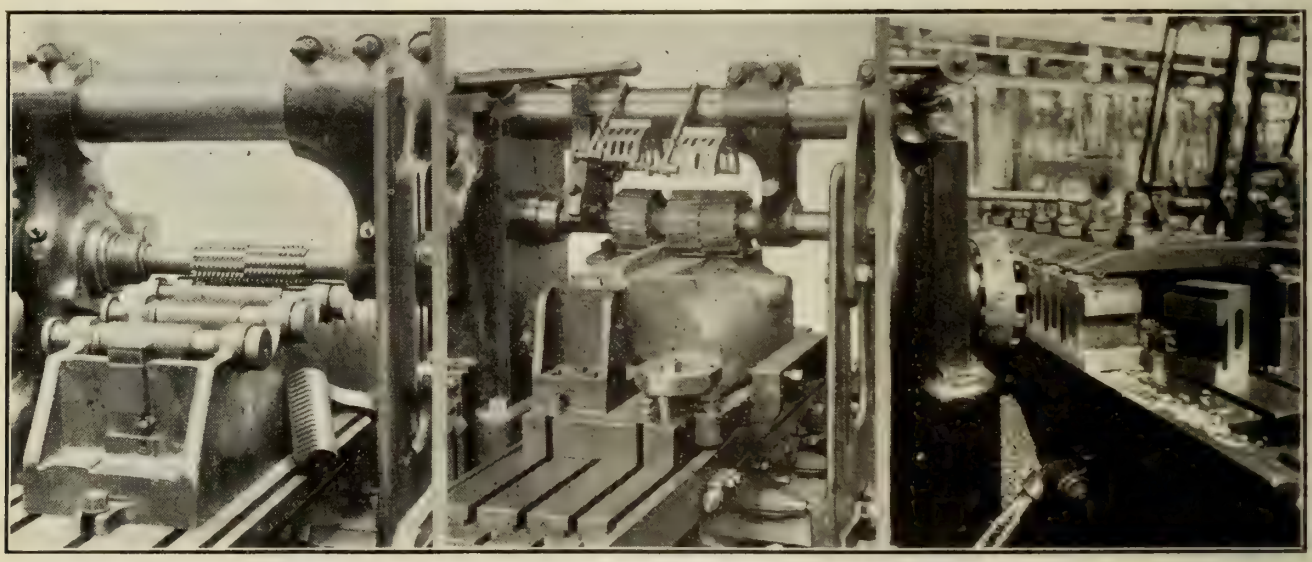
Milling Machines Show Production Results

The milling machine is making rapid progress as a production factor in the machining of large surfaces at speeds surpassing those previously recorded on other tools. Three interesting operations are shown here, the work being performed on Herbert Machines.

The view on the left shows the milling of rack teeth on phosphor bronze gluts for draw-in chucks used on capstan lathes. A special fixture is used for holding the pieces, with sufficient depth of box to take the extending arms of the glut, the cylindrical portion of which is supported on an arbor passing through the central hole. A gang of two annular hobs is used, the diameter of the hobs being 3 in. and the total length of rack 6 in., 8 diametrical pitch. The cutter spindle operates at a speed of 97 r.p.m., with a feed of 13/16 in. per min. Work is finished at one cut.

The centre view shows a milling operation on the base of the headstock for a capstan lathe. The surfaces are machined at two separate chuckings—roughing and finishing. The cutters are 6 in. diameter with inserted blades; the roughing cutters operating at a spindle speed of 20 r.p.m., and a speed of 39 r.p.m. for finishing. This gives a surface speed for cutters of approximately 31 and 61 ft. per min. respectively for roughing and finishing. The rate of feed for roughing is 2¾ in. per min., while a feed of 3 7/16 in. per min. is used on the finishing cut. On this class of work it is best to use a comparatively slow spindle speed, so that a batch of castings can be completely machined without having to break down for grinding. When being milled these bases are supported in a special fixture that minimizes the time required for setting up. It will be noted also that the table is prevented from working sidewise under the action of the cut or accidental movement of the cross feed handle, by the use of small adjustable jacks placed between the table and the supporting member of the overhanging arm. Similar jacks are used on the inner side to maintain maximum rigidity. Cutter guards are for protection of operator.

The operation shown at the right is the face milling of tool boxes for roller steady turners for hexagon turret lathes. One of these steady heads is shown to the left of the cutters in the center view assisting to support the arbor against the thrust of the cut. These tool boxes are first made in long pieces and afterwards cut into short sections which require to be milled on the ends as here shown. At this operation no special fixtures are employed, the work being clamped down to the table with ordinary shop tackle and set up against a strip in one of the tee slots. The face cutter is 9 in. diameter, operating at a spindle speed of 25 r.p.m. under a feed of 2 3/16 in. per min.



MACHINING ENGINE PARTS

(Continued from previous page.)

starter shaft bushing, all three surfaces being on the upper side of the casting as it is shown in the illustration.

Machining the Connecting Rods

The connecting rods are made of drop forged steel and as is the common practice in motorcycle construction have the center one fitting inside a forked type of rod, which enables the building of the machine more compact. The half tone Fig. 8 shows the jig used when boring the connecting rods, both the solid and forked pieces being machined in similar types of tools. The forging is located by means of a fixed vee block at the large end and a sliding block at the wrist pin or small end. On the center rod a 1-13/16 inch hole is bored and reamed at the large end and a ⅞ inch hole drilled and reamed at the small end. On the forked rod the hole at the large end is 1-9/16 inch and a similar size of hole drilled and reamed at the small end as that machined in the center rod. The reason for the difference in size between the center and forked rods is that the center rod is fitted with a bushing in a later operation, the hole of which is 1-9/16 inch, the bushing being cheaper to replace than an entire rod and as the bearing is shorter tends to wear more rapidly than the forked rod with its much longer bearing. One of the center rods is shown at A. and a forked rod at B., both of them having been bored and reamed in the operation here described.

At this plant they have a rather interesting method of making the cams which operate the inlet and exhaust valves on the motor. These are made of solid forgings, and are first accurately machined as shown in Fig. 9 at A. This is then placed in the chuck B. which centers it by its outside diameter and the cam profile machined as may be seen better by referring to Fig. 10. At A. is placed a form plate with a similar contour to that desired to be reproduced on the cam only of larger size to reduce any chance of variation. A weight is suspended from the lever B. to hold the milling cutter and cam in contact so that as the worm wheel C. is rotated and also the cam which is attached to the worm wheel member, by the action of the worm D. which is revolved by the belt shown on the right, a similar shape is machined on the forging as the former possesses.

After both cams have been machined, one on each side, one for the intake, the other for the exhaust, the teeth are machined on the blank, thus making this important part of the motor integral, and preventing accidents which might happen by cams slipping if fastened on the gear with keys or other mediums.

Benefit Society Develops Plant Fellowship

Has Been Functioning for Thirty-Nine Years in Connection With Goldie & McCulloch Co.—Surplus Funds Distributed—Some Employees of Long Standing—Industry Has Had Steady Growth

ALTHOUGH not altogether as hoary with age as one might expect by reason of its association with the parent firm, the Goldie & McCulloch Benefit Society can at least boast its 39th birthday, and that is quite an age, as benefit societies go. It was organized in Galt in 1883 as the Dumfries Foundry Benefit Society, and this name, indicative of the original title of the industry with which it is associated, was retained until one year ago when it was changed as above. The number of employees at that time was about 250, whereas to-day the staff has more than doubled. There were then a dozen men employed in the foundry, where now there are fifty, and the plant is easily four times its size at the time the Society was organized. The product of the Company consisted of engines, boilers, flour, woollen and sawmill machinery, besides elevating equipment, a line that was quite as representative of industry as it flourished throughout the province some forty odd years ago, as the lines to-day are an index to the great strides that have been made in engineering since that time.

The Benefit Society had its birth in the idea that, whereas subscriptions were from time to time taken among the employees to assist any of their number known to be down in his fortunes, it finally seemed advisable to conduct this work in an organized way. It was evident, occasionally, that the spasmodic subscription idea did not always include men who were quite as worthy, but whose misfortunes were not always as widely known as others. Hence it seemed well that in the movement there was embodied the plan that would make relief available to all alike.

Of the original members of the Society, three are still in the employ of the Goldie & McCulloch Company, H. H. Biggs, the present secretary, employed as shipper; Robert Baird, clerk of bill of materials, and Robert Hunter, foreman moulder. These three men have each been in the employ of the Company for more than forty years.

The membership of the Society has always averaged fully seventy-five per cent. of the staff. By way of benefit, a member receives 66 2-3 cents per working day for the first thirteen weeks. He is not entitled to such, however, until he is six working days from work. If four weeks sick, he receives pay from the first day's sickness and 33 cents per week for the second thirteen weeks and day for the second thirteen weeks and 25 cents per working day for the next 26 weeks, after which membership ceases. By paying dues, however, the member is entitled to free doctor and a funeral benefit of $50. In the event of death this latter amount is paid to nearest relatives, and if there are none such, this amount goes to those taking charge of the funeral.

On their admission, members pay 25 cents entrance fee. Regular dues are 25 cents twice a month, payable at noon the day succeeding pay day, but if necessary an extra levy may be made. To be entitled to benefits, every member must be one month in the Society. Among other duties, the treasurer is required to post in the shops the Monday following each pay day the names of those reported ill, number of days and amounts paid each, together with total receipts and expenditures for the previous two weeks, and balance on hand. The executive committee of the Society exercises a general supervision of the Society's affairs, collects the fortnightly dues from the respective shops, visits the sick on order of the president, invites new workmen to join and to have full power to admit or reject applicants. The treasurer receives at the rate of four per cent. and the executive two per cent. for all monies paid in, except on entrance fees.

Every employee of the Company is eligible for membership, provided he is in good health and of strict moral character. The Society doctor receives $1.30 per member per annum. He attends sick or injured members and provides them with proper attention. If able to walk, the sick member is expected to attend the surgeon and not require him to call. In surgical cases requiring a specialist the member, of course, pays for the specialist. If the surgeon neglects the patient, whatever sum is due him from the Society will go to pay the expense the member has been put to for another surgeon.

Apart from the membership fees, the Company makes a yearly contribution of $200.00, one-half of which goes into the general fund and one-half toward the annual picnic. Balances on the last item are returned to the funds. Apart from a reserve fund of $100 retained in the treasury at the end of the year, the amount remaining is divided proportionately, according to the period of membership.

The society has no relation, whatever, to the workmen's compensation law and finds as one of its chief benefits the feeling of fellowship which it has developed among the members of the staff and their families. The annual picnic is therefore, a pleasurable event. The present officers are: Hon.-pres., R. O. McCulloch; hon.-vice-pres., A. R. Goldie; president, J. Stewart; secretary, H. H. Biggs; treasurer, W. C. Sass; managing committee, one from each department of the works: carpenter shop, R. Keller; machine shop, W. J. Wilson; engine shop, F. Rayfield; moulding shop, J. Seville; boiler shop, C. Hirst; blacksmith shop, W. Dickson; safe shop, G. Bates; office, J. H. Unwin; box shop, D. McDonald. Auditors, W. Herriott and E. R. Scott.

CANADA'S TRADE MIDDLE EAST MARKET

DISCUSSING Canadian trade opportunities in the market of the Middle East, Trade Commissioner P. W. Ward, writing from Singapore, Straits Settlements, states:

Certain export houses in the Dominion have been very satisfactorily linked up with this market for a number of years, and substantial business has accrued. If manufacturers of articles, which will be definitely indicated in a later report, will apply the same concentrated effort and carefully follow the lines on which business can be obtained—and will be fully described by the writer—Canada's trade with the Middle East can be rapidly extended and the annual figures many times increased.

A fault in evidence with many exporters, however, is that they appear to be unwilling to use the present moment to plan for the future and go to the trouble, at this time, of carefully studying normal market prospects and negotiating relationships with buyers and importers against the day of returning trade. So many seem to be unattracted to anything which does not mean immediate results. The market of the Middle East is one which cannot be cultivated overnight, and a real study of conditions, with patience and carefully supervised methods, is necessary if success is to be obtained.

During the next few months the basis of trade in this territory will be laid for some considerable time to come, and only those who grasp the present opportunity are likely to share in the splendid returns which returning trade will bring.

The territory under consideration has a population of 76,200,000, a purchasing power, Canadian currency, of more than one billion dollars and total annual imports on which Canada can compete, of $173,800,000. The countries comprised in the review of trade conditions are: Straits Settlements, federated and unfederated Malay States, Siam, Netherlands, East Indies. Br. North Borneo, Sarawak and French Indo-China.

Efficient Handling of Work Facilitates Output

Local Needs a Guide to Equipment Used—Conserving Man-Power An Item of Economy—Trucking Aisles Should Be Kept Clear—Proper Storage Racks a Great Advantage

FEW factors in the problem of quantity production are more difficult to reckon with than the handling of material during the process of manufacture. The question of which is the best method is one that must be decided by the nature of the product, the volume produced, the layout of the plant, and the efficiency of the equipment available for the purpose. The individual operations of each machine and the skill of the workmen may be all that is desired, but unless the efforts of each man and machine are co-ordinated with one another, and each department working in harmony with all others, the aggregate efficiency may fall considerably below that of the average workman or machine.

Movement of Material

A very important item in the scheme of management is the system of moving the raw and semi-finished material from one location to another. It matters not whether this be the handling of work to and from a certain machine, from one machine to another, or from one department to another, the question is one that must be given careful consideration to assure the highest possible results from an economic standpoint. Where large quantities of material are constantly moving about in an extensive plant, undergoing a diversified number of detail machining and assembling operations, the labor involved is frequently an item of no little magnitude. The secret of profitable manufacture is largely a matter of keeping this handling cost down to the lowest possible minimum.

Illustrations through courtesy of Lakewood Engineering Co., Cleveland, Ohio.

The most essential and likewise the most obvious detail in regard to effective planning for quantity manufacture, is the layout of the plant and equipment so that the progress of the work will be continuous in one direction with little or no overlapping or backing up. When such a plan is adopted the cost of handling is greatly reduced.

When a certain machine is engaged in doing a detail operation—one of many on a certain piece of work—and large numbers are passing through, it is necessary to place them to one side while awaiting removal to the next machine. The old method of piling the pieces on the floor is gradually being superseded by other methods which eliminate the double handling that formerly added to the cost of manufacture. How easily many of us can look back and see the workman taking the piece from the machine, place it carefully—or otherwise—on the floor, and after doing the same with many pieces, watch another workman come along with a barrow or a truck, lift each piece separately onto the platform until it is fully loaded, wheel it away to another part of the shop and deposit the pieces, one by one, on the floor adjoining the machine that is to do the next operation. Few modern shops would tolerate such practice to-day.

During the past few years the question of factory transportation has received considerably more attention than that accorded it prior to the age of shells. During the period of excessive activity industry was forced to work under the handicap of a shortage of labor. This together with the necessity of efficient and rapid transfer of material about a factory, gave tremendous impetus to the better trucking methods that are now recognized as an imperative need in even the smallest of manufacturing plants.

Movement of Product

Second only to the systematic layout of equipment are the facilities provided for the movement of the goods through the various departments. Machines should not be crowded together. Ample space is required for the placing of work as it is brought to and taken from the machine, and this must not interfere with the space reserved for general truck movement in the shop. Interference is the one outstanding feature that must be avoided in shop conditions. If a truck load of parts is moving through a shop and is required to stop in its passage while the workman removes some obstruction, this interference momentarily disturbs other workmen in the vicinity; perhaps one or more is required to assist the truckman in clearing the passage—while others look on. Wherever trucks are employed it should be an understood rule that the passage reserved for such trucking must be kept clear at all times. If necessary provision should be made to prevent the truckman from trespassing on the territory of the other workmen, and vice versa.

Conserving Man-Power

In large plants where the handling of heavy sheet metal stamping and forming dies are used considerable time is required in taking the dies and bolsters to and from the storage rooms and presses. Unless adequate trucking facilities are provided for this purpose the labor cost runs into large figures owing to the number of men required to

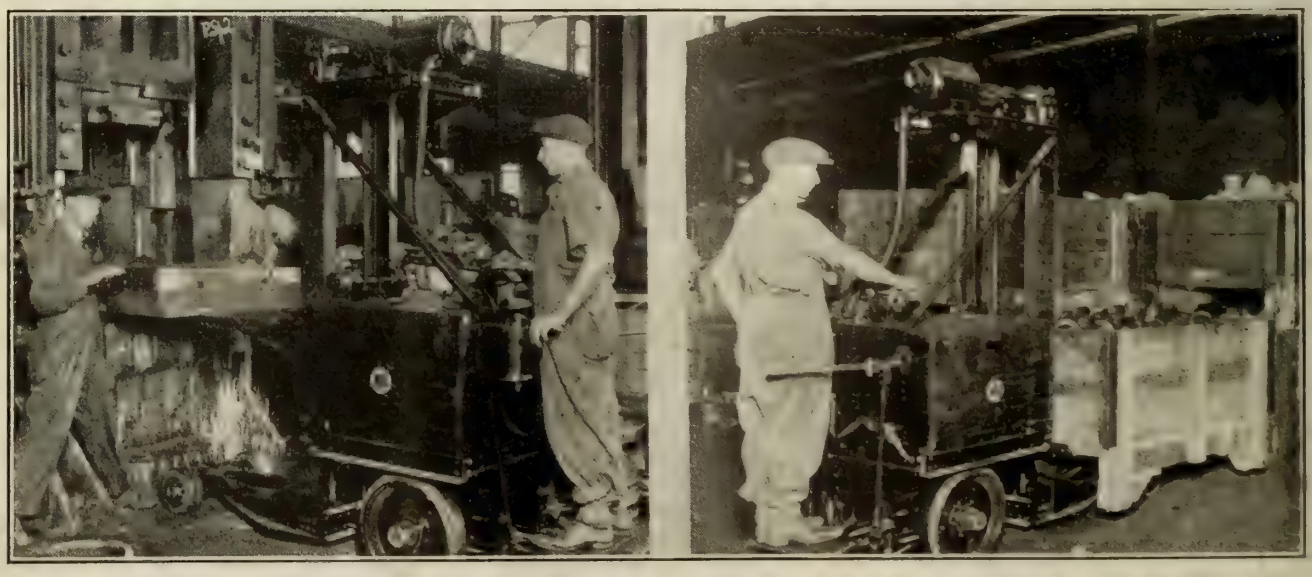


Fig. 1—Left: Tier-lift press removing large die from press. Fig. 2—Right: Handling large loaded crates of sheet metal stampings.

handle the heavy masses of iron and steel. By the use of tier-lift appliance the labor effort is reduced to a minimum, and the time consumed in placing and replacing dies permits of greater efficiency in the output of men and machines. Not only is it a great saving in time, but tools are subjected to less rough usage through the convenience of operation. Fig. 1 shows a tier-lift truck with the platform raised to the level of the press bed so that the die or bolster is easily pushed into place beneath the ram or removed from the press to the truck platform. This type of truck permits of storage racks being arranged so that the minimum amount of space is required for keeping the dies and at the same time provides adequate protection to all cutting edges and delicate mechanisms.

Saving Effected

Results of studies made by engineers in die handling metal stamping plants have shown that large savings can be effected by the adoption of equipment that will conserve the time of the workman in the handling of tools and product during the non-productive period. It is stated that from two to five hours is the usual time required for changing dies in the drop forge room, several men being used for the purpose. Under the old method of man power doing all the work the annual aggregate cost of changing dies in a certain plant amounted to over $33,000. In the installation of tier-lift trucks and proper die storage racks, the cost of the work indicated above was reduced to less than $2,000 per year. Fig. 2 shows a tier-lift truck handling large crates of metal stampings. These crates can be piled three deep if necessary.

The same reasoning applies to many classes of industrial plants where the labor cost for handling is a big item. Fig. 3 illustrates the use of lift trucks in a heat-treating plant, where the platform can be run right into the furnace to lift the rack that carries the work. Fig. 4 shows the application of the electric truck in a large foundry. These trucks and trailers are easily negotiated in narrow aisles on the moulding floor.

VARIED PRACTICE IN GEAR PRODUCTION

(Continued from Page 37)

producers, but the process labors under two difficulties. In the first case, as to accuracy of tools, it has the same status as the formed cutter process, in that its cutting tools are usually hardened after forming. All the distortion and shrinkage resultant from heating and quenching are reflected in the quality of the work. The nature of the hobbing process is such as to exaggerate these errors in the work, while the rotary cutter process minimizes them. Lately methods have been devised for grinding hobs all over after hardening. This is difficult and expensive on account of the form and relief, but if well done it eliminates a large part of the objection to hobbing. It does not, however, place it on a par with the Fellows process, no matter how perfect the hob, for the hobbing process has the inherent defect that it does not produce a smooth tooth curve, but really a series of flats. The sides of the hob teeth in the involute system are straight lines. The number of flutes in the ordinary hob is small, ten or twelve. The number of teeth of the gear actually being cut at any instant is the same as the number that would mesh with a rack, from one to three or four in ordinary gears according to size. It is plain that each hob tooth makes a flat cut and by the time the next hob tooth makes its cut the gear has advanced a definite angle.

The whole working surface of the tooth then is made up of from ten to forty, or so, flats. This is bad enough with a gear, but is evidently at its worst with a pinion. Now suppose the hob is warped, and all hobs warp more or less in hardening. It is quite possible for a pinion tooth to be so badly affected by the flats that result from the high teeth of a hob with a few flutes, as to be quite misshapen, as well as presenting a very bad surface. Good hobs with numerous flutes will produce good gears and fair pinions. The Fellows or Gleason systems on the other hand, since they cut the full face of the gear at each stroke, have a very slow rate of rotation, and what correspond to the flats of the hobbed pinion are only a series of fine scratches. Further, the condition is not markedly worse with a pinion of few teeth than with a gear. It should be mentioned here that the disadvantages due to flats disappear in the case of the worm wheel hobbed by the tangential feed method, for while this hob would generate flats in any one position, as soon as it is moved along the tangent to the work it wipes out all flats and leaves a perfect job. Defects due to hob warpage are also minimized in this particular case.

(To Be Continued)

EFFICIENT ENGINE INDICATOR

Engineers have the greatest possible regard for the simple indicator which has been used for so many years to reveal what is happening inside the cylinder of a steam engine. The indicator diagram of an engine is the recognised certificate of character. This standard instrument, however, is not exempt from the law of progress, and at a recent meeting of the Royal Society of Great Britain an instrument was shown which quite puts the old-fashioned indicator in the shade. This instrument will, within half a minute and almost automatically, produce ten successive permanent records of the performance of a high speed engine. It traces these records on a card which is ready either for immediate inspection and measurement in a very simple microscope, or for photographic enlargement. The value of such records taken at such rapid intervals is that they draw the attention of the designer or manufacturer to unsuspected or obscure defects which would not be revealed by the ordinary indicator. The new indicator can be used on motor cars and on flying machines when track tests or trial flights are being conducted, and where there is neither space or time for elaborate instruments or methods of testing. The records are mechanical, not optical or photographic, and the operator need not leave his seat in order to take them.

Fig. 3—Left: Tie-lift truck in heat treating plant. Fig. 4—Right: Electric hauling truck in large foundry.

News From the Welding Field

Oxy-acetylene Welding and Cutting Blow Pipes

Tests of Different Apparatus—Weighing Quantity of Gas Consumed—Accurate and Fair Records Should Be Kept—Better Understanding of Blowpipe Flame Necessary to Economy

By ROBERT S. JOHNSTON

AT THE request of the Standardization Section, Purchase Branch, Purchase, Storage, and Traffic Division of the War Department in the States, the Bureau conducted an investigation of the operation, efficiency, and safety of oxyacetylene welding and cutting blowpipes. Apparatus from fourteen different manufacturers were submitted to test. The tests were decided upon after a careful survey had been made of the technical literature on the subject and a thorough study made of the various operations in which these blowpipes are used. Suggestions for methods of tests were also secured from the manufacturers.

All blowpipes were submitted to a standard series of tests, which were developed with the idea of minimising the personal equation of the operator and securing data that were representative only of the blowpipe itself. In order to accomplish this result a rather elaborate testing equipment, consisting of a weighing system, a gauge-board equipment, welding table, cutting table, and safety and flashback testing apparatus, was designed and used throughout the investigation.

Gas Consumed

The weighing system was used to determine the amount of gas consumed in any blowpipe operation, the process consisting in determining the loss of weight of banked tanks of oxygen and acetylene. In order to transfer the loss of weight into cubic feet of oxygen and acetylene consumed, special studies of the density of oxygen and acetylene were made. The gauge-board system comprised a flow meter designed and calibrated for this investigation, which was used to furnish a check upon the quantity of gas consumed in the welding and cutting operations, and also to secure data that would show the fluctuation of gas volumes used at different periods of time during a test.

Special care was taken to furnish the gas delivered to the blowpipes at the pressure specified by the manufacturers. To accomplish this, special compound manometers were designed and used throughout the investigation, Bourdon tube gauges being used only as a check apparatus. Besides observational data of the gas volume being consumed as indicated by the flowmeter differential manometers and the pressures delivered to the blowpipes, autographic recording gauges were also installed to secure graphical representation of the pressure fluctuations.

Welding Tests

All welding blowpipes were submitted to welding tests on ½in. and ¾in. metal. The operation of the blowpipe, however, was necessarily performed by experienced operators. For the cutting tests the blowpipes were mechanically guided and controlled, so that practically all personal equation of the operator was eliminated. During the cutting tests the blowpipes were operated at the maximum speed at which they would cut metal of specified thickness. ½in., 2in., 6in., and 10in. metal were used in the cutting tests.

A further series of tests was made to determine the freedom from flashback and safety of operation of the various welding blowpipes.

The results of the initial series of tests carried out on the welding blowpipes indicated that there were some phenomena in connection with the operation of a welding blowpipe that were not understood. A very thorough study of the design of the various welding blowpipes was therefore made, and certain conclusions relative to the cause of inconsistencies in action noticed were arrived at. A supplementary series of tests was then carried on to prove the correctness of these conclusions. From this secondary investigation it is shown that the proper principles upon which the design of oxyacetylene-welding blowpipes should be based were probably not fully realized. The results of this entire investigation may be summarized as follows:

Cutting Blowpipes

1. There is to-day no generally accepted theory for proportioning, for the cutting of metal of various thicknesses, the volume and velocity of the issuing cutting jet, with the result that none of the apparatus submitted to test proved economical for all thicknesses.

2. There is for any thickness of metal cut a limiting velocity of exit of the cutting jet at which complete utilization of the oxygen takes place, and there is a limiting value for the amount of oxygen required to produce a cut.

3. An increase in acetylene consumption, in oxygen consumption, or in the velocity of exit of the cutting jet beyond the limiting value, does not produce increased efficiency in commensurate ratio.

4. A large majority of the blowpipes tested were equipped with excessive preheating flames for the thickness of metal the tip is specified for, and such excessive-sized flames are disadvantageous both from the standpoint of economy of operation and quality of work performed.

5. Considerable improvement in economy of operation seems possible in cutting material of 2in. thickness; possibly this condition may be found to exist for metal of other thicknesses than those used in the tests.

6. The maximum thickness of metal that may be economically cut with an oxyacetylene blowpipe of standard design, when neither the material nor the oxygen is pre-heated and the cutting is done from one direction, is about 12in.

7. Cutting blowpipes, due to their incorrect design, are subject to the same flashback troubles found in the welding blowpipes.

Welding Blowpipes

1. The blowpipes most subject to the so-called phenomena of "flashback" are those in which the oxygen is delivered at a pressure in excess of that at which the acetylene is delivered.

2. All blowpipes tested, including those in which the acetylene is delivered at an excess pressure, as well as the so-called equal or balanced pressure blowpipes, are subject to flashback phenomena on account of inherent defects in their design.

3. The cause of the development of the conditions producing flashback is the setting up, within the blowpipe tip and head, of a back pressure which retards or chokes off the flow of one of the gases.

4. This back pressure is the result of confining or restricting the volume flow of the issuing gases at the tip end.

5. Any cause tending to restrict the flow of the gases sets up a back pres-

(Continued on page 47)

Who Will Supply World's Steel Requirements?

Productive Capacities of Britain and America Considered—Will Immense Home Demand in U.S. Absorb Production—Heavy Transport Costs on One Side and Low Production Costs on Other —British Export Distinctly Upward

AS THE possibilities of American competition in the steel group of trades are provoking considerable speculation, attention may be called to some of the governing factors in competition between Britain and the United States in the heavy iron, steel, and engineering trades, writes a correspondent in the Manchester Guardian Commercial. From time to time America has been pictured as a country with the greatest natural resources, the most up-to-date manufacturing plants, the most efficient workmen, the cheapest transport, and the most pushful business men. Periodically we have been told that she was just about to undertake such an export campaign as would sweep our goods out of the markets.

The Americans, with their vast resources in coal and iron ore, built an enormous number of new plants. They put themselves in a mechanical position to produce more iron and steel than Britain and Germany put together. But they failed completely to capture the world's export trade. They manufactured in great volume for their own protected home market, but they could not touch either ourselves or the Germans in export trade. In the last fifteen years before the war Great Britain, with its relatively small productive capacity, sent to overseas markets nearly a sovereign's worth of iron and steel for every dollar's worth exported by the United States. We frequently saw mammoth steel plants in America, representing hundreds of millions of capital, standing idle while Britain and Germany between them divided nearly nine-tenths of the world's export business. Will history repeat itself?

Let us consider the productive capacities of Britain and America. In round figures these two countries could produce annually, with every furnace going, the following quantities:—

	Pig Iron tons.	Steel Ingots & Castings. tons.
United Kingdom	10,000,000	12,000,000
United States..	45,000,000	49,000,000

At the present moment they are producing at the following rates:—

	Pig Iron. tons.	Steel. tons.
United Kingdom	5,500,000	6,000,000
United States..	32,000,000	38,000,000

It is not, however, actual production so much as volume of exports that we are interested in from a competitive point of view. In round figures the current British and American iron and steel export rates per annum may be put as follows:—

Annual Rate of Iron and Steel Exports.

United Kingdom..... 3,500,000 tons.
United States..... 2,250,000 tons.

In 1917, under the munitions pressure and with no ordinary competition to meet, America produced 43,500,000 tons of steel, and her capacity has been increased since then. But last year she produced less than 20,000,000 tons. From the low level of July, 1921, the American steel output has increased as follows, notwithstanding a coal strike covering April and May:—

U. S. Steel Output.

	Tons.
July, 1921	954,000
August	1,351,000
October	1,920,000
December	1,694,000
January, 1922	1,892,000
February	2,072,000
March	2,815,000
April	2,897,000
May (est.)	3,200,000

U. S. Exports Falling Off

The latest advice from America puts the annual rate at something over 38,000,000 tons of steel, with production likely to go still higher when the coal strike is settled. The possible effects of this huge output on international trade are not easy to forecast. Month by month since the middle of last year steel orders have grown on United States home account. They grew on foreign account until the coal strike and increased prices were threatened. Since then there has been a falling off in shipments, but a much more marked decline in fresh orders. Actual export tonnages have been as follows since the depression in the middle of last year.—

U. S. Exports of Iron and Steel and Manufactures Thereof.

	Tons.
July, 1921	85,000
August	73,000
October	102,000
December	130,000
January, 1922	157,000
February	133,000
March	204,000
April	198,000
May (est.)	150,000

Against these figures Britain has so far this year exported at the rate of 260,000 tons per month, with the tendency distinctly upward.

Large American Demand

As soon as the American coal strike was threatened there was something like a rush of orders for steel, and the mills are pretty well booked up till August at the current high rate of output. Prices have been advanced, roughly, by £1 a ton since the end of March. But will this activity on domestic account continue? Will home demands be nearly sufficient to absorb the production after, say, August? Or will there be a huge surplus available for export in competition with our products? And if so, at what price will American steel be offered? Fuel prices are inflated, owing to the coal strike, and the consequent steel price advances have brought bars and shapes to about £8 a ton in English money at Pittsburg. With the settlement of the coal strike, with fuel prices down, and with the 10 per cent. reduction in railway rates, how far will steel prices recede in the United States? Will they go low enough, assuming a big surplus for export, to enable American steel to carry transport costs from the interior of the United States to far distant markets in which we are interested, and finally be sold in such markets at prices under those of our products?

The United States proved during the war that she could export more than 6,000,000 tons of iron and steel in a year, Probably the country's transport facilities are good enough now for 6,000,000 tons a year. But it is chiefly a matter of cost, and on this point British and American conditions are opposite. We have very short haulage distances. The Americans have tremendous distances separating their ore from their coal and their plants from ports of shipment. Again, the British steel output per unit of labour is small compared with the American output. American wages are higher than ours per man, but cost per ton is less. The Americans have much cheaper fuel than we have.

To sum up, it may be said that while we have our coal and ore supplies, steel works and shipping ports almost side by side, in the United States the ore is deposited 1,000 miles from the coalfields, and the steel works, on account of the coal, are between 400 and 500 miles from seaboard. America's transport costs for minerals and heavy metal products are tremendous relatively to the free on board prices of the goods. The railway rates carried by a ton of common steel by the time it gets to tidewater in the United States amount to $9. We have the advantage in low assemblage and shipping costs; they have the advantage in low production costs—or labour costs per unit of output. We also have some advantage in the reputation we have for the soundness of our steel products. If we keep our fuel and other costs at something like current levels we can successfully compete in the heavy lines of steel and engineering, though we may be beaten in some of the lighter lines in which transport costs do not form a big proportion of the final selling price.

Practical Ideas From Practical Men

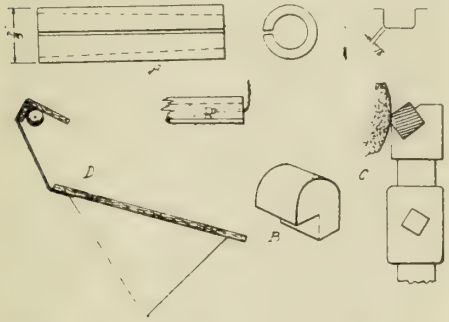
SOME SHOP KINKS

By D. A. H.

Job shops, more than others, suffer from the annoyance of drills being made both straight and taper shank. Each style of drill is all right of itself and fits into work schemes where the other will not, but when the shop has a typical stock consisting of one drill of each size from ⅜ in. up to 2 in. by sixteenths, there is sure to be a mixture of shanks. Job shops find the two-jaw chuck the best method of driving and changing drills—the chuck, of course, being designed for straight shanks.

Adapter For Taper Shank Drills

Collets with different combinations of sizes are on the market or may be shop-made (preferably the former) but there is one form of collet, or rather adapter, that is worth adding to the stock already on hand. It is shown at A. It is simply a sleeve with a taper



inside and straight outside, then split full length. This adapter may be made thinner than are stock collets and in that way will permit the use of the taper shank drills in smaller chucks. Another advantage is that it does not require the use of a drift. The sizes given are but one that may be made.

Bending in the Vise

There is quite a variety of bending and forming that may be done more conveniently at the bench vise in the machine shop than carrying to the blacksmith department. It is a frequent sight to see workmen hammering on the body of the vise in the rear or trying to bend round corners over the jaws—one is unexcusable abuse, the other is working without tools. Sketch B shows a simple little horn block that will save time and raise the standard of workmanship. Cast iron will do for ordinary purposes—once the pattern is made the pieces are so cheap that the shop can afford to discard when battered. The lower extension is gripped between the jaws; the horn part can be made to any curve desired or a variety of shapes gotten out that will answer every requirement as to height and radius.

Removing Corners of Key Stock

At one time we had a job that used a good many pieces of 7/16 in. square cold-drawn steel in lengths from 3 in. to 36 in. This is called "key stock" in many plants and we were using it as a removable key in keyways that were ordered cut with beveled corners. The bevel on the key had to be slightly greater than that in the keyway, for clearance. For a while we planed or milled off the two corners after the pieces were cut to length. This made a nice looking job but was expensive and to speed up the work we began to grind the corners freehand, grinding in the bar. This was quick but very uneven.

The work rest illustrated at C was made to overcome this weakness and it did enable us to do a nice job in quick time. Two pieces of steel were put together—one the shank of 1 in. c. d. s. and the other a square piece about 4 in. long forming the rest proper. In this latter, was milled a groove for the bar to lie in. The workman could not go wrong; there was space enough to manipulate easily but the angle was retained and too much could not be ground off unless the bar was deliberately lifted and held against the wheel.

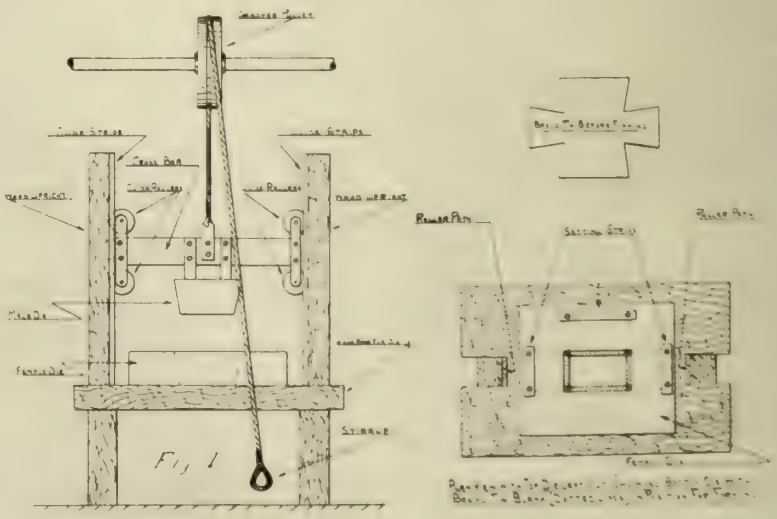
Shaded Light for Drawing Board

Drawing board light ideas have been about as numerous as ink bottle holders. As a good makeshift, if not for permanent use as well, the one shown at D is worth considering. Two pieces of board are joined in the form of an inverted trough. In the centre, at the highest part is fastened the lamp, which may be an extension or drop cord if not a line set in pipe. The interior is painted a flat white, the outside left unpainted or finished in dark color. A method of support adaptable to local conditions will suggest itself, the simplest being two upright boards at the ends which shut off light that way at the same time.

NOVEL FORMING DIE

By G. Blake

Although the making of bakers' bread tins is rather outside general engineering, yet on the other hand the devising of appliances and methods for economical production, provides scope for the tool maker. We recently had a contract to make a large quantity of bakers' bread tins; this type of tin is not folded at the ends, as is usual with these tins, but it is welded at the corners thus making an extremely sound tin. The first operation is to cut the corners of the flat sheets, which, by the way, were supplied the exact size so that they only required the corners to be cut out. The sketch in Fig. 2 shows the sheet after the corners have been cut out on the press; the next operation is the forming, or shaping, prior to the welding. A casting was made to the inside dimensions of the tin, this being the male die; see Fig. 1. Another casting was made to the outside dimensions of the tin, this being the female die block, see Fig. 1. At first it was intended to utilize an upright pillar drill, and to attach the male die to the drilling spindle and the female die to the circular work table, and to use the drilling spindle in the same manner as an arbor press and using the hand feed lever to press the tin to shape; this, however, did not work out successfully; and apart from its non-success, it was tying up a drilling machine which was often required for its ordinary work.



The writer got out a better method as shown in Fig. 1, the idea being taken from the well-known drop-stamping apparatus. A stout wood bench was made to support the female die block, it will be noted that there are two wood uprights on the ends of this bench, and, on these uprights, there were fixed by wood screws, mild steel guide bars two on each upright. These bars were set ½ in. apart; the cross bar, which is bolted to the studs on the male die, is a sliding fit between the guide bars. To facilitate and ensure easy movement, a couple of straps carrying four steel rollers (also running between the guide bars) were fixed to the cross piece; see Fig. 1. The studs referred to were screwed into the male die, a shackle provided the necessary link between the die and the rope for actuating the stroke. Fortunately, we had an idle length of line shafting fixed to the wall, this shafting was not used for transmitting power, so it was accordingly brought into use. The drop-stamping machine as described and shown in Fig. 1, was fixed to the floor under this line shaft, a special grooved pulley was attached to the shaft, the rope was passed over the pulley, and a stirrup was formed at the loose end; so that the boy, operating the machine could get his foot through it. By pressing his foot downwards he automatically raised the male die, and keeping his foot in the stirrup, inserted the plate as shown in Fig. 2; this plate was located by stops as shown, so that it was impossible to get it in the wrong way. To form the tin the boy simply raised his foot so that the weight of the male die being released it dropped down and formed the tin, he then pressed his foot down raising the die, took the formed tin and inserted another blank and proceeded as already described.

The feeding and delivery of the tins before and after forming is as follows: A small bench was placed at the right of the machine, upon which was placed (within arm's reach of the boy) blanks ready for forming and on his left hand was the work bench where the edges of the corners were hammered over prior to welding; the idea being that the boy operating the drop stamp would not have to move away from the work; he simply lifted a sheet with his right hand, placed it on the bottom die, formed it, and with both hands withdrew it from the die, and then with his left hand placed it on the bench for the hammering operator; meanwhile he would reach out with his right hand for another blank, it being understood that his foot would be continually in the stirrup, thus leaving his hands free as already described. The tins were thus formed cheaply and efficiently at a rate of 120 per hour at a cost of 8 cents.

MACHINING COILER WHEELS

By Geo. Barrett

The sketch, Fig. 1, shows a coiler wheel used to coil cotton into a round tin cylinder after going through the carding process. The first step in manufacturing these wheels is to face bottom side and cut groove; this groove acts as a bearing to hold the wheel in position on coiler stand and must be very accurate in dimensions.

Sketch, Fig. 2, shows the special chuck made for facing operation, and is a kind of a bell chuck having 3 steel lever jaws, A, 180 degrees apart as represented at front view, Fig. 3. In making this chuck, after fitting steel jaws, they are bored about 1/16 in. larger in diameter than the teeth on coiler wheel, giving the least possible movement when gripping work.

This chuck could be attached to any turret lathe or an ordinary engine lathe using air chuck or hand-wheel attached to draw rod, B. Fig. 2, for tightening purposes.

After facing and turning to diameter, the next step is to bore the hole which is on an angle of 45 degrees. This being done on an horizontal boring mill or engine lathe set for the purpose and using jig, Fig. 4, which is of the ordinary box type with the required angle. It is also bored out about ¼ in. deep at A, Fig. 4. To suit the diameter of work for truing purposes, the wheel is centered by scratching a line on outside diameter using an ordinary machinist's square for the purpose, and the mark being set to center line of jig. After clamping, the job is set ready for boring.

After boring, the next operation is to turn small diameter A, Fig. 1, also face same and put radius diameter inside of bored hole, the wheel being held similar to boring only using a lathe face-plate recessed out for the purpose. As the box must be of glass finish, the final operation consists of lead lapping inside of the hole to get the required smoothness.

OXY-ACETYLENE WELDING

(Continued from page 44)

sure which immediately causes a change in the amount of each gas delivered to the mixing chamber.

6. A fluctuating gas-volume ratio, due to restriction of volume flow from whatever cause, prevents a blowpipe from maintaining constantly and at all times during operation the desired "neutral flame."

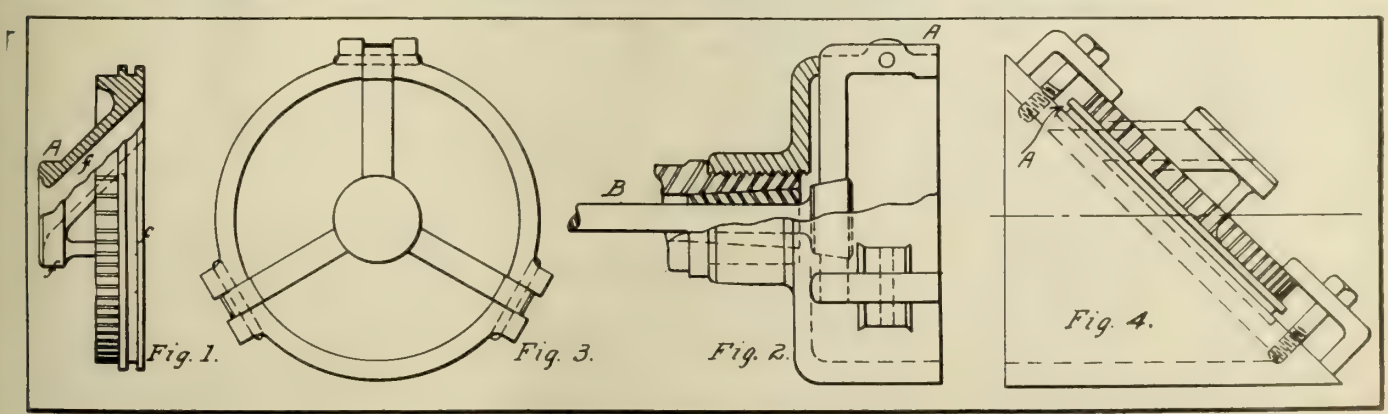
7. A blowpipe that cannot maintain under all operating conditions a neutral flame cannot logically be expected to produce sound welds.

8. All the blowpipes tested during this investigation either through improper gas pressure or improper interior design, or both, are incapable of maintaining a neutral flame (constant volume gas ratio) under all conditions of restricted gas flow, and are therefore incapable of producing sound welds where there is any liability of the gaseous products of combustion being momentarily confined, such as occurs in practically all welding operations.

9. The ability of a blowpipe to consume an equal ratio of gases when burning freely and undisturbed in air is no criterion that it is capable of producing sound welds—that is, that it is not subject to detrimental fluctuations in gas ratio during a welding operation, and therefore is capable of maintaining a neutral flame under all operating conditions.

10. Whether a blowpipe of present design will consume equal volume ratio of gases when burning freely and undisturbed in air depends on how nearly correct the operator sets the so-called neutral flame, and experience indicates that the average operator checks the acetylene-gas flow too much and actually develops an oxidising rather than a neutral flame.

Conservation of coal by the railways seems advisable and the Grand Trunk announces cancellation of a number of local trains. Main line services will not be affected.

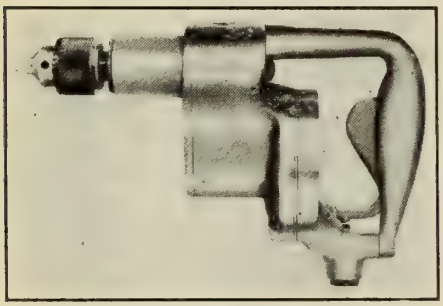


Method of machining coiler wheels.

New Things in Shop Equipment

TINY TURBINE DRILL

A specially designed light weight yet well-balanced and powerful air drill has just been placed on the market. The propelling portion of this tool is a turbine similar in character to some of the well-known turbines at present on the market, therefore, it is not an experiment. The turbine is made from an aluminum magnesium alloy having the strength of mild steel with about one-third of the weight. The speed of the



Lightweight Turbine Drill.

turbine being high, a gear reduction of considerable amount is necessary, likewise, the stresses on the gears are fairly high to meet these conditions, and insure long life. All gears and shafts are made from high carbon chrome nickel steel, oil treated, to insure the maximum physical ability. The tool is ball bearing throughout, thus reducing frictional losses to a minimum. All ball bearings are of the highest quality. The housing of this tool is made from an aluminum alloy, highly finished, and the tool is pleasing and sturdy in appearance.

A special care has been exercised in its design relative to that member which contain the nozzles, so as to permit of easy cleaning of dirt or any foreign matter which may become lodged in the nozzles. The lubrication of the tool is accomplished by having all bearings and gears in one housing, using an especial semi-liquid lubricant which is sufficient for from three to six months' use, depending upon the total actual working time. This drill has a capacity of 5/16 in. in steel and ⅜ in. in wood, and is equipped with Jacobs chuck, and, weighs 6 lbs. complete. It is manufactured by The Turbine Air Tool Co., Cleveland, Ohio.

PNEUMATIC DRIVING CLUTCH

A pneumatically operated clutch has recently been placed on the market. The clutch consists of two discs with cork-covered conical faces on the periphery. The discs are driven by pins to a triangular plate which forms part of the hub. When operating the clutches the air passes through the hubs between the discs while the hub is revolving, the discs being fastened together at the periphery with a flexible, air tight connection. When the air comes through the inlet it is forced between the discs, spreading them apart, this action forcing the conical friction surfaces of the discs into contact with the outer case, the latter being carried on a ball bearing quill. When released the discs are brought back to normal position by means of springs. These clutches are particularly adapted to fields where clutches of large horse power are required, or where control is desired at a distance. Low pressure air is all that is necessary, the amount being one to three pounds. End thrust on bearings is eliminated owing to the opposed nature of the drive. To maintain constant contact a continuous flow of air is allowed to go into the clutch. One pound of air in a 30 in. clutch gives a spreading power of about 1,400 lbs. These clutches are manufactured by the Rogers Foundry and Manufacturing Co., Joplin, Mo.

IMPROVED PNEUMATIC GRINDER

An improved pneumatically operated portable grinder has recently been offered to the trade. When used in connection with a wire brush an air motor is required to deliver continuous service, and therefore the bearings are more efficiently lubricated, so that an oil separator has been incorporated in the grinder. This improvement enables continuous service for 28 hours or even longer without replenishing the supply of lubricant. The application of a brush to this particular grinder makes this equipment serviceable for such work as removing rust, paint and scale from steel and iron surfaces. The brush consists of ⅛ inch steel back plate fixed so as to better retain the wires, and the other ⅛ front plate having a series of slots through which the wire extends. These wires are grouped in 30 renewable units of heat-treated crucible steel. The shell of the oil separator revolves around the vent tube and the oil laden air feeding the motor passes through the holes of the shell. The oil is separated from the air by means of centrifugal action and returns back into the mechanism of the grinder. These tools are manufactured by the Chicago Pneumatic Tool Co., New York.

PORTABLE OIL-BURNING FURNACE

A special forging and welding furnace that may be transported from place to place in the shop for forging and rivet-heating has recently been placed on the market. The furnace is substantially and firmly made, the frame work being of angle iron and sheet steel. The work opening is 6in. wide, 3in. high at the edges and 4in. high in the centre. The fire chamber is 9in. wide, 7in. deep and 5¾ in. from the butt to the back. The oil tank which is placed within the frame and beneath the fire chamber will stand the pressure of 100 lbs. per square inch. It has a capacity of 14 gal. of fuel, sufficient for 10 hours of average operation. The tank has a 2in. air-tight filling opening and is likewise provided with a safety valve. The fire-clay shapes are simply constructed and may be quickly renewed. Air pressure is obtained from the ordinary shop line. The shipping weight of the furnace is 600 lbs. These furnaces are manufactured by the Wayne Oil Tank & Pump Company, Fort Wayne, Ind.

B. & S. THICKNESS GAUGE

The Brown and Sharpe Thickness Gauge No. 646, affords a relatively inexpensive precision tool of this type, which it is claimed, fills an important need. It contains six blades: .0015 in., .002 in., .003 in., .004 in., .006 in. and .015 in. in thickness, which can be used together or singly and give a variety of measurements up to .0315 in. These sizes have been selected by the makers as ones most frequently used, and to give a complete range of measurement. These blades are not rolled to size, but

New Thickness Gauge

are ground to the correct thickness. The gauge has been designed with an eyelet in one end so that it can be carried on a ring or hung up. It is especially useful to the motor mechanic and to automobile drivers, for it answers the requirements in many places around a

(Continued on Page 60)

CANADIAN MACHINERY
AND MANUFACTURING NEWS

Published in the Interests of the Machinery, Manufacturing, Iron, Steel, and Metal Working Industries.

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Modern Hoisting Efficiency

IN THE development of equipment making for economy and efficiency in the modern industrial plant, hoisting and conveying equipment occupies an important place. Since production costs must be kept at a minimum in order to meet competitive conditions, operations must be carried on with the greatest possible economy. The day is passing when the shifting of a machine or the transfer of material or the routing of work calls for the attention of more men than those immediately concerned in that particular operation.

The useful chain block, the pneumatic hoist, the portable floor crane, the heavy travelling crane, the industrial or freight elevator, all figure prominently in the scheme of industrial purposes, and to-day it is a most exceptional case when they are not employed as essentials in some shape or form.

Imagine a three-floor furniture factory without a hoist or elevator of any description, conveying by hand the different pieces of work by stairway from floor to floor. Consider the handicap to continuous, concentrated labor in such an establishment to say nothing of cost of production as compared with a plant where shifting and other routing processes are done by machinery. Consider, on the other hand, a large leather manufactory, not only with ten or twelve elevators, and employing hoisting equipment for the handling of large quantities of hides in various tanning processes, and thus eliminating much manual work. Consider these two actual cases and you have the difference between modern efficiency and effete conservatism.

Problems of Malingering

IN THEIR attempts to reduce malingering to a minimum under the Workmen's Compensation law, manufacturers have been confronted by some interesting facts. In 1920, the scale of compensation was increased from 55 to 66 2-3 per cent. There was an increase in the number of accidents during the first year under this scale, of 10.592, though the number of workmen employed was practically the same, and the amount of compensation awarded increased from 4 1-4 millions to 7 3-4 millions although 2 1-4 millions went to pay increases in respect of old cases. The startling increase, it is held, is undoubtedly due, in part, to malingering. The figures for 1921 show that while there was a decrease of 17 per cent. in the number of accidents, the awards had actually increased by about $100,000. It is evident, therefore, that workmen did not return to work as promptly as when the scale was 55 per cent. This fact is important when it is considered that 50 per cent. of the cases were one to two weeks cases and that the cost of medical aid was, in a great many cases, more than the actual compensation.

It is not surprising therefore to find that manufacturers are inclined to express themselves as favorable to a three-day absolute rather than a seven-day non-absolute waiting period, and that, further, they favor a contribution by employees to the cost of medical aid. A feeling on the part of the employee that he has some responsibility in the matter, except in most extreme cases, would seem helpful in the malingering problem.

When Stability is Necessary

TWIST drill production, of late, has been confronted by somewhat the same condition as that affecting the machine tool industry—a capacity that, for the time being, seemed beyond the requirements of the market, especially since that market came out of the war with large stocks on hand. In this case, however, these have become fairly well absorbed, but the change from a buyer's to a seller's market brought developments not altogether desirable in the viewpoint of the manufacturer desiring stability.

Discounts, in some cases, have been such as to bring the selling price perilously near, if not actually below, the cost of production at the present time. In fact a 70 per cent. discount on a half-inch $2.20 carbon drill is lower than the pre-war figure at 65 per cent. On high speed drills, a discount of 60 and 10 at the present time compares with 40 and 10 before the war when material and labor were both available at lower prices.

Naturally, the price war, if such it may be termed, was chiefly effective where most business seemed to offer, that is in the Windsor and Walkerville districts, the buying headquarters of a large section of the motor car industry, where to-day the competition is still at its keenest, confined as it is, largely, to two local concerns.

Then, on bit stock goods, sold largely through the hardware dealers throughout the country, the same tendency manifested itself, but a firming process is evidently developing here. Where a discount of 65 and 10 was the rule a recent reduction to 60 and 5 was introduced, with prospect of general recognition.

Even in carbon and high speed drills, the figures given above are not representative, and this but illustrates the condition of the market. On carbon drills a discount of 65 and 10 is quoted in some quarters, as against 70, and on high speed a discount of 50 as against 60 and 10. One manufacturer, asked for his fair market price, preferred to withhold it, considering the problem beyond any positive assertion.

Conditions on taps and dies are better. Here some stability has developed, and fairly good business is being done. There is quite a demand for hobs and other small tools for the motor car industry. It is gratifying to note a movement to get away from production on a below cost basis. The ship of industry can best make headway on an even keel. Stability is the thing and a better general outlook, rather than local possibilities, will undoubtedly bring the remedy.

Situation Producing Uncertain Market Condition

Advices From Iron and Steel Centres Say Minimum Prices Only Nominal—Blue Annealed Sheets $2 a Ton and Black and Galvanized $3 a Ton Higher—Steel Production Average Lower—Pig Iron Up $2.

STRUCTURAL MATERIAL STILL IN GOOD DEMAND

ANY LIKELIHOOD that the year's output of pig iron and steel would reach exceptionally high levels and thereby strengthen the feeling that industrial prosperity was "just around the corner," is meeting with discouragement. The shopmen's strike in the United States has already handicapped delivery of coal from non-union fields and metal production is already from 5 to 10 per cent. below the highest rate. A coal shortage in Canada, so far as industrial requirements are concerned, seems difficult of definite estimate. Only 16,100 tons entered Toronto in July this year as compared with 118,000 in July, 1921. The probability of Welsh coal getting beyond Montreal is more or less remote, unless the problem produces an organization that will work out a temporary rationing scheme. Manufacturers are considering the best step to be taken, but on the other hand, enquiries indicate that the number of firms having good supplies on hand as the result of foresight, is quite large. As conditions grow more serious in the United States, Government control of the situation is more in evidence. The Interstate Commerce Commission has introduced a priority system and as iron and steel producers are far down in the list, there is likely to be a considerable accumulation of orders against the day of settlement. An embargo on coal shipments to Canada seems almost unnecessary as there is very little coal moving.

Despatches from Pittsburg state that shortage of coke supplies is the big difficulty since many of the mills have enough coal to roll all the steel they can produce. Here again, the shutting down of furnaces seems to be anything but general as there are better supplies of coal in some districts than in others. Producers and buyers are taking the situation calmly and outside of some pressure on mills for specific delivery on contracts, there is no excitement.

Business men declare that the strike trouble is likely to cause a period of caution, based on necessity for economical production and reasonable prices. In fact, it is held in some quarters that the present disturbance will hasten reaction due to the tendency to do too much building all at once. The steel market, however, seems strong. Mills are well sold up. Minimum prices are being adjusted temporarily. In sheets, while old prices are nominally in effect with some mills, buying is being done at higher levels, say $2 a ton higher on blue annealed, and $3 a ton higher on black and galvanized.

Advance in Pig Iron

The market generally seems to be developing that aspect when nothing seems sure and every phase of the situation must be considered on its merits as it appears. Canadian prices reflect the situation. An advance of $2 a ton on pig iron only serves to illustrate problems of production. In one instance a Canadian firm has shut down its two pig iron furnaces. One was being relined and it was expected would again be placed in operation when completed, but now the coal shortage has necessitated the inactivity of both. There are, however, large supplies of pig on hand. Specific dates are now being observed and as to new business it is doubtful if anything is being booked for later than September.

July, on the whole, has been a fair month in Canadian business. A slump in the two vacation months is generally regarded as a matter of course, but this year it has been slow in coming. June was a good month in many respects—so good in fact that a serious reaction was looked for in July, but it did not develop seriously. Large tonnages in structural material were called for and producers say that this movement shows little abatement.

Montreal reports that July business will show a very good average, with general demand much better than it was one year ago. In addition to the advance of $2 in pig iron, there has been a boost of 10 cents in steel at the mills. There is also a firming tendency in non-ferrous metals. Stocks are very low in standard sizes and gauges of galvanized sheets, and it is predicted that the demand in this department is something more than seasonal. So far as machine tools are concerned, the situation appears to be brightening and dealers are optimistic as to the Fall outlook. Sales policies are aggressive, for enquiries encourage the feeling that business is approaching the stage where it is more susceptible to actual development. There have been no price changes, the general feeling being that they are now on an attractive basis.

Toronto

August 2 1922

GENERAL satisfaction with July business as compared with that of June marks the half year's turn in this market. Good tonnages of structural materials are still being received, foundry business has improved, and there is a distinctly better tone throughout the iron and steel business—but the cloud that threatens is the coal and rail strike. Manufacturers who are well stocked are beginning to watch the effects of daily consumption, while those who are not well supplied are considering ways and means by which they may carry on. The extensive use of electricity is an important factor when labor troubles develop in the summer months; had it been winter, with its necessity for warmth, the situation by this time might have been serious indeed. In fact, a more or less prominent labor man expresses the opinion that had the strike been called in winter months, the strikers would have won an easy victory. Just what provision the unions would count upon by which to supply members with fuel, does not appear. The news of most importance is that which promises an early settlement of the present trouble. In the meantime, Canadian industry is carrying on.

Scrap metal markets are reported as being decidedly lethargic. There have been no price changes of any importance during the past week. One dealer sized up the situation as follows: "Consumers seem of the opinion that prices will shortly show a reduction, while, on the other hand, dealers declare that, all things considered, present rates are about right and that they can see no immediate reason for expecting reductions." In fact, should present labor disturbances develop seriously and supplies of material dwindle, the price movement, if any, will hardly be downward. Current prices follow:

Copper, light ... ... per 100 lbs.	8 50
Copper, crucible	11 00
Copper, heavy	11 00
Copper Wire	11 00
No. 1 composition	9 00
New brass cuttings	6 00
Red brass turnings	6 50
Yellow brass turnings ...	4 85
Light brass	3 50
Medium brass ...	4 50
Scrap zinc	4 00
Heavy lead	4 50
Tea lead	3 00
Aluminum	11 00
Boiler plate, per gross ton ...	9 00
Heavy melting steel ...	11 00
Axles (wrought iron) ...	16 00
Rails (scrap)	11 00
Malleable	11 00
No. 1 machine cast iron ...	16 00
Pipe, wrought ...	6 00
Car wheel	16 00
Steel axles	15 00

Iron and steel bar prices in which department there was an advance of 10 cents three weeks ago have now become stabilized. Some price-cutting was reported from the East, but this has evidently been eliminated and the raise now has general application. Otherwise prices are stationary, and reflect none of the disquieting or uncertain tendencies reported from American markets. Very marked changes are reported to be developing in the sheet

market. Reports from Pittsburg show advances of $2 a ton on blue annealed and $3 on black and galvanized. For some time the demand has found a short supply in this department and now it appears an advance will be in order.

Iron bars	3 15 to 3 25
Steel bars	3 15 to 3 25
Reinforcing bars	3 15 to 3 25
Steel hoops	4 00
Tire steel	3 15
Spring steel	7 00
Band steel, No. 10 gauge and 3-16 in base	3 65 to 3 75
Small shapes	3 25
Sheets, black, No. 28	5 25
Sheets, blue ann., No. 10	4 25
Canada plates, dull, 52 sheets	5 25
Canada plates, all bright	5 25
Galvanized Sheets, No. 28	6 00
	6 35

In non-ferrous markets, the condition exists of a slack demand and a trend toward decidedly firmer prices. Activity in sheet lead is reported with prices generally unchanged. Tin is also meeting with some demand, and is now quoted at $36.25, while in other departments slight advances are scored. It is a difficult market to consider except from day to day as Canadian trend almost entirely reflects that on the American side, where at the present time the markets are subject to quickly changing conditions. Prices follow:

Lake copper	17 25
Electrolytic copper	17 25
Castings, copper	17 00
Tin	36 25
Spelter	7 50
Lead	7 00
Antimony	7 40
Aluminum	21 00

Machine tool markets report little improvement. Some sales are being made and enquiries are good. September it is felt, should see a better demand. Suplies are keeping up and tap and die manufacturers say that their market is showing quite a nice disposition toward buying. In drills and reamers, certain sections of the country are passing through a period of price adjustment, which has taken on something of the aspects of a price-cutting campaign, regardless of cost. It is remarkable that in a locality where business should be on a fairly stable basis, competition has developed very keenly—so keenly in fact that some manufacturers are remaining away until the situation shows some return to reasonable prices.

Although supplies are low, turpentine has again registered an advance of 10 cents—$1.65 to $1.75 per gallon in barrel lots.

Montreal

August 2nd.

FIGURES for the month of July indicate that about the same amount of business was handled as in June, which latter month was the best so far this year. During the past week the volume offered has not been large, but as the first two weeks of the month were exceptionally good the average for the month is good. Prices of steel at the mills have advanced another ten cents this week. The jobbers have not altered their prices as yet. Pig iron has advanced two dollars a ton. Business in steel products is much better than it was this time last year, but is below the figures of some weeks ago. Consumers of pig iron are rather well covered and buying is slowing up. Machine tools are still very dull. Shop supplies are moving satisfactorily. The non-ferrous metals are somewhat stiffer in price, the demand remaining about the same as last week. The scrap metal market continues dull.

Iron and steel:—The demand for galvanized sheets continues to be slightly in excess of the supply. Shipments arriving for local jobbers do not often find their way into the warehouses. For some time past, warehouses have carried no stocks of standard sizes and gauges except in a few rare instances. Black and blue annealed sheets are also enjoying a good demand. The activity is seasonal, but this year it is believed that sheets will be active right up until the close of navigation. Structural steel, merchant bars, and a large range of steel products are moving very well indeed, considering the fact that this is the month that is generally accepted as being dull, owing to the general disorganization due to the holiday season. Plates are very dull locally. The coal and rail strikes are commencing to have a direct influence on local trading. The mills advanced their price of steel ten cents per hundred pounds base during the week. Large consumers are quoted $2.50, and jobbers $2.70 base per hundred pounds. The jobbers are still quoting from $3.15 to $3.25 to the consumer, the larger orders getting the lower figure. The C. P. R. recently purchased a considerable tonnage of rails, and it was thought that the national system would also come into the market. This conjecture proved an error and it is now thought that nothing will be done till the directorate is appointed. The supply of steel locally has been sufficient to take care of all demands, but the future is viewed with more or less apprehension, as it is not known just to what extent the strike situation will influence supplies of raw and finished material. Local quotations are as follows:

Iron bars	3 15 to 3 25
Steel bars	3 15 to 3 25
Reinforcing bars	3 15 to 3 25
Steel hoops	4 00
Tire steel	3 15 to 3 25
Spring steel	6 00
Band steel, No. 10 gauge and 3-16" base	3 25
Small shapes	3 00

Pig Iron:—An increase of two dollars a ton has been announced in the case of both Canadian and imported pig iron. No. 1 Canadian iron is quoted at $33.80 a ton on track in car lots, while Summerlee iron is quoted at about thirty-two dollars on docks. To this figure there must be added wharfage and cartage, or rail haul if such is necessitated. In a great many instances the figure for Summerlee varies from the quotation on the Canadian by only a few cents. Foundries have covered their requirements for the next few months and the demand is falling off somewhat. The strike situation has a very direct bearing on this market and before the close of navigation there is a possibility of many peculiar situations developing. The foundries are increasing their daily melts slowly but surely, and this increased consumption will bring them into the market in the course of a couple of months.

Non-ferrous Metals:—Quotations on copper remain steady but from London there comes a report that tin is advancing rapidly. The local quotation on tin jumped a cent and a quarter during the week. Spelter, influenced by conditions in the United States, is up a quarter of a cent a pound. Lead stiffened a little during the week. Antimony remained firm at six and a half cents. Aluminum eased off a cent during the last few days. The local demand is much the same as last week, being composed mostly of small lots from points widely scattered over the province. The local quotations are as follows:—

Lake Copper	17 75
Electrolytic Copper	17 50
Castings, Copper	17 25
Tin	36 25
Lead	7 00
Spelter	8 25
Antimony	6 50
Aluminum	22 00

Scrap Metals:—Another quiet week has been noted in the scrap metal market. The local demand continues light. Some orders have been received from outside points. Local dealers are not stocking up to any extent, until there appears a better prospect of business. The local quotations are:

Copper, light per 100 lbs.	8 50
Copper, crucible	11 00
Copper, heavy	11 00
Copper Wire	11 00
No. 1 compositon	9 00
New brass cuttings	6 00
Red brass turnings	6 50
Yellow brass turnings	5 00
Light brass	4 00
Medium brass	5 50
Scrap zinc	3 50
Heavy lead	4 50
Tea lead	3 00
Aluminum	11 00
Boiler plate, per gross ton.	9 00
Heavy melting steel	10 00
Axles (wrought iron)	20 00
Rails (scrap)	11 00
Malleable	10 00
No. 1 machine cast iron	20 00
Pipe, wrought	7 00

Machine Tools:—No change is noted in the demand for machine tools. Inquiries continue to come in, but there is little actual business moving. For some months past, the sales have been only small tools and these in lots of one and two. In many ways the situation appears to be brightening, and dealers feel optimistic, stating that they expect a better demand in the Fall. In the meantime, sales are aggressively sought. There is no attempt at price cutting, and the turning in of used tools is discouraged. There is a small demand for used equipment.

Machine Shop Supplies:—The supply business has dropped off a little but there is still a fair volume of business passing. Repair and jobbing shops are rather busy and contribute largely to the business moving. The railways are buying only in small quantities for im-

mediate use. Some of the larger local manufacturing plants are closed and thus the business that they ordinarily would create, is absent. Prices are rather stable and little changes are noted from week to week.

Pittsburg

August 2, 1922

PRODUCTION of pig iron and steel has continued to decline, and the rate of output is now between 5 and 10 per cent. below the highest rate, which was attained late in June. There had been a rapid increase in the rate of production in the first three months of the year, and a small increase in the next three months, after the coal strike began. The restriction now is due chiefly to poor functioning of railroads, on account of the shopmen's strike begun July 1. The roads serving non-union coal fields in West Virginia and Kentucky were, however, overburdened, there being extra production induced by the failure of supplies from union fields, and the great decrease in production in the Connellsville region, where there have been many sympathetic strikes. In particular, by-product coke plants were depending largely upon West Virginia and Kentucky coal.

Government Steps

The Government has taken charge of coal distribution and coal prices, a general priority system being announced July 25 by the Interstate Commerce Commission, while July 28, H. B. Spencer was appointed coal administrator. However, in this district the Pennsylvania Railroad and the Pittsburgh & Lake Erie have announced that as they are functioning 100 per cent. they have no occasion to observe the general priority and will make no change in the operations unless specifically instructed from Washington. Where the priority system has to be observed iron and steel producers and consumers are unlikely to get any coal, as naturally they are far down in the list.

Set prices, at something like a moderate level, say $3.50 for mine-run, are expected to be enforced, and in the last three days of last week the local coal market gradually lost its activity, consumers deciding to hold off for lower prices. Connellsville steam coal had reached a firm level of $8.50 but declined to $7.50 by Saturday. Connellsville coke, which is a rarity and has scarcely been bought at all except by foundries, advanced to $14 for furnace and $15 for foundry, but lower prices are now expected.

Operations in the iron and steel industry are affected chiefly by coke supplies, as steel mills seem to have enough coal to make and roll all the steel they can produce, once they have the pig iron. As to coke, the change is chiefly in by-product production. Some by-product plants have had their coal receipts reduced much more than others, while some have stocks, say enough to last 30 days more without any fresh receipts. Accordingly, the banking and blowing out of blast furnaces has been spotty, eastern Pennsylvania and the valleys being conspicuous, while the Buffalo district is probably next in line for a great decrease in furnace operations. Thus far, the Pittsburgh district seems to have gotten along rather well.

Steel Market Quiet

Unlike the condition in 1920, when a slight restriction in steel production, causing the industry to run at about 80 per cent. of rated capacity, threw buyers of steel into a panic and made them bid altogether fancy prices for steel, although when the excitement was over some of them had considerable stocks, the present restriction in production and shipments is taken very calmly. Perhaps the general run of steel buyers have fair sized stocks, or perhaps it is simply a case of their feeling they cannot afford to bid extra prices, on account of prices at which they are selling their products. Many buyers are exerting pressure on mills, trying to get better deliveries on orders they have already placed, but that is different from going out into the market and making fresh purchases at premium prices. There is some of this, causing delivery premiums to be stiffer, but the tonnage involved is practically inconsequential.

As to the more distant future of the steel market, and of business conditions generally, the present troubles due to the railroad and coal strikes unquestionably have a bad influence. The point is being commented on generally in business circles that the present disturbance is likely to have a bad effect, tending to slow down business and make men cautious. In 1920 rising prices were wrongly interpreted as foreshadowing longer continued and greater "prosperity" but all business men afterwards recognized their mistake. The philosophy of business is that for real prosperity there must be economical production and reasonable prices and anything that puts prices up or causes industry to operate at a disadvantage, is unfavorable. It is plain that commodity prices generally are trending upward, on account of these strikes and the enormous amount of building now going on. The country is trying to do too much building all at once. Accordingly, it is feared that some time in the not distant future there will be a reaction.

Great Strength

Whatever the prospects for the future, the steel market, on the surface at least, presents an appearance of great strength. It is very difficult to buy any steel for prompt shipment, as mills in general are well sold up, and the period for which a mill is sold up must be estimated longer than 30 days ago, because production is not going to be as heavy for a time as was expected. For later delivery it is also difficult to buy, partly because on general principles mills do not want to sell so far ahead, and partly because they have not unlimited confidence in buyers' estimates as to what they will need. Requirement or option contracts are particularly objectionable to mills, but specific orders against construction work, when the mill is satisfied the construction job will go through, are acceptable.

The 1.60c minimum on bars, shapes and plates has practically disappeared, even on the most attractive orders for delivery at mill convenience, 1.70c being now the minimum, while that is possible only on late deliveries, large tonnages and desirable specifications. For anything like nearby delivery the price may be 1.80c to 2.00c, depending on various circumstances.

In sheets 2.40c on blue annealed, 3.15c on black and 4.15c on galvanized are still nominally in effect with some mills, for indefinite delivery, but as a rule buying, if done at all, is at higher prices, at least $2 a ton higher on blue annealed and $3 a ton higher on black and galvanized. There is not much buying, the chief interest of consumers being in deliveries against orders already placed.

Inquiry for pig iron is extremely light. Forced buying of any magnitude would send prices up sharply, as there is little iron to be picked up. Evidently consumers are not in a position to pay fancy prices and prefer to get along as best they can with iron in stock or iron due on previous purchases. Some foundries are found to have considerable stocks, which was hardly to be expected with the limited production of the past three months, and there are stocks at a few furnaces. Last sales were at $25 for Bessemer, $24 for basic, $25 for foundry and $27 for malleable, f.o.b. valley furnaces, but it does not follow that these prices could be duplicated on fresh purchases. On the other hand no one can be sure that if any large tonnage were forced on the market it would bring prices as high as these. In other words, no one can be sure of anything and developments are being awaited.

Strike of railway shopmen has been averted for the present. The dispute will be considered by a Board of Conciliation on which Isaac Pitblado, K.C., Winnipeg, will represent the railways and James Simpson, Toronto, the shopmen.

Montreal carpenters and joiners engaged in the repair and alteration of ships in port, have unanimously endorsed the report of a board of arbitration which sat recently to consider differences as to wages which arose last April between the local and a number of navigation companies, represented by the Shipping Federation of Canada, Inc. The scale of wages was fixed by the board at 55 cents per hour per day, and 65 cents at night. This is five cents per hour above the rate which went into force April 22 last, but considerably under the scale asked for by the men at that time.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Toronto price:—	
Silicon, 2.25% to 2.75%	$32 65
Grey forge, Pittsburgh	$26 27
Lake Superior, charcoal, Chicago	31 65
Standard low phos., Philadelphia	30 00
Bessemer, Pittsburgh	25 00
Basic, Valley furnace	24 00

IRON AND STEEL

Per 100 lbs. to Large Buyers	Cents
Iron bars, base, Toronto	$3 15 3 25
Steel bars, base, Toronto	3 15 3 25
Iron bars, base, Montreal	3 15 3 25
Steel bars, base, Montreal	3 15 3 25
Reinforcing bars, base	3 15 3 25
Steel hoops	4 00
Tire steel	3 15
Spring steel	7 00
Band steel, No. 10 gauge and 3-16 in. base	3 65 3 75
Chequered floor plate ¼" and heavier	6 00
Bessemer rails, heavy, at mill	2 35
Steel bars, Pittsburgh mill prices	1 80
Tank plates, Pittsburgh mill prices	1 80
Structural shapes, Pittsburgh mill prices	1 80
Steel hoops, Pittsburg	2 50
F. O. B., Toronto Warehouse	
Small shapes	3 25
F. O. B. Chicago Warehouse	
Steel bars	2 48
Structural shapes	2 58
Plates	2 58
Small shapes under 3-in.	2 48

FREIGHT RATES

	Per 100 lbs. C.L.	L.C.L.
Pittsburgh to Following Points		
Montreal	52	65½
St. John, N. B.	76	96
Halifax	77½	97
Toronto	34	48½
Guelph	34	48½
London	34	48½
Windsor	31½	45½
Kingston	48½	61

Current surcharge 1 per cent.

METALS

	Montreal	Toronto
Lake Copper	$17 75	$17 25
Electrolytic Copper	17 50	17 25
Castings, Copper	17 25	17 00
Tin	36 25	36 25
Spelter	8 25	7 50
Lead	7 00	7 00
Antimony	6 50	7 40
Aluminum	22 00	21 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$3 75	$3 50
Plates, ¼ up	3 40	3 25

PIPE—WROUGHT

Standard Buttweld Pipe S/C

Per 100 feet

	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
⅛ inch	$ 6.00	$ 8.00	$	$ ....
¼ inch	3.84	5.94	7.20	9.30
⅜ inch	3.84	5.94	7.20	9.30
½ inch	4.85	6.46	7.31	8.93
¾ inch	5.87	7.71	8.86	10.70
1 inch	8.16	11.05	12.58	15.30
1¼ inch	11.04	14.95	17.02	20.70
1½ inch	13.20	17.88	20.35	24.75
2 inch	17.76	24.05	27.38	30.30
2½ inch	28.08	38.03	.....	.....
3 inch	36.72	49.73	.....	.....
3½ inch	47.84	63.48	.....	.....
4 inch	56.68	75.21	.....	.....

Standard Lapweld Pipe S/C

Per 100 feet.

Below Dividing Line—Price Per Foot.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
2 inch	$21.46	$27.38	$31.08	$37.00
2½ inch	31.50	40.95	46.80	56.16
3 inch	41.31	53.55	61.20	73.44
3½ inch	48.76	65.32	72.68	89.24
4 inch	57.77	77.39	86.11	105.73
4½ inch	66.04	86.36	1.04	1.24
5 inch	76.96	100.64	1.21	1.45
6 inch	1.00	1.31	1.57	1.88
7 inch	1.30	1.76	2.02	2.45
8L inch	1.40	1.85	2.13	2.58
8 inch	1.61	2.13	2.45	2.97
9 inch	1.97	2.59	2.97	3.59
10L inch	1.82	2.40	2.75	3.33
10 inch	2.35	3.09	3.54	4.28

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4-in. and under 60 per cent.
4½-in. and larger, 50 per cent.
4-in. and under, running thread, 40%.
Standard couplings, 4-in. and under 30%
Do., 4½-in. and larger, 10%.

OLD MATERIAL

Dealers' Average Buying Prices

	Montreal	Toronto
Copper, light	$ 50	$ 8 50
Copper, crucible	11 00	11 00
Copper, heavy	11 00	11 00
Copper, wire	11 00	11 00
No. 1 machine composition	9 00	9 00
New brass cuttings	6 00	6 00
Red brass turnings	6 50	6 50
Yellow brass turnings	5 00	4 85
Light brass	4 00	3 50
Medium brass	5 50	4 50
Scrap zinc	3 50	4 00
Heavy lead	4 50	4 50
Tea lead	3 00	3 00
Aluminum	11 00	11 00
	Per Ton	Gross
Boiler plate	$ 9 00	$ 9 00
Heavy Melting Steel	10 00	11 00
Axles (wrought iron)	20 00	16 00
Rails (scrap)	11 00	11 00
Malleable scrap	10 00	11 00
No. I machine cast iron	20 00	16 00
Pipe, wrought	7 00	6 00
Car wheel	17 00	16 00
Steel axles	10 50	15 00
Mach. shop turnings	4 00	6 00
Stove plate	16 00	14 00
Cast boring	4 00	6 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, 7-16 and up	30
Carriage bolts, ⅜ in. and smaller 6 in. and shorter	40
Coach and lag screws	45
Stove bolts	72½
Wrought Washers	60
Do., corru. head	60
Machine bolts, 7-16 and over	35
Machine bolts, ⅜-in. and less	35
Blank bolts	35
Bolt ends	35
Machine screws, fl. and rd. hd., steel cut thread	37½ & 10
Machine screws, o. and fil. hd., steel cut thread	30
Machine screws, o, and fil. hd., brass cut thread	15
Standard couplings, 4-in. and under, brass cut thread	30% 30
Nuts, square, blank off net list	$1.00
Nuts, square, tapped off net list	50c.
Nuts, hex., blank off net list	50c.
Nuts, hex., tapped net list	
Copper rivets and burrs, list less	32c.
Burrs only, list plus	10%
Iron rivets and burrs	47%
Boiler rivets, base ¾ in and larger	$5.75
Structural rivets, as above	5 65
Wood screws, O. & R., bright	80
Wood screws, flat, bright	82½
Wood screws, flat brass	77½
Wood screws, O. & R., brass	75
Wood screws, flat, bronze	72½
Wood screws, O. & R., bronze	70

MILLED PRODUCTS

(Prices on unbroken packages)

Set screws	65
Square and hexagon head cap screws	60
Round head cap screws	20
Fillister head cap screws	35
Flat head screws	25
Button head cap screws	20
Studs	45
Semi-finished nuts up to and including 9/16 in.	70
Semi-finished nuts ⅝ to 1¼ in.	65
Semi-finished nuts 1⅜ to 2 in	35
Coupling bolts	35
Taper pins, No. 2 to No 5	65
Taper pin No. 6 and over	10
Planer bolts without fillet	10
Planer bolts with fillet	Net
Patch bolts	Plus 10%
Hollow set screws	20
Thumb screws	50
Thumb nuts	70

BILLETS

F. O. B. Pittsburgh

	Per gross ton
Bessemer billets, 4 in. x 4 in. and larger	$35 00
Open hearth billets	35 00
O. H. sheet bars	35 00
Forging billets	40 00
Bessemer rods	40 00

NAILS AND SPIKES

Wire nails, base	$3 65
Cut nails, base	4 35
Miscellaneous wire nails	72½%

ROPE AND PACKING

Plumbers' oakum, per cwt.	6 30
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 23
British Manila rope	0 20
New Zealand hemp	0 20

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	Net..

Solder, strictly	$0 22½
Solder, guaranteed	0 24
Soldering coppers, lb.	0 62½
White lead, pure, cwt	13 20
Red dry lead, 100-lb. kegs, per cwt.	10 75
Wood alcohol, per gal.	1 75
Whiting, plain, per 100 lbs.	3 00

CARBON DRILLS AND REAMERS

	Discount.
S. S. drills, wire size	60
Can. carbon cutters	plus 10
Standard drills, all sizes	60
3-fluted drills, plus	10
Jobbers and letter sizes	60
Bit stock	50
Ratchet drills	25
S. S. drills for wood	10
Wood boring brace drills	50
Electricians' bits	30
Sockets	50
Sleeves	30
Taper pin reamers	25
Drills and countersinks	20
Bridge reamers, carbon	50
Centre reamers	Net
Taps, machine screw	50 to 60
Taps, hand, sizes up to 1"	30 to 60
Chucking reamers	20 off
Hand reamers	20
High speed drills, list	40
Can. high speed cutters	plus 10
American	plus 40

COLD ROLLED STEEL
(At Warehouse)

Rounds and squares	$4.50 base
Hexagon and flats	$5.50 base

MALLEABLE FITTING LIST

1 in. elbow	.32	.53
2 in. elbow	1.05	1.70
1 in. tee	.43	.70
2 in. tee	1.45	2.40
1 in. coupling	.33	.53
1 in. locknut	.15	.23

Discount to dealers 70/5 off list.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$5 40	$5 25
Sheets, blue ann., No. 10	4 05	4 25
Canada plates, dull, 52 sheets	5 50	5 25
Can. plates, all bright	7.00	6.00
Galvanized sheets, No. 28		6 35
Queen's Head, 28 B.W.G.	7 25	
Fleur de Lis, 28 B.W.G.	7 00	
Gorbal's best, No. 28		
Colbornes Crown, No. 28		
Premier	6 85	6 40
Premier 10£ oz.	6 85	6 40
Zinc sheets	9 25	10 00

PROOF COIL CHAIN
B. B. B. CHAIN

⅜ in., $16.45; 7-16 in., $14.00; ½ in., $12.95; 5-8 in., $13.15; ¾ in., $12.75; ⅞ in., $12.25; 1 in., $11.85; 1⅛ and 1¼ in., $10.55. Fire weld chain same sizes respectively are $14.00; $11.50; $10.40; $10.55; $10.15; $9.75; $9.35; and $8.25.

ELECTRIC WELD COIL CHAIN B.B.B.

⅛ in. $20.00; 3-16 in. $16.50; ¼ in. $15.50; 5-16 in. $12.70.

FILES AND RASPS

Globe	60 5	Vulcan	50
		P. H. and Imperial	60/5
		Nicholson	40
		Black Diamond	40
		J. Barton Smith, Eagle	55
		McClelland, Globe	50
		Delta Files	20
		Disston	40
		Whitman & Barnes	60
		Great Western-American	50
		Kearney & Foote, Arcade	60/5

BOILER TUBES

Size	Seamless	Lapweld
1 in.	19.00	
1¼ in.	20.00	
1½ in.	20.00	
1¾ in.	21.50	
2 in.	20.00	16.00
2¼ in.	22.00	20.00
2½ in.	23.00	20.00
3 in.	27.00	24.00
3½ in.	32.00	28.00
4 in.	41.00	35.00

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS

Castor Machine Oil, per lb.	34½
Royalite, per gal. bulk	21
Palacine	24
Machine oil, per gal.	39
Black oil, per gal. (Summer)	19
Cylinder oil, Capital	69½
Petroleum fuel oil bbls., net	10.80
Pure turp., single bbls., gal.	1.75
Linseed oil, raw, single bbls.	1.10
Premier Gasoline	35½

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	30%
Standard	30 and 10%
Cut leather lacing, No. 1	1.75
Leather in side, (Lacing)	1.50

TAPES

Chesterman Metallic, 50 ft.	$5 00
Lufkin Metallic, 603, 50 ft.	3 17
Admiral Steel Tape, 50 ft.	3 00
Admiral Steel Tape, 100 ft.	4 50
Major Jun. Steel Tape, 50 ft.	3 75
Rival Steel Tape, 50 ft.	4 00
Rival Steel Tape, 100 ft.	8 75
Reliable Jun. Steel Tape, 50 ft.	5 25

PLATING SUPPLIES

Polishing wheels, felt	$3 80
Polishing wheels, bull-neck	1 50
Emery in kegs, Turkish	08
Pumice, ground	05
Emery glue	05
Tripoli composition	08
Crocus composition	12
Emery composition	11
Rouge, silver	16
Rouge, powder, nickel	38

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	20
Brass sheets, 24 gauge and heavier base	23
Brass tubing, seamless	28

WASTE

XXX Extra	16	Atlas	18
Peerless	21	X Empire	13
XX Grand	15	Ideal	18
Superior	20	X Press	11½
X L C R	14		

Colored

Lion	12	Fancy	13½
Standard	10½	Popular	9
No. 1	13	Keen	7½

Wool Packing

Arrow	24	Anvil	16
Axle	20		

Washed Wipers

Select White	18	Dark colored.	13
Mixed Colored	14		

This list subject to trade discount

RUBBER BELTING

Standard 36 ....28% Best grades 28%

ANODES

Nickel	.55 to .60
Copper	.38 to .40
Tin	.70 to .17
Zinc	.16 to .17

COPPER PRODUCTS

Prices per lb.

	Montreal	Toronto
Copper Bars, ½ to 2 in.	.29	.28
Brass Tube		.28
Plain sheets, 16 oz. in. 30 x 72	.30	.29
Copper sheet, tinned, 16 oz.	.37	.36
Copper sheet, planished, 16 oz. base	.42	.41
Braziers', in sheets, 6 x 4 base	.30	.29
Copper tubing, seamless		.32

LEAD SHEETS

Roll Lot Prices

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$ 8 75	$ 9 25
Sheets, 3 1-2 lbs. sq. ft.	8 75	9 25
Sheets, 4 to 6 lbs. sq. ft.	8 25	8 50

Cut sheets, ¾c. per lb. extra
Cut sheets to size, 1c. per lb. extra

PLATING CHEMICALS

Acid, boracic	.23
Acid, hydrochloric	.03¾
Acid, nitric	.10¼
Acid, sulphuric	.03¾
Ammonia, aqua	.20
Ammonium, Carbonate	.15
Ammonium, chloride	.18
Ammonium, hydrosulphuret	.75
Ammonium, sulphate	.10
Arsenic, white	.18
Copper, carbonate, anhy.	.32
Copper, sulphate	.08
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.14
Nickel carbonate	.32
Nickel sulphate	.14
Potassium sulphide (substitute)	.40
Silver chloride (per oz.)	.85
Silver nitrate (per oz.)	.65
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.35
Sodium hyposulphite per 100 lb.	6 50
Sodium phosphate	.15
Tin chloride	.30
Zinc chloride, C. P.	.30
Zinc sulphate	.06

Prices per lb. unless otherwise stated

News From the Industrial Field

Walker Twist Drill Co., Walkerville, have ceased operations for a two weeks' vacation period.

Frederick J. Clark, Toronto, has been appointed Industrial Commissioner, Niagara Falls, Ont., at a salary of $3,500 and expenses.

D. B. McCoy, formerly sales manager at Vancouver, B. C., of Steel Company of Canada, was recently transferred to the Toronto office, Bank of Hamilton building, as manager.

Canada Machinery Corporation, Galt, report continued improvement in business especially as regards wood working machinery. The staff is being increased gradually.

Reports from Galt indicate that the coal situation there is not without some serious aspects. Industries that have been fairly busy have fast dwindling supplies, while others whose operations have been curtailed have considerable quantities. Manufacturers generally made provisions against shortage but the strike is more protracted than was expected.

A despatch from Peterboro states that manufacturers in that city are so aroused over the continued shortage of power that they have given consideration to the feasibility of the municipality taking over the control of the water powers. They charge discrimination on the part of hydro by serving new and seasonal canning concerns, while the old customers go begging, and they charge the hydro with over selling.

Western demand is reported by manufacturers as showing greater activity, a reflection of the encouraging crop outlook. Tap and die manufacturers say they have been receiving large volume of business from that quarter and well pump makers are shipping increasing quantities. One of these concerns received an order recently for a carload of small pumps: nothing exceptional in normal times, but indicating a much better buying feeling than has been for some time.

Windsor.—Dodge Brothers Motor Co., Ltd., of Canada, has purchased seven and one-half acres in this city as a plant site, it has become known through registration made at the Sandwich registry office. The land purchased is triangular in shape and is bounded by the Canadian Pacific Railway, Jeanette Avenue and Pelessier Street. It has 1,934 feet of frontage on the Canadian Pacific Railway and is about three miles from the water front. No plans have been made for the erection of buildings, however.

Indicative of the coal shortage is the fact that only 16,100 tons entered Toronto in July this year, as against 118,000 in July, 1921. No anthracite entered Toronto since early June. As regards coal from Wales, an authority declares that it would take somewhere around 1000 boats to supply a week's shortage on the continent.

Kingston.—Another indication that business conditions are returning to a normal and prosperous state is shown by a betterment in local industries. The Frontenac Floor and Wall Tile company, started as a small concern, is employing sixty hands and expects to need more. Two new kilns have recently been installed for the manufacture of wall tile and will soon be in full operation.

The John T. Hepburn Co., Toronto, have just completed some Maclean underfeed stokers for the Farmers Dairy, Toronto. They have also finished a big derrick with a 70 foot steel boom for Kilmer & Barber, Toronto, this being the largest they have ever made. They are at present making some new hand pressed brick machines, and report their steam pump line as very good. A few days ago they shipped to the Queen's University, Kingston, a 10 x 6 x 12 outside center packed high pressure pump, and say that things looked somewhat brighter all round.

Montreal.—The United States Government announces through the office of the Quartermaster General of the American Army at Washington, D.C., that Charles S. Gerth, of Gerth's Realty Co., expert international auctioneers and specialists for the liquidation of industrial properties, will sell at auction on Tuesday, September 5th, the Peter Lyall Construction Company plant at Longue Pointe, Montreal, and the Munitions and Machinery, Limited, plant in the City of Lachine. The conditions and terms under which the sale has been ordered should prove of unusual interest to either American or Canadian industrial concerns contemplating expansion. The bidder for the Peter Lyall plant which is successful in acquiring same, will find it only necessary to pay 20 per cent. at time of sale and the balance in 5 years at 5 per cent. interest. The purchaser of the Munitions and Machinery, Ltd., plant will be required to pay down 30 per cent. cash and the balance in two years at 5 per cent. interest. The plants are to be sold "as is" without any guarantee as to condition. Prospective purchasers will be given ample assistance in visiting and investigating the general conditions of the plant both as to buildings and equipment. A prospectus containing pictures and complete details of both plants is being prepared. The hour of the sale of Peter Lyall plant will be 10 o'clock in the morning and the sale of the Munitions and Machinery, Ltd., plant will be 3 o'clock in the afternoon of Tuesday, September 5th.

Peterboro.—The Manufacturers' Association have requested Mayor Taylor to call a meeting of coal dealers to confer on the local situation. The importation of coal from Great Britain was urged as one solution.

Montreal.—It is understood that the Montreal harbour commissioners are ready to build a modern pier at the Peter Lyall, Longue Pointe, plant with a guarantee that the wharfage will show a profit of 7 per cent. of the cost, annually for at least ten years. In the event of a pier being built and the manufacturer's business falling short this amount, he would have to make the deficit good. On the other hand, however, he would not be called upon to spend any money for the construction of the pier.

Kingston.—General outlook for industrial activities in Kingston is very bright at the present time. Not only have two or three very satisfactory industries commenced operations here, but the prospects for building operations on a large scale in the very near future are indeed encouraging. Following on this comes the announcement that the Baldwin Locomotive Company is winding up the details of purchasing the Canadian Locomotive Company's plant here. The various municipal boards and boosting societies are becoming more convinced daily that the city of Kingston is on the eve of a very prosperous era.

Montreal.—A field house is to be built for McGill University adjoining the Molson Stadium, which will cost approximately $32.000 when completed and equipped. The contract for the erection has been let to the firm of D. G. Loomis & Sons. Construction will start soon and the building will be completed and equipped early in the autumn. Tenders will also be asked for the new McGill Gymnasium on or about August 25th. It is understood that the plans will be completed about August 5th. Tenders for the new pathological building which is to be built between the Royal Victoria Hospital and the Molson stadium will also be asked for during August. The foundations for this building are completed. In addition the foundation for the new mining-geological building will be started this autumn, but the erection will not be commenced until early in 1923. The extension to the power station will be undertaken as soon as the new buildings are sufficiently advanced to demand more power than produced at present.

Kingston.—Elmer Davis, president Kingston Board of Trade and head of A. Davis & Son tanning company here, has just returned from a trip through western Canada to Winnipeg, Calgary and Edmonton. He is firmly convinced that the tide has definitely turned for the better in the business world, and that we are entering upon an era of sound, solid business prosperity. In an interview Mr. Davis said:

"I think that the depression is over without question, and that business conditions from now on in this country will steadily improve just as they are steadily improving in the United States in spite of the coal and rail strikes. This year promises to give us the best crop Ontario has ever had, while the crop prospects in the West are fair, to say the least. This means the creation of millions of dollars of new wealth. Wherever I went I found changed sentiment and a most encouraging note of optimism, business men and leading financial interests all agreeing that we had turned the corner and that we could look ahead with much more confidence and hope."

EXPLAINS TAX INCREASE

Ottawa.—The Minister of Customs and Excise, Hon. Jacques Bureau, explains the increased taxes which come into effect August 1, as follows:

"The increased stamp tax on bills of exchange, bank advances, overdrafts, cheques, sales and transfers of stocks and bonds, express money orders, travelers' cheques and post-office money orders, becomes effective on August 1 next.

"The tax on bills of exchange promissory notes and advances or overdrafts is payable at the rate of 2 cents for every $50 or fraction thereof.

"Cheques, money orders and travelers' cheques for amounts of $50 or under require a 2 cent stamp. If the amount for which they are issued exceeds $50 but does not exceed $5,000, a 2 cent stamp for every $50 or fraction thereof is required to be affixed thereto. Cheques, money orders and travelers' cheques which exceed $5,000 in amount require a $2 stamp.

"The tax is to be paid by means of excise tax stamps in preference to postage stamps, affixed to the face of the cheque or money order. Regulations have, however, been issued whereby the tax on cheques may be paid monthly in place of affixing such stamps to the individual cheques. Under these regulations the cheques are embossed with a stamp stating that the excise tax has been paid. Special licenses are issued by the Department of Customs and Excise to firms who desire to pay the tax monthly."

J. T. Hepburn of John T. Hepburn Co., Toronto, is at present in Scotland with his family on a pleasure trip. He has purchased a motor car over there, and is touring the country seeing the beauties of the old land.

RAILWAY SHOPS TO RUSH ROLLING STOCK FOR CROPS

Fort William.—Definite announcement is made that starting August 1, local shops of the Canadian Pacific Railway, which since the first of the year have been operating at part time only, will go on full time operation. The increase in operation is due to anticipation of the operation officials of the road, of the need for every available article of rolling stock to move the 1922 grain crop in the west.

Every effort is being made to have the million bushel capacity storage annex to elevator O,—N. M. Paterson and company, grain firm,—completed in time to handle 1922 grain. 1,600 piles have been driven for the foundation and in two weeks, work will have advanced to a stage ready for the pouring of concrete. The annex will comprise forty-three concrete bins, circular, and ninety feet high, giving elevator O a total capacity of 1,750,000 bushels. The work is being done by the Fegles Construction Company.

Fort William has three months' supply of coal stored for domestic, district and Manitoba use. There are 70,000 tons of nut and egg coal with no stove coal available. This time last year there were 80,000 tons of this class of fuel on hand. Soft coal is more plentiful, about 200,000 tons showing on the record of stocks, about equal to last year's figures. But no coal is arriving to replace the dwindling stocks. Only two cargoes have reached here so far this season. None is in sight. If mining is resumed it would probably be six weeks before coal could be available for western shipments. The situation seems to be that Fort William and the districts usually receiving supplies from this port, will be under fuel famine conditions at the worst and suffer a decided pinch by snow time at the best.

Both railroads here are beginning to run short. The Canadian Pacific has 60,000 tons and the Canadian National 10,000 tons. It is expected if an emergency arises both roads would commandeer the domestic stocks from dealers' yards here. They did so in a similar emergency during the war.

Coal prices were advanced here to-day, hard coal going from $18.50 to $19.50 per ton; the so-called pea coal moving up 50 cents from $13.50, and soft coal advanced $2 per ton.

Concrete work in the new two-millions-bushels-capacity annex to the Northwestern elevator here, is now practically finished, and the contractors, Barntt and McQueen, expect to have the house completed by September 15. The same company is also building a $1,500,000 addition to the Richardson elevator at Port Arthur, and expect to have it completed on September 15 also.

THAT the strike situation in the United States is reaching that stage when it is having serious significance from a national point of view is evident from the emergency order of the Interstate Commerce Commission establishing priorities in all railroad traffic and in fuel distribution. The order was effective last Tuesday at midnight. It recalls the war priorities of four years ago, but there is a difference in the present case which requires that, until the more essential consuming lines have been supplied, iron and steel and associated activities must wait for their supplies of fuel. It is stated that industrial supply in United States would be badly depleted within 30 days. Already the stoppage of shipments from steel mills is noticeable. There has been a slackening in the steel industry generally although it is reported that activities in the Pittsburgh district are keeping up well on a level with previous weeks. Food shipments are fully provided for.

While no such order has yet been issued in Canada, it is a fact that the railroads are cutting off many local trains in order to conserve coal supplies. In the steel and iron industry there is a tendency in a similar direction. Buyers are beginning to specify dates on their contracts and furnaces are adhering to the necessities of this development rather than to the consideration of tonnages from new sources. That is, their customers will receive prior service. It is a fact that Canadian railroads and industry generally have shown the benefit of experience by storing large quantities of steam coal, but of course there are cases where foresight was not brought into play, and there will be shortages. A thirty-day consumption on reserves would, however, reduce them to the danger point. One favorable factor is that a good many industries are operating below normal. Foundries and other plants working on material for the building trade, and thus fairly busy may be hard put to it for necessary fuel. It is likely that there may be co-operation among industries to help each other over their fuel difficulties.

There is a ready market for hand tools of all kinds in Belgium, according to a report from reliable trade sources.

A British oil company has been occupied during the last few years in completing one of the largest oil refineries in the world. This refinery occupies a site of about 650 acres near a British port, and it has involved the expenditure of about three million pounds. From the jetties where the tank steamers are unloaded pipe lines are laid down to eight tanks, which are capable of holding ten thousand tons of oil. Electrically-driven pumps are used to convey the oil from these tanks to storage tanks situated at the refinery about four miles away. The storage tanks have a total capacity of nearly twenty-one million gallons.

LARGE HERRINGBONE GEARS FOR DRIVE

The Hamilton Gear & Machine Co., Toronto, Canada, have just completed some large herringbone gears for the Dodge Mfg. Co. These gears were much larger than the usual run, and are to be used for the head drive on grain elevator legs. The largest gear of the pair was 45 in. diameter, 12 in. face, while the other was 12 in. diameter with a similar size face. Three sets were made.

This new style of drive will supersede the old style rope drive where the power was located at the bottom of elevator and transmitted by ropes and groove pulleys to the top of leg. The motor will now be located at head, and connected by herringbone gears and flexible coupling to the upper drum of bucket conveyor. This arrangement is said to be the newest and best method of driving grain elevator legs.

In addition to the above, the Hamilton Gear & Machine Co. are working on an order for double reduction truck axles for the Harmer Knowles Truck Co., Toronto, also making some large spur gears for the Goodyear Tire & Rubber Co., who are making some enlargements to one of their mill lines.

Montreal.—Mr. W. M. Brittain, general manager of the Import and Export Board of Trade of Baltimore, and Mr. John Baker, general foreign traffic manager of the same organization, visited Montreal, July 14th, as guests of Mr. P. Fennell general manager of the local harbour. These gentlemen showed great interest in the facilities of the local port.

Introducing

G. M. WILSON,

Superintendent Grand Trunk Motive Power Shops, Pointe St. Charles, Montreal.

BORN IN Belfast, Ireland, Mr. Wilson came to Canada at an early age. His taste for things mechanical was very pronounced, long before his school days were completed. Before entering actively into machine shop life, he was often found in the vicinity of repair shops. It is related that on one occasion he was lending a hand on a job of assembling a steam traction engine that had been undergoing repairs. Single handed he set the valves, and gave the engine a test run around the streets of Sarnia. Thus, his desire for motoring manifested itself before motors were commonly seen.

In 1889-90 Mr. Wilson was employed as a machinist with the St. Clair Tunnel Co. For a short time after this he was with the Jenks Shipbuilding Co. of Port Huron, Mich. In November, 1890, he entered the Grand Trunk Railway shops at Fort Gratiot, Mich., now known as North Port Huron. In these shops it was not long before he rose to be an expert machinist, and later was promoted to be machine shop foreman. In 1910, he was supervising the repairs and maintenance work on the three large car ferries running between Windsor and Detriot. In the late autumn he went to Ottawa to supervise the installation of the power plant and machinery of the Central Station and the Chateau Laurier Hotel. He spent two years in Ottawa, at the conclusion of which time he was appointed general foreman of the Toronto shops. In 1914 the position of general inspector fell to his lot, and in 1916 he was made assistant superintendent of the Point St. Charles G. T. R. motive power shops, Montreal. Upon the death of the superintendent in 1917 he was appointed superintendent, a position which he now holds.

Mr. Wilson is of a very genial disposition, and is interested in many lines of sport and recreation. Motoring gives him great pleasure, but he thinks that it is wonderful sport to land a fish. Lawn bowling has a place in his heart, and he is a great lover of football. He is an all-round sport but at the same time is always busy and takes great pleasure in his work. He has many outside connections, among which is the Canadian Railway Club, which organization recently elected him president.

Safety As An Efficiency Factor Demonstrated By Actor-Workmen

COMPARISON of present day safety methods, with those of an earlier period when responsibility for an accident had, like the vagrant, no permanent place of abode, was strikingly illustrated at Hamilton. The occasion was a meeting of the Implement and Vehicle Manufacturers Safety Association at the plant of the International Harvester Company.

The feature of an interesting program was the sketch: "Fixing the Responsibility for Accident," put on by the employees of the Steel Company of Canada, the International Harvester Co., and the Canadian Westinghouse Co., under the direction of Chas. E. Naphtale, Guelph. The men entered with particular zest into the presentation, and, their task was to present two sides of conditions applicable to daily experience, the realism of their acting was little short of perfection. The scene was that of a machine shop as operated under two widely different sets of safety regulations. William Light, a 20th century foreman, and Sam Stone, an old time foreman, were parts taken respectively by C. MacMenemy and A. Bramhall. Other characters were: George Brown, a guide boy for the employment office, a boy scout, by E. H. Hutchinson; Frank Cole, a bench worker in machine shop, by F. C. Reynolds; James Smith, a bench worker in machine shop, also a member of shop safety committee, by F. Watkinson; Leo Wise, a shop clerk, by Harold Bayley; Thomas White, operator of lathe No. 2 in the machine shop, by J. Slocomb; Harry James, a new employee, by E. T. Marks; Roy Lang, a new employee, by J. Smith; Charles Metz, a plant safety inspector, by J. Manewell; John Telford, supt. of machine shop, by L. L. McIntosh.

The playlet was a practical demonstration of the fact that in the so-called early days there was very little co-operation as between employer and employee toward safe working conditions. The foreman was very often a bulldozer who could see no merit in safety devices, who insisted that blame, if any, attached to the employee, and who drove his men, very often in picturesque language, to their duties amid surroundings that filled their lives with perpetual menace. There were few warning signs; guards to gears and other dangerous moving parts were conspicuous by their absence, and the penalty for accident was very often discharge, sans sympathy and sans compensation of any kind.

The players gradually worked up to the idea that protection pays and that sense of safety makes for efficiency. The contrast between the old and new was strikingly emphasized, greatly to the interest of the large attendance.

F. M. Morton, general superintendent of the International Harvester Company, presided. Prominent business men spoke of the importance of prevention work. A. H. Young, manager of industrial relations, International Harvester Company, Chicago, spoke on accident prevention. F. H. Wyse, of the Ontario

(Continued on page 59)

Babbitt as Material for Light and Heavy Bearings

Minimum Wear on Shaft Due to Composition of the Metal—Wearing Qualities of Good Babbitt—Oil Grooves Easily Cut—Various Grades for Different Uses—Method of Handling

By W. S. STANDIFORD

BABBITT as a material for light and heavy machine bearings does not seem to be used to the extent that it deserves; which is due, no doubt, to a lack of information as to its merits as a bearing metal and also to a prejudice against its use on various machines caused by ignorance in handling, as workmen can make the most expensive and high-grade babbitt appear worthless, in regard to the length of time a bearing lined with it will last and the trouble such a metal will make during the operation of machinery causes many factory owners to keep it out of their machine bearings.

Babbitt and brass are mostly used all over the civilized world as a bearing metal on various classes of machinery; both giving good results if they are of fine quality and well made, also suited to the weight of moving parts and plentifully supplied with grease or oil, care being taken not to let such bearings run dry. Brass is an excellent metal for journals and it gives fine results when constantly looked after. In these days of efficiency methods and rapidity of operations, the human element cannot entirely be ignored, and sooner or later, a factory's oiler will neglect to supply a brass bearing with oil when it needs it the most, a cut shaft and bearing resulting in a loss of time and money until the machine can be started again. The oiler in these cases mostly putting the blame upon dust working into a bearing and clogging it up, etc.; when in reality it was his own fault.

Brass and Babbitt

Brass has serious disadvantages when contrasted with babbitt ones which are as follows: owing to its composition, it is a metal that heats up rapidly if for any cause the flow of lubricant becomes irregular or intermittent; heating makes the brass expand rapidly, this in turn causes both shaft and bearing to be pressed together too tightly, the lubricating oil getting rubbed off their surfaces, a "frozen" bearing as it is technically termed, resulting. On the other hand, due to babbitt metal having altogether different characteristics from brass, it will stand more abuse (not that it is advisable to ill treat any machinery), and will run longer before a bearing cuts and seizes a shaft as compared to brass. Babbitt proves to be a very suitable composition for machinery bearings; its advantages in this respect are so great where smooth running machines are desired with the least wear on shafts, that this material gives the utmost satisfaction in factories when it is rightly looked after.

The fine wearing quality of babbitt is due to the fact that it has a more dense grain and also a greasier nature than brass. This gives to it great anti-frictional qualities, thus such a metal will run very much cooler under equal conditions than brass or any other metal. As babbitt can be melted in an iron ladle over any fire, great rapidity in replacing worn bearings in machinery breakdowns is a most desirable feature and also a money saver. In addition, oil grooves can be easily and quickly cut, or if preferred, cast ready made by the millwrights or machinists repair forces using asbestos cord. Uniform bearings are easily obtained in casting such bearings when care is observed in doing the work. Babbitt also has another valuable money-saving feature conferred by its low melting temperature, that allows the use of a portable forge for melting purposes, thus enabling all work to be done on the spot near the engines or other machines. This saves time by eliminating walking of the workers to and fro from the job, to the lowest possible extent.

This metal deadens noise, and last but not least, is cheaper than brass. There are a variety of different grades of babbitt on the market adapted to various machine requirements, such as high pressure and fast speed journals, medium pressure and medium speed and also low pressure and fast speed metals generally contain more tin and antimony with a small amount of copper; while the low pressure and medium speed metals usually have smaller quantities of tin and antimony and a large amount of lead. Tin, antimony and copper confer hardness to babbitts; so it will readily be seen that those who prefer to make their own formula for use in various classes of machinery bearings, can easily regulate its hardness to suit all requirements. There are many varieties of babbitts on the market so that any manufacturer who desires to purchase his own instead of having it mixed at his plant by the repair forces will have no difficulty in selecting a grade suitable for various machines; of course, taking into account the work they have to do as the conditions of working differ in various factories.

Most Suitable Grade

The methods of handling by workmen also have a great influence on the length of time bearings will last. None but high grade men should be employed to re-babbitt bearings. Personally, the writer thinks that, except for a few special cases, two kinds, one a lead-base alloy and the other a tin-base one are sufficient for the average class of machine journals, rolls being included in this list. But each metal ought to be of the highest possible grade that can be made. Rarely are bearings made entirely out of solid babbitt, except some very small ones including those made on die-casting machines, these latter are cast complete with oil grooves, etc. They need only to be turned and faced off before using. In general use, is used only as a lining in bearing shells of cast iron, malleable iron, brass and bronze.

Steel castings were found out by experience to be unsuitable for this purpose on account of warping tendencies when the casting strains are removed by machining. Cast iron shells on account of their cheapness and great strength, are most commonly used for stationary machines, also some malleable ones for the same purposes. The latter class gives fine results in machines which are subjected to heavy vibrations. The railroads generally make use of bronze shells so as to insure the completion of their runs and keep their time schedules as accurately as possible. Bronze or brass shells with a babbitt lining are also made use of extensively in the automobile trade. From the foregoing facts it will readily be seen the esteem in which this metal is held as a bearing material in different lines of manufacture. Owing to varying sets of working conditions encountered in shops and mills, it is necessary to use babbitts of such a composition as will prove suitable in order to have all machinery operate with the least amount of trouble.

Long Wearing Composition

Thus bearings carrying a heavy weight and rotating at high speed, need a metal whose ingredients are varied and also mixed in such proportions so as to obtain the best results. The formula given below is one that has been found out by long experience to give good satisfaction in journals supporting a weight of 2,000 lbs. and moving at a rate of 185 revs. per minute; it being one that enables machinery to continue in action for long periods of time assuming that lubrication is attended to regularly before bearings need replacing.

Formula For a Long Wearing Journal Babbitt

1,400 lbs. lead.
232 lbs. antimony.
165 lbs. alloy. (Tin and antimony mixture.)
5 lbs. bismuth.

In making up this mixture, there is needed a cast iron pot and also some ladles of various sizes; the latter should be of the self-skimming type having a

After All—It's Only Common Sense!

SOMEWHERE in every shop, there's bound to be a machine that—frankly speaking—should be scrapped. The floor space alone is too valuable for anything but a real producer—that's common sense.

We've met cases of this kind, we've listened to the old excuse "replacement too costly"; then we've shown them machines which straightway settled the argument. Often, we are asked how we can do it; and we reply, "Quality goods plus quick turnovers and small profits"—that's common sense, too.

If you're nursing along one of those "Cost-eaters" in your shop give us a chance to quote you. We'll make you feel glad you did and—after all, it's only common sense.

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welded bridge across their spouts so as to prevent dirt and dross from getting poured in with the babbitt. This iron bridge also prevents splashing and enables a good sized stream to be poured. A supply of mandrels, clamps, etc., will also be required by machinist's or millwright's repair forces. In making up the formula listed, experience shows that it is best to melt the tin and antimony alloy and bismuth in a crucible separately from the other ingredients; this is necessary because of the fact that it takes a greater degree of heat to melt them, than lead, as it is a matter of great importance in melting babbitt, (whether it is purchased ready for use or made on the premises) to avoid burning as the latter produces heavy shrinkage in all lining shells, besides reducing its antifrictional qualities.

Mixing the Metal

Such a mixture is also rendered dirty and softer in texture, causing all burnt bearings to wear out rapidly during the operation of machinery equipped with this metal. It is better to melt the lead components in an iron pot until it becomes fluid and then add the well-stirred antimony and bismuth mixture stirring frequently; after which, allow the alloy to remain upon the fire for awhile longer so as to make sure every ingredient is thoroughly melted and mixed. This ensures even wearing journals, the amount of time depending upon the bulk of metal melted. Powdered charcoal or else sawdust should be kept on its surface to prevent oxidation and a formation of dross by the action of the air.

(To be continued.)

SAFETY AN EFFICIENCY FACTOR

(Continued from page 57)

Safety League, outlined campaign plans, by which it is proposed to impress the importance of "safety first" not only upon the employees of industrial concerns, but also upon the public generally, young and old. One plan in view is to have motorists, during a safety week, pick up children or elders and demonstrate to them, for a short distance, how important it is that both pedestrian and motorist feel responsibility in taking every precaution possible.

R. B. Morley, general manager, Industrial Accident Prevention Association, also spoke. The outstanding idea was that one must be educated to think in terms of safety, and it was shown that all efforts in that direction had resulted in a lessening of the accident record.

FILMING ACETYLENE

Acetylene is one of the most wonderful substances in the world; and in order to make its marvels understood a British firm has produced a kinematograph film which reveals many of the processes adopted in compressing and using the gas. The compression is done in cylinders which contain a downy substance which is able to absorb an extraordinary amount of acetylene. In this form acetylene can be safely transported and employed in soldering, welding, and cutting metals and also in manufacture of jewelry.

INDUSTRIAL WELFARE IN SCOTLAND

When the construction of large factories was first begun, very little attention as a rule was paid to the health and comfort of the employees. The example given by Robert Owen about 100 years ago in Scotland was looked upon as the eccentricity of an enthusiast, but now it is generally recognized that on business as well as humane grounds the right policy is to give systematic care to the well-being of every class of worker. This phase of industrial enterprise has been very highly developed in England and Scotland; and the extent of its growth may be gauged from the fact that the Scottish Society of Welfare Supervisers has produced a national welfare magazine, consisting of forty pages, for distribution generally among those engaged in welfare work in Scotland. The aim of this magazine will be to co-ordinate as far as possible the various welfare activities carried out in Scotland.

NEW THINGS IN SHOP EQUIPMENT

FRICTION CLUTCH FOR GEAR-HEAD LATHES

A new design of friction clutch has recently been developed and placed on the market. Contrary to the usual design of expanding the ring on the one side, this clutch is constructed so that the ring is expanded on both sides. The expanders are in the centre of the clutch and are operated so as to produce pressure directly on the toggle lever. The levers are mounted on eccentric shafts so that uniform leverage can be maintained. These clutches have a larger diameter than the former models and are practically 50% wider on the base. They are manufactured by the Greaves-Klusman Tool Co., Cincinnati, Ohio.

SEMI-AUTOMATIC ARC WELDING SET

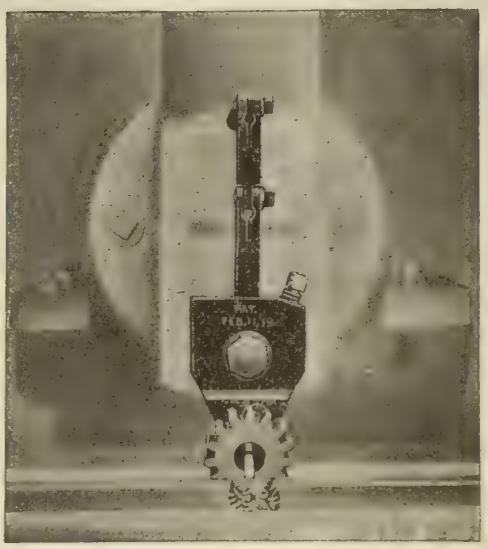
A portable semi-automatic electric arc welding set has recently been placed on the market. The set comprises complete semi-automatic equipment, all of which is mounted on a small truck that can be moved or pulled by hand or lifted by a crane. The welding equipment has an automatic welding head with controlled mechanism, and a stand for holding a reel of electrical wire. The reel carrier takes any size of reel up to 2½ feet in diameter. Owing to the continuous speed of electrode the time for welding operation is considerably reduced. The entire appliance weighs about 400 pounds and is manufactured by the General Electric Company, Schenectady, N.Y.

ELECTRIC HEATER FOR FORGING

A new type of Berwick two-path electric heater has recently been offered to the trade. The machine is especially designed for forging operations requiring the heating of the ends of bar stocks or points along the material. The heating operation is performed without burning or melting of the metal. These heaters are made on a unit principle with one, two or three electrodes, and may be supplied with a greater number if desired. The length of the heat can be varied from one to eight inches, or the machine can be adapted for heating lengths from three to eleven inches. With slight modifications in the machine these lengths may be increased to 18 inches. The lower or left hand electrode of each unit is stationary, while the upper or right hand electrode has a vertical movement operated by depression of the treadle which raises the electrode sufficiently to insert or remove the material. Each unit of the heater has two pairs of electrodes, insulated from the other. The right hand electrode is movable while the left hand electrode is stationary, so far as the vertical motion is concerned. Depression of the foot pedal causes rotation of the shafts which raises the shaft carrying the electrode. These heaters are manufactured by the American Car and Foundry Company, New York.

SLOTTING ATTACHMENT FOR SHAPERS

A slotting attachment for shapers is adaptable to production work in the tool room or machine shop work on intricate jobs. It is bolted to the clapper in



Moore slotting attachment for shapers.

place of the tool post and can be applied easily and as quickly as changing a tool. For shaping on jigs, gauges, dies, key ways slotting etc., it soon pays for itself. Made by The H. A. Moore Company, Rochester, N. Y.

PORTABLE PNEUMATIC DRILL

A new type of portable pneumatic drill has been added to the Thor line, and will be marketed under the name of "Pigmy." The drill has a pistol-grip handle with the control valve within easy reach. The machine is light in weight and non-reversible. These drills are made in three sizes, smallest taking drills up to one quarter inch and the larger taking up to one half inch, the latter weighing six pounds. The respective speed for the three tools are 2200, 1400 and 1000 r.p.m. All these drills are fitted with Jacob Chucks. A screw driver attachment which is recommended for use on the medium size, can be furnished if desired. These tools can, of course, be employed for reaming and wood-boring, as well as drilling. They are manufactured by the Independent Pneumatic Tool Company, 600 West Jackson Blvd., Chicago.

SHORT STROKE CRANK PLANER

A specially designed Crank Planer with two heads on the cross rail has recently been placed on the market. The machine has a capacity of 32 in. in width and 32 in. in height, with a maximum stroke of 43 in. The uprights are of box section while the base is a one piece, grey iron casting. The hard steel gears in the driving box are of the sliding type and fully enclosed to run in oil. The driving gear, which is of the helical type, is 37 in. in diameter, 4½ in. face. All driving bearings are bronze bushed. An indicator is provided to indicate the length of the stroke, which can be set from the operating side. The operating speed ranges from 6 to 35½ strokes per minute. The cable has an adjustment of 20 in. along the bed and is of the double I-beam construction. The cable motion is controlled by means of a clutch and a brake operated by a lever at the operating point. This lever can be locked out of position so that the operator cannot possibly injure himself. The motion is of the double cycle type operating on the return stroke of the cable. This is transmitted to the cross rails through a rack and pinion. The planer is particularly well adapted for work on forming dies, locomotive cross heads, screws, wedges and all other short stroke work. These machines are manufactured by the Newton Machine Tool Works, Philadelphia, Pa.

FLEXIBLE POWER PRESS

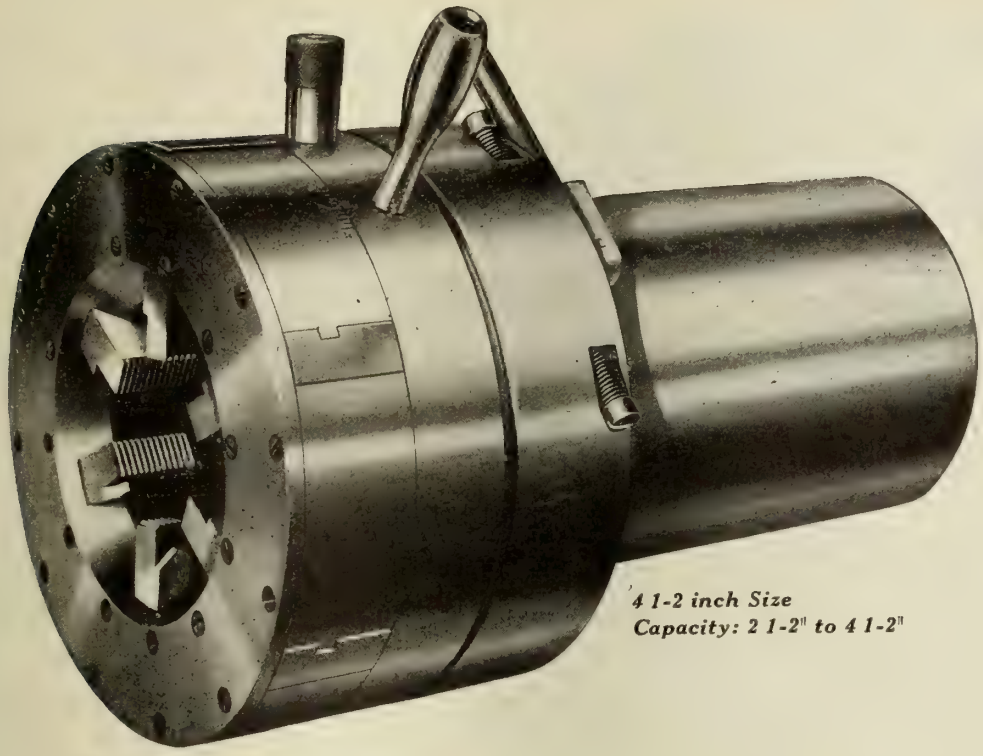
An interesting design of Flexible Power Press has recently been developed and placed on the market. The pressure can be regulated at the will of the operator, this pressure ranging from a few pounds up to 8 ton. This feature makes the press especially adapted for straightening, pressing in bushings, or for assembling parts at each press. This has a scope of nine inches, which makes it very suitable for bush broachings and similar jobs. The upper head is supported on three steel columns, the table at the base being 30 inches from the floor. The posts are so arranged that the two front ones are in tension while the third post is under compression. The ram is threaded with a long Acme thread and run through a nut four inches in length. When operating, the nut turns with the ram until pressure is applied on the foot pedal. This pressure closes the asbestos-lined brake band on the nut and the ram passes down immediately through the latter until the pressure on the foot pedal is released or until the pressure supplied by the ram on the work equals the pressure supplied on the foot pedal. The ram is returned to its normal position by means of a spring around the top of the ram. The speed the ram travels is regulated by the speed of the driving pulley. The thrust is taken on a ball bearing between the nut and the main casting. These machines are manufactured by the General Manufacturing Company, 255 Meldrum Ave., Detroit, Mich.

B. & S. THICKNESS GAUGE

(Continued from Page 48)

car: for setting valve tappets, distributor headpoints, spark plug gaps, fitting pistons and determining the size of shims for joints or parts where there is play or looseness. The manufacturers state there is a broad range of use for this gauge.

This new tool is described in detail, in a pamphlet issued by the manufacturers.



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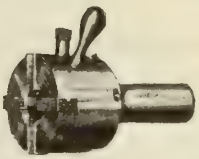
Capacity: 2 1-2" to 4 1-2"



5-16 inch Size
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It doesn't matter how strenuous the job a Geometric is built to handle it easily.

Make Screw Thread-Cutting the Most Satisfactory Operation in Your Shop

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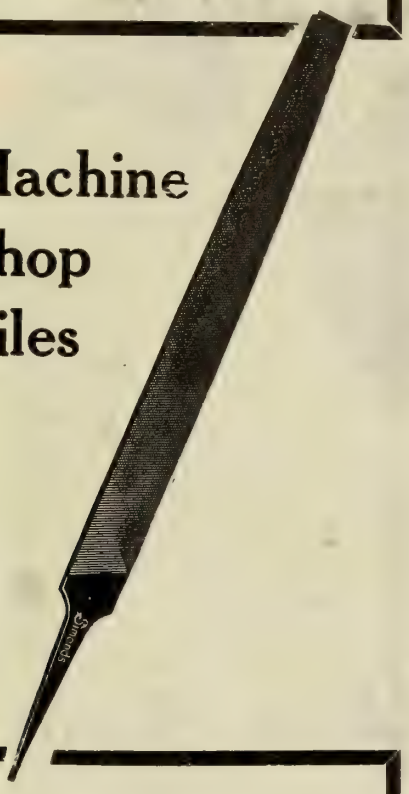

Highest Quality

Good files are as necessary in a machine shop as any other tool—In fact, files like Simonds are really essential for smooth work. All Simonds Files are made absolutely uniform and hold their cutting edge longer.

Mechanics should try Simonds Machine Shop Files.

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BUILDING HUGE INTAKE

Four hundred men are employed constructing the intake at the mouth of the Chippawa river on the Chippawa-Queenston Hydro construction. Tomlinson, Macaw & McDonald, contractors, expect to have the work done before winter sets in.

Alternating with the intake gates there will be six big concrete tubes in the intake wall. These will be entirely submerged 38 feet below the surface. When the ice comes the gates will be closed, the submerged tubes alone being open. Most of the ice will be deflected back to the current by the gerat wall of concrete which extends up the river beyond the intake openings, and the rest will be opposed by the closed gates and slide along until it is caught once more in the power of the river. At the same time the water will flow beneath the ice through the submerged intake tubes and on through the Chippawa until it is claimed by the canal proper at the Montrose intake.

This great activity is going on within a big area temporarily reclaimed from the Niagara River by the construction of a coffer-dam of interlocking steel piling. The water was pumped out and hundreds of men, aided by drills, dynamite, shovels and powerful trucks, are working below the level of the great river, slowly scooping out the bed.

THE HYDRAUTOMAT

To utilize a fall of water in order to raise water much higher than the height of the fall seems an impossibility. Nevertheless it has been achieved by a British inventor, and without the use of any power except that supplied by the falling water. The action is entirely automatic—as the name suggests—and there are no moving parts except the sluices. The apparatus consists of a series of tanks and tubes built into the form of a tower suggesting a kind of water ladder. The paradox is only apparent, as the volume of water raised above the level of the fall is less than that flowing over the weir, although the efficiency is surprisingly high. The apparatus is expected to have a wide field of usefulness in irrigation especially where there exists a head of water that cannot at present be utilised in any other way. Another advantage is that a fall of dirty water can be used to lift clean water or any other fluid from another source.

AN EASY STARTING OIL ENGINE

Right through the history of the oil engine the difficulty of starting, especially when the engine is cold, has occupied the attention of inventors. Hitherto the most popular way of getting over the difficulty has been to use a high grade oil of the petrol type for starting and, after the engine has got going, to change over to the crude oil which forms the cheapest fuel for such prime movers. This arrangement, however, is really only a make-shift, and engineers have felt that the problem would not be really solved until an engine was designed to start "from cold" on crude oil. This problem has now been solved by a British firm. The new engine, after receiving the usual first impulse from compressed air, starts right away with the heavy fuel oil of the quality generally used in running. In point of fact, any fuel which can be pumped is suitable for this engine, which has been satisfactorily running on tar oil and even on sewerage grease. This grease is in the form of a thick paste and has to be warmed before it can be pumped. The engine is of the horizontal four-cycle type, and is of exceedingly simple and robust construction. The single cylinder type is made in sizes ranging from 20 to 150 brake horse power, and the two cylinder type go as high as 300 brake horse power.

In order to commemorate its 50th anniversary the Institution of Electrical Engineers of Great Britain has founded a bronze medal, designated the Faraday Medal, to be awarded once a year for notable scientific or industrial achievement in electrical engineering or for conspicuous services rendered to the progress of electrical science. The medal is to be granted without restriction as regards nationality, country of residence, or membership of the Institution.

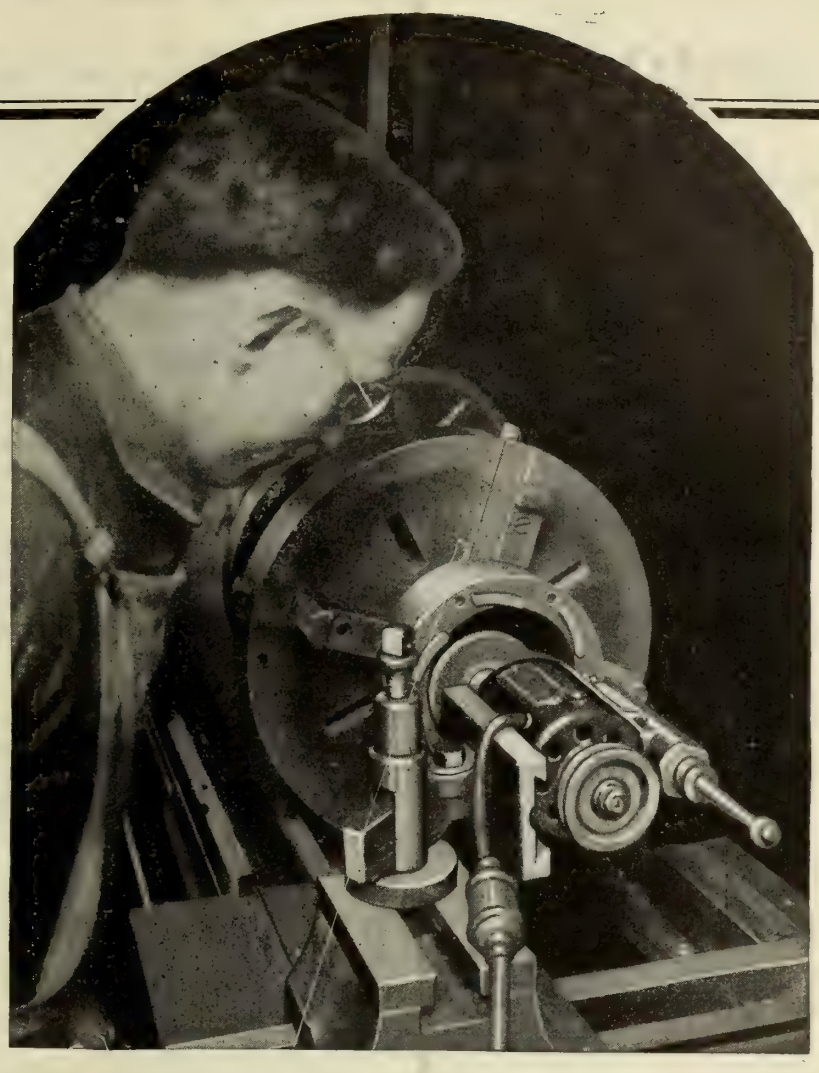
Although Great Britain is the home of the iron foundry it was not until this year that an exhibition devoted solely to foundry plant was organized in that country. The excellence of the display may, however, be regarded as atoning for the delay. Practically every type of furnace and appliance for melting and casting metal was exhibited. A British firm which specializes in large castings was unable, owing to the size of its usual productions, to find room for any of these in the exhibition. It therefore adopted the ingenious method of exhibiting models in wood about a quarter of the actual size of the steel casting. This firm is able to cast single pieces up to 110 tons; and during the war it supplied over one million tons of steel.

Are railway shopmen better paid than in private industry? is the question that arises in connection with the present labor trouble that is tying up a continent's supply of coal. In a statement issued by the National Industrial Conference Board, it is shown that, the average hourly earnings of the railroad employees stand at least 25 per cent. and weekly earnings at last 32 per cent. above those paid to men performing practically identical work in privately controlled plants. Railroad skilled shop mechanics include machinists, boiler makers, blacksmiths, sheet metal workers, and electrical workers, whose duties in the railroad shops are practically identical with the duties of men employed in commercial foundries and machine shops.

How to Get Greater Production at Lower Operating Costs.

EQUIPPING the tool room with one or more handy DUMORE high-speed GRINDERS means an increase of output and a lessening of costs on intricate grinding work. Because of their adaptability, these efficient grinders eliminate the need for costly tearing down of jobs and consequent wasteful delays.

Durably built in six useful styles and sizes, these compact high-speed grinders have long ago become indispensable in many varied industries. DUMORE grinders combine perfect running balance with correct cutting speed and work with a total lack of end play and absence of vibration—insuring speed and accuracy on the most delicate jobs.



The above picture shows a DUMORE grinder attached to the toolpost of an engine lathe at the Geometric Tool Company, New Haven, Conn. A cam for a die head has just been machined and the hole is being accurately ground without tearing down of the original "set up." Result—faster work at a decreased operating cost.

Let the DUMORE solve **your** grinding problems. Ask your dealer about them or write us for descriptive literature, and learn how DUMORE economy saves time and money. Write **to-day.**

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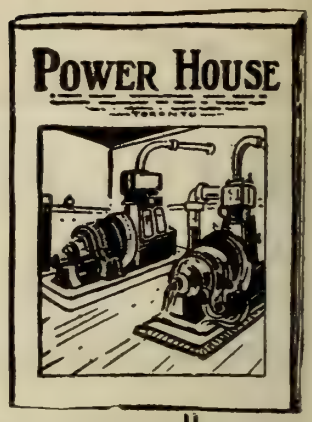

DO YOU Manufacture Industrial Equipment?

Are you a manufacturer of twist drills, hack saws, mechanics' tools, wire guards, bolts, rivets, paints—do you manufacture lines of any description that can be used in machine shops, metal-working plants, power plants or foundries? If you do the publications you see illustrated here (Canadian Machinery, Canadian Foundryman, and Power House) can build a bigger demand for your products.

This group of technical newspapers is read by the men who are prospective buyers of your lines. You can bring to the attention of these men the reason why they should demand your goods when purchasing from their dealers. You can effectively do this by placing a message in the paper which serves the field in which your products are sold.

CANADIAN MACHINERY AND MANUFACTURING NEWS is published weekly and covers the machinery, iron and steel and general metal-working industries of Canada.

POWER HOUSE is published semi-monthly; it serves steam, electrical, water and gas power plants, and the power houses of all general manufacturing plants.

CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS is published monthly; it serves the grey iron, steel and non-ferrous foundries.

Each one of these publications reach proprietors, managers, purchasing agents, foremen—the men who direct the purchasing of goods. A message to these men in any of the MacLean Technical Newspapers is certain to have a strong influence.

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as easily applied to the shaper and as quickly as you can change a tool in a tool post.

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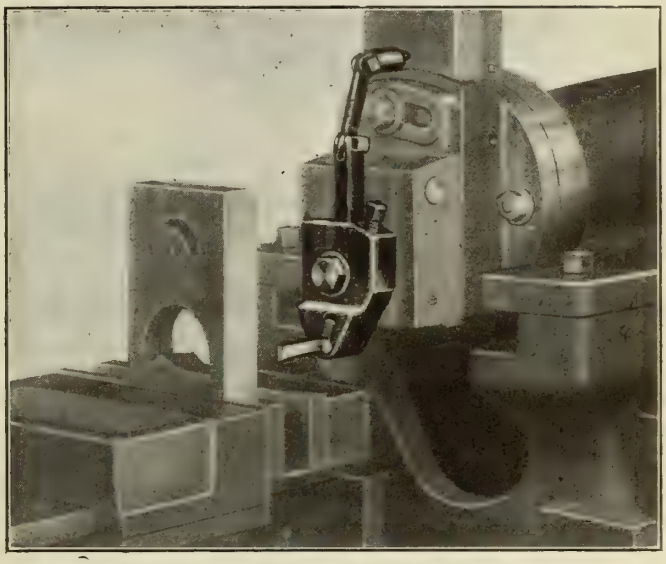
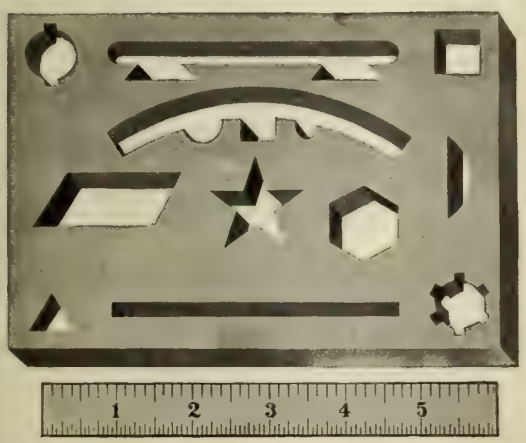


Order a Bruno Slotting Attachment—use it for 10 days—if you find you can afford to do without it—return it.

WHY FILE?



Photograph of a steel plate, one inch thick, machined with our slotting attachment. Note the sharp points of the star. Why file? You can quickly and accurately machine these shapes with BRUNO attachment.

Your Choice of Three Sizes

No. 0 takes 3/8″ to 1/2″ Round Shank
No. 1 takes 1/2″ to 5/8″ Round Shank
No. 2 takes 5/8″ to 3/4″ Round Shank

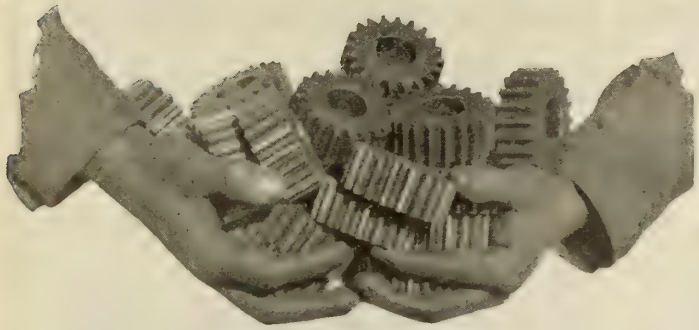
Each size is furnished with two cutting tools sharpened and ground ready for use.

Notice—Kindly state size preferred

H. A. MOORE COMPANY

ROCHESTER Dept. M. N. Y., U. S. A.

Hardened Steel Pinions



For Durability

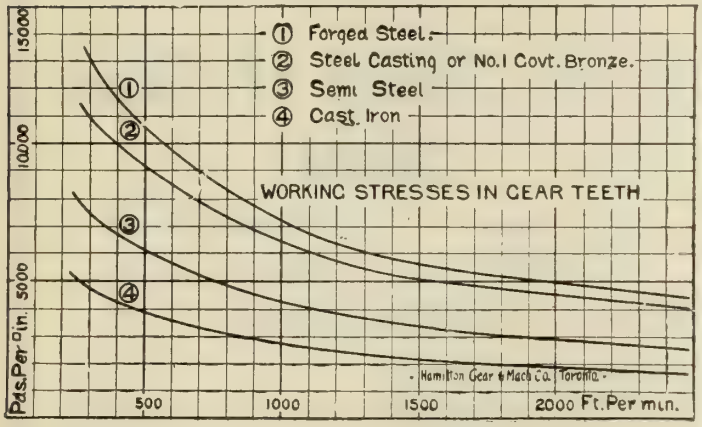
Gear Data for Your Note Book

CUT THIS OUT—MORE COMING LATER

Strength of Gear Teeth

from

The Hamilton Gear and Machine Co.



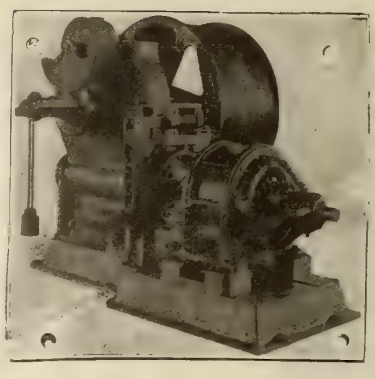
See our advertisement of July 20th for formula, and n xt week's issue fo. table to use in connection with above.

WRITE US FOR QUOTATIONS

Hamilton Gear & Machine Co.

76 VAN HORNE ST. - TORONTO

Tighten Up —



On Your Freight Handling Costs

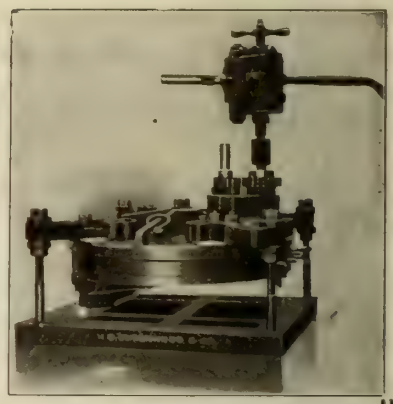
Roelofson Elevators

Once installed, the Roelofson Elevator—noiseless, smooth running, self-oiling, dust proof, and remarkably efficient—carries on its work with hardly any attention. In addition, its self-adjusting brake, phosphor bronze gears and worms cut from solid steel forging, make it absolutely safe and reliable. Enquiries solicited.

Roelofson Elevator Works

GALT, ONTARIO

Use This Planer for Deeply Worn Valve Seats



THE UNDERWOOD (Heavy Type) PORTABLE VALVE SEAT PLANER was designed to meet the demand for a machine that would face off deeply worn seats at one cut. That its work has been satisfactory is evidenced by the numerous repeat orders received from the most prominent shops.

It is rigidly constructed to stand heavy work without spring or strain. It will easily plane as heavy a cut as is required in valve seat work. The gears are cut steel. Two changes of speed are easily obtained by shifting the motor to either shaft. The tool post is strong and carries an inch square tool.

All exposed gears are guarded.

Write for catalogue.

H. B. Underwood Corporation

1025 Hamilton St., Philadelphia, Pa.

Every Machine in Stock Re-Priced

We have completed inventory of our entire stock of Machinery and have **re-priced** every machine to a new low figure. Listed below is a brief description of some of the machines on our floors ready for delivery.

Write us giving the stock number of machines you are interested in and we will promptly give you full particulars as to price set.

Our Office, Show Rooms and Shops are at 163 Dufferin St., Toronto, right at the extrance to the Exhibition. **Call and see us about all your machinery needs.**

Stock No. DRILLS

2500 Edlund 16" high speed drill, (New)
2544 Bertram 36" Sliding Head Drill, (Used)
2572-3-Woodward & Rogers 4 spindle drills, (Used)

Stock No. GRINDERS

2504 Lafayette Universal Motor Driven Grinder, (New)
2510 Perfect, No. 4 Bench Grinder, (Used)
2534 Perfect, No. 6 Double End Emery Grinder, (Used)
2537 Perfect, No. 8 Double End Emery Grinder, (Used)
2541 Heavy type Double-End Emery Grinder, 1¼" spindle, (Used)
2543 Landis Plain Grinder, 12 x 42, (Used)
2550 Pedestal Double End Emery Grinder, with 1" spindle, (Used)

Stock No. HACK SAWS

2514 Perfect Power Hack Saw, No. 3, capacity 6" x 6", (New)
2515 Racine Power Hack Saw, No. 10, capacity 8" x 8", (New)

Stock No. LATHES

2505 Cataract Bench Lathe 32" bed, 7" swing fitted with chasing attachment, (Re-built)
2506 Cataract Bench Lathe, 32" bed, 7" swing with compound rest, (New)
2545 Putnam Engine Lathe, 36" x 18", (Used)
2546 McGregor-Gourlay Engine Lathe, 18" x 8", (Used)
2547 Oliver 18" Turret Lathe
2553-4-5-Davis Turret Lathe, 24" capacity, (Used)
2570 Bardons & Oliver 16" Turret Lathe, (Used)
2556 Turning Lathe 14" x 5", (Used)
2571 Turning Lathe, plain rest, rod feed 16" x 18", (Used)
2589 Rae Engine Lathe, 18" x 8" face plate centres, countershaft and steady rest, (New)
2539 Warner & Swasey, No. 1, Screw Machine, (Used)

Stock No. MILLING MACHINES

2516 Gooley and Edlund Plain Milling Machine, 22" traverse, type A, (New)

Stock No. PRESSES

2518 Greenerd Arbor Press, on pedestal, No. 3½, (New)
2549 Greenerd Arbor Press Bench type, No. 3½, (New)
2557 Styles-Parker Punch Press, No. 172, (Used)

Stock No. PUNCHES

2503 Hand Punch, ½" bench type
2507 Hand Punch and Shear, ⅜" capacity, 2" knife, bench type, (Used)

Stock No. RICH DRILLS

113—Size 7/16", (New)
20—Size 9/16", (New)
3—Size 11/16" (New)
45—Size 13/16" (New)
6—Size 15/16", (New)
4—Size 1-1/16", (New)
22—Size 1-3/16" (New)
22—Size 1¼", (New)

Stock No. RIVETERS

2512 Townsend, No. 1 single head. (Used)
2513 Townsend, No. 1, double head, (Used)

Stock No. TAPPING MACHINES

2508 Burke Bench Tapper, ¼" capacity, (Used)
2574 Burke Horizontal Tapping Machine, on pedestal, ¾" capacity, (Used)

Stock No. MISCELLANEOUS

2529 Castellating attachment for Garvin Miller No. 3 (New)
2552 Thor Electric Drill, ½" capacity, fitted with Jacobs Chuck, (Used)
2538 Jardine Canadian Giant, No. 50, Power Hammer, (Used)
2559 Perrin Hydraulic Pump, 2 plunger, 2½" diameter, 6" stroke, 1¼" inlet and discharge, (Used)
2560 Westmacott Gas Furnace, 18" x 8" opening, 2 burners, lift door, (Used)
2561 Gas Furnace, 12" x 15" x 8", 2 burners, lift door, pedestal type, opening 10" x 8", (Used)
2562 Bellevue Oil Furnace, 10" x 5" double fire pot, on pedestal, (Used)
2564 Goldie-McCulloch Pump, 2" suction 1½" discharge, (Used)
2565 Westinghouse Starting Box 20-30 h.p., 550 volts, 7,200 r.p.m.
2566 Northey Duplex Pump, capacity 8" x 4" x 7" (Used)
2579 Roots No. 1 Pressure Blower, (Used)
2580 Lincoln, 20 h.p. Electric Motor, 3 phase, 60 cycle, 220 volts, 1,200 r.p.m., (Used)
2581 Allis-Chalmers, 5 h.p. Electric Motor, 3 phase, 60 cycle, 550 volts, 1,200 r.p.m., (Used)
2584 Garvin Slotter, (Screw), No. 1, (Used)
2588 Racine 10" Hack Saw Blades
2590 Smart-Turner Duplex Pump, 4½" x 2¾" x 6", (Used)
2591 Thor Universal Electric Drill, 5/16" capacity, (Used)

Write for further particulars. Full list of machines on request.

GARLOCK MACHINERY LIMITED

WOOD WORKING AND METAL WORKING MACHINERY

163 DUFFERIN ST. TORONTO TELEPHONE, PARKDALE 7855

"Specialists in Metal Working and Wood Working Machinery."

Classified Opportunities

Two cents a word, including "Canadian Machinery" box numbers; minimum charge is $1.00 per insertion for 50 words or less, set in 6-pt. type. Each figure counts as a word. Display ads., or ads. set in border, are at the card rates.

PATENTS

The old established firm. Patents everywhere. Head Office, Royal Bank Bldg., Toronto. Ottawa Office, 5 Elgin St. Offices throughout Canada.—Booklet free.
FETHERSTONHAUGH & CO.

PATTERNS

TORONTO PATTERN WORKS, 65 JARVIS Street, Toronto. Patterns in wood and metal for all kinds of machinery. (ctfm)

BRANTFORD PATTERN WORKS ARE PREpared to make up patterns of any kind—including marine works—to sketches, blue prints or sample castings. Prompt, efficient service. Bell 'Phone 631; Machine 'Phone 733. Brantford Pattern Works, 49 George St., Brantford, Ont. (ctfm)

FOR SALE

"RICARDO" ENGINES, PETROL OR PARAFfin, excellent for marine, commercial or stationary use. Brand new. 100 h.p. 4-cylinder, 150 h.p. and 250 h.p. 6-cylinder, 300 h.p. 12-cylinder, Thirty shillings per horse-power sterling London. Sykes, Patching, Sussex, England.

ENGINE FOR SALE

1 only 15" x 34" Wheelock Engine 125 H.P. also 5'6" x 15' H.R.T. Boiler—both in good condition for immediate delivery. Apply:
THE STEEL COMPANY OF CAN. Ltd.
1272 Notre Dame St. West, Montreal.

WANTED

SCRAP ENDS
STEEL PLATES 9, 10, 11 Gauge
Carloads or less. Suitable for making Iron Washers.
The Graham Nail Works
Toronto

OPPORTUNITIES

FOR SALE OR ROYALTY—CANADIAN PATent No. 214964 on resilient wheel for automobiles and trucks, absorbs the shock in the leaf spring spokes of the wheel, either hard rubber or pneumatic tires may be used; simple, practical and substantial in construction. Reasonable terms. Wm. H. Schlake, Yuma, Colo.

NOW!

You've been going to send in that ad for weeks, so why not mail it now for next week's issue?

CANADIAN MACHINERY & MFG. NEWS
143 University Ave. - TORONTO

REGO WELDING *and* CUTTING APPARATUS

Oxygen, Acetylene, and a complete line of Welding and Cutting Supplies.

Carter Welding Co. of Toronto, Limited
7-11 Sheppard St., Toronto, Ont.
Phones: Adelaide 2941 and 1521

SITUATIONS WANTED

SITUATION WANTED AS SUPERINTENDENT or general foreman of machine shop, twenty years' experience. At present employed; best of references. Box 861T. Canadian Machinery. (c23m)

MECHANICAL DRAFTSMAN DESIRES A change; age 30; married. Experienced in tool, jig and machine design. If you are looking for a young man who by practical shop experience, knows his job from the drafting office to the shipping platform, arrange interview, at your convenience. Box 798, Canadian Machinery.

MECHANICAL DRAFTSMAN AND DESIGNER desires position, preferably firm where advancement and responsibility is given. Competent chief draftsman with machine shop experience, well educated. Box 810, Canadian Machinery, Toronto. (C.18M.)

SALESMAN, 6 YEARS' MACHINE TOOL EXperience 10 years' general engineering with A1 practical and theoretical knowledge of mechanics, open to represent manufacturer in Toronto and district. Box 805L, Canadian Machinery.

Grey Iron Castings

Light and Medium-Bench and Floor Repetition Castings; Capacity 15 tons per day.
Expert Metal and Wood Pattern Work. Our advice and estimates will save you money.
Semi-finishing operations on Lathe or Grill on Castings supplied if required.
ASK US.
THE KATIE FOUNDRY, GALT, ONT.

CLOSING TIME

Advertisements for this section must be in our composing room Tuesday morning prior to day of issue.

In order that the announcements of your wants, machinery for sale, etc., etc., shall not be delayed, please try to have them in our office with the Tuesday morning mail.

Canadian Machinery

NORTHERN MADE IN CANADA CRANES & HOISTS

Northern Type D Electric Hoists.

NORTHERN CRANE WORKS, LTD.
WALKERVILLE - - ONTARIO

The Brown-Boggs Co., Limited
HAMILTON, ONT.
Grey Iron.

Fisher Motor Co., Limited.
ORILLIA, ONT.
Die Castings.

Sully Brass Foundry, Limited
618 Brock Ave., TORONTO, ONT.
Brass, Bronze, Copper and Aluminum.

Canadian Rumley Co., Limited
Queen West and Abell Streets,
TORONTO, ONT.
Grey Iron.

Galt Malleable Iron Co., Ltd.
GALT, ONT.
Malleable.

S. Vessot & Company
JOLIETTE, QUE.,
Grey Iron, Brass and Aluminum.

Miller Bros. & Sons, Limited,
120 Dalhousie St., MONTREAL.
Grey Iron, Semi-Steel Castings up to 10 tons.

Can. Mead-Morrison Co., Ltd.,
MONTREAL, P.Q. WELLAND, ONT.
Grey Iron Machinery Castings.

Hugh Park Foundry Co., Ltd.,
OSHAWA, ONT.
Grey Iron, Patterns, Etc.

Hull Iron & Steel Foundries Ltd.
HULL, CANADA.
Steel, Manganese, Chrome.

Aurora Foundries, Limited,
AURORA, ONT.
Grey Iron.

Aluminum Last & Metal Co.,
KITCHENER, ONT.
Aluminum, Brass, Bronze and Special Alloys.

Can. Hanson & VanWinkle Co.
LIMITED
TORONTO, ONT.
Monel, Aluminum, Brass, Bronze, Grey Iron.

Tallman Brass & Metal, Ltd.
HAMILTON, CANADA
Brass, Bronze, Manganese Bronze, Aluminum.

Dom. Foundries & Steel, Ltd.
HAMILTON, CANADA.
Steel Castings all sizes.

Manitoba Steel Foundries, Ltd.
Office Winnipeg. Works Selkirk, Man.
Steel Castings up to 5,000 lbs.

Brantford Brass Foundry Co.
BRANTFORD, ONT.
Aluminum, Brass, Bronze, Specialty.

The Katie Foundry
GALT, ONT.
Grey Iron, Semi-Steel, Brass, Aluminum.

William Kennedy & Sons, Ltd.
OWEN SOUND, ONT.
Steel, Malleable and Heavy Grey Iron.
See Advertisement Page 8

Machinery & Foundries, Ltd.
BROCKVILLE, ONT.
Light and Medium Grey Iron.

A. F. McCulloch
OSHAWA, ONT.
Brass, Alum. Castings—Wood, Metal Patterns.

Corbet Foundry & Machine Co. Ltd.
OWEN SOUND, ONT.
Grey Iron, Brass.

Fittings Limited,
OSHAWA, ONT.
Malleable, Grey Iron, Brass, Aluminum.

John T. Hepburn, Limited
TORONTO, ONT.
Grey Iron.

W. W. Wells
370 Victoria Street, TORONTO, ONT.
Nickel and Monel Metal.

The Robert Mitchell Co., Ltd.
64 Belair Ave., MONTREAL.
Light Grey Iron.

Canadian Steel Foundries, Ltd.
MONTREAL, QUE.
Steel and Ferro-Alloy.

Langley & Austin,
GALT, ONT.
Copper, Bronze, Brass and Aluminum.

Maxwells, Limited
ST. MARYS, ONT.
Light Grey Iron, Tinning same a specialty.

The Eureka Planter Co., Ltd.,
WOODSTOCK, ONT.
Specialty Light Grey Iron.

Lindsay Foundry and Pattern Works, Limited
Victoria Avenue, LINDSAY, ONT.
Grey Iron.

Dominion Engineering Works, Limited
MONTREAL, QUE.
Grey Iron.

Smith's Falls Malleable Castings, Limited
SMITH'S FALLS, ONT.
Malleable.

Joliette Steel Co.
JOLIETTE, QUE.
Electric Steel and Ferro-Alloy.

International Malleable Iron Company, Limited
GUELPH, ONT.
Malleable.

Getting The Business
You Can Do Likewise
A Few Panels For Sale

APPLY

Canadian Machinery & Mfg. News
143 University Avenue,
TORONTO, CAN.

BRANTFORD BRASS FOUNDRY COMPANY
BRANTFORD, ONTARIO

Foundry and Office 35 Leonard St.

June 17th., 192[illegible]

The MacLean Publishing Co., Limited
Toronto, Ont.

Gentlemen;-

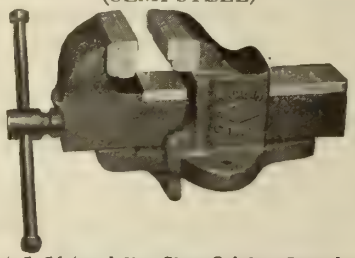
We wish to inform you that we have had quite satisfactory results from our advertisement in Canadian Machinery and Manufacturing News, which runs under the classified heading " Where to Buy your Castings ".

Yours Truly,
Brantford Brass Foundry Company.
per David Alexander

HINTS TO BUYERS

BEAVER VISES
A Thorough Canadian Product
(SEMI-STEEL)

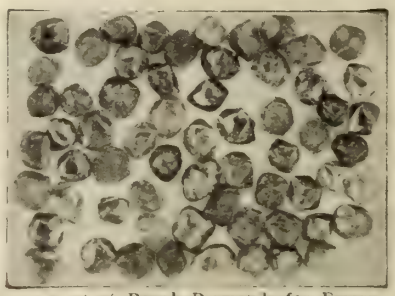
Super-Strength
Fine Workmanship



Good Appearance
The All-Purpose Vise

4, 4½, 5, 5½ and 6in. Sizes Solid or Swivel Bases
ATTRACTIVE PRICES; Manufactured by
Philip Gies Foundry, Kitchener, Ont.

Diamonds and Diamond Tools
for Accuracy and High Production



Shape of Rough Diamonds for Emery Wheel Dressing

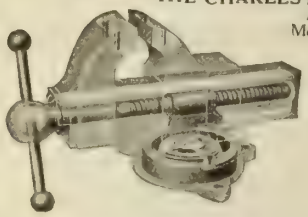
We stock diamonds and dressing tools for all services and sizes of abrasive wheels.

Write for Catalogue and Prices.

The Canadian-Desmond Manufacturing Co., Limited
Hamilton, Ont.

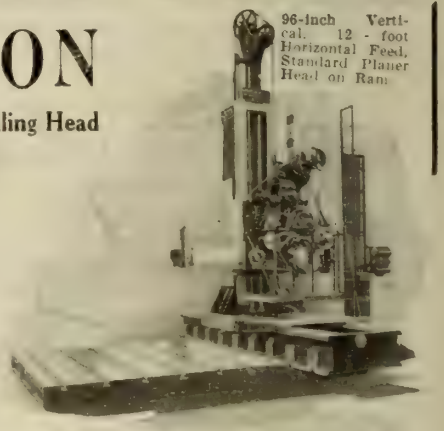
PARKER VISES
Swivel Locks Easily and Securely
The swivel base has the strength of a solid back jaw. It locks easily and securely at any angle by an expansion ring.

One of a number of "Parker Points."
Get the Rest in Folder No. 12.
THE CHARLES PARKER CO.
Master Vise Makers
Meriden, Conn., U.S.A



MORTON
72 inch Stroke Travelling Head
PLANER
Rigidly constructed to give years of accurate service. Equipped also for boring and milling. Morton means long service. Ask for catalogue No 8-A.

Morton Mfg. Company
Muskegon Heights
Mich.



96-inch Vertical, 12-foot Horizontal Feed, Standard Planer Head on Ram

SPRING SHACKLE BOLTS
Complete Line of Oilers, Oil Cups, Brass Dowel Pins and Pressed Steel and Brass Grease Cups All Types

Write for catalogues and prices

THE CANADIAN WINKLEY CO.
Limited
WINDSOR - ONTARIO

"D"

J.C.McLAREN BELTING

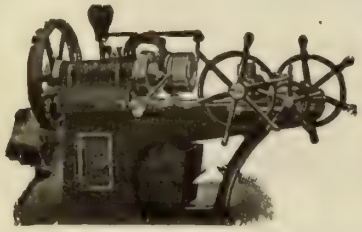
THE J.C. McLAREN BELTING CO. OAK EXTRA TANNED EST 1856

Will Save You Money In Every Day of Service

Modern plant and thorough knowledge of requirements of belting guarantees perfect satisfaction to all buyers. Our belts are the result of using best leather, and our 57 year's experience.

Ask for Quotations.

J. C. McLAREN BELTING CO.
Limited
Montreal Toronto Winnipeg



BOLT, NUT, FORGING AND WIRE NAIL MACHINERY

"National" Bolt Cutters, "Wedge Grip" Bolt and Rivet Headers, Forging Machines, Nut Machines, Roll Threaders and Wire Nail Machines are used by leading Railroads and Industrials.

THE NATIONAL MACHINERY CO TIFFIN OHIO U.S.A.

CANADIAN AGENT
H. W. PETRIE, Ltd.
TORONTO, ONT.
MONTREAL, QUE.
VANCOUVER, B.C.

WHEEL TRUEING TOOL CO.

IMPORTERS OF
INDUSTRIAL DIAMONDS
Goods Submitted on Memorandum if Desired
JOHN W. GORDON, Manager
Ja nes Street, ST. CATHARINES, ONTARIO

WINDSOR

MANUFACTURERS OF
DIAMOND POINTED TOOLS
All Mountings Fully Guaranteed
Office and Factory:
88 West Pitt Street, WINDSOR, ONTARIO

Gear Cutting Machines
Hand Feed
Semi-Automatic, Fully Automatic
Also Lathe Chucks and Centering Machines
THE D. E. WHITON MACHINE CO.
NEW LONDON, CONN., U. S. A.

Miller Bros. & Sons, Limited
Founders, Machinists, Millwrights and Engineers
120 Dalhousie St., Montreal
Contractors' Derricks and Equipment—Belt and Chain Elevators—Conveyors—Paint Machinery

Strand — **Flexible Shafts and Equipments**
Flexible shaft equipments for grinding, polishing, drilling, reaming, scraping, scratch brushing, power screw driving and nut setting.
Write for circulars and prices.
N. A. STRAND & Co., 625 W. Jackson Blvd., Chicago, Ill.

MILWAUKEE MILLING MACHINES
ACCURATE RIGID DEPENDABLE
Manufactured in various types and sizes for all classes of milling.
KEARNEY & TRECKER CORPORATION
MILWAUKEE WIS., U.S.A.

NORTON JACKS
FOR ALL KINDS OF HEAVY LIFTING
Send for complete catalogue showing 50 styles 10 to 100 tons capacity.
Made only by A. O. NORTON, Limited
Coaticook, Prov. Quebec, Canada

PRESSES and SHEARS
Sheet Metal Working Machinery
THE D. H. STOLL CO., INC.
26 Lansing St., BUFFALO, N.Y.

VICTORIA Special Machinery
DESIGNS PATTERNS
CASTINGS FORGINGS
Send for Catalogue
Victoria Foundry Co., Limited, Ottawa, Canada

THOMPSON
UNIVERSAL GRINDING MACHINES
THE THOMPSON GRINDER CO.
SEND FOR BULLETIN NO. U.13. SPRINGFIELD, OHIO.

ROCKFORD
HORIZONTAL BORING MACHINE
Unexcelled for Continuous Service
ROCKFORD DRILLING MACHINE CO.
ROCKFORD, ILLINOIS, U.S.A.

Model B (Five-wheels)
Model B (Six-wheels)

Model B Gear Counters
will give you your accurate production. Tested 20,000 per hour.
SEND FOR CIRCULAR
R.A. HART MFG. CO., 31 WILSON COURT BATTLE CREEK, MICH.

"CUSHMAN" CHUCKS 1862
Building *for* the Future
On the Experience of the Past

The "Incomparable"
That New Steel Chuck
Style 214
THE CUSHMAN CHUCK CO. HARTFORD, CONN., U.S.A.

MALLEABLES
OF QUALITY SINCE 1878.
SMITH'S FALLS MALLEABLE CASTINGS LTD
SMITH'S FALLS, ONTARIO.

The CHICAGO
APPROVED PORTABLE
WATCHMAN'S CLOCK

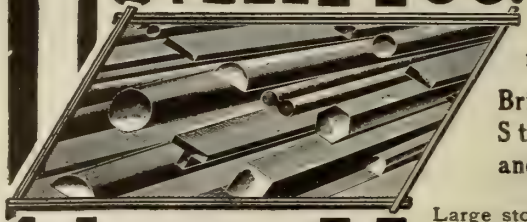
with its special Waltham movement, its lock stations and its superior quality throughout, is especially desirable for mills and factories and for either indoor or outdoor patrol.

Write for Catalogue

CHICAGO WATCHMAN'S CLOCK WORKS
1526 S. Wabash Ave., Chicago

CANADIAN FAIRBANKS-MORSE CO. MONTREAL
BENNETT & WRIGHT, TORONTO

UNION DRAWN STEEL CO. LTD.

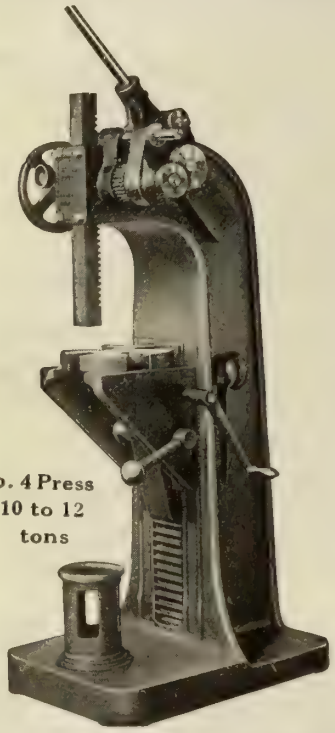


HAMILTON, ONTARIO

Manufacturers of
Bright Finished Steel Shafting and Shapes.

Large stock of all sizes.

Send for Price List



No. 4 Press
10 to 12 tons

Write for complete information on Atlas Arbor Presses. All sizes for all purposes.

ATLAS PRESS CO
330 N. Park St.
Kalamazoo, Mich., U.S.A.
Canadian Representatives:
Chas. A. Strelinger Windsor, Ont.

BLACK DIAMOND OVENS

"OVENS"

Japanning and Varnishing Ovens heated by Gas, Electricity, Steam or Coal. Kernchen and Apex Siphonage Ventilators, Bakers' Ovens, trucks, casters, etc. Write for Booklet.

BRANTFORD OVEN & RACK CO.
Brantford, Canada

BLACK DIAMOND OVENS

Rubber Mill MACHINERY

BERTRAMS LIMITED
SCIENNES EDINBURGH

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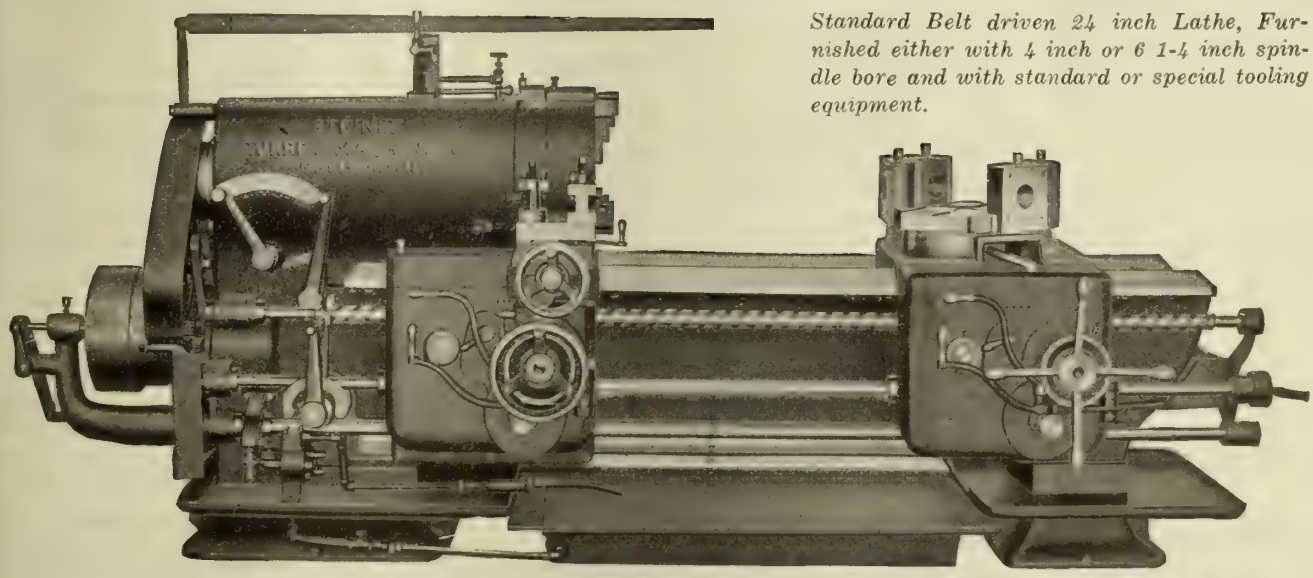

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Dominion Engineering Works, Limited, Montreal, Que.
Gisholt Machine Co., Madison, Wis.
Hamilton Gear & Machine Co., Toronto,

EXPANDERS, TUBE
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

FANS, ELECTRIC
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

FANS, EXHAUST
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Petrie Ltd., H. W., Toronto, Ont
Sturtevant Co., B. F., Boston, Mass

FANS, VENTILATING
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

FIBRE
Diamond State Fibre Co., of Can. Ltd., Toronto, Ont.

FILES AND RASPS
Nicholson File Co., Port Hope, Ont.
Simmons Canada Saw Co., Montreal, Que.

FILLER, IRON (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J.

FIRE ESCAPES
Roelofson Elevator Co., Galt, Ont.

FITTINGS, PIPE
International Malleable Iron Co., Guelph.
Fittings, Limited, Oshawa, Ont.

FLEXIBLE SHAFTS
Strand & Co., N. A., Chicago, Ill

FLUXES, WELDING
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd, Toronto
Liquide Air Company, Toronto, Ont.

FORGING MACHINERY
Acme Machinery Co., Cleveland, Ohio
Bertram & Son Co., Ltd., The John, Dundas, Ont
Brown Boggs & Co., Ltd., Montreal.
National Machinery Co., Tiffin, Ohio.
Steel Co. of Canada, Ltd., Hamilton.

BUYERS' DIRECTORY

FORGINGS, DROP
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Ltd., Toronto, Ont.

FORGINGS, HAMMER
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Hepburn Ltd., John T., Toronto, Ont.

FOUNDRY EQUIPMENT
McDougall Co., Ltd., R., Galt, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

FOUNDRY SUPPLIES
Rice Lewis & Son, Ltd., Toronto, Ont.

FROGS, SPRING OR RIGID
Can. Steel Foundries, Montreal, Que.

FURNACES, ELECTRIC
Rockwell Co., W. S. New York City.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

FURNACES, HEAT TREATING COAL
Rockwell Co., W. S., New York City.

FURNACES, HEAT TREATING OIL AND GAS
Bellevue Industrial Furnace Co., Detroit, Michigan.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Rockwell Co., W. R., New York City.

FURNACES TEMPERING AND ANNEALING
Bellevue Industrial Furnace Co., Detriot, Mich.
Brown & Sharpe Mfg., Co., Providence R. I.
Rockwell Co., W. S., New York City.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

FURNACES AND OVENS, ELECTRIC
Petrie, Ltd., H. W., Toronto, Ont.
Rockwell & Co., W. S., New York city.
Starrett Co., L. S., Athol, Mass.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

GAGES, MEASURING (See Tool Work)
Brown & Sharpe Mfg. Co., Providence, R. I.
Greenfield Tap & Die Corp., Galt, Ont.
Lufkin Rule Co., Windsor, Ont.
Starrett Co., L. S., Athol, Mass.

GAGES, RECORDING
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GAGES, SPECIAL MEASURING (See Tool Work)
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GAGES, THREAD
Brown & Sharpe Mfg. Co., Providence R. I.
Starrett Co., L. S., Athol, Mass.

GALVANIZING
Fittings, Limited, Oshawa, Ont.

GAS, COAL COMPRESSED
L'Air Liquid Society, Toronto, Ont.

GAS, COMPRESSED
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

GASKETS
Diamond State Fibre Co. of Ca., Ltd., Toronto, Ont.
Smooth Mfg. Co., Jersey City, N. J.

GAUGES VACUUM AND PRESSURE
Taylor Instrument Co. Toronto, Ont.

GEAR BLANKS
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.
Dominion Engineering Works, Limited, Montreal, Que.

GEAR COUNTERS
Hart Mfg. Co., R. A., Battle Creek, Michigan.

GEAR-CUTTING MACHINES
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Fellows Gear Shaper Co., Springfield, Vt.
Petrie, Ltd., H. W., Toronto, Ont.
Whiton Machine Co., D. E., New London, Conn.

GEAR TESTING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.

GEARS, CAST
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Hull Iron & Steel Foundries, Hull, Que.
Dominion Engineering Works, Limited, Montreal, Que.

GEARS, CUT
Brown & Sharpe Mfg. Co., Providence, R. I.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Gardner & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto, Ont.
Hepburn Ltd., John T. Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

GEARS, DRESSED
Kennedy & Sons, Wm., Owen Sound, Ontario.

GEARS, FORGED
Canada Foundries & Forgings Co., Welland, Ont.

GEARS, HERRINGBONE
Hamilton Gear & Machine Co., Toronto, Ont.

GEARS, RAWHIDE (See Gears, Cut)
Hamilton Gear & Machine Co., Toronto.

GEAR, SILENT CHAIN
Gardner & Son, Robt., Montreal, Que.
Can. Link-Belt Co., Ltd., Toronto, Can.
Hans Renold of Canada, Ltd., Montreal, Quebec.

GEARS, WORM
Hamilton Gear & Machine Co., Toronto.

GENERATORS, ACETYLENE
L'Air Liquide Society, Toronto, Ont.

GLOVES, PROTECTIVE
Industrial Glove Co., Toronto, Ont.

GOGGLES, SAFETY
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

GRAB BUCKETS
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Cleveland Twist Drill Co., Cleveland, O.

GREASE CUPS, PRESSED STEEL AND BRASS
Can. Winkley Co., Ltd., Windsor, Ont.

GREASES, LUBRICATING
Canadian SKF Co., Toronto, Ont.

GRINDING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Norton Co., of Canada, Ltd., Hamilton.

GRINDING MACHINES, ABRASIVE BELT
Norton Co. of Can. Ltd., Hamilton, Ont.

GRINDING MACHINES, AUTOMATIC
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, BENCH
Blount Co., J. G., Everett, Mass.
Geometric Tool Co., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
McDougall Co., Ltd., R., Galt, Ont.
Norton Co. of Canada, Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, CENTER
U. S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES, CUTTER AND REAMER
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Petrie Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, CYLINDRICAL
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.
Norton Co., of Canada, Ltd., Hamilton.

GRINDING MACHINES, DIE
National Acme Co., Cleveland, O.
National Machinery Co., Tiffin, Ohio.

GRINDING MACHINES, DRILL
Bellevue Industrial Furnace Co., Detroit, Mich.
Bertram & Son Co., Ltd., The John, Dundas, Ont.

GRINDING MACHINES, ELECTRIC
Strand & Co., N. A., Chicago, Ill.

GRINDING MACHINES, FLOOR AND TOOL
Blount Co., J. G., Everett, Mass.
National Acme Co., Cleveland, Ohio.
Norton Co. of Canada, Ltd., Hamilton, Ontario.
Petrie, Ltd., H. W., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.

GRINDING MACHINES, INTERNAL
Garlock Machinery Ltd., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES PORTABLE
Strand & Co., N. A., Chicago, Ill.

GRINDING MACHINES, SNAGGING
Blount Co., J. G., Everett, Mass.
Norton Co., of Can. Ltd., Hamilton, Ont.

GRINDING MACHINES, SURFACE
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Petrie, Ltd,. H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, THREAD
Pratt & Whitney Co., of Canada, Ltd.,

GRINDING MACHINERY, TOOL POST
Gisholt Machine Co., Madison, Wis.
Grenfield Tap & Die Corp., Galt, Ont.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES, UNIVERSAL
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co., of Canada, Ltd., Hamilton, Ontario.
Petrie, Ltd., H. W., Toronto, Ont.

GRINDING WHEELS
J. R. Baxter & Co., Ltd., Montreal, Que.
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Norton Co. of Can., Ltd., Hamilton, Ont.

GUN-BARREL MACHINERY
Steinle Turret Machine Co., Madison, Wisconsin.

HACK SAWS, POWER
Atkins & Co., Inc., E.C., Indianapolis, Indiana.
Petrie, Ltd., H. W., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.

HAMMERS, CHIPPING
Cleveland Pneumatic Tool Co., Toronto, Ont.
High Speed Hammer Co., Rochester.

HAMMERS, DROP
Bertram & Son Co., Ltd., The John Dundas, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

HAMMERS, ELECTRIC
Brown, Boggs & Co., Ltd., Hamilton, Ont.

HAMMERS, PNEUMATIC
Can. Steel Foundries, Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto Ont.

HANGERS, SHAFTING
Canadian SKF Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Hamilton Gear & Machine Co., Toronto.

HOBBING MACHINES
Shore Instrument Co., Jamaica, N.Y.

HARDENING, CASE-HARDENING AND TEMPERING
Barnes Company, Wallace, Hamilton.
Chapman Double Ball Bearing Co., Toronto.
Petrie, Ltd., H. W., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Cleveland Pneumatic Tool Co., Toronto Ont.

HAMMERS, POWER
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

HOBS
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

HOISTS, ELECTRIC
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

HOISTS, ELECTRIC
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

HOISTS, HAND
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

HOISTS, PNEUMATIC
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

HOLDERS-ON, PNEUMATIC
Cleveland Pneumatic Tool Co., Toronto Ont.

HYDRAULIC MACHINERY
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

IGNITERS, GAS ENGINE
Canada Foundries & Forgings Co., Welland, Ont.
Burke Machine Tool Co., Conneaut, O.

INDICATORS, SPEED AND TEST
Brown & Sharpe Mfg. Co., Providence, R.I.

INSULATION
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.

IRON BARS
Steel Co. of Canada, Ltd., Hamilton, Ont.

JACKS, HYDRAULIC
Norton, A. O., Boston, Mass.

JACKS, PLANER
Armstrong Bros Tool Co., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

JAPANNING AND VARNISHING OVENS
Brantford Oven & Rack Co., Brantford, Ont.

JIGS AND FIXTURES (SEE TOOL WORK)
Fisher Motor Co., Ltd., Orillia, Ont.
Gisholt Machine Co., Madison, Wis.
Preston & Schwartz, Galt, Ont.

KEYSEATING MACHINES
Morton Mfg Co., Muskegon, Mich

BUYERS' DIRECTORY

Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

KEYS, MACHINE
Can. Dranw Steel Co., Hamilton, Ont.
Morton Mfg. Co., Muskegon, Mich.

KNIVES, MACHINE
Atkins & Co.. E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

KNURL HOLDERS
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

LATHE ATTACHMENTS
Hendey Machine Co., Torrington, Conn.
Petrie, Ltd., H. W., Toronto, Ont.

LATHE TOOLS
Armstrong Bros. Tool Co. ,Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

LATHES, AUTOMATIC AND SEMI-AUTOMATIC
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, BENCH
Hardinge Bros., Inc., Chicago, Ill.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

LATHES, BORING
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, CHUCKING (SEE LATHES, HORIZONTAL TURRET, AND LATHES, VERTICAL TURRET)
Acme Machine Tool Co., Cincinnati, O.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, ENGINE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd, H. W., Toronto, Ont
Rockford Lathe & Drill Co., Rockford, Illinois.

LATHES, EXTENSION AND GAP
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, O.
Petrie, Ltd., H. W., Toronto, Ont.
Steinle Turret Machine Co., Madison, Wis.

LATHES, PRECISION
Hardinge Bros., Chicago.

LATHES, RELIEVING
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.

LATHE, UNIVERSAL HAND
Brown & Sharpe Mfg. Co., Providence, Rhode Island.

LATHE, SPEED AND HAND
Plount Co., J. G., Everett, Mass.

LATHES, SPINNING
Pryibil Machine Co., Torrington, Conn.

LATHES, VERTICAL TURRET
Bertram & Son, Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

LATHES, WOOD TURNING
Blount, Co., J. G., Everett, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.

LEAD PIPE
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

LEATHER FILLET
D. K. McLaren Co., Ltd., Montreal, Que.

LIGHTING AND GENERATING SETS
Beardmore & Co., Ltd., Wm., Montreal, Que.

LINOLEUM MILL MACHINERY
Bertrams, Ltd., Edinburgh, Scotland.

LIQUID AIR PLANTS
L'Air Liquide Society, Toronto, Ont.

LOCKERS, CLOTHES
Dennis Wire and Iron Works, London, Ont.

LUBRICANTS
Oakley Chemical Co., New York, N.Y.

LUBRICATING SYSTEMS
Bowser, S. F., & Co., Ltd., Toronto, Canada.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Ltd., Welland, Ont.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R. Toronto Ont.

MANGANESE STEEL
Can. Steel Foundries, Montreal, Que.

MANDRELS, EXPANDING
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MANDRELS, SOLID
Greenfield Tap & Die Corp., Galt, Ont.
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Pratt & Whitney Co., of Canada. Ltd., Dundas, Ont.

MEASURING MACHINES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MECHANICS' FINE TOOLS
Lufkin Rule Co., Windsor, Ont.

METALS, ALLOY
Canada Metal Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.

METAL WORKERS
Parker Co., Charles, Meriden, Conn.

MICROMETER CALIPERS
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Rice Lewis & Son, Ltd., Toronto, Ont.

MILLING ATTACHMENTS
Burke Machine Tool Co., Conneaut, O.
Hendey Machine Co., Torrington, Conn.
Hinckley Machine Works, Hinckley, Ill.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

MILLING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Burke Machine Tool Co., Conneaut, O

MILLING MACHINES, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence, R. I.
Hardinge Bros., Inc., Chicago, Ill.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

MILLING MACHINES, BENCH
Burke Machine Tool Co., Conneaut, O.
Hardinge Bros., Inc., Chicago, Ill.

MILLING MACHINES, HAND
Brown & Sharpe Mfg. Co., Providence
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MILLING MACHINES, HORIZONTAL PLANER TYPE.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Kearney & Trecker Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto.

MILLING MACHINES, PLAIN
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, O.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

MILLING MACHINES, THREAD
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MILLING MACHINES, UNIVERSAL
Brown & Sharpe Mfg. Co., Providence,
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

MILLING MACHINES, VERTICAL
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, O.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto.

MOTORS, ELECTRIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Roelofson Elevator Co., Galt, Ont.
Williams Machinery Co., A. R., Toronto,
Wisconsin Electric Co., Racine Wis.

NAILS AND STAPLES
Canada Metal Co., Ltd., Toronto, Ont.

NIPPLES
Canada Metal Co., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton,

NITROGEN
Carter Welding Co. Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

NUT TAPPERS
(See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
National Acme Co., Cleveland, Ohio.

NUTS, FINISHED and SEMI-FINISHED
Galt Macine Screw Co., Galt, Ont.
National Acme Co., Montreal, ue.

NUTS (Up to 4-in.)
Steel Co. of Canada, Ltd., Hamilton.

NUTS, S.A.E., PLAIN AND CASTELLATED
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

OIL FILTERING AND STORAGE SYSTEMS
Bowser, S. F., & Co., Ltd., Toronto,

OIL STORAGE ENGINEERS
Bowser, S. F., & Co., Ltd., Toronto,

OIL HOLE COVERS
Can. Whitney Co., Ltd., Windsor, Ont.

OILS, SOLUABLE
Brantford Oven & Rack Co., Brantford, Ontario.

OXYGEN
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

OXY-ACETYLENE APPARATUS
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Atlas Press Co., Kalamazoo, Mich.

PAPER MILL CONVEYORS
Bertram Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd., Montreal, Que.

PATTERNS, WOOD AND METAL
Fittings, Limited, Oshawa, Ont.
Victoria Foundry Co., Ltd., Ottawa.

PHOSPHOR TIN
Canada Metal Co., Ltd., Toronto, Ont.

PHOTOGRAPHIC DUPLICATING MACHINES
Photostat Corp., Providence, R. I.

PIPE BENDING MACHINES
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Underwood Corp., H. R., Philadelphia, Pa.
Williams Machinery Co., A. R., Toronto.

PIPE CUTTING AND THREADING MACHINES
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

PIPE
Canada Metal Co., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.

PIPE FITTINGS
Canada Metal Co., Toronto, Ont.
Fittings, Limited, Oshawa, Ont.
International Malleable Iron Co., Guelph Ont.

PIPE AND NIPPLE THREADING MACHINES
Landis Machine Co., Inc., Waynesboro, Pa.

PIPE FITTERS' TOOLS
Rice Lewis & Son, Ltd., Toronto, Ont.

PIPE THREADING DIE HEADS
Landis Machine Co., Inc., Waynesboro, Pa.

PISTON-RING MACHINES
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

PLANING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Williams Machinery Co., A. R., Toronto

PLANING MACHINES, ROTARY
Bertram & Son Co., Ltd., The John, Dundas, Ont.

PLATE ROLLS
Bertram & Son Co., Ltd., The John, Dundas, Ont.

PNEUMATIC TOOLS
Cleveland Pneumatic Tool Co., Toronto.

POLISHING AND BUFFING MACHINES
J. R Baxter & Co., Ltd., Montreal, Q.
Blount Co., J. G. Everett, Mass.
Brown & Sharpe Mfg. Co., Providence.
Pryibil Machine Co., New York, N.Y.

PRESSED STEEL PARTS
American Pulley Co., Philadelphia, Pa.
Fisher Motor Co., Ltd., Orillia, Ont.

PRESSES, ARBOR
Atlas Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

PRESSES, DROP AND FORGING
Brown, Boggs & Co., Ltd., Hamilon.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

PRESSES, FOOT AND HAND
Brown, Boggs & Co., Ltd., Hamilton.

PRESSES, HYDRAULIC
Bertram & Son Co., Ltd., The John, Dunldas, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Perrin Ltd., W. R., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

PRESSES, POWER
Bliss Co., E. W., Prooklyn, N. Y.
Brown, Boggs, & Co., Ltd., Hamilton,
Hepburn Ltd., John T., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Stoll Co., Inc., D. H., Buffalo, N.Y.

PRESSES, SCREW
Brown, Boggs & Co., Ltd., Hamilton.
Petrie, Ltd., H. W., Toronto, Ont.

PROFILING MACHINES
Prtt & Whitney Co., of Canada, Ltd., Dundas, Ont.

PROTRACTORS
Brown & Sharpe Mfg. Co., Providence
Lufkin Rule Co., Windsor, Ont.

PROPELLERS
Kennedy & Sons, Wm., Owen Sound. Ontario.

PULLEYS, CORK INSERT
American Pulley Co., Philadelphia, Pa.

PULLEYS, METAL AND FIBRE
American Pulley Co., Philadelphia, Pa.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.
D. K. McLaren Co., Ltd., Montreal, Que.

PULP AND PAPER MILL EQUIPMENT
Dominion Engineering Works, Ltd., Montreal, Que.

PUMPS, HYDRAULIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Dominion Engineering Works, Ltd Montreal, Que.
Hepburn Ltd., John T., Toronto Ont.

BUYERS' DIRECTORY

PUMPS, LUBRICANT AND OIL
Bowser, S. F., & Co., Ltd., Toronto.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Hepburn Ltd., John T., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.

PUMPS, POWER
Bowser, S. F., & Co., Ltd., Toronto.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hepburn Ltd., John T., Toronto, Ont.

PUNCHES, CENTER
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

PUNCHES, HAND
Brown Boggs & Co., Ltd., Hamilton.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Jardine & Co., A. B., Hespeler, Ont.

PUNCHES, POWER
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

PUNCHING MACHINES, HORIZONTAL
Bertrams Ltd., Edinburgh, Scotland.

PYROMETERS, ELECTRIC
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Hiram Walker & Sons Metal Products Co., Walkerville, Ont.

RACKS, CUT
Hamilton Gear & Machine Co., Toronto.

RACKS, STORAGE
(See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ontario.

REAMER HOLDERS
Simonds Canada Saw Co., Montreal, Q.

REAMERS, EXPANDING
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

REAMERS, SOLID
Butterfield & Co., Inc., Rock Island, Q.
Morse Twist Drill & Machine Co., New Bedford, Mass.

REAMERS, TAPER
Brown & Sharpe Mfg. Co., Providence, R. I.
Butterfield & Co., Inc., Rock Island, Q.
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canad, Ltd., Dundas, Ont.

RECORDERS, TEMPERATURE
Taylor Instrument Co., Rochester, N. Y.

RECORDERS, TIME
Gisholt Machine Co., Rochester, N. Y.
Taylor Instrument Co., Toronto, Ont.

REGULATORS, TEMPERATURE
Taylor Instrument Co., Toronto, Ont.

RIVETS AND BURRS
Parmenter & Bulloch Co., Gananoque, Ont.
Steel Co., of Canada, Ltd., Hamilton,

RIVETS, CHAIN
Pittings, Limited, Oshawa, Ont.

RIVET-MAKING MACHINERY
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

RIVETING MACHINES
Can. Fairbanks-Morse Ltd., Montreal Q.
High Speed Hammer Co., Rochester, N.Y.
Parmenter & Bulloch Co., Gananoque Ont.
Petrie, Ltd., H. W., Toronto, Ont.

RUDDER FRAMES, STEEL
Can. Steel Foundries, Montreal, Que.

RUBBER MILL MACHINERY
Bertram Ltd., Edinburgh, Scotland.

RULES, STEEL AND WOOD
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Windsor, Ont.

RUST PREVENTATIVES
Oakley Chemical Co., New York, N. Y.

SAND EQUIPMENT
Can. Link-Belt Co., Toronto, Ont.

SAND RAMMERS, PNEUMATIC
Cleveland Pneumatic Tool Co., Toronto.

SAW FRAMES AND BLADES, HACK
Atkins & Co., Inc., E. C., Indianapolis.
Diamond Saw & Stamping Works, Buffalo, N. Y.
Rice Lewis & Sons, Ltd., Tornto, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWING MACHINES, POWER HACK
Atkins & Co., Inc., E. C., Indianapolis.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

SAW SHARPENING MACHINES
Atkins & Co., Inc., E. C., Indianapolis.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

SAW SHARPENING MACHINES
Atkins & Co., Inc., E. C., Indianapolis.

SAW TABLES, UNIVERSAL
Petrie, Ltd., H. W., Toronto, Ont.

SAWS, CIRCULAR METAL
Atkins & Co., Inc., E. C., Indianapolis.
Pryibil Machine Co., New York, N. Y.
Gisholt Machine Co., Madison, Wis.

SAWS, HAND
Atkins & Co., Inc., E. C., Indianapolis
Simonds Canada Saw Co., Montreal, Q.

SAWS, HOT AND COLD
Atkins & Co., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Q.

SAWS, HIGH SPEED STEEL
Atkins & Co., Inc., E.C., Indianapolis, I.
Butterfield & Co. Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWS, METAL BAND
Atkins & Co., E. C., Indianapolis, I.

SAWS, METAL CUTTING
Brown & Sharpe Mfg. Co., Providence,
Butterfield & Co., Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.
Starrett Co., L. S., Athol, Mass.

SAWS, SCREW SLOTTING
Atkins & Co., Inc., E., C., Indianapolis.
Butterfield & Co., Inc., Rock Island, Q.
Greenfield Tap & Die Corp., Galt, Ont
Pratt & Whitney Co., of Canda, Ltd., Dundas, Ont.

SAWS, SCREW SLOTTING
Atkins & Co., Inc., E. C., Indianapolis.
Butterfield & Co., Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWS, WOOD
E. C. Atkins & Co., Indianapolis, Ind.

SCALES
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Lufkin Rule Co., Windsor, Ont.

SCREENS
Dominion Engineering Works, Ltd., Montreal, Que.

SCREW DRIVERS, OPTICAL, JEWELRY AND NOVELTY
Strand & Co., N. A., Chicago, Ill.

SCREW MACHINE WORK
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Montreal, Que.

SCREW MACHINERY, WOOD AND LAG
Cook Co., Asa S., Hartford, Conn.

SCREW MACHINES
Brown & Sharpe Mfg. Co., Providence, Rhode Island.

SCREW MACHINES, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.

SCREW MACHINE PRODUCTS
National Acme Co., Montreal, Que.

SCREW PLATES
Butterfield & Co., Inc., Rock Island. Que.
Jardine & Co., A. B., Hespeler, Ont.

SCREWS, CAP AND SET
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

SCREWS, SAFETY, SET
Galt Machine Screw Co., Galt, Ont.

SECOND-HAND MACHINERY
See last page of directory.
Petrie, Ltd., H. W., Toronto, Ont.

SEPARATORS, MOISTURE AND OIL
Bowser, S. F., & Co., Ltd., Toronto, Canada.

SEPARATORS, OIL AND WASTE
Bowser, S. F., & Co., Ltd., Toronto.

SHAFTS, FLEXIBLE
Strand & Co., N. A., Chicago, Ill.

SHAFTING
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
Williams Machinery Co., A. R., Toronto.

SHAPES, COLD-DRAWN SPECIAL STEEL
Union Drawn Steel Co., Hamilton, Ont.

SHAPING MACHINES
Hendey Machine Co., Torrington, Conn.
Morton Mfg. Co., Muskegon, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Williams Machinery Co., A. R. Toronto.

SHEARS HAND
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

SHEARS, POWER
Bliss Co., E. W., Brooklyn, N. Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Stoll Co., Inc., D. H., Buffalo, N. Y.
Williams Machinery Co., A. R., Toronto, Ont.

SHEARING MACHINES, ANGLE, IRON BAR AND GATE
Bertrams Ltd., Edinburgh, Scotland.

SHEET LEAD
Canada Metal Co., Ltd., Toronto, Ont.

SHEET METAL WORKING MACHINERY
Bliss Co., E. W., Brooklyn, N. Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Stoll Co., Inc., D. H. Buffalo, N. Y.

SHEETS, NICKEL, MONEL AND FIBRE
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.

SHEETS, O.P.C.R. & B. A. AND BLUE ANNEALED
Steel Co., of Canada, Ltd., Hamilton, Ont.

SIDE FRAMES, LOCOMOTIVE
Can. Steel Foundries, Montreal, Que.

SLOTTING ATTACHMENTS
Brown & Sharpe Mfg. Co., Providence, R.I.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

SLOTTING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.

SOLDERS
Canada Metal Co., Ltd., Toronto, Ont.

SPECIAL MACHINERY AND TOOLS
Brown Engineering Corp., Ltd., Toronto.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Cleveland, O.

SPIKES, RAILWAY AND PRESSED
Steel Co of Canada, Ltd., Hamilton, Ont.

SPINNING LATHES
Pryibil Machine Co., P., New York City.

SPRING, MILLED
Barnes & Co., Wallace, Hamilton, Ont.

SPRINGS, SMALL SPIRAL HELICAL, COMPRESSION, EXTENSION, TORSION AND SPECIAL
Barnes Company, Wallace, Hamilton,

SPRINGS
Barnes Company, Wallace, Hamilton.
Cleveland Wire Spring Co., Clevleand, O.
Steele Ltd., James, Guelph, Ont.

SPRINGS, FLAT STEEL, BRUSH HOLDER, CLOCK, SMALL FLAT SPRINGS
Barnes Company, Wallace, Hamilton.

SPROCKETS AND CHAINS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Renold Hanson of Canada, Ltd., Montreal, Que.

SQUARES
Brown & Sharpe Mfg. Co., Providence, R.I.
Lufkin Rule Co., Windsor, Ont.
Steel Co. of Canada, Ltd., Hamilton. Ont.

STAMPING, METAL
American Pulley Co., Philadelphia, Pa.
Barnes Company, Wallace, Hamilton.
Diamond Saw & Stamping Works, Buffalo, N. Y.
Parmenter & Bulloch Co., Gananoque, Ont.

STAMPS, STEEL
Diamond Saw & Stamping Works, Buffalo, N. Y.

STEEL CONCRETE REINFORCEMENT
Steel Co. of Canada, Ltd., Hamilton.

STEEL PLATE
British Empire Steel Co., Montreal, Que.

STEEL AND IRON BARS
Steel Co. of Canada, Ltd., Hamilton.

STEELS TOOL
British Empire Steel Co. Montreal Q.

STEEL, COLD-ROLLED STRIP
British Empire Steel Co., Montreal, Q.
Barnes Company, Wallace, Hamilton.

STEEL, CRUCIBLE, SPRING
Barnes, Company, Wallace, Hamilton.
British Empire Steel Co., Montreal, Q.

SHEETS, OPEN HEARTH STEEL
Steel Co., of Canada, Ltd., Hamilton.

STEEL, SHAFTING AND FREE CUTTING SCREW
Union Drawn Steel Co., Hamilton, Ont.

STEEL, SHEET
British Empire Steel Co., Montreal, Q.
Rice Lewis & Son, Ltd., Toronto, Ont.

STEEL, STAINLESS
Steel Co., of Can. Ltd., Hamilton, Ont.

STEELS, ALLOY AND CARBON
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Can. Steel Foundries, Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont
Steel Co., of Canada, Ltd., Hamilton. Ont.

STEELS, HIGH-SPEED
Armstrong Bros. Tool Co., Chicago, Ill
Atkins & Co., Ltd., Wm., Sheffield, England.
British Empire Steel Co., Montreal, Q.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton

STEEL TUBING, CLOSE JOINT AND WELDED
Standard Tube & Fence Co., Ltd., Woodstock, Ont.

STERN FRAMES, CAST STEEL
Can. Steel Foundries, Montreal, Que.

STRAIGHTENING MACHINERY
Bertram Ltd., Edinburgh, Scotland.
Williams & Co., J. H., Brooklyn, N.Y.

STUDS
Galt Machine Screw Co., Galt, Ont.

BUYERS' DIRECTORY

STUD SETTERS, SELF-OPENING
Geometric Tool Co., New Haven, Conn.

SWAGING MACHINES
Atkins & Co., Inc., E. C., Indianapolis, Indiana.

SWITCHES, RAILWAY
Can. Steel Foundries, Montreal, Que.

TACHOMETERS
Bristol Co., Waterbury, Conn.

TANKS AND PUMPS, OIL
Bowser, S. F., & Co., Ltd., Toronto.

TAP HOLDERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
William L. Procunier, Chicago, Ill.

TAPER PINS
Galt Machine Screw Co., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

TAPES, MEASURING
Starrett Co., L. S., Athol, Mass.
Lufkin, Rule Co., Windsor, Ont.

TAPPING MACHINES AND ATTACHMENTS
Burke Machine Tool Co., Conneaut, O.
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Wm. L. Procunier, Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

TAPS AND DIES
Butterfield & Co., Inc., Rock Island, Q.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

TAPS, COLLAPSING
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.

TEETH, DREDGE BUCKET
Kennedy & Sons, W., Owen Sound, Ont.

THERMOMETERS
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Greenfield Tap and Die Corp., Galt, Ontario.

THREAD-CUTTING TOOLS
Butterfield & Co., Inc., Rock Island, Q.
Greenfield Tap and Die Corp., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

THREAD CUTTING MACHINES
Landis Machine Co., Inc., Waynesboro, Pa.

THREADING MACHINES
Acme Machinery Co., Cleveland, Ohio.
Geometric Tool Co., New Haven, Conn.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Williams Tool Corp., of Can. Ltd., Brantford, Ont.

THREAD LEAD TESTING MACHINES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

THREAD-ROLLING MACHINES
Bliss Co., E. W., Brooklyn, N. Y.

TIE PLATES
Steel Co. of Canada, Ltd., Hamilton.

TIME RECORDERS
International Business Machine Co., Ltd., Toronto, Ont.

TONGS
Hepburn Ltd., John T., Toronto, Ont.

TOOL CASES
Rice Lewis & Son, Ltd., Toronto, Ont.

TOOL HOLDERS
Armstrong Bros., Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Bertrams Ltd., Edinburgh, Scotland.

TOOL POSTS, LATHE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Williams & Co., J. H., Brooklyn, N. Y.

TOOLS, SMALL
(See Machinists' Small Tools)
Armstrong Bros. Tool Co., Chicago, Ill.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Lufkin Rule Co., Windsor, Ont.
National Machine Tool Co., Racine, Wis.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S. Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A.R., Toronto,

TOOL WORK
Brown Engineering Corp., Ltd., Toronto, Ontario.

TORCHES, BLOW
Rice Lewis & Son, Ltd., Toronto, Ont.

TRACKWORK, RAILWAY
Can. Steel Foundries, Montreal, Que.

TRACKWORK, MANGANESE STEEL
Can. Steel Foundries, Montreal, Que.

TRANSMISSION MACHINERY
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound.
Petrie, Ltd., H. W., Toronto, Ont.
Renold, (Hans) of Canada, Ltd., Montreal, Que.

TROLLEYS AND TRAMWAYS
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Wright Mfg. Co., Lisbon, Ohio.

TROLLEY WHEELS
Langley & Austin, Galt, Ont.

TROWELS, PLASTERING
E. C. Atkins & Co., Indianapolis, Ind.

WRENCHES, MACHINISTS'
Armstrong Bros. Tool Co., Chicago, Ill.

TRUCKS
Can. Fairbanks-Morse Ltd., Montreal, Q.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

TUBING, SEAMLESS STEEL, BRASS AND COPPER AND FIBRE
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Goldstein Mfg. Co., Ltd., Toronto, Ont.

TURRET HEADS
Bertram & Son Co., Ltd., The John Dundas, Ont.

TURRET MACHINES
(See Lathes, Horizontal Turret)
Acme Machine Tool Co., Cincinnati, O.
Cook Co., Asa S., Hartford, Conn.
Gisholt Machine Co. Madison Wis.
National Acme Co. Cleveland O.
Pratt & Whitney Co. of Canada Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin

TURRETS, TOOL POST
Gisholt Machine Co. Madison, Wis.

UNIONS, PIPE
Fittings, Limited, Oshawa, Ont.

VALVES
Canada Metal Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Mon-
Dominion Engineering Works, Limited. Montreal, Que.

VISES, DRILLING MACHINE
Burke Machine Tool Co., Conneaut, Ohio.
Charles Parker Co., Meriden, Conn.
Cleveland Pneumatic Tool Co., Toronto, Ontario.
Kempsmith Mfg Co., Milwaukee, Wis.

VISES, PIPE
Charles Parker Co., Meriden, Conn.

VISES, PLANER AND SHAPER
Bertram & Son Co., Ltd., The John Dundas, Ont.
Philip Gies Foundry, Kitchener, Ont.
Hendley Machine Co., Torrington, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

VISES, WOOD WORKERS'
Charles Parker Co., Meriden, Conn.
Parmenter & Bulloch Co., Gananoque, Ontario.

VOLTMETERS
Bristol Co., Waterbury, Conn.

WAGON LEADERS
Can. Link-Belt Co., Toronto, Ont.

WASHERS, LOCK, SPLIT AND SPRING
Barnes Company, Wallace, Hamilton.

WELDING APPARATUS, OXY-ACETYLENE
L'Air Liquide Society, Toronto, Ont.
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto, Ont.

WELDING APPARATUS
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.

WELDING, ELECTRIC, ARC, SPOT AND BUTT
International Malleable Iron Co., Guelph, Ont.

WELDING MACHINES, OXY-ACETYLENE
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.

WELDING, ELECTRIC
McLaren Belting Co., J. C., Montreal, Que.
Steel Co. of Canada, Ltd., Hamilton.

WELDING ROD, TOBIN, MANGANESE, BRONZE AND ALUMINUM
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto, Ont.

WELDING SUPPLIES
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.

WHEELS, INDUSTRIAL
American Pulley Co., Philadelphia, Pa.
Hull Iron & Steel Foundries, Hull, Que.
Kennedy & Sons, Wm., Owen Sound, Ontario.

WINCHES, HEADGATE
Kennedy & Sons, Wm. Owen Sound, Ontario.

WINCHES, STOPLOG
Kennedy & Sons, Wm., Owen Sound, Ontario.

WIRE
Barnes Company, Wallace, Hamilton.
Canada Metal Co., Ltd., Toronto, Ont.
Dennis Wire & Iron Works, London, Ontario.
Greening Wire Co., B., Hamilton, Ont.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

WIRE, BLACK TEMPERED, MUSIC PHOSPHOR BRONZE AND PREMIER
Barnes Company, Wallace, Hamilton.

WIRE, COPPER AND BRASS, FINE AND HEAVY
Steel Co., of Canada, Ltd., Hamilton, Ontario.

WIRE STRAIGHTENING AND CUTTING MACHINERY
Brown, Boggs & Co., Ltd., Hamilton, Ontario.

WIRE, WELDING
L'Air Liquide Society, Toronto, Ont.
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.

WIRES, SPECIAL
Dennis Wire & Iron Works, London, Ontario.
Greening Wire Co., B., Hamilton, Ont.

WOODWORKING MACHINERY
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Williams Machinery Co., A. R., Toronto, Ontario.

WRENCHES, DROP FORGED
Armstrong Bros. Tool Co., Chicago, Ill.
Canada Foundries & Forgings Co., Welland, Ont.

List of Directory of Dealers will be Found above Advertising Index

When answering advertisements kindly mention Canadian Machinery

DIRECTORY OF DEALERS

THE Buyers' Directory of CANADIAN MACHINERY was originally intended to contain information regarding lines actually manufactured by our advertisers. We now carry the advertising of leading machinery dealers, some of whom represent scores of manufacturers in addition to being manufacturers themselves in some cases. We recommend, therefore, if our subscribers cannot find what they want in our Directory that they communicate with the dealers whose names appear herewith.

MACHINE TOOLS, ETC.

Bertram & Sons, Ltd., John, Dundas, Ont.

The Canadian Fairbanks-Morse Co., Montreal, Que.

Garlock Machinery Ltd., Toronto.

H. W. Petrie, Ltd., Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

Yeates Machinery Co., London, Ont.

SHOP and FACTORY SUPPLIES

The Canadian Fairbanks-Morse Co., Montreal, Que.

Garlock Machinery Ltd., Toronto.

H. W. Petrie Ltd., Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

Yeates Machinery Co. London, Ont.

POWER EQUIPMENT, ETC.

The Canadian Fairbanks-Morse Co., Montreal, Que.

H. W. Petrie, Ltd., Toronto, Ont.

WOODWORKING MACHINERY

The Canadian Fairbanks-Morse Co., Montreal, Que.

Garlock Machinery Ltd., Toronto.

H. W. Petrie Ltd., Toronto, Ont

A. R. Williams Machinery Co. Toronto, Ont.

Yeates Machinery Co., London Ont.

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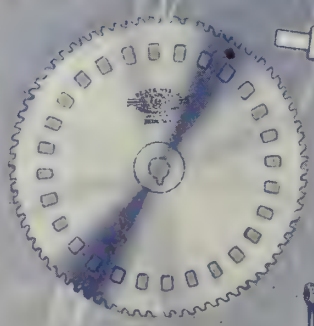

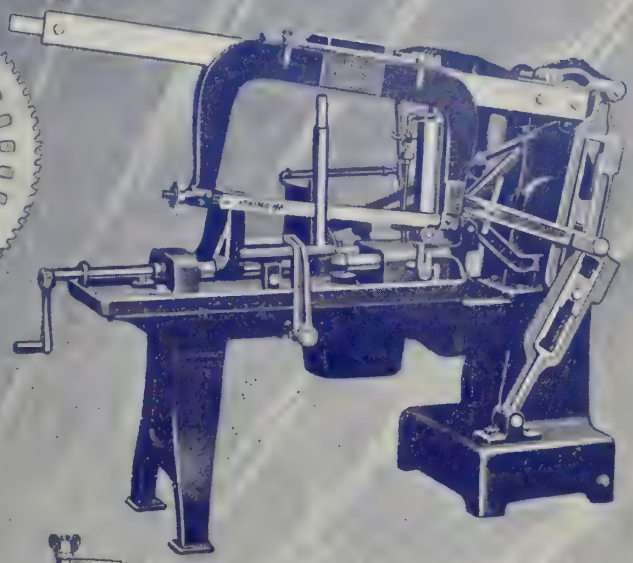

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are noted for their efficiency. Their use will increase your production.

Ask for new literature describing Atkins Kwik Kut Power Hack Saw and Metal Cutting Band Saw Machines, Circular Metal Cutting Saws, AAA Hack Saw Blades and Frames, etc.

"A Better Saw For Every Use"

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E. C. Atkins & Co.

Established 1857

"The Sterling Quality Saw People"

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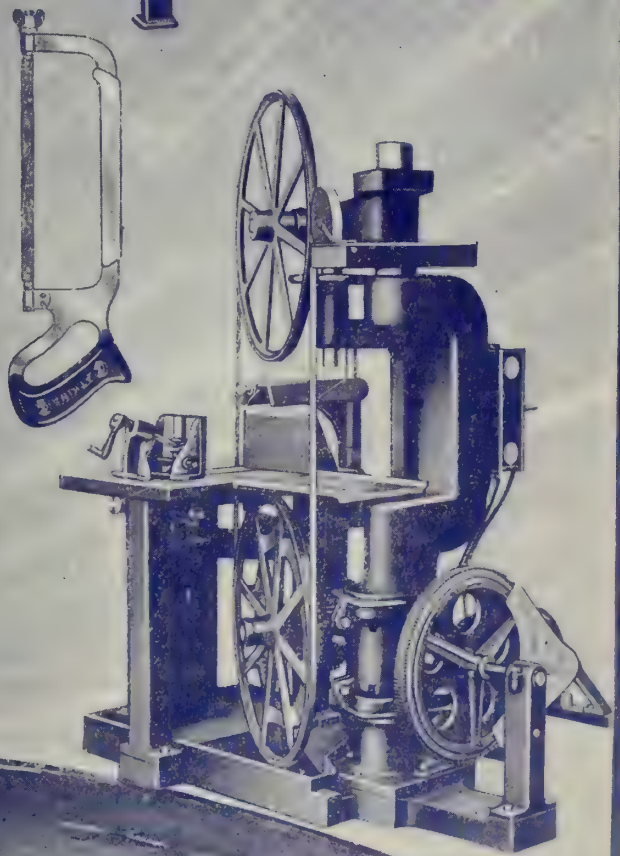

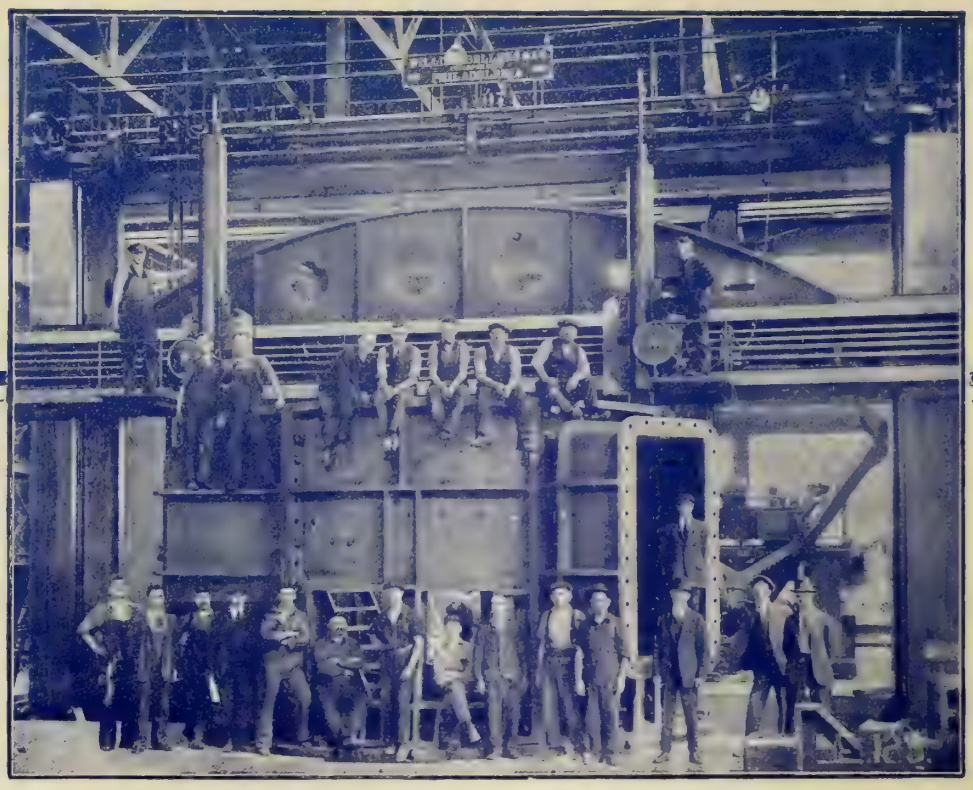

Foundation Ring for 20,000 h.p. I. P. Morris Turbine on 35 ft. Boring Mill

UNUSUAL SERVICE FOR UNUSUAL NEEDS

Machine builders can procure from us castings up to 75 tons per piece, in Grey Iron or Semi-Steel, rough or machined. We can arrange to give you special mixtures, true to formula and uniform throughout. Our machining facilities will handle anything turned out by the moulding department and comprise a number of large special tools, including the 35 ft. boring, turning and facing mill shown in the cut.

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I. P. Morris Hydraulic Turbines and Centrifugal Pumps. The Larner-Johnson Hydraulic Valve in sizes up to 20 ft. diameter. Large Gate and Pivot Valves.

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Fourdrinier Machines for Fine Papers, High-speed Machines for Newsprint or Kraft, Cylinder and Wet Machines, Millspaugh Suction Rolls, etc.

The Kaelin Electric Steam Generator

This Generator converts surplus alternating current into heat with a loss of less than 5 per cent. The coal saving usually pays for it in a short time. May we send you information?

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(M63)

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CANADIAN MACHINERY
MANUFACTURING NEWS

Vol. XXVIII. No. 6 | Published Weekly by the MacLean Publishing Company, Limited, Toronto, Ont. | August 10, 1922 | $4.00 a Year Subscription Price

READ AND PASS TO	Check	See Page	READ AND PASS TO	Check	See Page

BERTRAM MACHINE TOOLS

An Auxiliary Rail supports the Bars, giving them a length of bearing support equal to one half the total length of the bar.

Special 100" Boring and Turning Mill with D.C. Motor Drive

Maximum Swing ..102"
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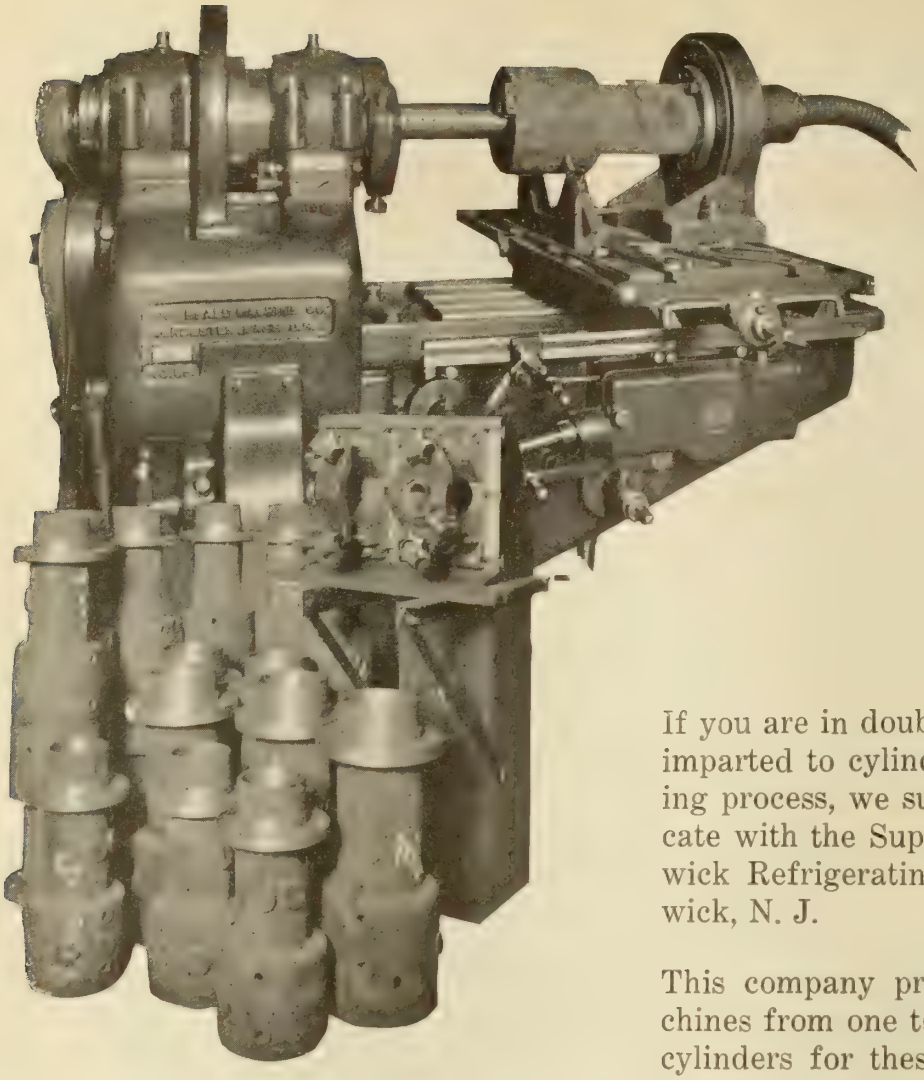

Gives Up Boring for Grinding

Found the latter gave a better product at lower cost

If you are in doubt as to the superior finish imparted to cylindrical bores by the grinding process, we suggest that you communicate with the Superintendent of the Brunswick Refrigerating Company, New Brunswick, N. J.

This company produces refrigerating machines from one to twenty tons rating. The cylinders for these machines are made of unusually tough semi-steel. The bores are extra long, and when finished by boring—the former practice—were an expensive proposition.

Something less than a year ago a cylinder grinder was purchased for a try-out on this work and now it handles all of the cylinders used in the plant and has run night and day continuously for over six months. A better product at lower cost has resulted from HEALD use, and far less machine supervision is required.

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Cylinder Grinder

All Heald users have the same to say concerning Heald performance—"An excellent machine for our class of work."

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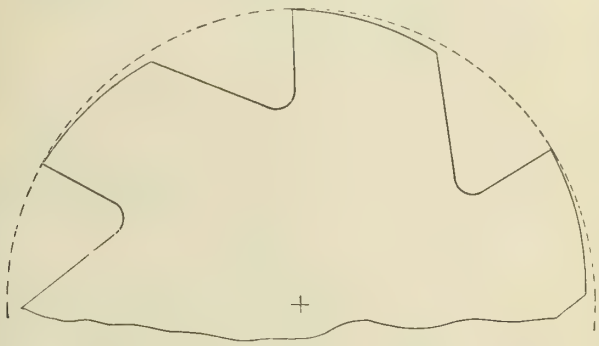
With Eccentric Relief

THE cut below shows our patent eccentric relief which is an exclusive Pratt & Whitney feature. Eccentrically relieved Reamers, as made by us, have the distinguishing advantage that they can be sharpened by grinding on the face of each flute, thus retaining a true working size for a much longer period than is otherwise possible.

Pratt & Whitney Reamers are the only reamers having this eccentric relief, which should not be confused with the so-called "Eccentric tooth," which is nothing more than unequal spacing and adds nothing to the life of the tool.



Be Sure They Are Stamped Pratt & Whitney

--a stronger tooth--a smoother hole --no chatter--maintained size

All P & W Adjustable Reamers have **eccentric** relief, can be set to size without regrinding and can be made to **face the bottom of a hole.**

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All Canadian hand power punches and Shears are made with "Armor Plate" frames.

This frame construction consists of a rolled steel plate having a tensile strength 7½ times that of cast iron. This strength permits of a machine much lighter and more compact than is possible with either cast iron or cast steel.

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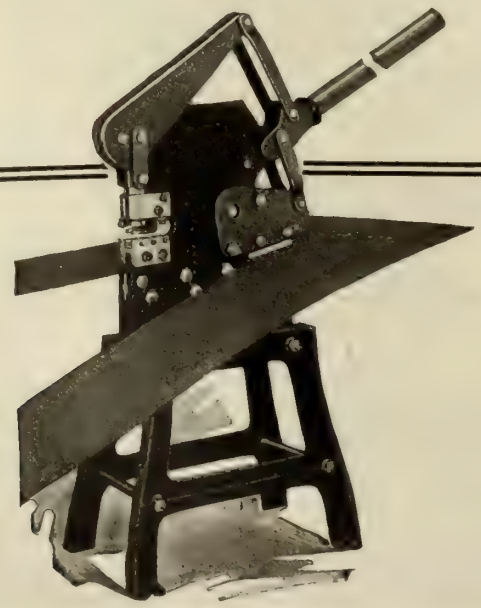

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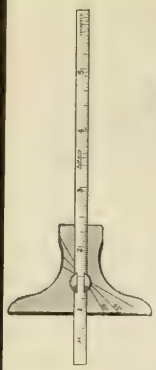

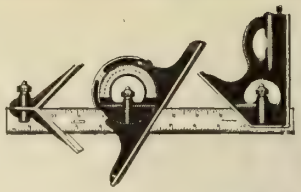

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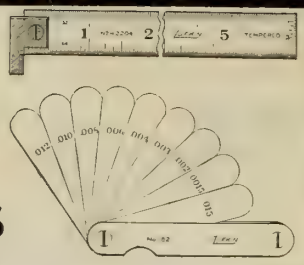
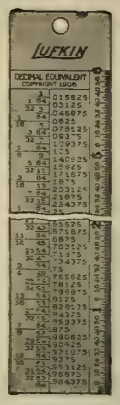
RELIABLE

MECHANICS' TOOLS

APPEAL TO EVERY PROGRESSIVE MECHANIC





Accurate, and having all the other essential qualities of precision tools; also many improvements which mean better work, easier done.

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HEADS RIVETS COLD

Heads 'em tight or loose, flush, countersunk, or finishes heads any shape desired, and at the rate of:

A rivet a second, sizes up to 3/16".

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And on special order we build machines to handle rivets up to 1½" with proportionate rapidity.

Built in eight sizes.

Besides riveting, the High Speed Riveting Hammer does all kinds of peining, swaging, upsetting, etc.

Send us sample assembly parts with rivets or sketch of your work,

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Let us shoulder your riveting problems.

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TURRET LATHES
Hand Operated
For Chucking and Bar Work
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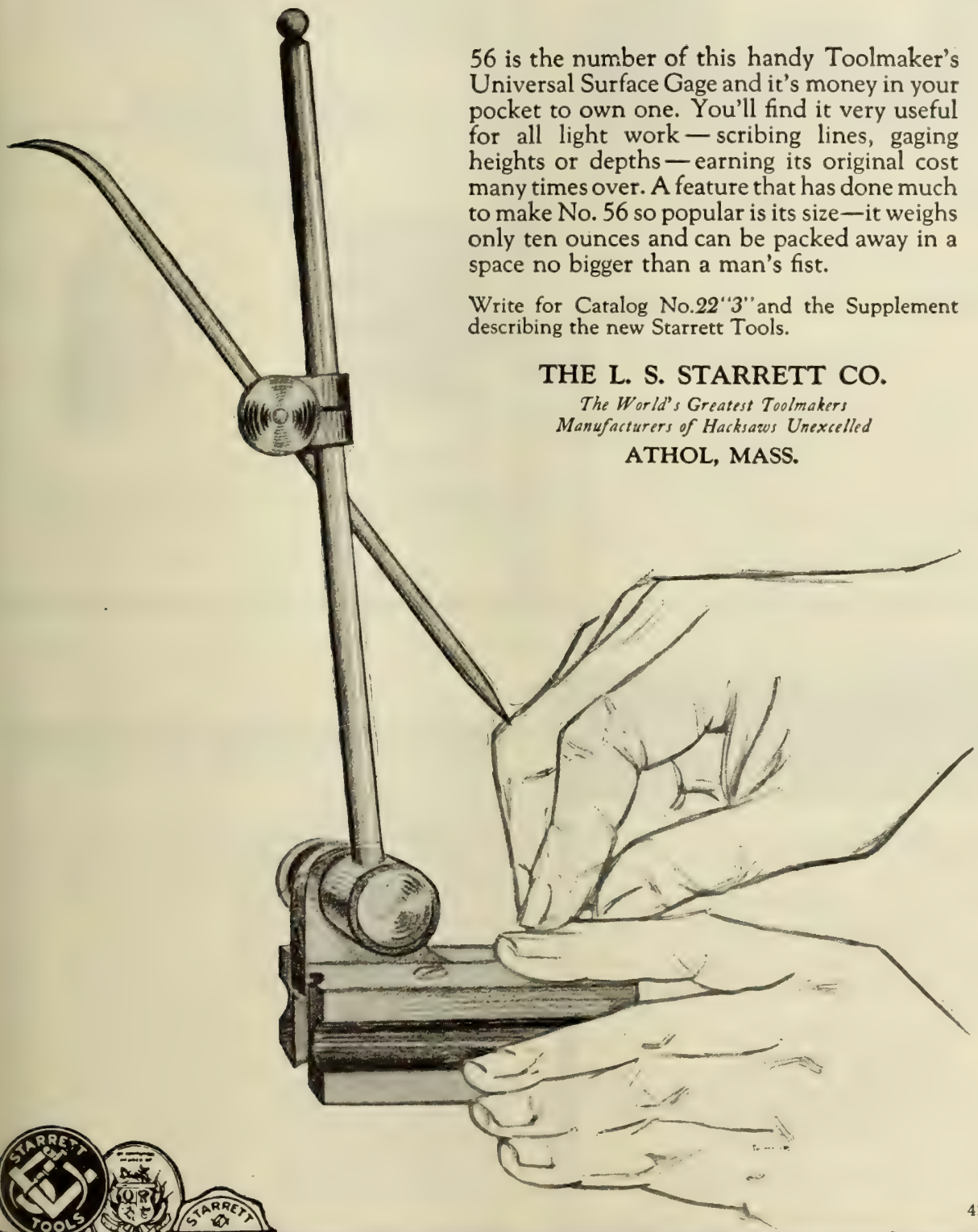

56 is the number of this handy Toolmaker's Universal Surface Gage and it's money in your pocket to own one. You'll find it very useful for all light work — scribing lines, gaging heights or depths — earning its original cost many times over. A feature that has done much to make No. 56 so popular is its size—it weighs only ten ounces and can be packed away in a space no bigger than a man's fist.

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The World's Greatest Toolmakers
Manufacturers of Hacksaws Unexcelled

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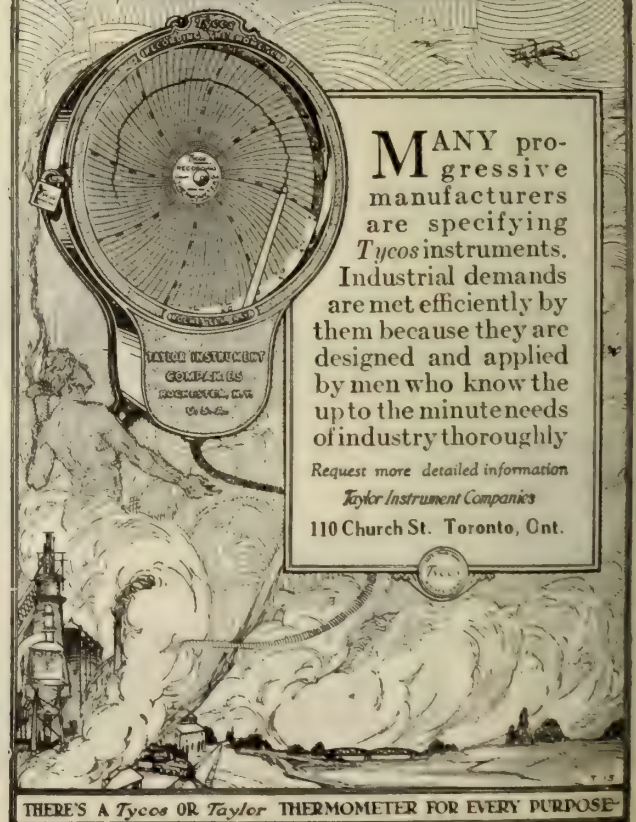

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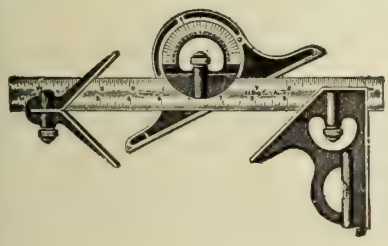

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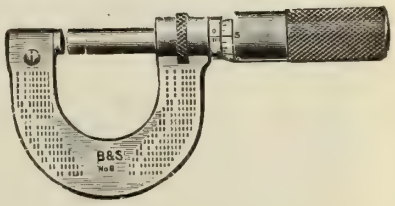

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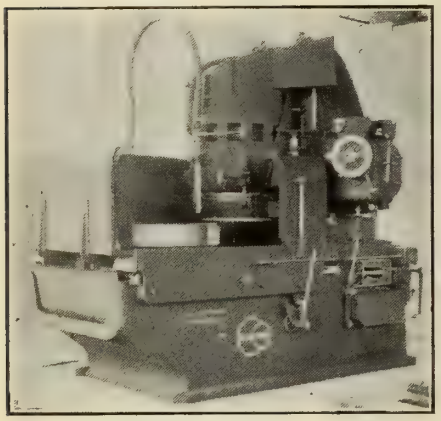
NEW No. 27-R, BLANCHARD VERTICAL SURFACE GRINDER



Courtesy The Blanchard Machine Co., Cambridge, Mass.

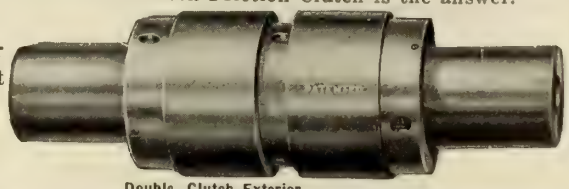
Another advance of progress in abrasive engineering is the use of Johnson friction clutches on this *NEW* machine.

Two No. 6 double clutches provide for rapid raising or lowering of the wheel.

One No. 10 single clutch is located in the gear box for rotating table.

The **AUTOMOTIVE INDUSTRY** demands reliable friction control—the Johnson Friction Clutch is the answer.

Write for Stock List and Yellow Catalog



Double Clutch-Exterior

THE CARLYLE JOHNSON MACHINE CO. MANCHESTER-CONN

STEEL CASTINGS

QUICK DELIVERIES

High Carbon Steel
Manganese Steel
Chrome Steel
Mild Steel

QUALITY GUARANTEED

Sizes—½lb. to 5,000 lbs.

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OWEN SOUND, ONTARIO
ESTABLISHED 1860

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Bliss Double Crank Toggle Drawing Press in Production

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Built in many sizes, there is a standard size for every standard requirement. Weights 15,000 to 550,000 lbs. We also build them special to suit individual requirements.

They give superior results and effect economy in drawing and forming, from heavy stock, irregular and oblong shaped articles of large area.

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CANADIAN WHEELS of QUALITY

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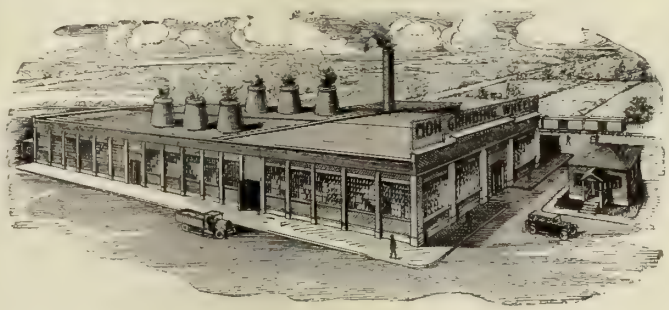
FOR GRINDING HIGH TENSILE MATERIAL



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A high speed Riveter that cuts cost of operation and speeds delivery.

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BULLETIN NO. 53

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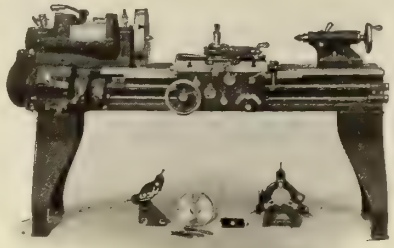
ROCKFORD "ECONOMY"
A Powerful Tool Room Lathe



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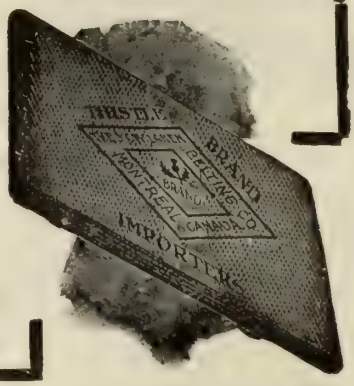

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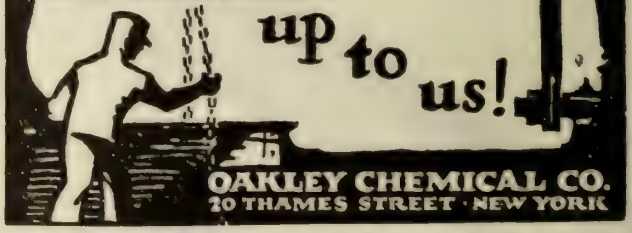

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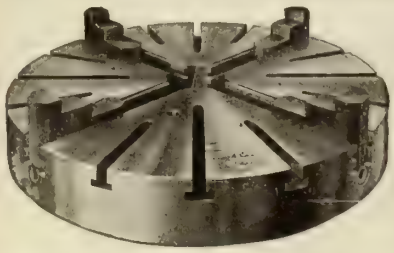

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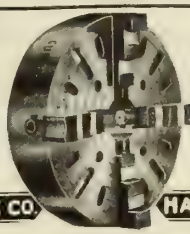

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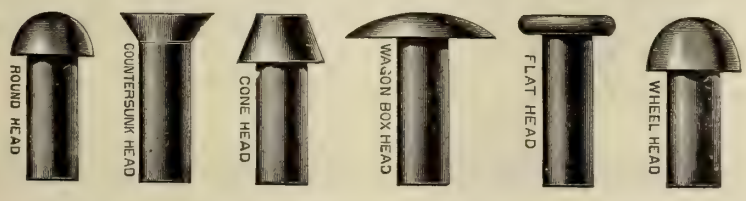

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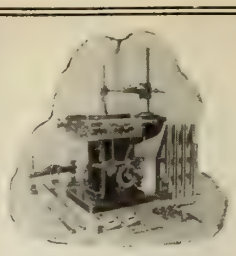

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Classified Opportunities on Page 48

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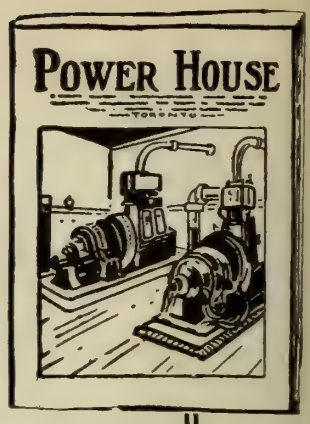

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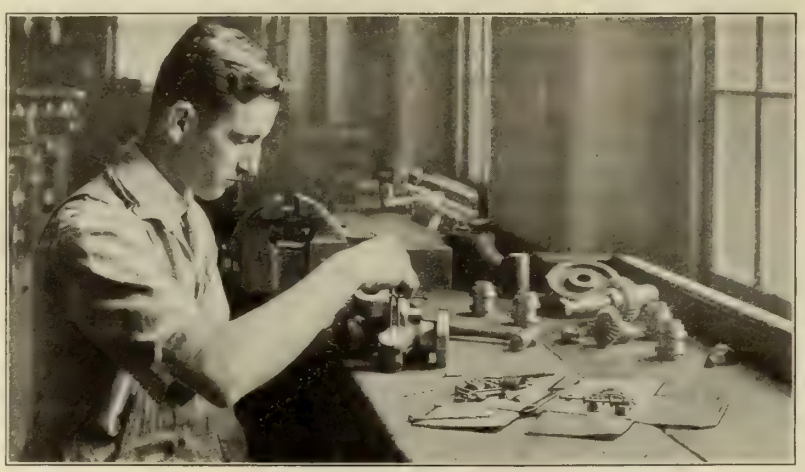

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CANADIAN MACHINERY
AND
MANUFACTURING NEWS

VOL. XXVIII, No. 6 AUGUST 10, 1922

Saving Time And Money With Portable Tools

Rapid Development of This Type of Equipment — Taking The Machines to The Work—Making Repairs With Portable Welding Outfits—Handling Loose Material Economically

FEW labor-saving devices have shown more rapid development than the widening range of portable tools that are now extensively used in every phase of industrial life. It would be difficult to classify exactly what portable equipment really is, but the general meaning would be a tool or machine that can be conveniently transported from one location to another for the accomplishment of mechanical operations. The range of portable tools is almost unlimited, as the list is comprised of all manner of small hand tools, up to and including many of the heavier machine tools used in large engineering plants, where it is often more desirable to bring the tools to the work than to carry the work to the machines. In the latter instance the floors are generally fitted with large surface plates so that machines are properly aligned when located near the work by means of the overhead crane. Among these machines might be mentioned large radial drills, slotting machines, large boring tools, millers, etc. From this it may be seen that it is almost impossible to properly define a portable tool.

Air and Electric Tools

Probably the tools that are the most deserving of the name portable, are the varied types of pneumatic and electric appliances that have been developed for the speeding up of work formerly performed by hand labor. The conservation of man-power has been greatly enhanced by such equipment and the great saving effected has been reflected in the steadily growing demand for all classes of light portable air and electrically operated hand tools.

The most suitable tool for any particular purpose would naturally be suggested by the nature of the specific operations and the local conditions governing the source of power. Where it is a question of percussion, such as chipping, riveting, sand ramming, etc., the choice would obviously be the pneumatic tool, as the reciprocating motion of the air plunger is best adapted for such operations. Where it is a matter of drilling, reaming, grinding, and other work, where a rotary motion of the tool is required, the selection would depend on the nature of available power, as both air and electricity are extensively used for work of this character. Generally speaking electrically-driven portable tools are best suited for grinding operations, owing to the greater speed that may be obtained with this apparatus.

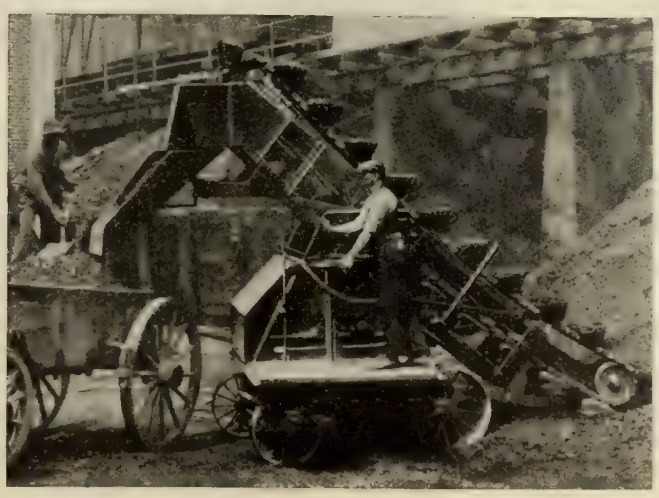
In the assembling of heavy machinery and in general repair work, the small portable tool is indispensable. The hand-operated ratchet drill is still to be found in many shops, but its application is confined to a much smaller range now owing to the greater production qualities of pneumatic and electric tools for this purpose.

Foundry Equipment

Before the event of the pneumatic hammer the work of fettling castings in the foundry was a tedious and expensive operation, frequently requiring two men for the work, one holding the chisel while the other used the hammer. This work is now accomplished almost entirely by means of air tools, and one man performs the work formerly requiring from one to six. Sand ramming in the foundry is another operation that is now advantageously handled by means of air-operated tools. Before the advent of the sand rammer the preparing of large molds was a laborious job, but with these modern air tools

Illustrations through courtesy of the Independent Pneumatic Tool Co., the Cleveland Pneumatic Tool Co., R. G. Hoskins Co., and The Canadian Link Belt Co.

Ramming sand in mold.



Loading loose material by portable bucket elevator.

Chipping fins off castings.

Grinding a large die block.

the work can be performed with less effort and with greater satisfaction, and likewise considerable saving over the old method. The portable grinding outfit is another serviceable tool that has met with considerable favor in foundry practice. A much higher finish can be given to a rough casting by grinding the portions that have been previously chipped or snagged with the air hammer.

A workman's capacity to produce results is determined by his reserve energy. His ability will decline as this energy is expended. The development of mechanical appliances has enabled the workman to produce considerably more work than was ever possible under the old hand method. The physical effort required of a man when using light mechanically-operated hand tools, is much less than that necessary under the old system, and more and better work is the result.

Large Portable Tools

While the large machine tools are not generally included in the portable class, there are many instances especially in the larger engineering plants, where it is often advisable and perhaps necessary to take the tool to the work owing to the inconvenience and great expense that would be entailed in the frequent movement of massive castings from one machine to another. Under such circumstances it is within reason to classify these tools as portable. In the case of bulky castings for large engine work, turbo-generators, and heavy machinery, the necessary equipment for performing many of the machining details is taken to the work and located, by means of the overhead crane, in the desired position for doing the work. In this way it is often possible to perform numerous operations of a varied character on a large casting without removing it from its original position. In order to carry out this class of work successfully it is imperative that the shop floor be fitted with level plates on which the various machines can be located, so as to minimize the need of aligning the tools before machining operations are commenced.

Welding Outfits

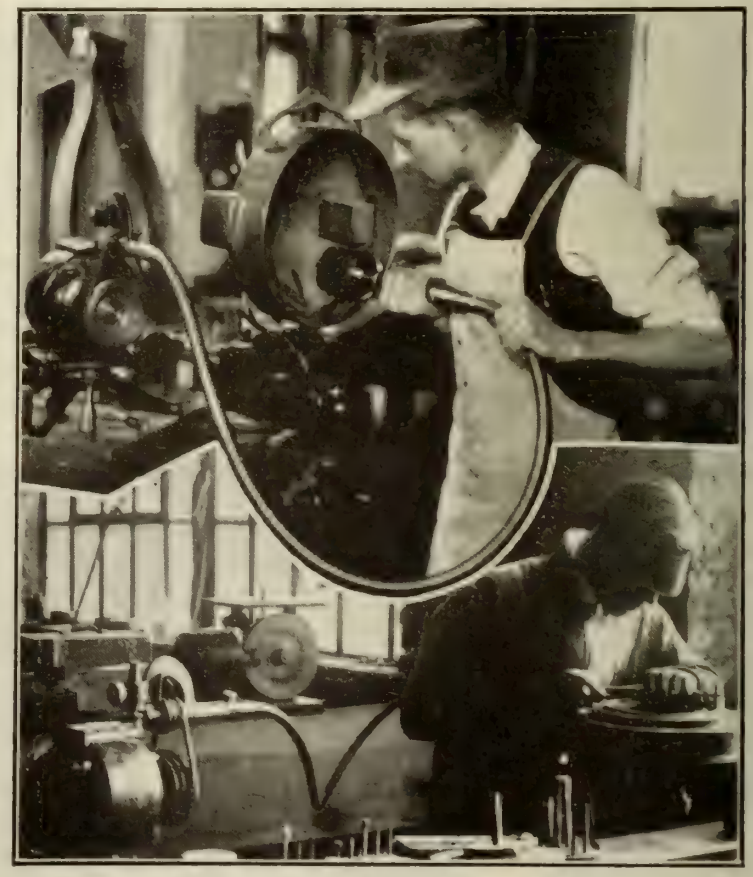
Included in portable equipment now in constant service in industrial plants is oxy-acetylene and electric welding. Where breakdowns to machinery occur at a distance from a repair base, and where the removal of the broken part would entail prohibitive delay to regular operations the presence of a welding outfit has often saved the situation. The cost of such emergency repairs has often meant the saving of thousands of dollars that would otherwise have been expended in replacements, in addition to the loss of production resulting from the unavoidable shut down.

Elevating Appliances

The handling of material such as loose earth, coal, ore, etc., is often economically performed with portable conveyors and elevating apparatus. The loading and unloading of such materials by means of the ordinary hand shovel required the services of a large number of men, whose ability rapidly depreciated as the day progressed. The mechanical loading conveyor conserves the energy of the workman and reduces the number of men required to the lowest possible minimum, as a machine of this description can be operated continuously by one man and moved from place to place with the greatest ease.

Smoothing surface of rough casting.

Operations on casing performed with pneumatic drill.



Top.—Polishing inside of cover.
Bottom—Grinding shear on combination die.

From Office Boys to $30,000 a Year

Slow Steady Progress to Responsible Positions—Man With the Right Stuff Goes to the Top—Recreation and Clean Living Essential to Success—Salesman Must Have Personality.

AN ANNOUNCEMENT was recently made by the Standard Oil Co., of Indiana, that three men of its rank and file—two of whom started as office boys and the third as a dray-driver—have been made directors of the company at a salary of $30,000 a year each.

No sudden rise was theirs, but a slow steady advance. According to their own estimates they were endowed with no exceptional talents. They consider themselves average men, possessed of average abilities and presented with average opportunities. Their genius consisted in making the most of these opportunities. The story of their careers, as related by themselves to the "New York Sunday Times" should prove an inspiration to all young men who possess the capacity for hard work. The three men are Robert H. McElroy, traffic manager; Edward J. Bullock, director of purchases, and Thomas J. Thompson, general manager of the sales department.

"I was fortunate enough," said Mr. McElroy, "to secure association with a business organization which represents true democracy—an organization wherein every employee, no matter what his financial or social status, is given opportunity to rise to the most important executive position within the company's power to bestow.

"In the Standard Oil Company there is no such thing as 'pull.' Every man stands on his own feet, and if he has the right stuff in him he will inevitably go to the top. I, who began life as a messenger boy, am no exception among the executives of the Standard Oil Company of Indiana. Every member of the board of directors and every executive of any importance in this company is a man who has had to fight his way up. Many of them have acquired their education through correspondence and night schools. There are, of course, many college men among our executives—men who hold masters' and doctors' degrees, but they, too, had to start at the bottom of the ladder and work their way up, proving they had a lot more in them than just education.

"Next to opportunity," Mr. McElroy continued, "the most important factor in success is the incentive to fit oneself to take advantage of the main chance. My incentive has been a wife and children.

"Leaving school at twelve, I ran a corner news stand for a while. One of my customers was a wealthy man and one day I asked him if he couldn't get me a 'decent' job. He did—as messenger boy at $15 month for the Chicago, Milwaukee & St. Paul Railroad. In the past year we have had messenger and office boys refuse to accept a job with us at $60 a month. But I thought it was a pretty decent job at $15 a month, and so it proved to be.

The man who got it for me is eighty years old to-day and when I was made a member of our Board of Directors a few weeks ago, I received a nice letter of congratulation from him.

"Two months after I got the job, I was promoted to office boy. In the meantime I had enrolled in the Chicago North Division High School at night. I worked from 6.30 a.m. to 6.30 p.m. six days a week and every other Sunday, and studied and attended classes at night. I thought it was pretty tough then, but now I know it was good for me.

"My night school work helped me and soon I was promoted to clerk, and then went up through various positions until I was made chief clerk. In 1906 I was offered a position in the traffic department of the Standard Oil Company of Indiana. I made inquiries, found it was an organization where every man had a chance, and took the job. In 1917 I was made traffic manager of the Marketing Committee.

Loyalty a Big Thing

"Any boy," added Mr. McElroy, "who has the right stuff in him, who is willing to work at his job and study after working hours, who will keep his eyes open till he can place himself with a thoroughly democratic organization headed by men of integrity who give a square deal to employees, can achieve the same success that I and many of my associates have.

"He must, however, always extend absolute loyalty to his employer, and just as great a loyalty to his subordinates. The man who fails to be loyal to the men under him, who refuses them a square deal, or tries to shift on them responsibility for his own mistakes, won't get very far. Be loyal to your subordinates and they will be loyal to you, and once a man gets a loyal organization back of him. he needn't be afraid of anything.

"Decent living and decent morals are also essential. I don't mean that a man shouldn't play. He needs recreation. But he must not make play his chief aim. When one gets to be forty-five, his early efficiency in baseball, tennis, golf, pool, etc., won't have gotten him very far. Play enough to keep healthy in mind and body, but don't let play interfere with your job."

Thirty seven years ago Thomas Thompson entered the employ of the Standard Oil Company of Indiana as a drayman. The next year he was promoted to be driver of a tank wagon. He realized that this was as far as he could ever get with the educational equipment he then possessed. Like Mr. McElroy, he started to study. He mastered not only the subjects necessary to gain him promotion to some position near the wheels of the great corporation, but many academic subjects as well. His promotions were slow, but steady, and on Dec. 10, 1920, he was appointed general manager of the sales department. After that his appointment as a Director of the company followed as a natural sequence.

"I have but one fundamental formula for success," said Mr. Thompson, "and that is work, work, work. I do not care what a man's abilities are—he may be a genius of the first water—he will never attain success without careful preparation and extended effort. The world is filled with failures who possessed all the talent necessary for success, but lacked the willingness to work for it. On the other hand, there are thousands of successful men who possess mere ability rather than genius who have won their places simply by hard work and square dealing.

"One of the policies adopted by our company is that the selling organization must work just as hard for the customer as for the company. When I began selling, I did not try to sell myself, but concentrated on trying to sell the Standard Oil Company of Indiana to every customer I approached.

"Many salesmen fail when they strive to sell themselves rather than the company they represent. When a man obtains orders merely on his personality and neglects to sell his company he stands alone in an exposed position, ready to be bowled over by a competitor's attack. No matter who the salesman is, there is some other salesman who possesses a more pleasing personality, and the competitor is going to send that man into the field, with the result that the salesman who depends on his personality rather than on the quality and service given by his company is out of luck. The other fellow will get the business. But had the salesman sold the company, the quality of the goods and service rendered, he would have convinced the customer that no other company could give such service or better quality at a better price, and it would have meant the holding of the business. The salesman who sells his company rather than himself does not stand alone; he has an organization back of him.

A "Different" Salesman

"One must be as loyal to a customer as to himself. Lots of times I have had orders come in which I knew were

(Continued on page 21)

Practical Method of Testing Centrifugal Pumps

Individual Tests Given to Each Unit—Proved Efficiency When Placed in Service—Interesting Method of Mounting Motor—Speeds Recorded on Vibration Tachometer.

DEFINITE characteristics of centrifugal pumps cannot be as accurately calculated in advance, as those of reciprocating pumps of various designs, and for that reason manufacturers usually prefer to test the former types before placing them in service. The reputation of the pump is thus guarded and at the same time statements, and guarantees as to performance, can be intelligently and confidently made.

Messrs. Darling Bros. of Montreal, manufacture a wide range of sizes of centrifugal pumps. Every pump is subjected to an individual test. To standardize results, and to make tests thoroughly and economically, a very interesting apparatus has been developed. Most of the impellers are bronze castings and practically all the pump casings are cast in iron.

It is not practical to machine some of the surfaces exposed to the liquids to be pumped, and in spite of the fact that the greatest care is taken in preparing the cores and setting them in the mold, small variations are found. This is only natural as molding can not be done to within a few thousandths of an inch. These variations are only infinitesimal but are reflected in the fact that capacities of the pumps vary slightly. For that reason this firm decided to test every centrifugal pump they built, and to do so in a very thorough manner under varying conditions. This would enable them to state with confidence just what every unit would do when placed in service.

Testing Appliance

The present apparatus was not designed, but rather developed from a basic idea. Improvements have been made from time to time, and now the apparatus is very complete. It is the intention of the firm to design a very complete apparatus from the data obtained in developing the original unit, which we are about to describe. The base consists of the bed of lathe. On one end of the base, or frame, is mounted a d.c. Allis-Chalmers-Bullock electric motor, which is used to drive the pumps to be tested. As the current supplied the factory is a.c. it was necessary to procure a source of supply of direct current. Nearby is located a belt driven d.c. Canadian General Electric generator of 6 k.w. capacity. The field rheostat of the generator, as well as motor rheostat, are located on the frame of the testing apparatus carrying out the idea of centralized control. At one end of the apparatus a switch board is located. This board carries the starter of the motor, an ammeter and a voltmeter.

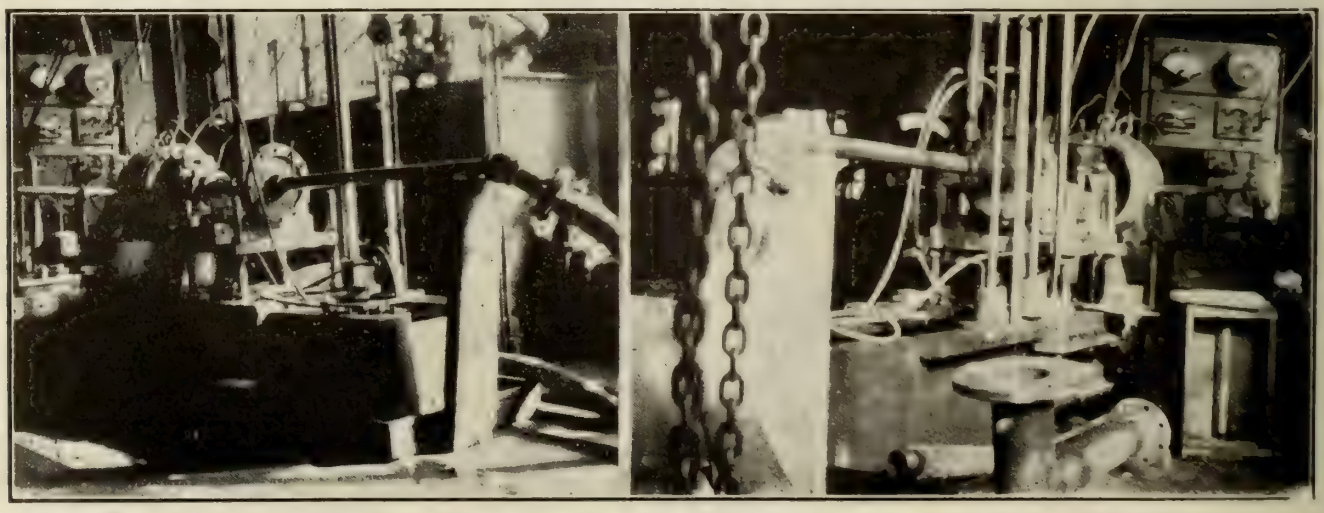
Unique Motor Mounting

The motor is mounted on the testing frame in a unique manner. It is held suspended at a fixed height in two bearing standards. The motor frame is free to rotate (on ball bearings,) about the centre line of the armature shaft. The armature is free to rotate with its shaft, independently of the motor frame, as in ordinary installations. The feet of the motor frame are in mid-air some eight or ten inches above the ways of the testing apparatus. A piece of 1 1-2 inch pipe is threaded into the side of the motor frame so that when the feet of the motor frame are in the horizontal plane, the pipe extends horizontally, at right angles to the centre line of the armature shaft, and with the axes of both pipe and shaft in the same horizontal plane. This arm is made to press on the platform of a very sensitive Toledo scales of the dial indicating type and originally designed for shell work. A special dial has been placed in the scales, reading pounds and tenths of a pound. An ingenious arrangement has been provided to take up the effect of any angularity of the arm. This is shown in Fig. 1. It might be mentioned that the effective length of the arm, measuring from the centre line of the shaft, is 31.416 inches, or ten times pi., which greatly facilitates calculations. The armature current is brought from the generator to two binding posts on the stationary standards which support the motor. The current is carried over to the frame of the motor, and thence to the brushes and field coils, (the motor being shunt wound,) by means of two conductors of brass wire cloth, which are very flexible and offer but infinitesimal resistance to the mechanical turning of the motor frame, which turning effort, or torque, is thus registered accurately on the scales.

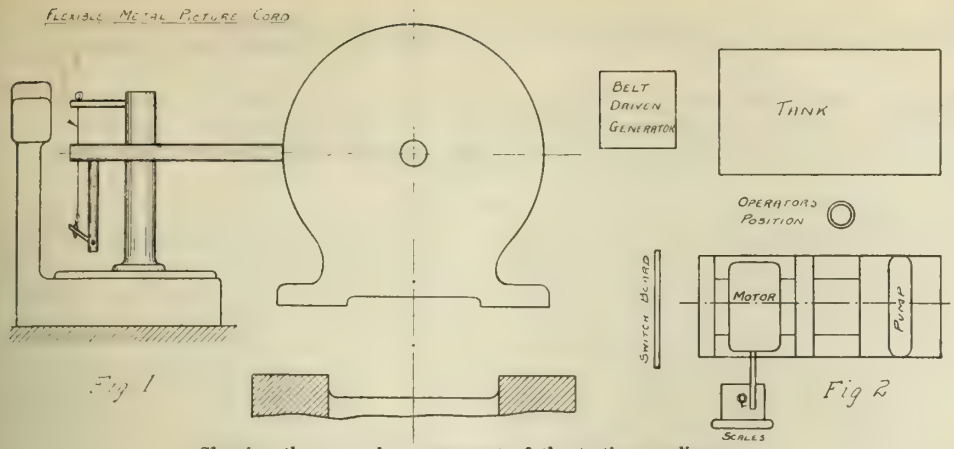
There are arrangements which provide for running the motor either way so that right and left hand pumps can be tested. Speeds up to two thousand r.p.m. are obtainable from the motor. The motor and pump speeds are recorded through the medium of a portable vibration tachometer.

Power Delivered

First impressions might suggest that the voltmeter and ammeter were used to determine the mechanical power delivered to the pump shaft. As electric motors operate at various efficiencies under varying load and speed conditions, this method would involve a new set of variables in the calculation and thus open up a new field for error. A characteristic curve of the motor would be necessary. To avoid these complications the ingenious and accurate dynamometer device is used to determine more directly the mechanical power delivered, without considering either mechanical or elec-



Two Views of Darling Bros.' Installation For Testing Centrifugal pumps.



Showing the general arrangement of the testing appliance.

trical efficiencies. The meters on the switch board are used largely to determine the loads on the motor and generator and thus guard against overloading. As before stated, the generator is a 6 k.v.a. machine, but when large pumps are being tested, a steam driven generator of larger capacity is used.

There is a flexible coupling on the motor shaft which is used to connect up to the shaft of the pump to be tested. The coupling also provides for the small amount of end play that it is desirable to have in the pump and in a motor of this type.

Locating the Pumps.

On the ways of the apparatus, toward the end remote from the motor, a sliding carriage is located. It presents a flat square surface and is gibbed to the ways. Provision for locking in any desired position is made. This longitudinal motion is used in locating the pump. Vertical adjustment is also provided. There are four threaded posts of generous cross section, located, one at each corner of the carriage. A platen is supported on these posts. Lock nuts above and below the platen permit of its adjustment to any desired vertical position. When a pump is being tested, the pump frame is bolted or clamped to the platen. The adjustments just described permit of the necessary movements required to line up the pump shaft with that of the motor.

Hydraulic System

The hydraulic arrangements are very complete. A 900 gallon steel tank supplies the water. It is open to the atmosphere. The suction pipe leads from the bottom of the tank. A complete arrangement of valves permits suction lines of desirable size to be coupled up. A combination of pipe and hose is used in nearly all lines for convenience in coupling up. A small hose is led off from the suction line to a mercury manometer, which indicates the amount of vacuum.

The discharge line is led to a 4 in. pipe header located near the ceiling. From the discharge line also a small line is taken, which line is led to a mercury manometer, which is graduated to read directly in feet of head and pressures, up to 70 feet and 30 pounds, respectively. For higher heads and pressures a specially graduated pressure gauge is connected to the line, there being a small "T" in the manometer line and valves which would permit the cutting out of the manometer.

From the header into which the discharge is led, there are three pipes leading vertically down to the tank. There are two 2-in. pipes and one 3-in. pipe, each provided with a Venturi tube. One 2-in. pipe has a 2-in. x 23/32 in. throat, the second 2-in. pipe has a 2-in. x 1-1/16 in throat, while the 3 in. pipe has a 3 in. x 1-3/4 in. throat. Each Venturi tube is connected with a third manometer. Three scales are provided. These scales are removable and to read the discharge from any of the tubes it is only necessary to place on the proper scale and to cut out the other tubes. This is easily done as valves are provided. The discharge can be made through any one of the three tubes, or any two, or all three can be used at once. To get the total discharge in the case where more than one tube is used it is necessary to read the discharge of each tube separately. The whole apparatus is so designed that an operator can remain at one point and control and gauge every part of the apparatus.

The device has been developed largely in the plant and at no small expense. The calculations are very simple and in most cases the data is read directly. The only calculation is that of the power supplied When this is figured, it is a comparatively easy matter to deduce all the data required. As variable velocities are possible, the action of pumps under a wide range of speeds can be obtained. Valves are placed in the lines so that the vacuum in the suction line can be varied, and also the discharge pressures by valves in the lines containing the Venturi tubes. Complete data of the performance of a pump can be obtained in a remarkably short space of time.

FROM OFFICE BOYS TO $30,000 A YEAR

(Continued from page 19)

greater than the customer's needs. I saw that the agent or the merchant was overstocking. I have made many a personal trip to see a customer and argue with him until he reduced the size of his order. I would rather sell a customer one barrel of oil a year for fifteen years, if that were his requirement, than to sell him fifteen barrels in one year and wait fifteen years until he had used that up.

"A good salesman will know his customer's needs and protect them, sometimes protecting his customer against himself. It may mean a smaller order, but the salesman who protects his customer against overstocking will win in the long run. Following the policy of our company, I have never yet permitted the size of an order to tempt me into accepting it if I knew it were contrary to the best interests of my customer to buy or use that much oil, even if the customer did not know it himself."

The Way to the Top

"E. J. Bullock climbs to success via a soap box, proving that this well known article may be put to more constructive uses than of serving as a rostrum for Bolshevist oratory," was the caption the Stanolind Record, a Standard Oil house organ, used in announcing Mr. Bullock's elevation.

"Back in August, 1889, R. G. Collins, at that time manager of the Milwaukee division," said the Stanolind, "hired the smallest office boy then at large. He wore knee-breeches and had a piping voice, and was the last youngster in the world to be suspected of ever aspiring to the height of six feet; yet he cherished that ambition and numerous others besides. To-day this diminutive youngster, is a husky specimen, six feet tall.

"Bullock's first step upward came soon after his employment. Essaying to answer the telephone, he was chagrined to find that he could not reach it, but Mr. Collins, noting the difficulty, provided him with a soap box.

"Fifteen years later, in 1905, he came to Chicago as assistant manager in the lubricating oil sales department. In 1905 he was made manager of the Chicago sales division, and when the oil products purchasing department was created in 1919 he was placed at its head. In 1921 he became director of purchases, having supervision over the entire purchasing department, and still giving his personal attention to the buying of oil products. On his shoulders rests the responsibility of keeping the refineries supplied with crude, which he must procure at prices which will permit operation at a profit.

"Mr. Bullock's theory is that if a man devotes his time, attention, intelligence and energy to the interest of the company which gives him employment, he will gain recognition and a sure reward."

A SMALL POWER PRESS

In the manufacture of many articles, small stampings or pieces of pressed metal are used in enormous quantities. Frequently, it is the custom for manufacturers who require such stampings to purchase them from firms specially equipped for their production. In other cases, however, where they are merely accessory to some machine or appliance, it is very convenient to be able to make them on the spot as required. For this purpose a British firm has produced a small power press of a very simple type and at a low cost.

Progress of Standardization Work in Canada

Many Industrial Firms Interested—Sectional Committees Formed—Developing a Uniform Product—Benefits of Far-Reaching Character—Domestic Industry Receives First Consideration

By R. J. DURLEY, M.I.C.E., M.E.I.C., Am. Soc. M.E.

STANDARDIZATION work undertaken by the working committees of the C. E. S. A. commenced, in every case, at the request of responsible parties interested. The progress to date has dealt almost exclusively with the preparation of specifications for material or manufactured products rather than with dimensional work.

The main committee has felt that such questions as may arise regarding dimensional standardization in Canada would most frequently deal with the advisability of adopting, possibly in a slightly modified form, standards already agreed upon by bodies undertaking this work in the United States, Great Britain, or elsewhere. In other words, it has not seemed likely that many instances will occur where the work on dimensional standardization can be completely independent of the work done in other countries.

Sectional Committee Work

One of the first C.E.S.A. sectional committees to be formed was that on machine parts under the chairmanship of A. R. Goldie, of Goldie & McCulloch, and under this sectional committee there will naturally be organized, from time to time, whatever working committees are needed. There is of course no intention to undertake any action tending to limit the freedom of the designer by insisting on uniformity of design of complete machines. Parts and components used in quantity by all manufacturers of a given line are naturally the object of the association.

The questions so far considered by the sectional committee just named have been matters in which co-operation has been requested by the A.E.S.C. One case of this kind is now before the committee, namely: the proposed American standards for the dimensions of shafting keys. In such a case the American proposals are usually forwarded to us before they are finally adopted in the United States, and we are thus given an opportunity of considering and criticising them and advising how far the proposed dimensions meet the views of Canadian manufacturers.

Quite recently, H. G. Bertram of John Bertram & Sons Co., Dundas, who is a member of Mr. Goldie's committee, has suggested that much useful work might be done by the C.E.S.A. in developing standards for machine tool parts, which have not yet been dealt with in the United States except by firms individually, who have standardized the dimensions of such items as crank handles, machine handles, keys, splines, nuts of various types, taper and cotter pins, oil rings, cap screws, washers and wrenches, for use in their own establishments. Mr. Bertram gives as an example of this, work which has been done by his own firm in conjunction with other firms attached to the Niles-Bement-Pond organization. He believes that if standards of this kind, which have been adopted by individual firms in Canada, were given publicity, so that other manufacturers could compare them with their own, the way would be paved for agreement on dimensions of these parts, covering all firms in Canada engaged, say, in the manufacture of machine tools, or in other branches of machine manufacture, as the case may be.

Economic Importance

It is hardly necessary to enlarge on the economic importance of dimensional work of this kind. Agreement throughout Canada, for example, upon the standard sizes for cap screws, would enable their manufacture in larger quantities, and presumably at a lower cost, so that the sale of a uniform product to a larger number of individual purchasers would be possible. This seems particularly important in a country like Canada where the number of firms engaged in any one industry is not large, and where individual divergencies in practice thus lead to a demand for small quantities of many unnecessary varieties of detail parts to be furnished by outside concerns.

While the influence of the mechanical industry in the United States upon ours must inevitably be very great, it does not seem necessary that we should in all cases wait until dimensional standardization work has been accomplished there. It is often easier for us to obtain agreement among manufacturers in a given industry than would be the case in the same industry in the United States, where the number of divergent views is likely to be so much greater.

Perhaps the most striking example of dimensional standardization can be found in the admirable work of the Society of Automotive Engineers as applied to the automobile industry, and while it is not likely that we shall be able to accomplish anything of so far-reaching a nature, say in the machine tool industry in Canada, there seems no reason why the benefits of dimensional standardization should not be available here to a much greater extent than has hitherto been the case.

Many Different Features

The experience of the last two years has shown that standardization work in Canada presents features not only of particular interest but also of special difficulty. While it would appear at first sight that in many instances British or American standards could be adopted without change, owing, in the former case, to the fact of geographical proximity and industrial connection, and in the latter, to the intimate commercial relationship existing, this is not always found to be the case in practice. Differences in industrial conditions and in the class of material and workmanship available, differences in climatic conditions, and in legislative restrictions, tend in many cases to make differences in practice necessary or advisable.

Committees have to bear in mind in framing their requirements that while domestic industry must receive the first consideration, the interests of the purchaser and importer are also affected, since in many branches it is necessary for us to import not only material in a raw or semi-finished condition, but also manufactured machinery or completed engineering products.

Co-Operation Advisable

Speaking generally, it may be said that as regards dimensional standards, as, for instance, in ball bearings, screw threads, gearing, and the like, American practice is usually followed, and in many cases it may be found desirable to adopt American standards without alteration. In other cases, as, for example, the preparation of specifications for material, the influence of local conditions is often strongly felt, and in such instances specifications of our own, possibly differing from both British and American practice, are being developed. The closest co-operation is, however, being aimed at, both with the British Engineering Standards Association and with the American Engineering Standards Committee, and it is even hoped that in the case of certain British and American Standards it may be possible for the Canadian organizations to assist in bringing about international agreement.

Work in Railroad Field

In connection with railway work, the interchange of traffic obviously makes it necessary for Canadian practice to agree substantially with American standards as regards locomotive, car and track work, and our railway bridge specification is in general agreement with a practice adopted by the American Railway Engineering Association. During the past eighteen months the Canadian Association has published among other subjects, specifications for steel railway bridges, for distribution, type transformers for galvanized telegraph and telephone wire,

(Continued on page 29)

Methods of Hardening High Speed Steels

No Scaling Takes Place in Salt Bath Practice—Crucibles Have Short Life—Rapid Heating in the Lead Bath—Oil or Gas Fired Semi-Muffled Furnaces Generally Adopted

SALT BATH hardening was first introduced in 1902. Ordinarily, barium chloride is the salt used and the operating temperature is from 2,000 to 2,100 deg. F. (1,093 to 1,149 deg. C.) Graphite crucibles are used for holding the salt, the life of these crucibles being from six to eight heats. The tools to be hardened are immersed in the hot liquid and the tools permitted to remain until the entire mass of the tool has attained the temperature of the bath. These tools are then usually oil-quenched, and drawn to from 400 to 600 deg. F. (204 to 316 deg. C.) in oil, depending upon the kind of tool.

No scaling takes place by this method thus producing a cleaner tool than in muffle furnace hardening, but the method has the following disadvantages: (1) The quenching temperature is too low. (2) Soft scale is sometimes produced. (3) Blistering and pitting sometimes occurs. (4) Pots are very short lived.

It is a well known fact that to obtain the highest degree of red-hardness, partial austenization must take place. This means quenching from a temperature of 2,200 deg. F. (1,204 deg. C.) and upward; indeed, the higher the quenching temperature above 2,200 deg. F. (1,204 deg. C.) up to about 2,350 deg. called "secondary hardening"—the added hardness gained by tempering quenched steel. We have heated small test-pieces of high-speed steel 1½ hours in a barium chloride bath at 2,100 deg. F. (1,149 deg. C.) but the microstructure was the same as when left in the bath just long enough for the heat to soak through.

Blistering and pitting of tools heated in a barium chloride bath are said to be due to particles of the graphite crucible which have broken loose coming in contact with the tools and sticking to them. Sometimes these blisters or beads drop off, leaving pits. The longer service the bath has seen the more loss is suffered through this blistering and pitting.

A graphite pot lasts only from six to eight heats, making this method of hardening quite a costly one. A new salt is now being introduced for the hardening of high speed steel, which can be maintained at a temperature of 2,200 deg. F. (1,204 deg. C.), thus being superior to the barium chloride bath. The container used is a graphite crucible with a cast-steel liner. In this way the steel pot is protected from the flame, and there is no danger of blistering or pitting from particles floating through the bath.

Pack Hardening

Pack hardening consists of packing the high-speed tools with charcoal in a suitable container. The container is then luted carefully with clay, and the whole placed in a furnace, the temperature brought up to around 2,200 deg. F. (1,204 deg. C.) and held there a considerable length of time. Tools are then removed, oil-quenched or air-cooled. This method gives a tool free of scale, but has the following decided disadvantages: (1) Quenching temperature is too low, and (2) tools are carburised. We obtained the temperature of some test-pieces with an optical pyrometer just before they were removed from the pack, and found the temperature to be about 2,050 deg. F. (1,121 deg. C.), although the furnace temperature was 2,200 deg. F. (1,204 deg. C.), and they had remained 1½ hours at heat. Scleroscope tests and micrographs verified this temperature. Furthermore, test pieces showed a gain of 0.40 per cent. carbon on the surface after being given the pack treatment.

I have been informed by two different men who attempted this method that at times the cutting edges of tools melted, due either to the higher carbon content of the surface of the tools or to the tools coming in contact with each other. One other experimenter tried to use a cast-iron box for packing, but as cast iron melts at about 2,200 deg. F. the results can well be imagined. Carborundum powder has been suggested as a substitute for charcoal for a packing material, as the former would not carburize the steel. In the writer's opinion, however, high-speed tools treated in this way would be inferior to tools heated in the semi-muffle furnace, because the steel would have to remain at a high temperature for a long time when pack hardened, thus producing a coarse-grained structure.

A lead bath was tried quite extensively about 10 years ago for heating high-speed tools, but the method did not prove a success. At 2,200 deg. F. the vapor pressure of lead is about 20 mm. of mercury, so that severe volatization will inevitably ensue. It is also quite a problem to find pots to hold the same. Difficulty is also experienced in controlling the time of immersion, as lead is a very rapid heating medium. A metallurgist for one of the large tool steel mills in England told me recently that a large amount of high-speed steel was hardened in his country by the lead bath treatment. He stated that they were able to obtain a very pure grade of lead and could operate at a temperature of 2,300 deg. F. (1,260 deg. C.). His method for hardening a 1-in. high-speed hand reamer would be to preheat to 1,500 deg. F. (816 deg. C.) in a muffle furnace, then transfer the tool to the lead bath whose temperature was 2,350 deg. F. (1,288 deg. C.,) hold there 15 seconds and cool in an air blast.

Most of the high-speed steel hardened in this country is heated in semi-muffle furnaces, oil or gas fired. It is always advisable to have these furnaces equipped with pyrometers, using Noble metal couples. The optical pyrometer is also satisfactory for controlling these high-temperature furnaces.

Work to be hardened should be preheated to 1,500 to 1,600 deg. F. (816 to 871 deg. C.), and when thoroughly heated through at this temperature, transferred to the high-temperature furnace, whose temperature is higher than the desired hardening heat. The tool is left in this furnace until the cutting edges have attained the proper temperature—about 2,300 deg. F. (1,260 deg. C.)—and the material then quenched. Soaking at the high temperature is to be avoided, as it coarsens the grain and is likely to "burn" the steel. In such practice the time factor is evidently just as important as the temperature. Quenched tools are then drawn to the desired temperature. One great advantage of this method of hardening is the high temperature attainable, thus producing the greatest degree of red-hardness and almost complete solution of the carbides. The disadvantage is that the tool scales to a degree, which can be reduced to a minimum by a thorough preheating and the proper mixture of fuel and air in firing the high-temperature furnace. Large high-speed tools have been very successfully hardened by using two preheating furnaces; the first is maintained at a temperature of about 1,100 deg. F. (593 deg. C.) and is used as a stock furnace. The temperature of the second preheater is 1,700 to 1,800 deg. F. (927 to 982 deg. C.). The material will not scale in the first preheating furnace; while the steel will oxidize in the second preheater, it requires less time to bring it to heat, thus reducing scaling to the minimum.

NEW COIN MAKING MACHINES

It is an interesting fact that almost every government in the world employs British-made coining presses in its mint. Recently the French government installed a set of fourteen presses of British make for the minting of nickel bronze coins to replace the two franc, one franc, and half franc notes which have been used during the war. These new presses are constructed to work at a high speed and are capable of turning out one hundred finished coins per minute. The presses are automatically fed with blanks of metal from a hopper and should the supply of metal fail from any cause they stop automatically, thus preventing the dies being injured.

How to Handle Work on a Magnetic Chuck

Principles of Heald Magnetic Chuck Explained—Many Operators Fail to Take Full Advantage of Valuable Points—Understanding of Simple Features Necessary—Better Results Obtained

MAGNETIC chucks consist of several electro magnets, constructed so that their ends or poles will come in contact with the work to be held and so hold it by magnetism. One of the physical properties of a magnet is its ability to attract and hold steel and iron pieces. It has two poles or ends, a positive and a negative pole, which is illustrated by the fact that when a positive pole of one magnet is brought near the negative pole of another magnet they are drawn together; but if it be brought toward the positive pole of another magnet they are repelled.

Magnetism

Theory explains magnetism by assuming that all matter is composed of very small particles called molecules. In a piece of iron or steel each molecule is assumed to be an elementary magnet, having a positive and a negative pole In an unmagnetized steel or iron bar, these molecules are not arranged in any particular position, and so neutralize each other, Fig. 1. However, they can be arranged so that they lie in the same general direction with their positive poles all pointing toward one end of the bar, Fig. 2. When in this position, the bar itself becomes a magnet with a positive and a negative pole.

The Electro Magnet

This last position of the elementary magnets of the iron bar can be obtained by means of an electric current. There are lines of force surrounding a wire through which electricity is passing, which will force these molecules in position. So by winding a wire around the bar, the molecules will arrange themselves in the same general direction, when the electric current is allowed to flow through the wire. In Fig. 3, such a bar is shown bent in a "U" shape, commonly called a "horseshoe" magnet. The dotted lines represent the magnetic lines of force which tend to grip the work.

Chuck Construction

This particular chuck consists of several of these electro magnets constructed so that their poles can be placed and firmly held by means of the magnetic lines of force. The top plate consists of a cast iron frame in which soft steel pieces are inserted. These pieces called "pole pieces" rest on the ends of the magnets and transmit the magnetic lines of force to the surface of the top plate.

In Fig. 4, the sectional view of the top plate shows the pole pieces which rest on the magnets in the chuck body. The poles of these magnets alternate plus or minus, or positive and negative, and the lines of force are indicated by dotted lines. These you see radiate from pole piece to pole piece.

These pole pieces or poles are insulated from the cast iron top plate frame by non-magnetic metal, so that the magnetic lines of force will not escape into the top plate frame instead of going into the work. Pieces of work are also shown in position and the lines of force are seen entering the work and holding it. Since the force with which work is held on the chuck depends upon the number of these invisible lines of force which enter the work, it is evident that the work must reach from pole to pole and that it bear on the poles as closely as possible, for if there is an air space between the work and the poles, the lines of force will be greatly weakened. The resistance of air is 100,000,000 times as great as in iron or steel, which emphasizes the need of the work bearing on the poles.

Proving a Theory

To prove this take a rough crooked piece of steel and another piece of the same size but smooth and straight and see how much firmer the last piece is held. Now lay a piece of steel about ¼ in. square and long enough to reach across two poles, then lay it between two poles and then on top of a single pole and notice it is not held so firmly as when it lies across two poles. The greater part of the holding power of the magnets is perpendicular to the surface of the chuck. Therefore, on heavy operations, the "End Stop" and "Side Bar" are used to counteract the push of the cutting tool.

Since the work must have as much contact with the magnetic poles as possible to be held firmly, auxiliary means must be provided to transmit the magnetic lines of force to work which does not offer much bearing surface. Fig. 5 shows how many users have incorrectly tried to do this by means of a steel plate with recesses cut in it so it will fit the contour of the work.

This method is not successful, for the magnetic lines of force find an easy path through the steel plate and do not go into the work. On the right the correct method is illustrated. Here the pole pieces of the auxiliary top plate carry the lines of force into the work.

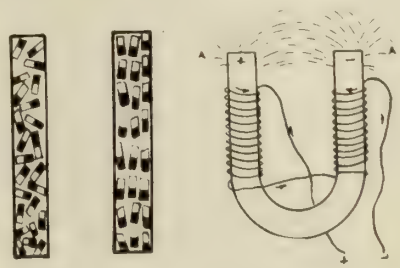


Fig. 1. left—Position of molecules in immagnetized bar. Fig. 2. centre.—Position when bar is magnetized. Fig. 3.—Common horsehoe magnet.

The Auxiliary Top Plate

The plate is a duplicate of the standard top plate of the chuck, except slots or recesses are machined in it to make it fit the work so that there will be a perfect bearing for the work to lie on. While the recesses might be cut in the standard top plate, it is not recommended, as it is apt to open up the joints between the pole pieces and allow water to leak in the chuck and cause the coils to burn out. There again the standard top plate would not be good for other work, while by using the auxiliary top plate it can be removed and another one substituted, or flat work held directly on the top plate.

The auxiliary top plate is fastened to the chuck top plate by bolts and care must be taken that its poles rest directly on the poles of the chuck top plate. It must be drawn down tight so that there will be no air space between the two plates.

By using auxiliary top plate all shapes of work can be handled. Sometimes simple fixtures will help. In every case where a filler piece must reach across two or more poles, it should be made of hard brass, or any non-magnetic metal, so as not to weaken the magnetic lines of force.

This applies as well to retaining rings and locating pieces frequently used with rotary chucks on lathes and universal grinders.

Demagnetizing Work

All standard chucks are equipped with demagnetizing switches, which demagnetize the chucks so that the work can be easily removed. Referring to Fig. 3, you see the current is flowing in one direction; the demagnetizing switch reverses this current when the

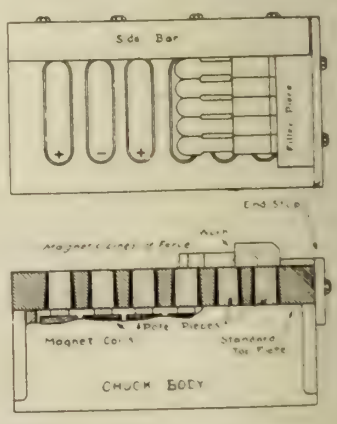


Fig. 4.—Plan and section of chuck.

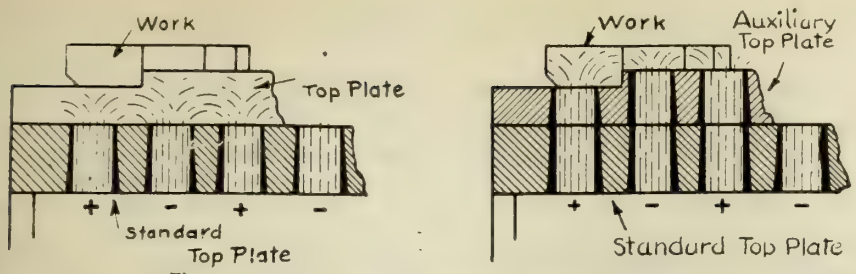


Fig. 5.—Old and improved method of making top plate.

handle is thrown back, so that the molecules are forced to change their position. The current, however, should not be allowed to flow in the reverse position only an instant; otherwise the molecules will again arrange themselves in position in the opposite direction.

The demagnetizing switch demagnetizes the average work, but hardened steel and very large pieces give up their residual magnetism reluctantly. Therefore, a demagnetizer is needed to neutralize the molecules. This is really a from of a simple magnet which continually reverses its polarity rapidly. This reversal is caused by alternating current, which continually changes its direction. It is readily seen that, if the current in the magnet of Fig. 3 changes its direction many times a second, the molecules will be thrown out of any fixed position.

POINTS TO REMEMBER

The greater the area of contact the work makes with the magnetic surface the stronger it is held.

Work must touch at least two poles to obtain greatest possible holding power.

Most of the holding force acts perpendicular to the face of the chuck. So when they will cross two or more poles, use end and side bars on heavy cuts.

Don't use iron or steel filler pieces as this weakens the pull. Use non-magnetic material.

Use auxiliary top plates instead of machining or drilling the standard top plate.

Auxiliary top plates must bear evenly on the standard top plate.

The pole pieces of auxiliary top plates must line up with those in standard top plate.

Do not use a chuck top plate after it gets too thin, it may leak water.

Magnetic chucks operate on direct current only.. Alternating current cannot be used.

Direct current drops in voltage if the feed wires are too small and if chucks are located too far from generator.

In case of trouble be sure to see if the required number of volts indicated on chuck name plate are entering the chuck. Make your test as near chuck as possible.

Don't jerk demagnetizing switch, work it quickly but smoothly.

Do not take chucks apart.

Analyze Different Phases Of Factory Profits And Costs

MOST of us if asked to define the word profit, as applied to the business activities of a machine shop, would consider the question almost too elementary for consideration. But do we really understand the term when it is expressed in percentages? In Fig. 1 it is shown how deceptive the term really is. It is capable of being expressed in percentages varying between 7½ and 20. Take the case of a factory whose net profit is $15,000. To qualify the figures in Fig. 1, the cost of operation would be $75,000, the total sales $90,000, and the investment $200,000. In attempting to reply to the question as to which would be the proper way to express the profits, it must be admitted that a difference of opinion exists. The total sales, or turnover, for the year, represents the gross income. If the gross cost of operation be deducted the difference is the profit and it is usual to express the profit as a percentage of the gross receipts. If the shop is owned by a joint stock company, the stock holder is most interested in knowing what percentage the profits will earn him as dividends. It is a question that must be carefully understood and when understood it is quite permissible to refer to the profit as a percentage of any of the three figures mentioned.

Another angle on costs is to break them up into component parts. To most of us the word "cost" conveys a more or less definite idea of what is referred to. In the case of machine shop activities, if we are to fully appreciate costs, we must break up the lump sum into its component parts. Graphical representations of two sets of cost figures are shown in

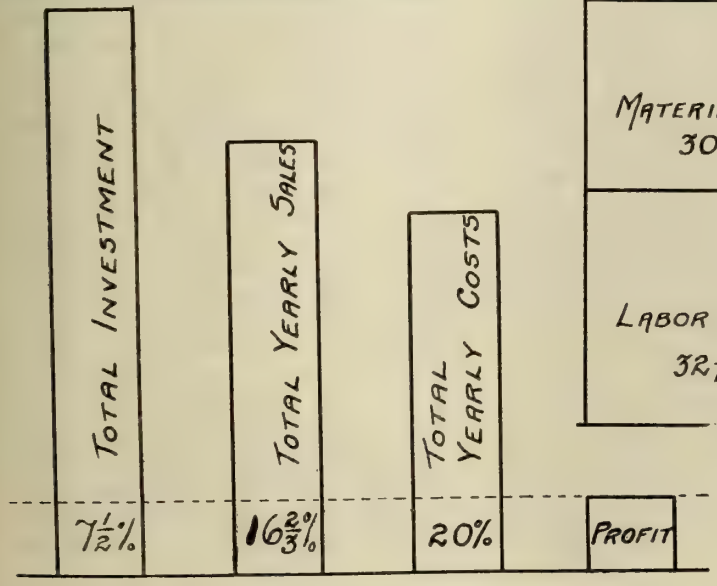


Fig. 1.—How can we measure it best?

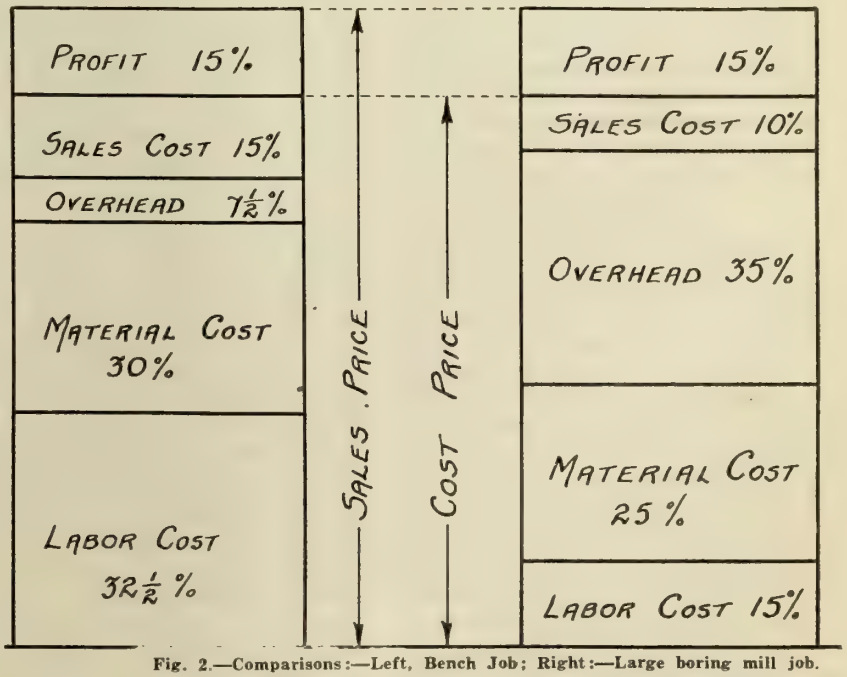


Fig. 2.—Comparisons:—Left, Bench Job; Right:—Large boring mill job.

Fig. 2. In the case of the bench job the labor cost represents a relatively high percentage of the sales cost, when compared to the large boring mill job. The cost of material is always a variable, because in the case where a simple iron

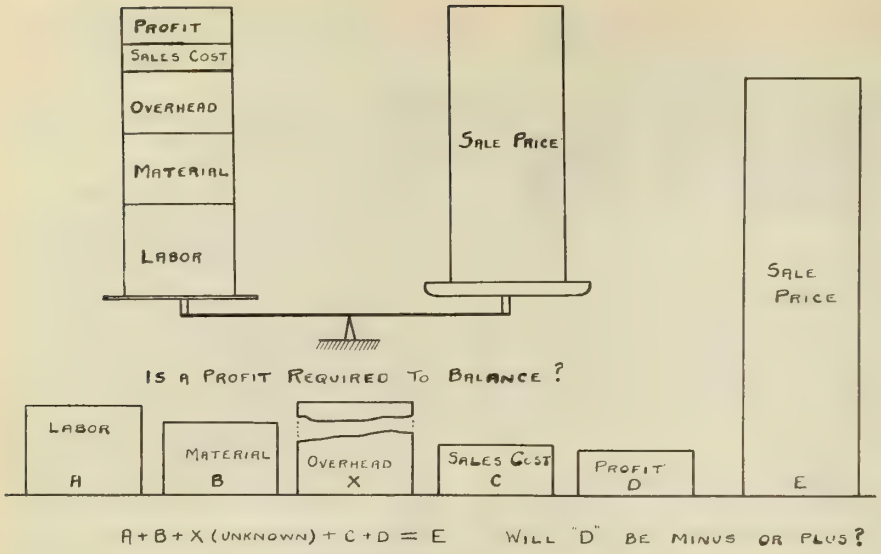


Fig 3—Two views of a question

casting is used it may be comparatively small, then again an intricate brass casting or a difficult forging may be the material required, and the cost is naturally greater, and represents a larger percentage of the sales figure. The overhead charges are also rather difficult to define, and at times are hard to determine. Actual overhead, that can be more or less directly attributed to a bench job, is not large, but at the end of a year indirect charges, in addition to direct overhead charges, would have to be borne by that particular class of work. On the other hand, direct overhead charges, in the case of a boring mill job, constitute quite a formidable item. Sales costs run somewhat higher as a general rule when small products of a machine shop are marketed, than when larger articles are disposed of. Thus in making up estimates on the probable cost, executives must be careful to view the work not only from the financial standpoint, but also from the shop viewpoint.

Fig. 3 is an attempt to graphically represent the relationship between the overhead factor of cost, and profit. Books must be balanced, and the term "balance" suggests a weighing scale. In the case where a selling price is fixed, the item of cost must be below that figure, if a profit is required to "balance." Both sides of the equation must balance, and in Fig. 3 the overhead is represented as an unknown quantity. The selling price is assumed to be fixed. Now if the "unknown quantity" can be kept down sufficiently, the profit will be positive, or plus. If the overhead soars, the profit must naturally become minus, as the equation must balance. A minus or negative profit is nothing other than a loss.

The foregoing suggestions may offer a new viewpoint to many who are to-day struggling along at a great disadvantage in these times of so-called depression. In machine shop practice the cost is an unusually complex item and there are few lines of endeavor that create such a problem in making up estimates.

EFFICIENT ANNEALING OF MALLEABLE CASTINGS

In reply to a question recently appearing in the transactions of the American Society for Steel Treating, on "What is the shortest time in which malleable castings can be annealed to produce the best malleable qualities?" H. A. Schwartz, manager of research, National Malleable Castings Co., Cleveland, gives the following:—

A strictly correct reply would probably be infinity since, speaking broadly, every means of accelerating graphitization is detrimental to the ductility of the product. A strictly logical conclusion thus would indicate that the slower the process the better the product, hence the best product can be made only in infinite time. Graphitization proceeds more rapidly and less completely the higher the temperature. Its commercial execution is accomplished by holding the metal for a time at a temperature well above A_1, and then cooling in such a manner that the metal shall be at or near A_1 for a sufficient time to complete the reaction.

Time will be saved by executing the preliminary treatment at the highest practical temperature. However, the higher temperature the coarser the temper carbon granules and the less strength and ductility, consequently there is a limit to the time to be saved by raising the initial temperature. Commercial opinion varies as to the highest safe temperature. Some manufacturers feel it unsafe to go above 1,500 degrees Fahr.; others go as high as 1,850 degrees Fahr. The former makes for quality, the latter for speed. A temperature of 1,600 or 1,625 degrees Fahr. is perhaps a conservative middle course.

Commercial practice varies with respect to the completion of the reaction. Some metallurgists cool slowly through the critical range; others feel it better to maintain a constant temperature just below A_1 for some time. The latter course, no doubt, saves time but requires very accurate control to avoid passing above A_1 by accident. Graphitization can be accelerated by an increase in carbon or silicon, both of which deteriorate the quality of the metal when present in too large an amount. Here again speed is had at a sacrifice of quality.

In the early days, using carbon and silicon in amounts now considered excessive, it was very common to occupy 7 days for the annealing cycle. The recent improvements in malleable castings were accomplished in part by reductions in carbon and occasionally silicon and by greater annealing precautions. The time for annealing has thus risen for two reasons. The writer has frequently annealed metal in small commercial furnaces in 3½ to 4 days. The metal was never of superior quality and frequently very unsatisfactory and this attempt to hasten deliveries was definitely abandoned.

The design of heating furnace also affects the answer since uniform rapid heating is difficult to attain in large furnaces; but such furnaces are economical of fuel and space. Under commercial conditions and on an operating scale, the writer would regard with suspicion metal annealed in less than 7 days and would not regard 10 or 11 days as excessive. Where particular importance is attached to ductility and to machine-ability, without sacrifice of strength, still longer times may be called for. A single piece, of inferior quality, could no doubt be produced experimentally in around 50 or 60 hours.

STAMP TAX PROBLEMS

In actual operation, the new stamp tax is revealing some objectionable features which may have to be remedied. A case in point is that supplied by a wholesale grocer in London, and is likely to have frequent repetition. In this instance the wholesaler drew on a customer to the amount of a bill of goods, the sum being about $600. The draft required 24 cents in stamps. The customer returned the draft because it was not convenient to pay, but in the meantime it had been discounted and it was necessary to issue a cheque to the bank to cover the amount. Thus another 24 cents was required in taxes. Thus the company paid 48 cents taxes on a deal that actually did not occur, and when the time comes again for payment of the postponed obligation the taxes will be called for a second time by the government. Though the amount is small, merchants object that such payments are a hardship in transactions where the margin of profit is limited.

After forging high speed steel it is always advisable to anneal it before hardening, as residual forging and cooling strains may cause breakage in the hardening process.

Iron and Steel in the Cement Industry

Stresses on the Crusher Shafts—Cause of Breakage—Proper Heat Treating Essential—Failures Generally Due to Physical Faults—Engineer Should Co-operate With Plant Metallurgist

BY W. R. SHIMER

THE WRITER cannot claim to be familiar with the mechanical details of cement machinery, and is, therefore, not in a position to ascribe failures to faulty design, although from an examination of certain failed parts there is every indication that some of the failures can be attributed to error in design. For example, the writer had the opportunity to investigate the breakage of shafts in an electrically-operated shovel. This shovel was operated in the same quarry with two steam shovels. No shafts were known to break in either of the steam shovels, while the shaft breakages in the electric shovel were quite frequent. The writer was called in on this matter after the cement plant had proven to the engineer who built the shovel that power was developed which stressed the shaft to a load of twice that for which it was originally designed. In other words, when the electric shovel was attempting to dig out the side of a hill in one scoop, and since an electric motor will withstand a 100 per cent overload momentarily, the shafts were stressed to double the amount for which they were designed, and as this stress was a sudden one, the shafts naturally twisted off. I understand that when a steam shovel is over-stressed, it will stall; there are no sudden shocks, and consequently shaft failures are much less frequent in shovels of this type.

Shaft Specifications

The shafts in the electric shovel could not be made larger without making very radical changes throughout the entire mechanism, and it was, therefore, necessary to use a special nickel chrome steel, heat treated to give more than twice the elastic limit of the original shafts, and at the same time, the elongation and the contraction of area had to be fairly high to insure sufficient ductility to withstand the usual shock and vibration. The physical properties of the failed shafts showed approximately the following:

Tensile Strength	62,000
Elastic Limit	32,000
Elongation, per cent.	35.5
Contr. of Area, per cent.	61.07

The heat treated alloy steel shafts showed:

Tensile Strength	112,000
Elastic Limit	90,000
Elongation, per cent.	22.5
Contr. of Area, per cent.	64.0

These physical properties more than make up for the deficiency in the size of the shaft. It might be of interest to mention in this connection that for quick repairs, cold drawn shafting was used for shafts in this shovel, and some broke in one week's time.

Cold Drawn Steel

While on the subject of cold drawn steel, I might mention its properties and the object in using it. It is made by pickling all the scale from the hot rolled bar, which is then pulled through a die 1/32 to 1/16 in. scale less in diameter than the original bar. This produces a bar of accurate size, with a smooth, bright finish. The bar is reduced cold and while cold extends in length in proportion to the amount of reluction in cross section. Low carbon steel is cold drawn without annealing but the higher carbon and alloy steels are annealed first. The physical effect of this cold working is to raise the elastic limit, in the smaller diameters, up to approximately 90 per cent. of the ultimate tensile strength, with a corresponding decrease in ductility. Prior to cold drawing, the elastic limit of the same steel approximates 50 per cent. of the tensile strength, with considerable ductility. I would not recommend that cold drawn steel be used for important structural parts which must withstand shock and vibration. It is an excellent steel for screw stock, bushings, sockets and parts of this nature which must be turned out cheaply by the thousands on automatics. It is satisfactory for line shafts and other parts of like nature which are not highly stressed. Some years ago an automobile company in an attempt to save money on lathe work used, for a time, a cold drawn alloy steel for axles. They were drawn to finished size, and all the machining that was required was to cut to length and mill the ends square. This proved to be expensive economy as these axles failed in many of the cars after short service, and replacements were made free of charge in order to satisfy the car owners. The replacements were made of a special heat treated alloy steel, and they returned to the practice of turning the bars on a lathe rather than to obtain the accurate size by cold drawing.

Cold drawn steel has its field, and I do not wish to be misunderstood in my remarks concerning it. It is, however, false economy to use it for highly stressed parts, as there are so many steels which can be heat treated to stand up under severe service and which will far outlive cold drawn steel.

Proper Heat Treatment

Many parts fail in cement machinery on account of not being heat treated, or having been improperly heat treated for the service to be performed. Many times steel of correct composition for a certain use fails in a very short time, because of improper heat treatment. When properly heat treated this same steel will give satisfactory service. As a concrete example of this, I will cite the case of an order we received some years ago for ten bars of nickel steel four inches in diameter. This order was received from a drop forge concern and from the composition of the steel ordered, it was inferred that the steel was to be cut up and forged into gear blanks, which were to be subsequently heat treated. This steel was, therefore, shipped to the customer in its annealed condition, having been annealed for machinability. A short time later, we received a complaint, stating they had made piston rods from three of these bars and put them in drop forge hammers. One lasted 2½ hours and broke, another lasted 5½ hours, and the third lasted about 15 hours. They stated this so-called high grade nickel steel was inferior to brass or wrought iron. The remaining seven bars were returned and given a special heat treatment by quenching in oil, with subsequent annealing, and were returned to customer and were found to be entirely satisfactory. This is one of the many examples which could be cited to show that while steel properly heat treated is satisfactory for the service required, steel of the same heat but improperly heat treated is not satisfactory. I might mention that in order to obtain the best service from alloy steels, they must be heat treated, as it is not good economy to use them otherwise. When heat treated, they are far superior to ordinary steels.

Proper attention is not always given to steel castings, due in part perhaps to the users feeling that because the casting was made of steel instead of iron that it had all the strength that was required, with the result that no check was made as to the analysis of the steel, or to its annealing. This applies, of course, to commercial castings. There have come to my attention quite a few failures of machines where steel castings have been used. The machines in mind at the present time are large jaw crushers.

Designing Crushers

Up to a few years ago, the primary crusher was fitted with a jaw opening of about 24 by 36 inches but with the advent of steam shovels, it became necessary to increase the size of crushers

with the result that these machines are now built with openings up to 5½ by 7 feet. In the designing of these larger size crushers, the manufacturers went to the use of steel and made a great many of the crushers in sectional design, i. e., the side frames and end frames being separate castings, machined and held together by turned bolts.

Another design of crusher consists of a "semi-steel" frame reinforced with a cast steel band which is shrunk around the bottom of the frame and a cast steel band around the top. The design of this crusher is such that the steel bands take all of the crushing strain. The failures of these steel crushers have been due partly to the fact that the analysis of the steel was incorrect, and partly to the fact that the castings had not been properly annealed, if annealed at all. In one of the large plants, not so long ago, there was broken in operation a crusher in which the frame was 20 feet long and the cross section of the steel about 6 inches by 5½ feet. The breakage of these castings showed that the steel was very coarse grained and that it had not been properly annealed, with the result that original strains were still in the castings. Had these castings been properly annealed, there is no question but that the machine would have stood up and that the breakage would not have occurred. The repairs to this particular machine will cost the operating company many thousands of dollars, as the machine will first have to be banded together to permit it to continue to operate, and later the side frames entirely replaced with new castings.

Failure of Parts

There has also been brought to my attention the failure of a crusher which was reinforced with a heavy steel band. This band was of oval shape and had a wall cross section of 5 by 24 inches. It broke at three points almost simultaneously, and the nature of the breaks indicated brittleness. Upon investigation, it was found that the casting was too high in carbon and further that it had not been properly annealed. The microscope showed a structure of steel in the same condition as when cast, and if it had been annealed at all, it only went through the motions of this operation, as there was no indication whatever of annealing from the examination of the casting itself.

Foundries or forge plants will often, in order to fill up their shop, take on work for which they are neither trained nor equipped to handle. Sometimes, by good fortune, their product stands up in service, but in many cases like the one just cited, it did not, and caused considerable loss to the cement plant and considerable embarrassment to the crusher manufacturer, who was not directly to blame. Manufacturers of machinery should, however, investigate the foundry prior to placing orders for castings, to determine if they are competent to make such castings, and the castings should be inspected to be sure they are of the right composition and properly annealed.

Taking Physical Tests

The practice generally followed is to specify certain physical properties in accordance with the specifications of the American Society for Testing Materials. These tests being taken from coupons which are attached to the casting, and heat treated with the casting. Test coupons are integral with the casting. They should not be broken from the casting until it has been heat treated. If, by accident, the coupons should be broken off prior to annealing, they should not be heat treated separately but should be charged in the same annealing furnace at the same time with the casting in order that it receive identical heat treatment with same. This is necessary in order to be assured that the physical results obtained from the coupon represent the physical properties of the casting itself.

Failures such as those just briefly cited might mislead prospective purchasers into believing the machinery itself was at fault. In cases of this kind, no reflection can be cast upon the make or design, because the failures are directly due to the fact that the makers of the castings did not furnish a good product. It is always unwise to place an order for a special part to the lowest or any bidder, without first having been satisfied as to his ability to furnish a satisfactory product.

The average mechanical engineer knows steel only in a general way, as he has neither the time nor the opportunity to keep up to date with the rapid advances made in this art. Even we, who are working on this subject all the time, find it difficult to keep pace. An engineer will design a part and figure on a certain factor of safety, for example of 5 to 1, when he expects to encounter shocks, etc. With this factor of safety, he may require steel of say 110,000 lb. elastic limit, which predetermines an ultimate strength of approximately 140,000 lb., but loses sight of the fact that to meet this high elastic limit, the elongation and contraction will be relatively low, and he will have a steel lacking in ductility, so that the real factor of safety is actually much lower. For such a highly stressed part, he would have a more satisfactory product if he used a factor of safety of 4 to 1, and asked for a steel having, say 90,000 lb. elastic limit, with proportionately lower tensile strength, since he would have a corresponding increase in ductility, thereby enabling the part to withstand shock and vibration.

One big problem in some cement plants is to obtain satisfactory shafts for gyratory crushers. Low to high carbon steels and alloy steels heat treated for high tensile strength and elastic limit have been used, but certain plants still have more breakages than they should. I have been investigating this subject with a view to developing a satisfactory steel and a heat treatment for this purpose. In general, I find the tensile properties need not be high, but the important properties are elongation and contraction of area. The shafts which on the average stand up longest in service are those with greatest ductility.

Reason for Shaft Breakage

On interviewing a number of cement plant operators who use the gyratory crushers it has been found that such shaft failures are peculiar to certain plants, while others rarely if ever have this trouble. The plants which have no failures attribute their success to the fact that they make a special effort to keep dipper teeth, sledge hammers, and other iron and steel parts from going through the crusher. The penalty to employees allowing such parts to go through is dismissal. I am inclined to believe that this is one of the major reasons for shaft breakages as this would explain why the harder shafts are more susceptible to failure than the softer and more ductile ones. When a large piece of steel passes through a crusher, something has to give, as the crusher itself cannot stall. If the liner plates do not break, the shaft must distort. A hard shaft will act as a spring, but the excessive strain which has been put on some points, usually on the outside surface, will produce a nick of perhaps microscopic size, which we might call an incipient break, and during continued service, it grows larger, finally resulting in the fatigue break, which these shafts manifest on fracture. The softer steel shafts will bend and at times even take a permanent set, but there is no doubt but that the increased ductility accounts for their being longer lived. When a plant has an unusual number of breakages of this nature, and if it is certain no foreign material has gone through the crusher, an investigation should be made by a competent party, as such a condition can generally be corrected either by a change of steel or by special treatment. Some gyratory crushers are being redesigned in order to permit shortening of these shafts, and these shorter shafts are reducing the breakages to a considerable extent.

It is easy to imagine how the cement plant engineer, or the engineer building machinery, who might interview six to a dozen representatives from as many different steel concerns, could become confused when attempting to boil down the diversified information received. The same thing would happen if the writer were in the market for cement, and with his limited knowledge of this product, would have difficulty deciding whose cement was best after interviewing representatives from as many cement companies. I would probably purchase from the lowest bidder, and no doubt obtain just what I paid for, namely, an inferior product. The enthusiastic steel salesman may elaborate on the wonderful physical properties of a special alloy steel, representing results obtained

from a small test bar, and leave the cement engineer to believe that these results can be obtained in a 15 or 20-inch diameter forging. Were the engineer to attempt to purchase a forging requiring such high properties, the reliable steel manufacturer would try to discourage such requirements, but the engineer might find some one hard up for work who would try to furnish it, and the chances for its giving satisfactory service would be very slight.

It is safe to state that cement machinery must stand as much or more abuse than machinery for most other industries, on account of the abrasive materials handled, and the considerable amount of dirt and dust always found in the cement plant, which becomes imbedded in bearings. Some parts must stand both wear and shock, and some must stand either shock alone or wear alone. In the case of parts which must stand both wear and shock, a happy combination can be obtained by means of case hardening the outside surface, which will resist wear, retaining a strong and tough core to resist shock. In the case of a part which is not subjected to shock, this can be made of a steel which can be hardened throughout. In the case of a part which must stand severe shocks and vibrations, certain steels can be specifically heat treated to stand up for this service. It is my impression that certain parts, such as gudgeons, liner plates for tube mills and crushers, are expected to wear out in a certain length of time, and replacing material is ordered without investigating the possibility of obtaining a material which will give double the service or better. It seems that breakages and excessive wear are accepted as a matter of course by many cement plants. There are manganese steel castings made which stand up best under certain conditions at one plant, while some other special steel casting or forging will give better service at another plant. Each plant has its own individual problems which can be worked out by the proper co-operation with reliable steel manufacturers.

Take pinions, for example. Cast iron pinions are cheapest if the first cost is considered only. Occasionally a cast iron pinion makes an exceptional record, but how often is a cast iron pinion obtained which wears out or breaks in a short time, usually breaking before being worn out, and where the cost of labor and curtailment of production on account of repairs would make the ultimate cost considerably higher than if good special steel, heat treated pinions had been purchased in the first place.

Obtain Full Details

Satisfactory iron or steel for almost any purpose can be obtained if the manufacturer is acquainted with full details concerning requirements, and if he is paid the price. No matter what the commodity is, we generally receive the quality we pay for. When a cement company wishes a forging and is only willing to pay a certain limited price per pound it will receive a forging which is worth the price paid for it and no more, since in order to make a forging at such a figure the steel manufacturer will have to select his steel accordingly, and perhaps at this price he cannot afford to heat treat it. If a forging is required, payment of a fair price to a reliable manufacturer will secure a special steel properly selected, and will insure careful heat treatment for service required. Though such a forging might cost three times as much per pound, it would probably last more than three times as long; but if it outlives the lower priced forging 2½ times, it would be cheaper in the end, on account of continued operation during this extended period and saving on cost of taking down and reassembling.

In the case of the steel casting failures on the jaw crushers, mentioned earlier in this paper, these castings would no doubt have been cheap at 50 cents a pound if they had not broken.

The cement engineer should work closely with the steel plant metallurgist and the cement plant purchasing agent should work closely with the cement engineer. In cases where the purchasing agent does not co-operate with the engineer, he will buy steel other than that specified by the engineer if he can obtain a reduction in price. This reduction in price may be quite costly, due to curtailment of production and cost of repairs on account of break-downs.

If there are parts which break or wear out too soon, the cement plant should look for something to give better service and go to a reliable source of supply, state what is wanted, with a complete history of the average service obtained from past material, and details of its iron or steel composition. With such information, the metallurgist should be able to recommend iron or steel which would be more satisfactory, and while many times he may recommend a steel which will cost somewhat more, sometimes he finds a high priced steel being used where a much cheaper steel would have given as good or better service.

Importance of Co-operation

It is necessary to emphasize the importance of co-operation between the cement engineer or the engineer building cement machinery, and the steel plant metallurgist. In our corporation, we find it valuable for our plant engineers and engineers who are designing or building machinery to keep in constant touch with our metallurgical departments. When they design a machine to perform a certain operation, they first consult the metallurgists to determine which steel will best stand up in service, and the physical properties which can be obtained from this steel, and they then design their machinery accordingly. In some plants the designing engineer will design his machinery independent of metallurgical advice and make some parts so light and at the same time requiring extremely high physical properties, that he works a hardship on the metallurgical and heat treating departments which must resort to the use of high priced alloy steels, which may be very sensitive to heat treatment, and which may crack and distort during the drastic heat treatments needed to obtain the extremely high physical properties. This results in high shop losses and often in the installation of defective parts, causing failure in service. Where there is close co-operation between the engineer and metallurgist, such a condition is not likely to occur, and although the machinery may be somewhat heavier, it will be more efficient. The metallurgist finds it necessary many times to consult with the engineer before recommending steels for certain parts in order to become acquainted with the exact details of the duty which the particular parts are to perform. We find in our corporation that neither can get along without the other, and certainly this same condition must hold true with the cement industry or any other industry using iron or steel.

PROGRESS OF STANDARDIZATION WORK

(Continued from Page 22)

and has in preparation many other important specifications.

The Association is now endeavoring to arouse Dominion-wide interest in the matter of safety codes as affecting public safety in such important connections as elevators, saw-mills, machinery, electrical work, etc., with a view of organizing a thoroughly representative committee and bringing persuasion upon the various provincial governments in order to unify their requirements and remedy the present unsatisfactory conditions. In this work there is no doubt that the results of the activities of the two American Committees dealing respectively with the National Electric Code and the National Electric Safety Code, will be fully considered and appreciated.

Much of the Safety Code work now being actively pressed forward in the United States is of great interest to Canadian industry and in many cases we have received cordial invitations to co-operate, which have been greatly appreciated.

IGNITION OF COAL DUST BY ELECTRIC ARCS

The extensive use of pulverized coal for fuel in industrial plants gives interest to tests recently made by the United States Bureau of Mines, which proved that coal dust suspended in air can be exploded by electric arcs under conditions that might prevail in a pulverized coal plant or in a coal mine. If there is electrical machinery in places where coal dust is apt to collect in quantities capable of producing a dust cloud, such electrical machinery should be housed in compartments designed especially for use in dusty atmospheres. Under Schedule 2B, the Bureau of Mines is prepared to conduct investigations.

Lathe Dial Screw Thread Indicator in Practice

Device Must Be Properly Understood—Application When Cutting Bastard Threads—Relative Movement of Dial and Threads Being Cut—Cutting of Fractional Pitch Screws

By HUBERT BENTLEY, A.M.I., Mech. E.

THE DIAL screw thread indicator now fitted to the majority of high class and medium size lathes is an exceedingly useful device when intelligently employed. If it is not properly understood, the probability is, that it will be removed from the lathe and the operator will resort to the old chalk mark method. Again, some operators may successfully employ the dial, working to the instruction chart, but not appreciating the limits of its usefulness, may condemn the attachment because they find it is not applicable to the cutting of a bastard thread. The purpose therefore of these notes is to make clear both the construction and the application of the dial screw thread indicator, so that it may be used intelligently when screw cutting.

Fig. 1 shows two views of a thread indicator attached to the carriage of a lathe by two hexagon-head set screws. There are four principal parts, the bracket, the dial, the vertical shaft, and the worm-wheel. The slot holes provided in the foot of the bracket allow the whole arrangement to be moved out of gear when it is not in use. In some designs, the bracket is made to hinge so that the worm-wheel can be swung out of mesh with the leading screw, when not required. When in use a spring device keeps the worm-wheel in gear. A dial, as shown in Fig. 2, is pinned to the top of the vertical shaft, and this generally has 16 divisions. The worm-wheel keyed to the bottom of the vertical shaft is cut to suit the lead-screw thread, and this should either have 16 or 32 teeth, according as the leading screw has two or four threads per inch.

Catching the Thread

Briefly, the thread indicator is a device used when screw-cutting, to enable the operator to catch the thread at the commencement of successive cuts, or to show when the screw to be cut and the lead-screw are in register one with the other. The pointer, or index mark, on the bracket must be made to coincide with one of the division lines on the dial when the half-nuts are in mesh with the lead-screw. This of course, refers to the preliminary fixing of the device on the machine. By using the thread indicator the old-fashioned chalk mark methods are dispensed with in the majority of cases, and there is no necessity for a reversing countershaft. The carriage can be traversed back by hand and the half nuts engaged at the critical point without fear of cross-threading. One revolution of the lead-screw (with the half-nuts disengaged), taking this as single-threaded, which is generally the case, would cause the dial to make a sixteenth of a revolution, or one division (see Fig. 2) if the worm-wheel had 16 teeth. With 32 teeth in the worm-wheel, the dial would make a thirty-second of a revolution, or half a division, so that two revolutions of the lead-screw would be necessary to move one division on the dial.

With the change wheels or feed-box gears arranged correctly for the screw to be cut, it is necessary to make engagements with the half-nuts at certain points only, to ensure the coincidence of the tool in the thread. These points, of course, depend upon the ratio of the threads per inch in the screw to be cut and the threads per inch in the lead-screw, or the ratio of the change-wheels, and occur when both work and lead-screw have made a whole number of revolutions. For example, if 15 threads per inch, it should be stated that lathe having a two threads per inch lead-screw, the work would have to rotate 15 times and the lead-screw twice, from being in register to coming in register again, i.e., in the ratio 15 to 2. Before proceeding to consider how the dial operates when cutting various threads, we must carefully observe that for cutting bastard threads, threads containing odd fractions, diametrical pitch threads, etc., the thread indicator can be used only if a chalk mark is placed on the work when commencing the cut, and adopting some division on the dial, say No. 1. The half-nuts must be re-engaged only when the No. 1 graduation and the chalk mark come into register. It must be understood however, that these are the unusual jobs, the indicator being applicable without the aid of chalk marks, for use in the majority of cases, as will be seen by the various examples which follow.

A lathe with a lead-screw having two threads per inch, a dial as in Fig. 2 and a worm-wheel with 16 teeth will be considered.

If the threads per inch in the screw to be cut are an even number, such as 2, 4, 6, 8, etc., the ratios per inch in the screw to be cut, to the threads per inch in the lead-screw, are 1 to 1, 2 to 1, 3 to 1, 4 to 1, and so forth. That is, for every complete revolution of the lead-screw the work will have made 1, 2, 3 or 4 revolutions, and the half-nuts may be engaged at this point and the thread caught correctly, one revolution of the lead-screw moving the worm-wheel one tooth, or 1/16th of a turn, i.e., 1 division of the dial. Thus the half-nuts may be engaged when any of the graduation marks on the dial are opposite the pointer, when an even number of threads per inch is being cut.

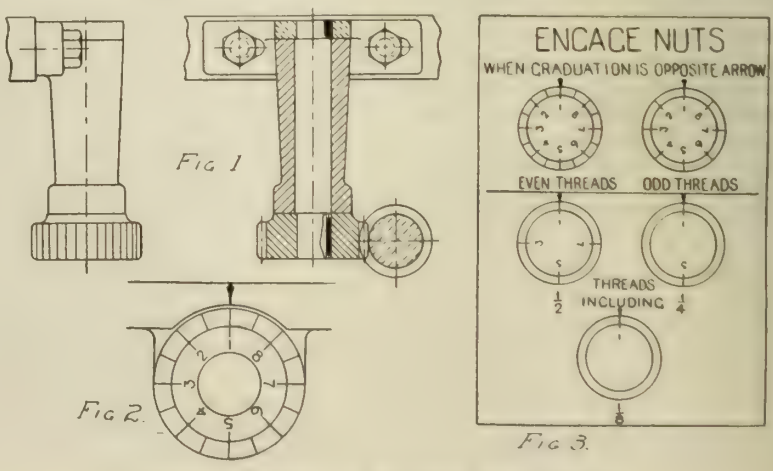
Cutting Odd Threads

Where the threads per inch to be cut are an odd number, such as 1, 3, 5, 7, etc., the ratios of threads per inch in the screw to be cut to the threads per inch in the lead-screw are 1 to 2, 3 to 2, 5 to 2, 7 to 2, and so forth. The work will have made in the respective cases 1, 3, 5 and 7 revolutions, while the lead-screw has made 2, and register is obtained, and the half-nuts may be engaged. In this case, the lead-screw has to make two revolutions that is, two divisions on the dial. Therefore where a screw having an odd number of threads per inch, is to be cut, the half-nuts may be engaged at alternate or numbered divisions on the dial.

Cutting Fractional Threads

When cutting fractional threads, if the fraction includes ½, say 1½, 2½,

(Continued on Page 32)



Showing application of dial screw thread indicator.

Industrial Application of Ball Hardness Test

Reliable Means For Testing Metals—Classification and Control of Various Alloys—Eliminating Possibility of Error Due to Inexperience of Operator—Observations on Test

THE importance of the ball hardness test and its wide application to all branches of the engineering industry are not yet fully realized. As a reliable means for testing metals, controlling heat treatment and the rapid testing of repetition work such as castings and forgings, where it is impracticable to apply the more extended tensile tests, the Brinell hardness test is particularly applicable.

With the inception of the small ball hardness testing machine and power operated hardness testing machine the scope for the application of the test was considerably increased.

With the object of giving fullest information for the efficient working of these machines, the publishers of The Machine Tool Review have just issued a comprehensive booklet, entitled, "The Industrial Application of the Ball Hardness Test."

The matter comprises four sections, the first section giving the title to the booklet, the other sections dealing with:—

Machines for making the test.

Observations on the ball hardness test; and

Brinell hardness number tables.

A brief survey of each section is appended to give an idea of the comprehensiveness of this booklet.

Industrial Application

The Brinell test for the hardness of metals was introduced in 1900, and is now widely used both in the laboratory and the workshop.

Its many applications may be summarized as follows:—

Tensile tests may be displaced by the ball hardness test, as the hardness number follows very closely the tensile strength in steels of the same type. For repetition work the ball hardness test is therefore particularly suitable, and where steels are used in considerable quantities a chart may be prepared for each kind of steel, showing its properties, the Brinell test then giving all the information required to denote the use to which the steel may be put and also its machining qualities.

Much trouble may thus be saved in the machine shop, where batches of stampings have to be machined as a first operation after heat treatment, by first applying the Brinell test to ensure uniformity. Heat treatment can easily be controlled by placing certain Brinell limits on the steel, any deviation from these limits being remedied by correction of furnace temperature.

The proportions of various constituents of a steel have a great effect on the machining operations, a steel suitable for turning being unsuitable for broaching. The test will decide the best steel for any operations. Differentiation can also be made on a steel suitable for case-hardening and a steel which is not.

The non-ferrous alloys can be classified and controlled just as easily. For instance, annealed copper is very soft, which is sometimes a disadvantage for screwing. The addition of arsenic, silicon or zinc will give the required hardness, determinable only by the testing machine. For testing, the impression should be made where the strain set up does not weaken or damage the article, and the width of the impression should be less than the distance between its edge and the edge of the work.

Machines For Making the Test

This section is devoted to a description of the patent power operated hardness testing machine, the small ball hardness testing machine and the microscope for use with the latter. The power operated machine employs a 10 mm. ball with standard pressures of 3,000 and 500 kilograms. Its leading feature is that the time taken for the application, duration and removal of the load is uniform for all tests eliminating the possibility of errors due to the operator.

The machine consists of a weighing element and a straining element. The former is a system of levers by which the weight is transformed into a pressure on the work through the medium of the ball.

The straining element is intended for applying, maintaining and removing the pressure by means of a vertically moving cylindrical ram actuated by a cam, the latter being driven through a worm wheel and worm by spiral gears from a single pulley. Depression of a foot pedal gives one revolution to the cam which applies, maintains and removes the pressure. The small ball hardness testing machine is employed for more delicate work than can be dealt with on the larger machine.

Thin walled tubes such as cartridge cases and other hollow forms may be tested without internal support; cutlery blades, wire at successive stages of drawing, the cutting edges of tools and material even less than one-hundredth of an inch in thickness can be dealt with by this machine. This is accomplished by using balls of 1 and 2 m/m. diameter with loads up to 50 kilograms. A 5 m/m. ball is supplied for very soft material. Hardness numbers are calculated in the same way as for the ordinary Brinell test.

The machine is hand operated, the specimen being placed on a table, vertically adjustable on two threaded columns. By means of a hand wheel the specimen is brought into contact with the ball which is carried by a stirrup to which is attached the weights. The stirrup is again carried by an upper stirrup, which, upon being lowered by a handwheel, transfers the weight through the ball on to the work. A reverse movement of the handwheel raises the ball, and the impression may be measured by means of the microscope which is supplied at extra cost. A description of the microscope, together with operating instructions, completes this section.

Observations on the Ball Hardness Test

The theoretical derivation of the Brinell hardness number is discussed under this heading, and it will be found of great practical value in special cases where a combination of ball and load is employed for which tables are not available.

Brinell's first attempt at determining the hardness number corresponding to a given load and ball diameter, by dividing the load by the area of the circle made by the ball, was erroneous, as the hardness number was not constant if the load was varied. This, however, was partially overcome by dividing the load by the spherical area of the impression.

The result obtained, though only empirical, was accurate enough for all practical purposes, and is now the accepted method for determining Brinell hardness numbers. Where the diameter of the impression is determinable the formula used is—

$$H = \frac{L}{\frac{\pi D}{2}(D - \sqrt{D^2 - d^2})}$$

Where L = Load in kilograms.
D = Dia. of ball in m/m.
d = Dia. of impression in m/m.
H = Brinell hardness number.

If the depth of the impression is known,

$$H = \frac{L}{\pi D t}$$

t being the depth of impression.

A useful paragraph is included in this section showing the relationship which exists between hardness numbers obtained with different loads and balls of different diameters.

By employing loads proportioned to the square of the ball diameter the same Brinell number may be obtained with balls of different size, and this is illustrated by a short list giving various ball diameters with corresponding different loads, each combination of which will

give the same Brinell number. This information may be practically applied in obtaining the Brinell number for a special combination of ball and load which cannot be obtained from the tables. The rule is to divide the diameter of impression by the diameter of the ball and look out the Brinell hardness number in table 1 at the end of the book. Multiply this number by the load and divide by ten times the square of the ball diameter; this gives the required Brinell hardness number.

Some practical suggestions are offered for the actual carrying out of tests such as the diameter of impression desirable relative to the diameter of the ball employed; the depth of impression relative to the thickness of the work; the preparation of the surface to receive the impression in order to avoid surface hardening and to facilitate measuring the impression.

Brinell Hardness Number Tables

Six comprehensive and reliable hardness number tables, more than sufficient to cover all practical purposes, complete the booklet. Tables Nos. 1 to 4 are specially compiled for use with the small ball hardness testing machine, and cover combinations of ball and load of 1 m/m. and 10kgs., 1 m/m. and 30 kgs., 1 m/m. and 50 kgs., and 2 m/m. and 40 kgs. respectively. For the 5 m/m. ball, when used with a load of 50 kgs., Table No. 5 is provided.

Table 1 may be used for calculating the Brinell hardness number for any combination of ball and load. Tables 1 to 3 may also be used directly for a ball of 10 m/m. diameter with loads of 1,000, 3,000 and 5,000 kgs. respectively, by moving the decimal point in the diameter of impression one place to the right. Table No. 6 is a shorter table for use with a ball of 10 m/m. diameter and loads of 3,000 or 500 kgs.

From the foregoing it will be seen that the booklet is a useful acquisition —in fact, a practical necessity to all modern industrial concerns who are desirous of applying an efficient and reliable control over the heat treatment and machining of their products in the course of manufacture.

LATHE DIAL SCREW THREADS INDICATOR IN PRACTICE

(Continued from page 30)

3½, 4½, etc., threads per inch, the ratio of threads per inch in the screw to be cut to the threads per inch in the lead-screw are 1½ to 2, 2½ to 2, 3½ to 2, 4½ to 2, and so forth. These written in simple form are 3 to 4, 5 to 4, 7 to 4, 9 to 4, etc. Here the lead-screw makes four complete turns, while the screw to be cut is completing 3, 5, 7, or 9 revolutions, i. e., four revolutions of the lead-screw moves four divisions on the dial or a quarter-turn before register is obtained. When cutting fractional threads that include ½, therefore, the half-nuts may be engaged at every quarter revolution of the dial.

Next, we can consider the fractional threads which contain ¼, such as 1¼, 1¾, 2¼, 2¾, etc., threads per inch. In these cases the ratios of thread per inch in the screw to be cut to the threads per inch in the lead-screw are 1¼ to 2, 1¾ to 2, 2¼ to 2, 2¾ to 2, which written in simpler form, become 5 to 8, 7 to 8, 9 to 8, 11 to 8. In these examples the lead-screw makes 8 complete revolutions before register is obtained, the screw to be cut making 5, 7, 9 or 11 revolutions in the same time. Eight revolutions of the lead-screw move the dial eight divisions, which is equivalent to half a turn. Therefore where the fractional thread to be cut contains ¼, register is obtained and the half-nuts may be engaged at every half-revolution of the dial.

If the fractional thread contains ⅛, for example 1⅞, 2⅛, 2⅜, 2⅝, etc., threads per inch to be cut, proceed as before to find the ratios of the screws to be cut to the lead-screw. These are 1⅞ to 2, 2⅛ to 2, 2⅜ to 2, 2⅝ to 2, etc., which, simplified, are 15 to 16 17 to 16, 19 to 16, 21 to 16, etc. In this case, sixteen revolutions of the lead-screw are necessary before the half-nuts may be engaged, the work in the same time making respectively 15, 17, 19 or 21 revolutions. The dial also will have moved 16 graduations, i. e., one complete revolution, while the lead-screw has made sixteen turns. Thus if ⅛ occurs in the fractional thread to be cut, register is made and the half-nuts can be engaged every time the dial has made a complete revolution.

The half-nuts may be engaged as shown in the previous examples if the lathe has a four threads per inch lead-screw, a worm wheel with 32 teeth, and a dial with 16 graduations, as shown in Fig. 2. Before engaging the half-nuts when commencing to cut a screw, see that a graduation mark on the dial is opposite the arrow, or pointer, on the bracket. It is advisable also in cutting fractional threads to use the numbered divisions only, as these make it easier to reckon the half and quarter revolutions. Some turners prefer, when cutting fractional threads containing either ½, ¼ or ⅛, to engage the half-nuts only when No. 1 graduation comes opposite the pointer.

It must be understood that when the half-nuts are engaged, and a screw is being cut, the dial does not rotate, but as soon as the half-nuts are disengaged and the carriage stops, the dial then commences slowly to rotate. Fig. 3 shows a self-explanatory index plate which is supplied with the thread indicator. It is hardly necessary to point to the fact that such an appliance, properly handled can be of great assistance to the lathe operator in the production of work within fine limits of accuracy. Engineers cannot afford in these days to rely upon the old rule of thumb methods for the execution of good work, and advantage should be taken of any scientific appliance available.

COMPOSITION OF STEEL AND ITS MANUFACTURE

Steel is the name applied to carbonized iron, having a high tensile strength combined with elasticity. It was first made by the ancient Egyptians and other early races, by reducing very pure iron ore mixed with chopped wood, in clay crucibles, which were heated in charcoal fires blown by goat skin bellows. From this steel, the celebrated Indian sword blades were fashioned. No finer steel has ever been made. The term "steel" as used in early times, designated a form of carbonized iron which would harden or "temper" when dipped in cold water, after having been heated to a red heat. This definition no longer holds good, as the carbonized iron produced by modern methods and used extensively in structural work, goes by the name of steel. Up to the time of the invention of the open hearth process, the only commercial process of making steel was by decarbonizing cast-iron, and then recarbonizing the resulting wrought iron in the cementation furnace. Steel may now be defined as a metal produced by a complete fusion of iron or iron alloys, in a bath, the necessary properties being given after conversion by the addition of carbon or carbon alloys. Many theories have been advanced as to what steel really is. One held by many metallurgists is that "steel is an alloy of pure iron and carbon only," all other elements being regarded as impurities. Good steel is of a bluish, gray color, uniform in grain and having little lustre.

There are three distinct methods used in making steel, the Open Hearth, the Bessemer and the Crucible. The latter is the oldest of the present methods of manufacture, having been in use for centuries. The first two methods are probably the ones most commonly used at the present time. In these, the carbon in the cast-iron is burned out, while in the last method, the carbon is burned into the wrought iron. Other methods formerly used, were Cement or Blister steel and Shear steel. In commercial importance, the processes rank, Open Hearth, Bessemer and Crucible. It was not until the Open Hearth and Bessemer processes came into use that steel began to supplant wrought iron to any extent.

A WORLD POWER CONFERENCE

A world power conference, to be held in London in 1924, is now being organized by the British Electrical and Allied Manufacturers' Association, with D. N. Dunlop as director. The conference will concern itself with actual and potential sources of industrial power, and will, in particular, discuss the world's mineral fuel resources, hydro-electric power, irrigation and transportation, the improvement of technical education and other cognate subjects. It is anticipated that the conference will result in the compilation of mechanical progress and an improved means of exchanging information relating to scientific invention and discovery.

Practical Ideas From Practical Men

TOOL LAYOUT FOR ENGINE CYLINDERS

By Geo. Barrett

We often hear a discussion over the ability to purchase a certain piece of machinery cheaper than from a neighboring machine shop. The writer will describe the method used in manufacturing a gas engine cylinder, Fig. 1. In the first instance, I may state that the part described would take from 4 to 6 hours in any jobbing shop, the time depending on equipment and workmen's ability.

The set-up shown is used on a Libby turret lathe using specialized help and producing one cylinder every 35 minutes. The cylinder is first drilled for tapping hole A, Fig. 1, which is for 2½ in. drilled pipe, using a special centering fixture on a Baker Drill. This drilling operation is to assist the operator in setting the cylinder true in cradle chuck, Fig. 2. The method in setting job is by using first index of turret, Fig. 4, using centering bar A. This bar is made an easy fit to the drilled hole and a sliding fit to steel bush in spindle of lathe. This trues the back end of cylinder, the front end being trued by taper bush B.

The next step is to tighten set-screws A, Fig. 3, then pull over clamp A, Fig.2. locking by using swing bolt B, Fig. 3, after which the remaining set-screws are tightened, which leaves very little adjustment after removing centering bar.

The first step in machining is to face front of cylinder and flange, using tool C on cross slide, Fig. 4. This is to help rough boring tool D to keep its edge as we have already got under the hard surface of the casting. The boring tools are of the inserted type, using a rougher and finisher, being supported by a hardened steel bush in the lathe spindle and the pilot of boring bars.

The chamfering is done after finish bore with the tools E, Fig. 4, after which the flange is finished with cross-slide tool E. All tooling, and chucks are of a stout nature and when the cylinder is finished the bore is very smooth and true after setting on engine frame. The lathe used has also very good features in being substantial and speedy in the quick return and entering of boring bars.

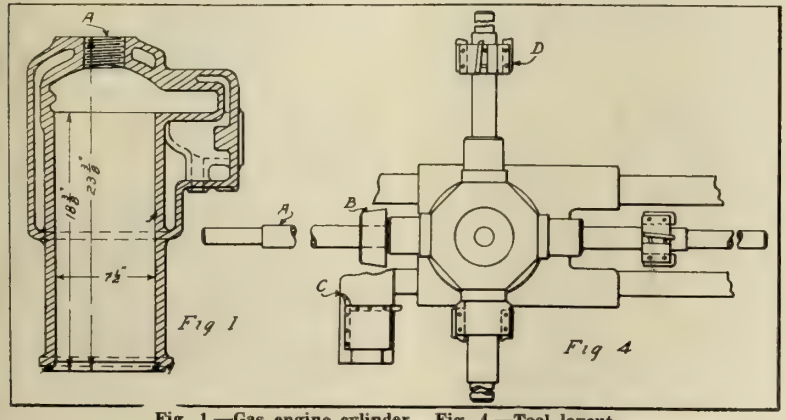


Fig. 1.—Gas engine cylinder. Fig. 4.—Tool layout.

INDUSTRIAL EFFICIENCY

By E. C. MacCormac

The late H. L. Gantt, one of the most capable and enlightened industrial engineers that America has produced, is reported to have said that the industrial efficiency of the United States was about 5 per cent. in 1919. This is a very remarkable statement coming from such an authoritative source, and has a number of very important implications. Let us study a few of these not necessarily in regard to the United States but in a general sense.

Capt. W. E. Elliott recently remarked that great difficulty was experienced by the British Ministry of Pensions in being able to tell a man what work he ought and ought not to do, and this physiological question was one upon which there was very little data available. It has been stated that owing to the faulty adjustment of the workers to the tasks which they are undertaking in industry, a sum of $300,000,000 per annum is lost in the United Kingdom, whilst another $350,000,000 per annum is lost through sickness. Whether or not this is right, there is no doubt that a very large sum is lost to industry due to these causes. With regard to the question of regularity of work, we still have to ascertain whether or not this is a good thing for the workers. Man has been brought up on spurts of energy and long rest periods, and that is why the soldiers during the war were happy as compared with the industrial worker to-day, who is subjected to long periods of hard, monotonous work.

Look at the present conditions in Russia where the Government has installed locomotive works at Sormorow, Kolumnad, and Brjansk, steel-plate works at Wykas, and wagon shops at Twer and Moscow. These works have promised to undertake a definite amount of work during a certain period. The Sormorow plant, for example, was entrusted with the production under six months, of eight new locomotives, heavy repairs to 30 locomotives, and the manufacture of a certain number of spare parts. The works, which employs some 8,500 workers, simply did the following:—new locomotives, none; locomotives repaired, 14; and about 80 per cent. of the number of spare parts promised.

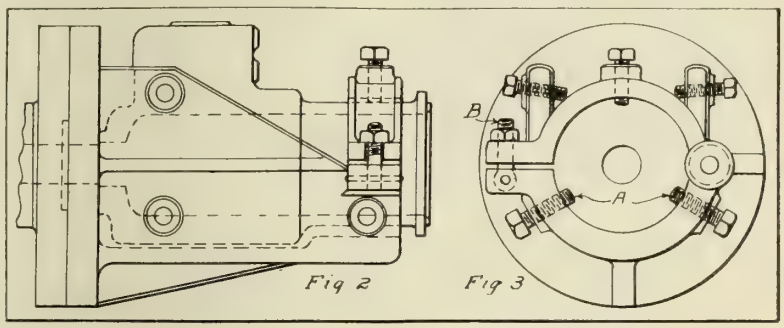


Fig. 2.—Cradle chuck. Fig. 3.—End view.

The reason for the present campaign against capitalism is clear when one begins to study its history. It got a bad name at the time of the introduction of machinery, and the consequent distress amongst the working classes following upon the discharge of many of the workers and the employment of unskilled labor at lower rates. It is true that distress at that time was acute, but the great improvements which had been discovered and which enabled goods to be produced at half the cost and half the trouble could not have been held back because they were going to hit a certain section of the community. The commun-

ity as a whole have benefited. Machinery was introduced when we were suffering from the effects of the Napoleonic wars, and steam had enabled us to recover ourselves. Then came the demand for better working conditions. It is unquestionably true that an industrial system, or even any particular industry, which fails to make possible adequate shelter, food, clothing and recreation for all of its operatives is unworthy to exist. Housing for those earning low wages or salaries should be legalized as a public utility; the manufacture of this class of homes as a profitable industry should cease and the Government, national and local, should at once adopt measures making possible the supply of this prime necessity of life."

Dr. E. M. Wilson's views on this subject are ably put, as follows:—

"Industrial experience has shewn that there is a far better thing than a minimum wage, namely, what one may call the 'optimum wage,' which means the best wage that can be paid to a man without crippling a business. The question of the best wage is a medical one. It means that a man must have enough to allow him to live in reasonably comfortable surroundings, to allow him reasonable pleasure, a reasonable amount of leisure, a reasonable amount to spend in emergency, and good food. Without that he could not keep up his efficiency and maintain his output."

REFERENCE DISCS AN AID TO MANUFACTURERS

By D. A. Hampson

Though gauges of the general "go, not go" type are considered the best form of measuring tool to use on manufacturing work, there are instances where the micrometer is preferred. The writer has a dozen machines—millers—running on work which has flat surfaces that we find are better measured with micrometers than gauges. The gauges would answer very well but the number that would be required would make the cost prohibitive and so, except in the case of half a dozen parts that are run steadily month after month, plain micrometers are used.

Now, the men on this work are semi-skilled and familar with the micrometer from long experience; as a consequence, we have no trouble from improper use or reading of the instrument. All our sizes but three are within the range of a one-inch micrometer and we bought several 1.000 in. reference discs with the first lot of instruments. Weekly, the micrometers are tested on these by a foreman and also tested at zero; these two tests may be made by the machine hands also at any time as one disc is kept with the machines.

Our sizes are such odd measurements as .687 in., .684 in., .758 in., 1.328 in., etc. Half a dozen basic sizes like this and then the rest made from these by a plus .083 in. and .125 in. With any instrument that is correct at the extremes of its range, it is still necessary to prove its correctness within its own graduations—and that is what we foun with the micrometers on our work. They would show wear at these points of greatest constant usage even though accurate at 0 and 1.000 in.

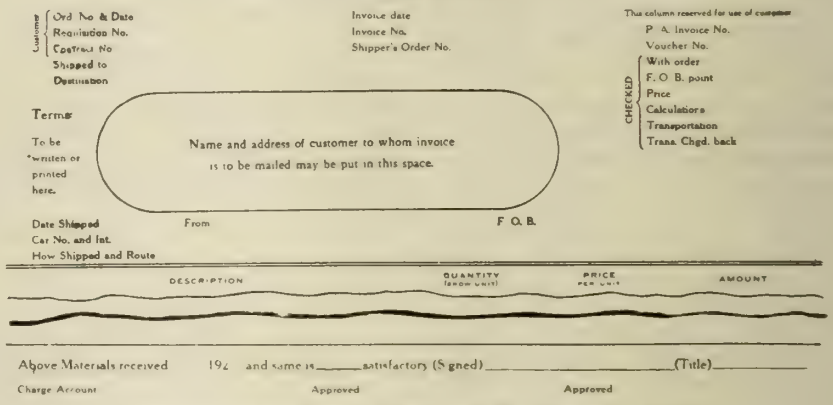
To remedy this troub.e, which was the cause of inaccurate work getting through, we had reference discs made for each of our basic sizes. These were Brown & Sharpe discs of similar form to those we already had. Now, when a thousand .758 pieces were to b run off, the micrometer to be used was tested on the .758 in. disc and corrected to it. For the over sizes, discs ground to these two thicknesses were secured and these used in conjunction with the basic sizes to form the test piece for the micrometer.

Manufacturers who are getting along without them will find reference discs or gauge blocks of unusual value to them. Too many places get along by trusting to the accuracy of an instrument within its own graduations or, worse, by using pieces of cold-drawn steel or chunks that have been planed up, the sizes of these latter being checked with Bill's micrometer which was the same as Joe Brown's who worked here in 1916 and "his micrometer was right."

NATIONAL STANDARD INVOICE FORM

Herewith is a sample of the seventh tentative form of the National Standard Invoice. This was developed at a conference of the four committees named on its face, the conference being held in Philadelphia, April 14th. During the summer the form will be put up to the conventions of the four associations for ratification. It embodies all of the practical suggestions which have been received from those using the present form during the year and a half it has been in force. These modifications, while not very great, eliminate the little difficulties which were met, and the form now is not apt to be changed for a number of years. The form which is now in use by a number of corporations was adopted by the National Association of Purchasing Agents at their convention in Chicago in 1920. It was afterwards endorsed by the National Association of Cost Accountants, as well as a number of railroads and other corporations. This form resulted from two public conferences, held a year apart in Philadelphia and Chicago, and the form represented what was then thought to be the most practical arrangement. Now that it has been in use for more than a year by a number of corporations certain constructive criticisms developed and were considered at the third public conference at Philadelphia, April 14, 1922. The seventh tentative form, adopted at the Philadelphia Conference, embodies all of the practical suggestions made. Because of this fact this form will undoubtedly meet with most enthusiastic support.

Seventh Tentative Standard Invoice Form
embodying constructive criticisms of present form received by
THE NATIONAL ASSOCIATION OF PURCHASING AGENTS
19 PARK PLACE, NEW YORK.



Form adopted by National Association of Purchasing Agents.

BRITISH HYDRO-ELECTRIC INVENTIONS

The countries richest in water power were naturally the first to develop hydro-electric enterprises and to design and construct the machinery for harnessing waterfalls in the service of man. Gt. Britain, which is far from well provided with water power resources, was for long absorbed in steam engineering, but latterly her engineers and manufacturers have thrown themselves vigorously and successfully into the hydro-electric field. One of the most recent signs of their activity is the production by a leading British firm, of several distinct improvements in hydro-electric machinery. One of them relates to the relief valve, which affords a safe means of escape for the water if at any time a turbine has to be suddenly put out of action. Most relief valves permit the water to escape in a solid jet, which is most destructive of anything upon which it impinges. By a most ingenious arrangement of valves the water is, in this new valve, given a whirling movement which opens out the jet to the form of a half-opened Japanese umbrella, thus rendering it quite harmless.

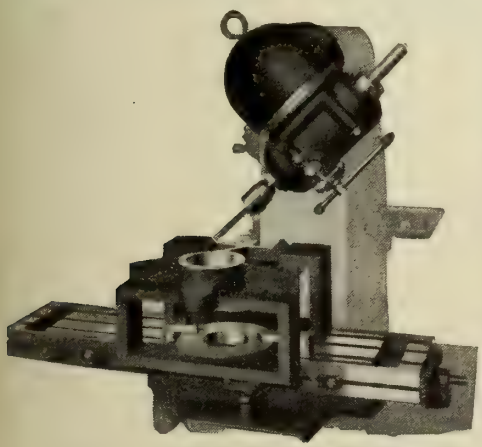
New Things in Shop Equipment

CYLINDER REBORING AND GRINDING MACHINE

A portable machine for reboring and grinding automotive cylinders has recently been offered to the trade. The machine can be used on open or closed cylinders up to a depth of 11½in. Many types of cylinders can be ground without removing the block from the chassis. A 1¼ h. p. motor is used to drive the machine, operating on 110 or 220-volt a. c. or d. c. current. The boring bar operates at a normal speed of 40 r. p. m. The bar is 2¾in. dia., with bearings 10½in. long. The grinding spindle is mounted inside the boring bar and runs on ball bearings at a speed of 5,000 r. p. m. The downward feed of the bar is automatic and is elevated by means of a crank at the top of the frame. The depth of feed is regulated by means of an adjustable automatic stop. The base of the machine can be clamped to the cylinder block and is so designed that it can be swung clear when desired. The device is located by dropping a conical plug into the top of the bore. The boring head is provided with three cutters, which are adjusted simultaneously by means of a central tapered plug. The head has a range from 2¾ to 3⅞in. After the boring head has passed through the cylinder, the device is merely swung on the base and the grinding head brought into working position. The grinding head is provided with an eccentric mechanism adjustable to a ½ in. throw. The entire device weighs only 140 lbs. and is easily handled by one man. These machines are made by the Simplicity Engine and Manufacturing Co., Fort Washington, Wis.

RING GAGE FOR SETTING REAMERS

A type of ring gage especially made for setting expansion reamers of the Critchley type has just been offered to the trade. These gages, known as "Simplex," provide for accurate setting of reamer size without the use of a micrometer, thus saving considerable time. The required size of gage is slipped over the reamer and the blades expanded to fit the ring; no other instrument or tool is necessary. It is advisable to hold shank of reamer in vise while adjustment is made. The rings are made of tempered steel and ground to size. Gages are made in standard sizes and can be furnished singly or in sets. All the reamers and bushings necessary for work on engine or transmission bearings are packed in one box, so that all parts are conveniently available. These sets are made by the Ampco Twist Drill and Tool Co., Detroit, Mich.



Milling attachment working at angle of 45 degrees.

THREADING DIAL FOR LATHES

A device, known as the "E-Z" threading dial, that may be attached to any engine lathe, has recently been marketed. The attachment consists of a cast iron bracket fitted with a brass sleeve in which is a smaller shaft carrying a dial on the upper end and a worm gear on the lower end that fits in the lead screw of the lathe. By the use of this attachment it is possible to cut almost any thread without using a cross belt to reverse the movement of the work, as the marks on the dial enable the half-nuts to be engaged at the proper time for each succeeding cut. The lathe may be run continuously and the use of this small device makes the ordinary engine lathe a more modern and economical tool. This device is being placed on the market by James M. Colven, Yonkers, N. Y.

MILLING MACHINE ATTACHMENT

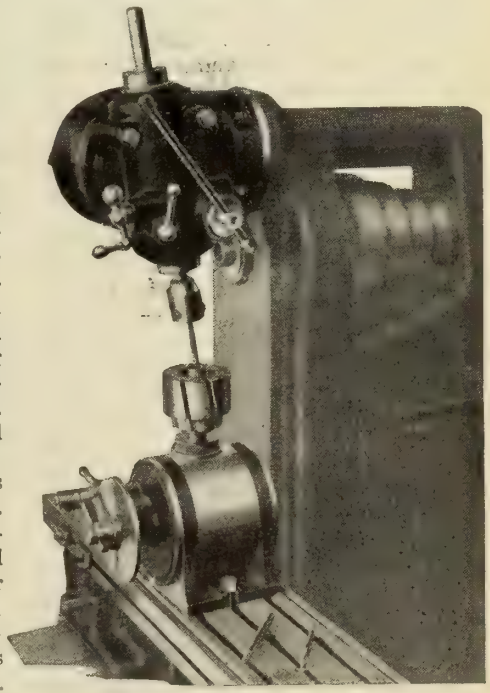
The milling and drilling attachment shown in the accompanying cuts has recently been placed on the market. The device is mounted on the face of the column immediately above the spindle and the drive is by means of a geared connection from the back end of the spindle through a sleeve substituted for the overarm. From this driving sleeve, motion is transmitted to the attachment through bevel gears. The method of locating and driving the device does not interfere with the free use of the main spindle. The two graduated swivel bases located at right angles to one another provide an unlimited range for operating, as every conceivable angle can be obtained. The spindle of the attachment is mounted in a graduated quill and can be moved in or out either by rack and pinion or by driving the pinion by worm gearing, providing the choice of two feeds in the ratio of 48 to 1. Sixteen spindle speeds are possible, ranging from 21 to 414 r. p. m. These attachments are manufactured by the Rockford Milling Machine Co., Rockford, Ill.

OILING ATTACHMENT FOR AIR DRILL

An oiling device that may be fitted to nearly all types of "Little Giant" pneumatic drills, has recently been developed. Its purpose is to provide a better means of lubrication, reduce the possibility of leakage and the frequency of oiling, and the saving of time and labor. The device consists of a sliding plunger that closes the passage of oil from the drill when the machine is operating in any position. Other improvements made in these drills is the interchangeable feature of the toggles and connecting rod units. The connecting rod is fitted to the piston by means of a ball and socket joint. Hinge-split collars are used which provide a large opening through which the crank pin bearings are lubricated. The new design makes it possible to assemble or disassemble any of the connecting rod units without dismantling the entire drill mechanism. These improvements have been developed by the Chicago Pneumatic Tool Co., of New York.

EXPANSION REAMER

A new type of inserted-blade expansion reamer has recently been offered to the trade. The blades are adjustable along slots cut in the body of the tool, the face of the slot being at a slight an gle to the axis of the reamer. The shanks are made of alloy steel while



Attachment working on cutter head.

the blades are of semi-high-speed tool steel. A double relief is given to each blade, a narrow land immediately back of the cutting edge and additional relief near the back of the blade to prevent dragging on the finished surface of the bore. The blades are supported on either end by means of steady rings, slotted on one side to receive the end of blade. By means of long threads and nuts these rings and the blades are adjusted along the slots to the desired position for size. It is usual to adjust the reamer to take light cuts, so that more accurate work, and smoother finish is obtained. These tools are made in seventeen sizes ranging in size from 15-32 in. to 4-1/16 in. dia., the blades of the latter being 7¾ in. long. These reamers are made by Samuel Hocking & Son, Lancaster, Pa.

SLITTING SHEAR AND BAR-CUTTER

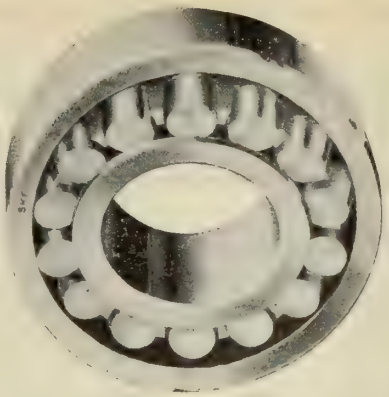
A machine especially designed for slitting steel sheets and cutting bars, and intended for use in iron shops and warehouses, has recently been placed on the market. The shear knives are 10 in. long and are capable of cutting plates of ½ in. thickness, or flat bars 6 in. x ⅝ in., at a speed of 30 strokes per minute. Five-piece knives are used in the bar-cutter, and will cut a wide range of structural shapes and sizes; 4 x 4 x ⅜ in. angles, 3 x 3 x ⅜ tees, 1⅝ in. round or 1½ in. square bars. Special knives may be fitted to accommodate other shapes. The frame is of "armor-plate" construction. Drive shaft bearings are bronze-lined and fitted with oiling rings. Gears are of semi-steel. The machine requires a floor space of 5 ft. 4 in. by 2 ft. 8 in., and weighs about 4,500 lbs. This shear is made by The Buffalo Forge Co., Buffalo, N. Y.

HEAVY DUTY ROLLER BEARING

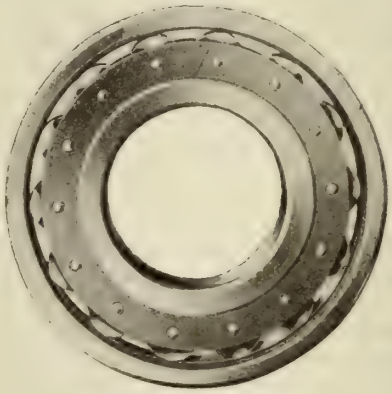
The S. K. F. Ball Bearing Co., King St., W., Toronto, have placed on the market a new self-aligning roller bearing of very rugged construction. The design allows for a double row of rollers, these being located in strong two-piece cages or retainers which compensate for creep in any one set of rollers when heavy thrust conditions are encountered. This feature prevents binding or skewing of rollers as far as is practically possible. The general construction follows the line of S. K. F. self-aligning double-row ball bearings.

This company have also introduced a new cylindrical or short roller radial bearing built on the same principle but without the self-aligning feature. Both lines are interchangeable in dimensions with the present standard ball bearings, and the cost is approximately the same. These two features can readily be appreciated by those in charge of a plant.

The two illustrations give a general idea of both styles of bearings, and they have been designed for special heavy service such as on railways, street cars, and any heavy machinery



Self-aligning roller bearing.



Short roller radial bearing.

where shock loads and comparatively low speeds are encountered.

For example: they have been in use on two trains on the Pennsylvania Railroad, one between Philadelphia and Pittsburgh, known as the Pittsburgh express, the other between New York and Pittsburgh, known as the Quaker City express. These bearings were installed the early part of last December and have been in steady service ever since, running at the average speed of 40 to 45 miles per hour. According to actual tests, they have shown a saving of 15 per cent. on coal, a large saving on oil consumption, and a marked drop in the heating of journal boxes. At a later date we intend showing more details of construction and application of both types of bearings.

COMBINED COLLET AND STEP CHUCK

A combination step and collet chuck, for use on machines with hollow spindles, has recently been placed on the market. As no draw bar is necessary these chucks have the advantage of handling larger stock than usual. The body of the chuck is fastened to a face plate that is secured to the nose of the spindle. The annular bevel gear within the chuck is mounted on ball-bearings, and threaded internally to fit the threaded end of the collets. A pinion wrench is used to turn the annular gear, it being inserted through a hole in the body of the chuck. Internal collets are furnished to hold all commercial sizes of round stock up to one inch diameter. Special provision is made for handling work of larger diameter by means of step rings. By using the larger rings and corresponding step collets, work up to 8 in. dia. can be held. These chucks are made by the Hartford Special Machinery Co., Hartford, Conn.

COMPARATOR ATTACHMENT

An attachment especially adapted for the Harkness comparator has recently been placed on the market. In order to permit the operator of the projecting lantern to have the projected and magnified image shown on the screen within his reach, a mirror is employed at some distance from the lantern so as to throw the image on the back of a ground-glass screen. The mirror used with this attachment is especially constructed with a deposit of silver on its front surface. This provides the highest degree of reflection and gives great accuracy so that a magnification of 1/100 diameter can be detected. Owing to the fact that most gears are chamfered on the end of the teeth, the instrument is focused at some point along the face of the tooth rather than on the very end of it. A slight tilt is given to the gear so that the light rays strike on the side of the tooth. When a needle is placed in the plane to be explored, it gives a very sharp projected point and shows the outline of the tooth clearly. The outline lies in the image on the screen between the point of the needle itself and the reflection of it in the face of the tooth. No polishing of the tooth face is necesssary. This attachment is being manufactured by the Jones and Lamson Machine Co., Springfield, Vt.

IMPROVED WATER TUBE BOILER

In Great Britain the water tube boiler for both land and marine purposes has been brought to a high state of perfection, but still, in the hands of British inventors, improvements are continually registered. One of the latest novelties in this line is a boiler specially designed to overcome one of the incidental difficulties sometimes encountered with earlier types. The lowest tubes in the boiler are those in immediate contact with the hottest flames, and therefore most liable to be burnt out if there is not a rapid flow of water through them. This burning out does not take place unless the boilers are being driven very hard—as they would be in the case of a sudden demand for steam. In the new type the lowest rows of tubes are provided with a separate supply of water in order to give the vigorous circulation required for safe working on emergency. Two types of boilers have been designed, one adapted for cases where the water supply is very pure and the other for installations where comparatively hard water is used. In the latter case the tubes are straight so that they may be very rapidly cleaned.

CANADIAN MACHINERY
AND MANUFACTURING NEWS

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Stupendous Wage Losses

THERE ARE those who claim that strikes now going on in the coal mining, railway and other industries, are foredoomed to the failure that has marked the settlement of so many of these struggles in recent years. Whether such prediction is verified remains to be seen, but it does appear that the actual loss in wages has been a most serious item as against the consideration involved. At the wage proposed, railway shopmen would receive 80 per cent. higher wages than in the pre-war period and somewhat more than mechanics are being paid elsewhere, and this at a period when industry is trying to struggle back to normal.

It is estimated that American workingmen are losing five million dollars daily in wages, irrespective of the loss to other mechanics whose employment is impaired by the strikes. There are one million and a quarter men out, and of these 80,000 are textile workers; 155,000 anthracite coal men; 573,000 bituminous miners, and 400,000 railway shopmen. An authority estimates that on an eight hour day basis the loss is equal to ten million man-hours per day.

These are stupendous figures, but one thing taught by the world war was the ability to cope with or ignore exceptional factors according as they affected general welfare. The American workingman would appear to have adopted the mass formation as a means of demonstrating his potentiality.

Struggling With Strike Problems

OUT OF THE mass of daily newspaper conversation about the coal and railway shopmen's strikes, the fact appears to develop that, should the trouble be protracted, some attempt will have been made to secure adequate supplies of coal for domestic and industrial purposes. Processes, however, are laborious and action beset with devious problems. Many people are asking why this, that or something else has not been done, and, if so, how or where, and the situation has the earmarks of an absolutely new proposition.

Out of it all comes some useful information. Manufacturers are working together, and it is hoped that sources of supply in Nova Scotia, Wales and even the United States may not prove altogether unfruitful. Before the end of the present year, Ontario will require about ten million tons bituminous and two million tons anthracite, and Quebec two and one-half million tons bituminous and one million tons anthracite. Under normal conditions, Canada consumes between 30 and 35 million tons of coal, of which 18 to 21 million tons are imported from the United States and the balance is from Canadian mines. Nova Scotia, Alberta and British Columbia produced some five million tons last year in addition to what they used. That is the Canadian end of the situation.

Some criticism is expressed with regard to the tardiness, in official circles, toward making definite survey of the country's requirements and sources of supply by means of special representative, as during the war period. The question is also asked why the possibilities of Nova Scotia mines were not appraised in preference to those overseas, but some consideration is probably given the fact that these mines are not altogether free from strike menace, although going strong at present. With regard to Welsh coal, it is pointed out that time is here the big element, and it is felt in some quarters that but a limited relief may now be expected from that quarter. A ray of hope appears occasionally, such as the statement of an American dealer to the effect that he has contracts for 100,000 tons for Ontario, and that he believes the strike will be over in two weeks.

In the meantime, an attempt to get the railway men back to work in United States is being made by President Harding. Railway executives, however willing to abide by the decisions of the Railroad Labor Board, declare that they will not reinstate strikers with unimpaired seniority rights. On the other hand Samuel Gompers, president of the American Federation of Labor, hints at a general strike to aid striking miners and shopmen. Against this is the report that drastic federal control, supervision and regulation of the coal industry, to avoid future strikes, is now in contemplation and it is generally agreed that this industry, above all else, is the one most in need of such control.

So it goes. Experience supplies the consolation that a situation may be entirely out of hand to-day and to-morrow may be under perfect control. The problem calls either for a man or a miracle to develop an organization that will safeguard the interests of the country generally.

Picking Off An Opportunity

IT WAS pointed out in these columns recently that exceptional business opportunities existed in Canadian mining regions for manufacturers of heavy machinery necessary in the handling and treatment of products from that source. Now comes the interesting announcement that a large manufacturing concern in the East is about to convert its plant to this purpose, as offering a more continuously active field than that in which it was engaged, that of shipbuilding Canadian rights have been secured upon British and American equipment such as conical mills, lime and cement kilns, trucks, cages, rotary dryers, skips, washing and crushing equipment, and as a result much work will be retained for Canadian industry.

Transportation Difficulties Cause of Higher Prices

Rail and Coal Strikes Result in Scarcity of Materials—Deliveries Are Uncertain—More Furnaces Closed—Steel Production Now Slowing Up—Pig Iron Still Advancing.

CANADIAN markets are beginning to reflect some of the strike difficulties that are affecting business on the other side. Iron and steel deliveries are becoming more and more problematical and positive scarcity is developing in certain bar and sheet sizes. Prices are trending upward and for new orders carrying specific are meeting with a more or less indifferent reception in some quarters. It is said of one mill that it could draw steel from now until the middle of October on present orders alone.

The situation is therefore becoming an increasingly difficult one for the buyer. One development will undoubtedly be the elimination for the present at least, of price-cutting that made its appearance in certain lines. While materials are difficult to obtain, and increasingly scarce, a tightening tendency is sure to manifest itself.

Strike conditions in the States have created an acute situation in the steel and iron industries and additional blast furnaces have been banked due to the scarcity of coke. It appears that consumers are fairly well stocked with steel. The production during the past several months has shown no marked falling off, in fact increase is reported for some months, so that with consumption light the sales of the past period must be largely for consumers' stock or dealers' and makers' warehouses. The duration of strike conditions, however, is having its effect on industrial activity as a slowing-up process is now in progress.

Toronto

August 9

SCARCITY of materials, caused by coal and rail strikes, promises to be responsible for a decidedly upward swing in iron and steel prices within the next three weeks. The demand in all lines remains fairly active and for prospective work there is likely to be a movement toward having requirements booked before any drastic change occurs. Already, big steel producers who have attempted to keep prices beyond criticism announced an advance of $3 a ton on all lines—shapes, bars, and plates—but deliveries are somewhat problematical. Considering the circumstances, it is remarkable that a Toronto firm reports the arrival of three carloads of hoop materials which left the Pittsburgh district only five days ago. This is considered exceptional service, and bears out the information published some days ago in these columns that conditions were somewhat better in and around that particular district than in any other. Canadian prices also show the upward tendency. The sheet and bar markets are decidedly firm, and although no definite announcement has been made as to advances beyond present levels, such a development, it is claimed, is not to be long delayed. Steel bars are in particularly strong demand and specific dates on new business are a somewhat difficult if not impossible proposition. Mills are said to have good supplies of billets and blooms, and present bookings are likely to run into October.

The pig iron situation also displays evidences of uneasiness. Although a two-dollar advance was recorded two weeks ago, it is now predicted that the upward swing has not yet reached the limit, and $35 pig iron is said to be within the range of early development. This would bring the market up to the level of May, 1921, but none will venture the absurdity that the fancy prices of two years ago, something over $50 a ton, will be repeated. It seems good advice to buyers that present market trend is entitled to immediate consideration.

Iron and steel bars and sheets reflect probably more than any other department the tightening tendency of the market. There is a marked scarcity and buyers are finding it increasingly difficult to meet requirements. Price advances are predicted. Current quotations follow:

Iron bars	3 15 to 3 25
Steel bars	3 15 to 3 25
Reinforcing bars	3 15 to 3 25
Steel hoops	4 25
Tire steel	3 15
Spring steel	7 00
Band steel, No. 10 gauge and 3-16 in base	3 65 to 3 75
Small shapes	3 25
Sheets, black, No. 28	5 25
Sheets, blue ann., No. 10	4 25
Canada plates, dull, 52 sheets	5 25 5 25
Canada plates, all bright	6 00
Galvanized Sheets. No. 28	6 35

Scrap metal markets are about as inactive as they could possibly be. "It is largely a problematical proposition," said an authority. "You may attribute it to the coal strike as much as anything. Consumers are awaiting some definite action looking to the end of the present trouble. There is nothing doing and the price situation remains the same." Quotations are:

Copper, light per 100 lbs.	8 50
Copper, crucible	11 00
Copper, heavy	11 00
Copper Wire	11 00
No. 1 composition	9 00
New brass cuttings	6 00
Red brass turnings	6 50
Yellow brass turnings	4 85
Light brass	3 50
Medium brass	4 50
Scrap zinc	4 00
Heavy lead	4 50
Tea lead	3 00
Aluminum	11 00
Boiler plate, per gross ton	9 00
Heavy melting steel	11 00
Axles (wrought iron)	16 00
Rails (scrap)	11 00
Malleable	11 00
No. 1 machine cast iron	16 00
Pipe, wrought	6 00
Car wheel	16 00
Steel axles	15 00

Non-ferrous metal markets show little change. Prices are firm but the demand is featureless and indicative of none of the unsettling influences in steel and iron. The New York market is reported as quite active while foundries were buying against actual requirements, but some reluctance to accumulate supplies was in evidence. Brass mills and wire drawers are reported to be taking large tonnages of copper. There was a slight advance in casting copper, and zinc went up 25 cents on activity among brass and zinc mills, and sheet galvanizers. London tin markets are reported as active and some slight advances were recorded. Current quotations are:

Lake copper	17 25
Electrolytic copper	17 25
Castings, copper	17 00
Tin	36 25
Spelter	7 50
Lead	7 00
Antimony	7 40
Aluminum	21 00

Owing to the drop from $3.25 to $3.00 a barrel in crude oil, some reductions are reported in the general oil list this week. Gasoline is down a cent and a half and royalite and polarine oils are lower by one cent.

There is a strong market for butt and lapweld pipe, but present prices hold. Skelp and other materials are increasingly difficult to obtain, largely as the result of shipping problems.

In machine tools and supplies the outlook, at least, is encouraging, although in the supply department, business is reported to be quite encouraging. July was a better month than it was last year, and half-yearly reports show, in some cases, a marked improvement over the same period in 1921. Reviews of general conditions are such as to cause optimism as to the autumn season, and while nothing great is anticipated, the feeling is that aggressive work will have far better results.

Montreal

August 9

DESPITE the general stiffening of price in different commodities there is little evidence of increased sales in any particular line. The prevailing tendency among iron and steel men seems to express a waiting attitude, as early future action is dependent on the trend of events in the coal and rail situation in the States. Dealers here are awaiting the outcome of present negotiations with a great deal of interest. An indication of American conditions, which rules the market here, is the fact that of the twenty-two furnaces in Buffalo, only

one is offering to-day and that at $30 as against $20 a short time ago.

Iron bars	3 15 to 3 25
Steel bars	3 15 to 3 25
Reinforcing bars	3 15 to 3 25
Steel hoops	4 00
Tire steel	3 15 to 3 25
Spring steel	6 00
Band steel, No. 10 gauge and 3-16" base	3 25
Small shapes	3 00

The market in pig iron is virtually unchanged, although prices on some grades show an advance of $3 a ton.

Non-Ferrous Metals.—Movement in this market continues light with prices firming. The situation as regards prompt shipment may develop an advance on some metals due to the evident scarcity. With prospect of higher quotations the week's prices are firm as follows:

Lake Copper	17 75
Electrolytic Copper	17 50
Castings, Copper	17 25
Tin	36 25
Lead	7 00
Spelter	8 25
Antimony	6 50
Aluminum	22 00

Machine Tools and Supplies.—The activity in machine tool equipment is still confined to an occasional sale of used machinery with little inquiry for new tools. The movement of supplies continues to be an encouraging factor in an otherwise dull situation. The purchasing, however, is still for immediate requirements and few manufacturing plants are buying heavily for future needs. While this state of mind continues, business will be more or less of the forced variety, but when industrial activity takes an upward turn, the depleted condition of a large number of plants will ultimately mean a heavy demand for all classes of equipment.

Scrap Metal.—Little of interest has transpired in the old material market and the movement of scrap is still light. Local prices are firm at following quotations:

Copper, light, per 100 lbs.	8 50
Copper, crucible	11 00
Copper, heavy	11 00
Copper Wire	11 00
No. 1 compositon	9 00
New brass cuttings	6 00
Red brass turnings	6 50
Yellow brass turnings	5 00
Light brass	4 00
Medium brass	5 50
Scrap zinc	3 50
Heavy lead	4 50
Tea lead	3 00
Aluminum	11 00
Boiler plate, per gross ton.	9 00
Heavy melting steel	10 00
Axles (wrought iron)	20 00
Rails (scrap)	11 00
Malleable	10 00
No. 1 machine cast iron	20 00
Pipe, wrought	7 00

Pittsburg

August 9

PRODUCTION of pig iron in July, was at a rate only 1.6 per cent. under the rate in June. As noted in recent reports, many blast furnaces were compelled to bank or blow out in the last two or three weeks of July owing to coke shortage, due to lighter receipts of coal at by-product coking plants, resulting chiefly from the railroad shopmen's strike of July 1. This would have suggested a very considerable decrease in pig iron production in July. The decrease in the rate of production did occur, but quite a number of furnaces had blown in during the latter part of June, adding little to that month's output. Transportation conditions are improving, as the railroads make headway in overcoming the effects of the strike, which is not settled formally. The coal strike continues. Thus the prospect is that pig iron production in August w be materially below that of July.

The slight drop in pig iron production from June to July was almost entirely among merchant furnaces, the steel interests having a good output, and as the steel works may have used a somewhat larger proportion of scrap in July it is possible that their production of steel ingots increased a trifle. At any rate it cannot have decreased materially. The ingot report for July will be out in a few days.

The important point in this matter of steel production is that a fourth month has been added to the list of months in the coal strike in which there has been heavy production and this means a great deal of steel shipped. April saw a heavier production of steel than any preceding month since November, 1920, May showed a material increase over April, and June a slight increase over May, while July at any rate did not go back to any extent. The result is that steel production in the four months after April 1, when the coal strike started, has been 40 per cent. greater than in the four months preceding April 1. The average rate of production in the past four months has been about 36,000,000 tons of ingots a year. This is only 14 per cent. under the rate in the first nine months of 1920, when steel was regarded as being in exceptionally heavy demand.

Consumers Well Stocked

In the circumstances, there is a possibility that some consumers are pretty well stocked with steel. In February, March and April the common view was that a considerable part of the steel buying at that time was in anticipation of curtailment in steel production arising out of the coal strike. It must be remembered that the coal strike was universally expected and not a few people thought it likely to prove the greatest strike in the history of the industry. While there may have been little stocking of steel in a speculative way, it was the testimony of steel producers that customers were taking in steel against contracts they held and would be executing in the later months of the year, contracts for making manufactured steel products and contracts for construction work.

The reduction in steel production that has been occurring, and the further reduction that is practically certain prospect for the next few weeks, therefore, does not necessarily promise that there will be a shortage of steel. The present dullness of the market is in keeping with this analysis. There is some urgent demand for prompt shipment, with delivery premiums naturally being paid, but the tonnage involved is not large. For delivery late in the year hardly any business is being done. The mills insist that they would not sell in any event, but the case does not come up to any extent, as buyers are not inquiring.

Instructions to Curtail

It is stated on excellent authority that some buyers of steel have instructed mills to curtail shipments. This may not involve much tonnage, but it is a significant development. Whether the buyers in question have accumulated extra stock, or are having their operations curtailed by coal shortage, cannot be learned precisely. There may be a combination of both circumstances.

Unless transportation and coal conditions improve sharply in the very near future, there will necessarily be some curtailment in steel consumption, for it is generally held that there is now a real shortage of coal. It is even possible that coal shortage may affect consumption of steel more than production, for at the present time the iron and steel industry is running partly on its stocks of coal.

Reports, rumors and guesses as to an early ending of the coal strike have been thick, but are not worth analyzing. It is a common remark in trade circles that when the strike is settled it will require several weeks to restore normal production and distribution.

Prices of steel products for forward deliveries, practically "delivery at mill convenience" are unchanged. They are partly nominal, representing in some cases simply levels at which mills would sell if they cared to sell at all. When, however, a buyer has a definite construction job on hand, involving work that is certain to be done, he can generally buy the steel or get a reservation.

Bars, shapes and plates remain at basis price of 1.70c., while early deliveries command somewhat greater premiums than two or three weeks ago, sales being reported up to about 2.00c. in some instances.

Sheets Quiet

The sheet market is quiet in point of turnover. Mills adhering to basis prices, at 3.15c. for common black, are sold up as far as they care to go, as a rule, and most of the buying, such as it is, is at premiums of $2 to $5 a ton, for early shipment.

The June report of the National Association of Sheet & Tin Plate Manufacturers, representing about two-thirds of the sheet industry, shows unfilled tonnage July 1, equal to 1.8 months of production at capacity, with stock sold but unshipped of about .3 month, so that the orders would require operation at capacity for 1.5 months or

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Country Approaches Period of Better Business

Unmistakable Signs of Returning Prosperity—Business Man Makes Survey of Western Ontario Cities—Finds Industry Well Employed—Massey-Harris Announce Policy of Production—Better Market for Implements.

RETURNING from a review of a considerable portion of western Ontario, a representative of large machinery house reports that present activity and the future industrial outlook warrants a genuine feeling of optimism Such cities as Guelph, Kitchener, London, Windsor and those of the Niagara peninsula were visited, and it was found that industries, in the majority of cases, were well employed. Particularly does this apply to those associated in any way with motor car enterprises, or with building and engineering operations. The market for machine tools remains quiet, but the opinion is expressed that inactivity cannot long be protracted in this deparoment. Improvement in general conditions must soon exert a beneficial influence.

"When I say that we are just turning the corner, I do not mean that we may expect a lot of business from large concerns with heavy overhead," said the representative referred to. "It is my opinion that the small manufacturer is going to be responsible for a nice volume of business. He is the man who can adjust his equipment to meet almost any requirement. His plant is not laid out for specializing and as a result, he is going to get business that the larger man, the specialist, does not care to handle. What he wants is business in his own line, and in a great many cases he is getting it.

Better Buying Feeling

"There has been a feeling among buyers that anything suggestive of expenditure was almost repulsive. It was a period of extreme conservatism. I think that feeling is disappearing and while we must not expect too much, the general tone is decidedly better. It only requirees a trip out through such cities as I have named, to convince one's self that quite a lot of work is going on. Some of it is of a public character, such as the Welland canal, but on the other hand, many factories are busy and those who are not are becoming exceptional.

"This does not mean that the time has arrived when business will walk into your office and plead for immediate attention. That time, I think, has gone forever. One of our best men adopts the plan of getting in touch, if possible, with the man who actually knows the immediate requirements of a shop. Thus, in calling upon a plant recently he was advised that nothing was required. In walking through, he noticed that an emery wheel was worn almost to the flanges. He called the attention of the boss to this fact and it transpired that they were facing a shortage on wheels, and further observation revealed a similar condition as to hacksaws. These are trifling things, but they serve to demonstrate that an aggressive, though tactful, policy has merit under present circumstances. One good feature of the times through which we are passing, is that it has taught us all—the big manufacturers, the small shop and the dealer, all alike—that it is necessary to hustle if we are to get anywhere. Having developed that habit once more, and there was a time when it was almost forgotten, we will, at least, be more deserving of better things."

Ford May Build Foundry

Reports from the Windsor district have some outstanding features. One is to the effect that the Ford Company are proceeding with a structure 400 ft. wide and 1,300 ft. long. In this they will house their machine shop, and, it is also understood, will manufacture their own bodies. It is further intimated that they will build and equip a large grey iron foundry. This may not be good news to many plants who are serving the Ford Company in this respect, but it is in line with the Ford policy to have their every department as selfcontained as possible as a necessity in dealing with growing competition.

While the Dodge people have not yet started building operations, it is a fact that they have bought 7½ acres of land in Windsor with the evident intention of establishing a Canadian industry thereon.

The Canadian Salt Company, Windsor, is also making extensive alterations to plant.

Improved activity is reported from boiler manufacturers. One Toronto plant is working night and day on boiler and tank business and in addition is turning out some heavy equipment used in the manufacture of motor car tires.

Massey-Harris to Speed Up

One of the most important announcements of the week is made by Thomas Bradshaw, general manager of the Massey-Harris Company, Toronto, that a more active production schedule had been decided upon for autumn and winter months. The annual inventory-taking period in this industry begins Aug. 15, and lasts for two weeks. Confidence in the future is behind the company's plans, which will mean the employment of about 1,600 men in the Toronto plant and 900 in that at Brantford. The program of increased activity indicates that normal conditions are felt to be approaching and that the organization prepared for good times will naturally be the first to participate in them.

The farmer, especially in Eastern Canada, is buying more implements, while in the West, because of piled-up indebtedness that has to be liquidated, the farmer is more conservative. Sales volumes are up to those of last year, however, and taking price reductions averaging 25 per cent. into consideration, this means that more implements have been sold. Stocks of both finished products and raw materials have been reduced to a low point. Consistent with the trend of business, and now that better conditions are in sight, activity will be all the more pronounced. It is understood that production in these plants will be close to 80 per cent. capacity. This in itself is one of the most cheering developments in the industrial field and is significant of better things.

Crop reports from the West continue to be encouraging, and manufacturers report that an improved buying impulse is evident. Farm supplies of all kinds are feeling the benefit of the movement which has behind it that inevitable stimulant contained in the prospect of a good yield.

All reports therfore point to better feeling and greater confidence in the future. While experience advises against great expectations, the signs are unmistakably in favor of reasonable optimism.

Guelph is Busy

"The industrial situation is very favorable at the present time," writes H. Westobey, secretary, Guelph Chamber of Commerce.

"The textile and rubber people are very busy, and the iron and steel industries continue to show a steady improvement. There is practically no unemployment in the city, although with the closing down of much of the out-of-door work, which is being carried on by the civic authorities, such as street paving, renewing the radial railway line, and such like works, there may be a certain amount of unemployment in the city during the forthcoming winter. A great deal depends, of course, on the settlement of the coal strike on the other side. This has not yet had much effect on our industrial establishments, but undoubtedly it will have a great effect if unduly prolonged. The situation to-day is much more favorable than it was a year ago and our manufacturers all appear to entertain a very hopeful view of the future."

Oshawa Reports Great Activity

Industrial conditions in Oshawa during the past month have shown great ac-

(Continued on page 46)

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Toronto price:—	
Silicon, 2.25% to 2.75%	$32 65
Grey forge, Pittsburgh	$27 76
Lake Superior, charcoal, Chicago	33 15
Standard low phos., Philadelphia	30 00
Bessemer, Pittsburgh	26 76
Basic, Valley furnace	25 00

IRON AND STEEL

Per 100 lbs. to Large Buyers	Cents
Iron bars, base, Toronto	$3 15 3 25
Steel bars, base, Toronto	3 15 3 25
Iron bars, base, Montreal	3 15 3 25
Steel bars, base, Montreal	3 15 3 25
Reinforcing bars, base	3 15 3 25
Steel hoops	4 25
Tire steel	3 15
Spring steel	7 00
Band steel, No. 10 gauge and 3-16 in. base	3 65 3 75
Chequered floor plate ¼" and heavier	6 00
Bessemer rails, heavy, at mill	2 35
Steel bars, Pittsburgh mill prices	1 80
Tank plates, Pittsburgh mill prices	1 80
Structural shapes, Pittsburgh mill prices	1 80
Steel hoops, Pittsburg	2 75
Small shapes	3 25
F. O. B. Chicago Warehouse	
Steel bars	2 60
Structural shapes	2 70
Plates	2 70
Small shapes under 3-in	2 60

FREIGHT RATES

Pittsburgh to Following Points	Per 100 lbs. C.L.	L.C.L.
Montreal	52	65½
St. John, N. B.	76	96
Halifax	77½	97
Toronto	34	48½
Guelph	34	48½
London	34	48½
Windsor	31½	45½
Kingston	48½	61

Current surcharge 1 per cent.

METALS

	Montreal	Toronto
Lake Copper	$17 75	$17 25
Electrolytic Copper	17 50	17 25
Castings, Copper	17 25	17 00
Tin	35 50	35 50
Spelter	8 75	7 50
Lead	7 00	7 00
Antimony	6 50	7 40
Aluminum	22 00	21 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$3 75	$3 50
Plates, ¼ up	3 40	3 25

PIPE—WROUGHT

Standard Buttweld Pipe S/C

Per 100 feet

	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
⅛ inch	$ 6.00	$ 8.00	$	$ ....
¼ inch	3.84	5.94	7.20	9.30
⅜ inch	3.84	5.94	7.20	9.30
½ inch	4.85	6.46	7.31	8.93
¾ inch	5.87	7.71	8.86	10.70
1 inch	8.16	11.05	12.58	15.30
1¼ inch	11.04	14.95	17.02	20.70
1½ inch	13.20	17.88	20.35	24.75
2 inch	17.76	24.05	27.38	30.30
2½ inch	28.08	38.03	.....	.....
3 inch	36.72	49.73	.....	.....
3½ inch	47.84	63.48	.....	.....
4 inch	56.68	75.21	.....	.....

Standard Lapweld Pipe S/C

Per 100 feet.

Below Dividing Line—Price Per Foot.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
2 inch	$21.46	$27.38	$31.08	$37.00
2½ inch	31.50	40.95	46.80	56.16
3 inch	41.31	53.55	61.20	73.44
3½ inch	48.76	65.32	72.68	89.24
4 inch	57.77	77.39	86.11	105.73
4½ inch	66.04	86.36	1.04	1.24
5 inch	76.96	100.64	1.21	1.45
6 inch	1.00	1.31	1.57	1.88
7 inch	1.30	1.76	2.02	2.45
8L inch	1.40	1.85	2.13	2.58
8 inch	1.61	2.13	2.45	2.97
9 inch	1.97	2.59	2.97	3.59
10L inch	1.82	2.40	2.75	3.33
10 inch	2.35	3.09	3.54	4.28

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4-in. and under 60 per cent.

4½-in. and larger, 50 per cent.

4-in. and under, running thread, 40%.

Standard couplings, 4-in. and under 30%

Do., 4½-in. and larger, 10%.

OLD MATERIAL

Dealers' Average Buying Prices

	Montreal	Toronto
Copper, light	$ 8 50	$ 8 50
Copper, crucible	11 00	11 00
Copper, heavy	11 00	11 00
Copper, wire	11 00	11 00
No. 1 machine composition	9 00	9 00
New brass cuttings	6 00	6 00
Red brass turnings	6 50	6 50
Yellow brass turnings	5 00	4 85
Light brass	4 00	3 50
Medium brass	5 50	4 50
Scrap zinc	3 50	4 00
Heavy lead	4 50	4 50
Tea lead	3 00	3 00
Aluminum	11 00	11 00
	Per Ton	Gross
Boiler plate	$ 9 00	$ 9 00
Heavy Melting Steel	10 00	11 00
Axles (wrought iron)	20 00	16 00
Rails (scrap)	11 00	11 00
Malleable scrap	10 00	11 00
No. I machine cast iron	20 00	16 00
Pipe, wrought	7 00	6 00
Car wheel	17 00	16 00
Steel axles	10 50	15 00
Mach. shop turnings	4 00	6 00
Stove plate	16 00	14 00
Cast boring	4 00	6 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, 7-16 and up	30
Carriage bolts, ⅜ in. and smaller 6 in. and shorter	40
Coach and lag screws	45
Stove bolts	72½
Wrought Washers	60
Do., corru. head	60
Machine bolts, 7-16 and over	35
Machine bolts, ⅜-in. and less	35
Blank bolts	35
Bolt ends	35
Machine screws, fl. and rd. hd., steel cut thread	37½ & 10
Machine screws, o. and fil. hd., steel cut thread	30
Machine screws, o, and fil. hd., brass cut thread	15
Standard couplings, 4-in. and under, brass cut thread	30% 30
Nuts, square, blank off net list	$1.00
Nuts, square, tapped off net list	50c.
Nuts, hex., blank off net list	50c.
Nuts, hex., tapped net list	
Copper rivets and burrs, list less	32c.
Burrs only, list plus	10%
Iron rivets and burrs	47%
Boiler rivets, base ¾ in and larger	$5.75
Structural rivets, as above	5 65
Wood screws, O. & R., bright	80
Wood screws, flat, bright	82½
Wood screws, flat brass	77½
Wood screws, O. & R., brass	75
Wood screws, flat, bronze	72½
Wood screws, O. & R., bronze	70

MILLED PRODUCTS

(Prices on unbroken packages)

Set screws	65
Square and hexagon head cap screws	60
Round head cap screws	20
Fillister head cap screws	35
Flat head screws	25
Button head cap screws	20
Studs	45
Semi-finished nuts up to and including 9/16 in.	70
Semi-finished nuts ⅝ to 1¼ in.	65
Semi-finished nuts 1⅜ to 2 in	35
Coupling bolts	35
Taper pins, No. 2 to No 5	65
Taper pin No. 6 and over	10
Planer bolts without fillet	10
Planer bolts with fillet	Net
Patch bolts	Plus 10%
Hollow set screws	20
Thumb screws	50
Thumb nuts	70

BILLETS

F. O. B. Pittsburgh

	Per gross ton
Bessemer billets, 4 in. x 4 in. and larger	$35 00
Open hearth billets	35 00
O. H. sheet bars	35 00
Forging billets	40 00
Bessemer rods	40 00

NAILS AND SPIKES

Wire nails, base	$3 65
Cut nails, base	4 35
Miscellaneous wire nails	72½%

ROPE AND PACKING

Plumbers' oakum, per cwt.	6 30
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 23
British Manila rope	0 20
New Zealand hemp	0 20

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	Net..

Solder, strictly	$0 22½
Solder, guaranteed	0 24
Soldering coppers, lb.	0 62½
White lead, pure, cwt	13 20
Red dry lead, 100-lb. kegs, per cwt.	10 75
Wood alcohol, per gal.	1 75
Whiting, plain, per 100 lbs.	3 00

CARBON DRILLS AND REAMERS

	Discount.
S. S. drills, wire size	60
Can. carbon cutters	plus 10
Standard drills, all sizes	60
3-fluted drills, plus	10
Jobbers and letter sizes	60
Bit stock	50
Ratchet drills	25
S. S. drills for wood	10
Wood boring brace drills	50
Electricians' bits	30
Sockets	50
Sleeves	30
Taper pin reamers	25
Drills and countersinks	20
Bridge reamers, carbon	50
Centre reamers	Net
Taps, machine screw	50 to 60
Taps, hand, sizes up to 1"	30 to 60
Chucking reamers	20 off
Hand reamers	20
High speed drills, list	40
Can. high speed cutters	plus 10
American	plus 40

COLD ROLLED STEEL
(At Warehouse)

Rounds and squares	$4.50 base
Hexagon and flats	$5.50 base

MALLEABLE FITTING LIST

1 in. elbow	.32	.53
2 in. elbow	1.05	1.70
1 in. tee	.43	.70
2 in. tee	1.45	2.40
1 in. coupling	.33	.53
1 in. locknut	.15	.23

Discount to dealers 70/5 off list.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$5 40	$5 25
Sheets, blue ann., No. 10	4 05	4 25
Canada plates, dull, 52 sheets	5 50	5 25
Can. plates, all bright	7.00	6.00
Galvanized sheets, No. 28		6 35
Queen's Head, 28 B.W.G.	7 25	
Fleur de Lis, 28 B.W.G.	7 00	
Gorbal's best, No. 28		
Colbornes Crown, No. 28		
Premier	6 85	6 35
Premier 10¾ oz.	6 85	6 75
Zinc sheets	9 25	10 00

PROOF COIL CHAIN
B. B. B. CHAIN

⅜ in., $16.45; 7-16 in., $14.00; ½ in., $12.95; 5-8 in., $13.15; ¾ in., $12.75; ⅞ in., $12.25; 1 in., $11.85; 1⅛ and 1¼ in., $10.55. Fire weld chain same sizes respectively are $14.00; $11.50; $10.40; $10.55; $10.15; $9.75; $9.35; and $8.25.

ELECTRIC WELD COIL CHAIN B.B.B.

⅛ in. $20.00; 3-16 in. $16.50; ¼ in. $15.50; 5-16 in. $12.70.

FILES AND RASPS

Globe	60/5
Vulcan	50
P. H. and Imperial	60/5
Nicholson	40
Black Diamond	40
J. Barton Smith, Eagle	55
McClelland, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	60
Great Western-American	50
Kearney & Foote, Arcade	60/5

BOILER TUBES

Size	Seamless	Lapweld
1 in.	19.00	
1¼ in.	20.00	
1½ in.	20.00	
1¾ in.	21.50	
2 in.	20.00	16.00
2¼ in.	22.00	20.00
2½ in.	23.00	20.00
3 in.	27.00	24.00
3½ in.	32.00	28.00
4 in.	41.00	35.00

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS

Castor Machine Oil, per lb.	34½
Royalite, per gal. bulk	20
Palacine	23
Machine oil, per gal.	39
Black oil, per gal. (Summer)	19
Cylinder oil, Capital	69½
Petroleum fuel oil bbls., net	10.80
Pure turp., single bbls., gal.	1.75
Linseed oil, raw, single bbls.	1.10
Premier Gasoline	34

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	30%
Standard	30 and 10%
Cut leather lacing, No. 1	1.75
Leather in side, (Lacing)	1.50

TAPES

Chesterman Metallic, 50 ft.	$5 00
Lufkin Metallic, 603, 50 ft.	3 17
Admiral Steel Tape, 50 ft.	3 00
Admiral Steel Tape, 100 ft.	4 50
Major Jun. Steel Tape, 50 ft.	3 75
Rival Steel Tape, 50 ft.	4 00
Rival Steel Tape, 100 ft.	8 75
Reliable Jun. Steel Tape, 50 ft.	5 25

PLATING SUPPLIES

Polishing wheels, felt	$3 80
Polishing wheels, bull-neck	1 50
Emery in kegs, Turkish	08
Pumice, ground	05
Emery glue	05
Tripoli composition	08
Crocus composition	12
Emery composition	11
Rouge, silver	16
Rouge, powder, nickel	38

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	20
Brass sheets, 24 gauge and heavier base	23
Brass tubing, seamless	28

WASTE

XXX Extra	16	Atlas	18
Peerless	21	X Empire	13
XX Grand	15	Ideal	18
Superior	20	X Press	11½
X L C R	14		

Colored

Lion	12	Fancy	13½
Standard	10½	Popular	9
No. 1	13	Keen	7½

Wool Packing

Arrow	24	Anvil	16
Axle	20		

Washed Wipers

Select White	18	Dark colored.	13
Mixed Colored	14		

This list subject to trade discount

RUBBER BELTING

Standard 36 ....28% Best grades 28%

ANODES

Nickel	.55 to .60
Copper	.38 to .40
Tin	.70 to .17
Zinc	.16 to .17

COPPER PRODUCTS

Prices per lb.

	Montreal	Toronto
Copper Bars, ½ to 2 in.	.29	.28
Brass Tube		.28
Plain sheets, 16 oz. in. 30 x 72	.30	.29
Copper sheet, tinned, 16 oz.	.37	.36
Copper sheet, planished, 16 oz. base	.42	.41
Braziers', in sheets, 6 x 4 base	.30	.29
Copper tubing, seamless		.32

LEAD SHEETS

Roll Lot Prices

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$ 8 75	$ 9 25
Sheets, 3 1-2 lbs. sq. ft.	8 75	9 25
Sheets, 4 to 6 lbs. sq. ft.	8 25	8 50

Cut sheets, ¾c. per lb. extra
Cut sheets to size, 1c. per lb. extra

PLATING CHEMICALS

Acid, boracic	.23
Acid, hydrochloric	.03¾
Acid, nitric	.10¼
Acid, sulphuric	.03¾
Ammonia, aqua	.20
Ammonium, Carbonate	.15
Ammonium, chloride	.18
Ammonium, hydrosulphuret	.75
Ammonium, sulphate	.10
Arsenic, white	.18
Copper, carbonate, anhy.	.32
Copper, sulphate	.08
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.14
Nickel carbonate	.32
Nickel sulphate	.14
Potassium sulphide (substitute)	.40
Silver chloride (per oz.)	.85
Silver nitrate (per oz.)	.65
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.35
Sodium hyposulphite per 100 lb.	6 50
Sodium phosphate	.15
Tin chloride	.30
Zinc chloride, C. P.	.30
Zinc sulphate	.06

Prices per lb. unless otherwise stated

News From the Industrial Field

Customs collections for Galt, Ont., for July show about 50 per cent. increase over the same month last year. The amount is $90,084.13.

Lewis Staples, Bethany, Ont., has lost two shingle mills by fire in the past thirteen months. One destroyed a few days ago had just been rebuilt.

Fire Losses for Kitchener, Ont., for the first six months of the year were $16,967, a reduction of about $3,000 for the same period last year.

The Canadian Salt Co., Windsor, are installing a 150-ton Canadian Fairbanks Morse truck scale. They are also making extensive changes to their plant.

New Car Barns for Kitchener, Ont., will be opened shortly. They will have three times the capacity of the present barns. The dimensions are 120 x 160 feet and will house 25 cars.

In accordance with the variation in the cost of living, statistics for the last quarter show that the basic wage in the Australian Commonwealth has increased from 78 shillings per week to 81 shillings 5 pence.

A gasoline tank of the British American Oil Company plant, Toronto, exploded recently, killing a workman. It is thought that gas fumes, accumulating in the tank, caused the explosion. The loss is estimated at $6,000.

In order to meet the threatened coal shortage, Toronto Board of Control has placed orders for $100,000 worth of Welsh coal for immediate shipment. The Board will ask the city council to vote another $500,000 for coal purposes.

Windsor, Ont., has a population of more than 41,000, an increase of 4,000 in the past year. The eastern part of the city has made great strides in building. The present year will probably show a record in that respect.

Almost Every Merchant flag in the world is seen among the shipping in the harbor of Sydney, N.S., clamoring for coal. Sydney piers are working 24 hours a day, and double shifts have been put on the steam shovels at Glace Bay coal banks.

Toronto is negotiating for the purchase of the Dominion Shipbuilding Co.'s plant in that city, which at the time of recent assignment was valued at $523,634. The plant may be occupied by the Dominion Envelope and Carton Co., employing over 1,000 hands.

That Sections of the Canadian National Railway between Toronto and Port Hope may be electrified shortly was the statement made to deputations recently by Premier Drury. He stated that he has already taken up the project with the Federal Minister of Railways.

Extensions Have Been made to three industrial plants in Woodstock recently and 30 new residences built. Forty permits were issued in the past month, amounting to $21,426, as compared with $7,258 for July last year. The total for the city so far this year is $117,202, as compared with $75,634.

A railway amalgamation, under a total capital of £348,000,000 is announced from London. The reorganization includes the Great Central Railway, Great Eastern Railway, Great Northern Railway, Great North Scot and Railway, North British Railway, North Eastern Railway and twenty-six small companies.

The Mountain Lumber Manufacturers' Association of British Columbia, announces a reduction of fifty cents per thousand feet in the delivered prices of all principal grades of lumber in order that the benefit derived from lower lumber freight rates to prairie points may be passed on to buyers and consumers of lumber.

Working night and day in their boiler department, the plant of the John Inglis Co., Toronto, is the scene of great activity. With the exception of a number of vulcanizing cylinders for the Goodyear Tire Co., and some extensive replacement work on a 500-ton blast furnace, they report that the demand is quite general and applies largely to their Kawanee type of heating boiler. Quite an amount of tank work is also being done.

Sydney, N. S.—A second blast furnace may be blown in at the Sydney plant of the British Empire Steel Corporation in the near future, if general labor and business conditions permit, it is stated here officially. The second furnace will make pig iron for foundry purposes, a branch of the market which has shown much improvement lately. It is also reported that a battery of ninety coke ovens will also be put into operation.

Amherst, N. S.—Work on the car-wheel order at the Canada Car plant is proceeding. It is expected that when work is fully under way the number of men will be increased to thirty. The order from the C.N.R., as stated before, is for 2500 wheels and to this there has been added another small order from the C.P.R. at Kentville for 100 more. These are for use on the Dominion Atlantic road. It is hoped that before these contracts are completed there will be many more of the same kind.

The Johns-Pratt Co., Hartford, Conn., whose selling arrangements through Johns-Manville Inc., were recently dissolved by mutual consent, have established a Boston office at 161 Summer Street, which is in charge of Daniel Fitts and Harold E. Morse. It is intended to have complete representation at this office for the following products of the company—Noark fuses and meter protective devices, also the Johns-Pratt moulded products.

By the Completion of the hydro power plant at Ranney Falls, Ont., 10,000 horsepower will be added to the electric supply of Central Ontario system. The plant will be completed about middle of August. In the meantime there has been a power shortage in this district, and the water level of Rice Lake may be lowered temporarily to relieve the situation. It is not unlikely that another power plant may be installed a half mile below Ranney Falls, which would produce 4,500 horse power.

It is reported from Montreal, that the United Brotherhood of Maintenance of Way Employees and Railway Shop Laborers, had reached an agreement with Canadian railways. Negotiations will be continued in regard to reduction in rates of pay made effective July 16. As a consequence of this understanding the employees' representatives have withdrawn their application made to the Minister of Labor for the establishment of a board of conciliation and investigation. The announcement continues that the interim agreement under which wages have been reduced since July 16, fully protects the interests of the employees until such time as definite agreement can be entered into.

Claiming That 77 Cents an hour is barely adequate under present living conditions, James Size, chairman of the Shop Crafts Federation, M.C.R., told the Conciliation Board at St Thomas, that a railway mechanic engaged at ordinary manual labor requires at least $1,958.24 to provide for himself, wife and children. Many of the estimates submitted in coming to this conclusion were exceptionally low, it was claimed, especially the $240 appropriated for house rent and $675.03 for food. Clothing for the mechanic was estimated at $152.11; for the wife, $117.59; for a boy of 12 years, $89.18; a girl of eight years, $81.16, and boy of five years, $50.02 a year. Among other items included in the budget were: Fuel and light, $188.30 per year; maintenance of home furnishings, $79.37; Labor organizations and church, $20; amusements, $30; car fare, $40; insurance, $40, and laundry and assistance for wife, $25.

There will be a Stratford show at Toronto Exhibition this year. The Chamber of Commerce Commission have charge of arrangements.

The Canadian Edison Appliance Co. Stratford, has changed its name to that of Hotpoint Works Division of the Canadian General Electric Company. R. S. Morgan is manager.

Stratford reports unusual activity in building. Sixty-six dwellings have been authorized this year and the total value of all new buildings up to the end of July was $602,181 as against $189,799 last year.

To construct a railway in Peru, 2400 miles long and at a cost of $120,000,000, is the concession for which Robert W. Dunsmuir, Vancouver, B. C., has been recommended to Congress by the Peruvian Government. It is described as one of the largest and most important concessions ever negotiated in Latin America.

The hourly wages of skilled mechanics employed by the American railroads are 25% higher than those paid skilled mechanical employees of other industries in the country at the first of the year. Wage rates in private industry have declined in the past six months, so that the comparative position of railroad shopmen and other shop workers in private industry is at present more marked than generally supposed. These figures are based on a report covering the wages of 388,560 men employed in 1,338 plants, or 73% of all the wage earners in foundries and machine shops as shown by the census of manufactures in 1919, and can therefore be regarded as thoroughly representative of the conditions existing in foundries and machine shops.

Ottawa.—With a population of 5,371,315 Canada exported produce to the value of $33 per head in 1901, as compared with a population of 8,750,000 in 1920 and exports per capita of $147, according to government statistics. The value of exports in 1901 was $117,776,044, as against $1,286,658,709 in 1920.

Ottawa.—Canada's production of gold since 1862 up to the middle of 1922 has reached a grand total of approximately $448,617,107. The silver output of the Dominion during the same period amounted to $265,292,685, while the value of copper produced up to the present time has reached approximately $270,529,237. The amount of nickel amounts to $173,473,403, while $54,000,000 in lead and $20,000,000 in zinc have been produced. The aggregate value of these metals have reached $1,271,912,432.

Ottawa.—A revised estimate of the areas sown to the principal grain crops, hay and potatoes, has been issued by the Dominion Bureau of Statistics. Wheat is reported as occupying 22,628,900 acres, a decrease of 3%; oats 17,183,500 acres, increase 1%; barley 2,732,000 acres, decrease 2%; peas 190,300 acres, or 1% less; mixed grains 865,650 acres, or 1% more. Rye continues to expand, the estimated area this year being 2,480,000, or 35% more than in 1921. The areas sown to hay and clover and potatoes are 10,858,100 acres and 693,600 acres respectively.

Sherbrooke.—The manufacture of finished asbestos products is no longer to be confined to the United States and Europe, but the region supplying practically 87% of the world's supply of the raw material is to engage in the finished manufacture. Plans have been completed by the Johns-Manville Co., Ltd., for the enlargement of their plant at Asbestos, Quebec, where it is expected to be able to take care of all the Canadian requirements of manufactured asbestos products. The Johns-Manville Company is already operating plants in Illinois and New Jersey.

Winnipeg.—Forty-one thousand harvesters will be required to handle the prairie crops this year, it was announced following a meeting of representatives of the railways, western labor commissioners, and the grain trade interests. The rates of wages discussed were $3.50 a day for harvesters and $4.00 a day for threshers. The harvester excursions will continue from Eastern Canada until August 25.

Construction on the various sections of the new Welland canal is now in full swing. The Lyall Co. have 550 men busy on sections 3 and 4. It is planned to lay 2,000 cubic yards of concrete daily at lock 6. Canadian Dredging Co. has four dredges and 250 men at work on section 5, and Porter Bros. have 1,000 men working.

The International Nickel Co., have just completed a large mill for rolling. This is of very large capacity and was installed in order to allow them to speed up delivery on rolled stock of all kinds.

The International Nickel Co. have entered upon an aggressive sales policy which they hope will increase and stimulate the sale and uses of Monel metal. Speaking to Canadian Machinery on this matter, Mr. Peckover, of Peckover's Ltd., Toronto, says: "We have been appointed exclusive distributors in Ontario, and are now carrying complete stocks of all sizes and shapes, so that firms can order direct from our warehouse and avoid delay. Other distributing points are being opened up in other large cities, but as mentioned previously we are the only ones to act in this capacity in Ontario."

Mr. Hollinrake of the A. R. Williams Machinery Co., Toronto, tells us that the plans for the new machinery hall for the Toronto exhibition have now been passed upon. In order to allow exhibitors, and prospective exhibitors, to study these plans, they will be displayed at the present hall this year, and it is more than likely that a special meeting will be held during the exhibition, when all parties concerned will have a chance to discuss the different angles of the situation.

Steel Company of Canada, Hamilton, are making extensive replacement repairs on one of their blast furnaces.

Galt, Ont.—A small fire at the plant of the Galt Malleable Iron Co., on civic holiday caused damage to the extent of several thousand dollars. No reduction in staff will result and rebuilding will be started immediately.

Belleville reports a new industry, the Bassick Mfg., Co., Chicago, manufacturers of the Alemite system of lubrication. The company is repoted to have five branches in the United States and will establish sales branches in Canadian cities.

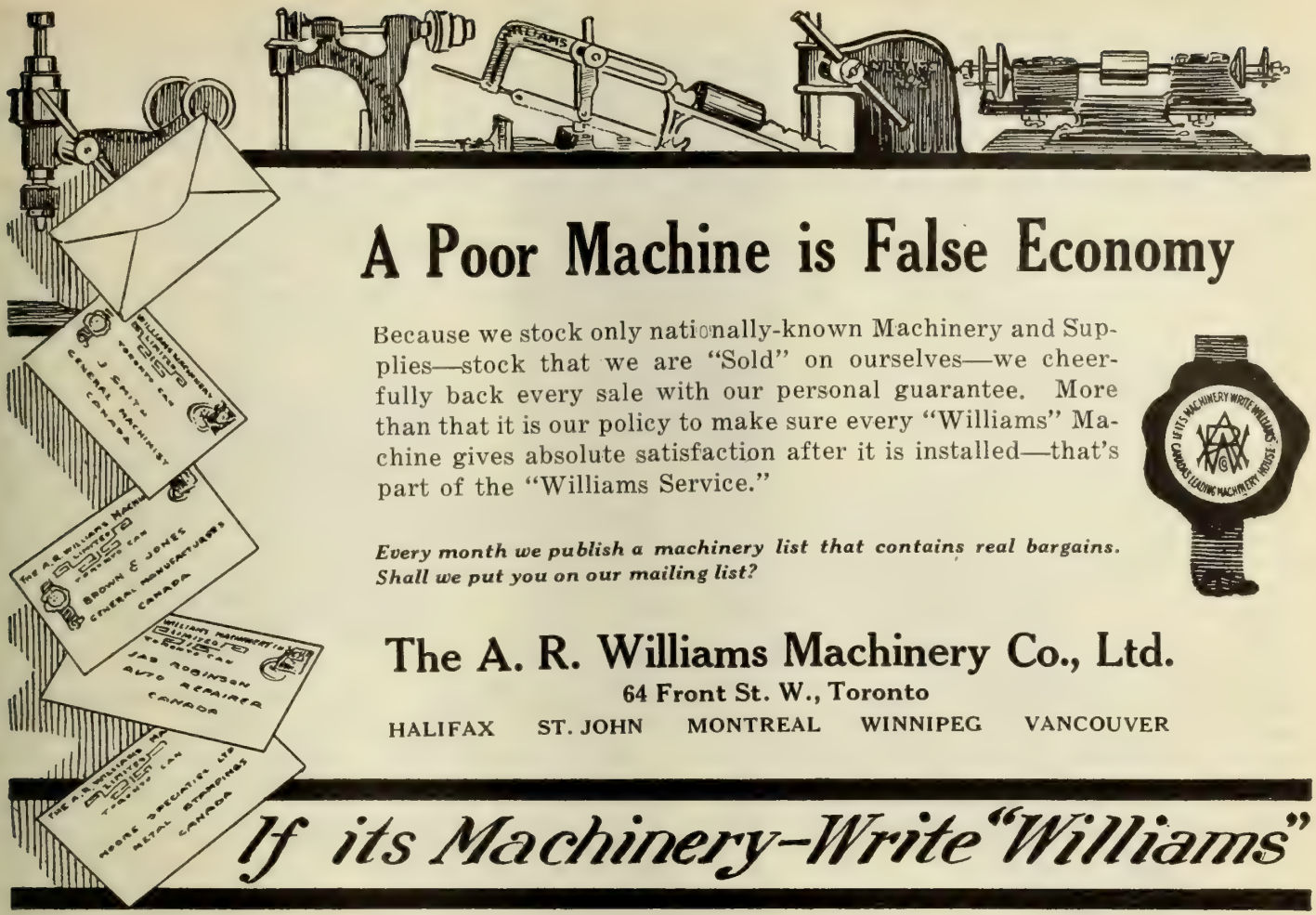
Speaking to A. H. Rolstein, of the Sanitary Wiping Products Co., 239 W. Richmond St., Toronto., Canadian Machinery finds that he has made a reduction of approximately 20 per cent. in his line of sterilized wiping rags, this to take effect immediately.

Sydney, N. S.—Twelve steamers are engaged in the export of iron ore from Wabana, Newfoundland, to Germany via Rotterdam. It is stated at the Sydney headquarters of the British Empire Steel Corporation that about three-quarters of a million tons will have been exported before the end of the calendar year. It is further stated that payment for the ore is being made in English funds.

Speaking to Canadian Machinery, Mr. F. Selway of the Office Specialties Co., Toronto, said that sales show a splendid improvement in their lines. He mentioned that they have just secured several government and municipal orders, these including the suplying of steel upright cabinets, fire walls, efficiency desks, chairs, etc. These orders are coming in from a very wide territory, being all the way from Halifax o Vancouver.

STEEL INDUSTRY FOR B. C.

British Columbia legislature will encourage the establishment of a steel industry in that province. The announcement was made following a Cabinet meeting, to representatives of the Coast Range Steel Company, a $15,000,000 corporation organized a year ago, under H. X. Landahl. According to the announcement, the provincial government will unite with the Imperial and Canadian governments and guarantee as its share, bonds not to exceed $4,000,000. Under plans which have been discussed by the steel people with the British Columbia government and the facilities committee of the Imperial Board of Trade, the total investment in the plant will run to $12,000,000 for the production ultimately of 120,000 tons of finished steel.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If its Machinery—Write "Williams"

TO BUILD HEAVY MACHINERY

At the annual meeting of Vickers, Limited, held in Montreal recently, A. R. Gillham, managing director, stated that the company has decided to enter into the manufacture of heavy mining and industrial machinery.

They have already completed arrangements with several leading English and American firms to build to their design such patented lines as conical mills, lime and cement kilns, trucks, skips, cages, rotary dryers, coal washing equipment and general mining equipment, and as well, had secured the manufacturing rights for Canada for the Vickers-Petters Semi-Diesel engine. Mr. Gillham stated that the company had secured the rights for Canada, as well as for Vermont, Massachusetts, Maine and New Hampshire, for building sea sleds to the design of A. Hickman of the Sea Sled Co.

He further reported that, in addition to its floating dock and ship repair yard at Maisonneuve, the company this year had opened an office on the harbor front, to deal with ship repairs while in berth. The following were elected as the board of directors of the company for the ensuing year: Sir Trevor Dawson, Sir Vincent Caillard, Sir James McKechnie, Preble Macintosh and A. R. Gillham.

UNEMPLOYMENT INSURANCE

That unemployment is a problem for industrial management rather than public insurance is the conclusion arrived at by the U. S. National Industrial Conference Board. Discussing unemployment insurance in theory and practice, it is claimed that the basis for applying public insurance to the relief or prevention of unemployment without enormous cost, did not exist. Among other things, it is pointed out that the political organization of the country would make the adoption of a national system of unemployment insurance impossible without constitutional changes, and the country's vast extent, diversified industries and social composition would create under such a system an administrative problem of gigantic proportions and cost. If, on the other hand, a system of unemployment insurance were to be built up by the separate states, the complications arising from attempting co-operation between the states in the placement of workers and adjustment of compensation would likewise present administrative problems of difficulty, especially in view of the probability that the legislation in the separate states would differ widely. In addition to these difficulties is the fact that there does not exist in most states either a system of labor exchanges or comprehensive organizations of wage earners, either one of which European experience indicates as a necessary basis for a public insurance scheme.

TOURISTS LEFT MUCH MONEY

Department of Customs reports that during the past year, 617,285 cars toured Canada, as against 93,300 in 1920. All but two thousand cars remained in the Dominion for less than one month. This motor traffic meant an expenditure in Canada of $108,000,000, and it is estimated that on a basis of five per cent. "improved roads are worth over two billion dollars without taking into account the service they render Canadians themselves." The parks branch estimate of expenditure in Canada by motor tourists is based on a stay of seven days for the larger number of cars and thirty days for the smaller number, while the daily expenditure for the former is put at $25 and $20 for the latter.

With the installation of camping sites throughout the country, the touring traffic will undoubtedly increase and the present year is likely to show a record. All of this means good business to the garage, or to machine shops equipped to do repair work, regrinding, etc.

PERIOD OF BETTER BUSINESS

(Continued from page 40)

tivity, writes J. A. McGibbon, Oshawa Board of Trade. "All factories are busy and there has been very little unemployment. The Pedlar people have been filled to capacity with orders along all lines of work. The motor industry has been very active, and the new models are being well received.

"Building operations are progressing favorably both in business and residential lines. In fact there has been more activity than usual in this line. The hospital is building a new wing, called the McLaughlin Memorial Wing, and St. George Anglican Church has commenced the erection of a new church. The Alger Press is preparing a new home, due to increased business. Several additions to buildings are in course of construction.

"The W. E. Phillips Co., Limited, who are occupying the former Thornton Rubber Co. factory, are a new concern and are already showings signs of growth.

"The Feldspar Glass Co. are making additions in the shape of large shipping rooms, while the Potteries Company, Ltd., are reported to have purchased the Reed property on the Kingston road, a two story brick structure.

"The McCulloch Brass Co., have taken over the works of the Parks Foundry Co., and are reported to be very busy at the present time."

PITTSBURG

(Continued from page 39)

for two months at 75 per cent., which is approximately the present rate.

Connellsville steam coal declined until it reached $6.00 August 1, whereupon some buyers entered the market again and prices have stiffened to a range of $7.00 to $7.50, fully $1 below the recent high point on this movement. Connellsville foundry coke is $15 to $15.50, both demand and offerings being limited.

The pig iron market has disappeared except as to small prompt lots. Furnaces are in no position to figure closely on prices for fourth quarter and consumers are indisposed to negotiate, realizing that this is no time to buy, when nearly all merchant furnaces are out of blast and a new market will have to be made when coke becomes available again to the ordinary buyer. There is only a prompt, practically a spot, market in pig iron, and this is higher, at $26 for Bessemer and $27 for foundry, valley. Last sales of basic were at $25, valley, representing the market's recovering the $1 loss sustained early in July.

The oxygraph is a machine for operating an oxy-acetylene cutting torch, and is designed to reproduce any outline drawing, pattern or template in full or half scale, cutting to the shapes in wrought iron or steel.

Introducing

E. T. SPIDY
Asst. Supt. Dominion Engineering Works.

BORN in 1887 in Brighton, England, receiving his early schooling in Australia and New Zealand and returning to England to finish his education, completing same by taking Mechanical Engineering Course at Brighton College of Technology, is a brief history of the early years of the assistant-superintendent of the Dominion Engineering Works, Limited, Rockfield P.Q. Immediately after this, Mr. Spidy became an apprentice in the shops of the London, Brighton and South Coast Railway. Five years were spent completing the apprenticeship, after which he worked for a year and a half in the same shops as a tool fitter. In 1909 he came to Canada, and entered the employ of the Canadian Pacific Railway in the piecework department of the Angus shops. At that time the Angus shops were being reorganized by H. H. Vaughen who had employed as management engineer, H. L. Gantt to introduce schedule and efficiency methods. Mr. Spidy's duties kept him in close touch with Mr. Gantt and he frankly admits that it is his contact with him and other big men, with big ideas, that have made his progress.

In 1911, he was transferred to the C.P.R. Toronto shops and in 1912 to the C.P.R. Winnipeg shops as asst.-general foreman with instructions to install the schedule methods established at Angus. Later, he was made shops engineer at Winnipeg when the whole plant maintenance was included in his duties.

During his last year at Winnipeg, Mr. Spidy lectured in the University of Manitoba on power plant design and machine design. At this time he felt a desire to broaden his experience and to apply his efficiency and production ideas to industrial plants.

Thus, in 1917 he accepted the position of production engineer at Canadian Ingersoll Rand Company's Sherbrooke plant. Late in 1919 however, the call from his previous associates on the railway proved too strong and he returned to the C.P.R. Angus shops as production engineer, where he remained until 1921 when he accepted the appointmnt of assistant-superintendent of the Dominion Engineering Works, which position he still holds. He is an associate member of the Engineering Institute of Canada and of the American Society of Mechanical Engineers.

Mr. Spidy insists that the study of production is the most fascinating in the world. Outside of engineering his leisure time is devoted to his family, who, including himself are musicians and the younger members he hopes are coming musicians. He also is an ardent fisherman and hopes some day, he says, to be a real fisherman.

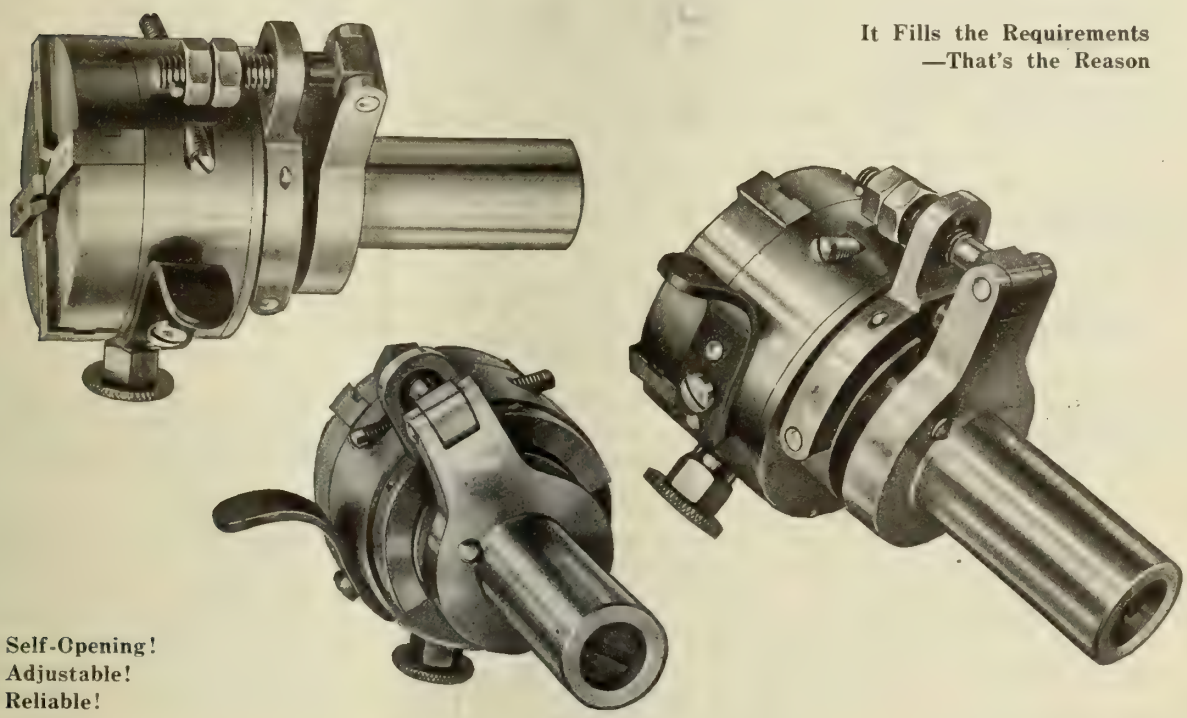
ELECTRICAL TRADE BEST

At the annual meeting of Vickers', Ltd., Sheffield, Eng., the chairman, Douglas Vickers, reviewing the year's operations, stated that the electrical trade still showed up best. There were few enquiries for ships, steel products or railway materials, but motorcars on the other hand were selling quite well. As to the cause of bad trade, the condition of Russia and impoverished Central Europe seemed inadequate as an explanation, and the chief cause must be at home, as far as engineering was concerned. Customers for engineering products, machinery, etc., were on strike. These goods were purchased almost entirely on capital account and paid for out of profits or raised by new subscription. Excessive taxation had almost stopped the former and as to the latter, investment of new money in plant at prices that were still high as compared with past years, offered little attraction to the investor, who could get a return from trust securities that compared not unfavorably with that of ordinary shares before the war. For the moment the outlook was still gloomy but there were points that indicated that the skies might clear.

A pantagraph frame supports a machine cutting torch and the small electric motor that operates the feed gear; this comprises a knurled driving wheel or disc geared to the motor through worm and spur gearing and mounted in the fork of a swiveled vertical member. This part is free to turn in any direction required. Thus means are provided for moving the torch mechanically in any horizontal direction at a uniform rate, the speed of which may be varied within wide limits.

The High Mark In Screw Cutting

The Geometric Style DS Die Head touched High Mark in popularity at a time when Buying was at Low Mark



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Brown & Sharpe Automatics, as well as other single spindle machines, needed just such a Screw-Cutting Die Head—and the Geometric DS is it. With a DS Die Head on the machine there is:

No reversing of the spindle to back the Die Head off the threaded work.

No stripping and shaving of threads, for the Die Head floats to suit the thread being cut, and does not depend on the turret feed.

No burden of tripping the Die Head, because of the easily adjustable lever trip, which lightens the reaction on the threads as they are cut.

No shock and wear, even when closing the Die Head rapidly, because of the spring closing attachment.

No face plate necessary, allowing the use of projecting chasers when cutting is close to shoulder.

No cutting of taper threads for the chasers have long bearings in the Die Head skeleton and are supported by hardened keys, which prevent tilting.

Consider the economy of these Die Heads with micrometer adjustment, over the use of a button die with no adjustment.

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FOR SALE OR ROYALTY—CANADIAN PATent No. 214964 on resilient wheel for automobiles and trucks, absorbs the shock in the leaf spring spokes of the wheel, either hard rubber or pneumatic tires may be used; simple, practical and substantial in construction. Reasonable terms. Wm. H. Schlake, Yuma, Colo.

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Brass, Alum. Castings—Wood, Metal Patterns.

Corbet Foundry & Machine Co. Ltd.
OWEN SOUND, ONT.
Grey Iron, Brass.

Fittings Limited,
OSHAWA, ONT.
Malleable, Grey Iron, Brass, Aluminum.

John T. Hepburn, Limited
TORONTO, ONT.
Grey Iron.

W. W. Wells
370 Victoria Street, TORONTO, ONT.
Nickel and Monel Metal.

The Robert Mitchell Co., Ltd.
64 Belair Ave., MONTREAL.
Light Grey Iron.

Canadian Steel Foundries, Ltd.
MONTREAL, QUE.
Steel and Ferro-Alloy.

Langley & Austin,
GALT, ONT.
Copper, Bronze, Brass and Aluminum.

Maxwells, Limited
ST. MARYS, ONT.
Light Grey Iron, Tinning same a specialty.

The Eureka Planter Co., Ltd.,
WOODSTOCK, ONT.
Specialty Light Grey Iron.

Lindsay Foundry and Pattern Works, Limited
Victoria Avenue, LINDSAY, ONT.
Grey Iron.

Dominion Engineering Works, Limited
MONTREAL, QUE.
Grey Iron.

Smith's Falls Malleable Castings, Limited
SMITH'S FALLS, ONT.
Malleable.

Joliette Steel Co.
JOLIETTE, QUE.
Electric Steel and Ferro-Alloy.

International Malleable Iron Company, Limited
GUELPH, ONT.
Malleable.

Getting The Business
You Can Do Likewise
A Few Panels For Sale

APPLY

Canadian Machinery & Mfg. News
143 University Avenue,
TORONTO, CAN.

BRANTFORD BRASS FOUNDRY COMPANY
BRANTFORD, ONTARIO
FOUNDRY AND OFFICE 33 LEONARD ST

June 27th., 1922

The MacLean Publishing Co., Limited
Toronto, Ont.

Gentlemen:-

We wish to inform you that we have had quite satisfactory results from our advertisement in Canadian Machinery and Manufacturing News, which runs under the classified heading " Where to Buy your Castings ".

Yours Truly,
Brantford Brass Foundry Company.
per David McCabe

Canadian Machinery BUYERS DIRECTORY

If what you want is not here, write us, and we will tell you where to get it. Let us suggest that you consult also the advertisers' index— last page of book, after having secured advertisers' names from this directory. The information you desire may be found in the advertising pages. This department is maintained for the benefit and convenience of our readers. The insertion of our advertisers' names undr proper headings is gladly undertaken, but does not become part of an advertising contract.

ABRASIVE DISCS
J. R. Baxter & Co., Ltd., Montreal, Que.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John, London, S.E., Eng.

ABRASIVE MATERIALS
J. R. Baxter & Co., Ltd., Montreal, Que.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John, London, S.E., Eng.

ACETYLENE, DISSOLVED
Carter Welding Co, Ltd., Toronto.
Dominion Oxygen Co., Toronto.
Liquide Air Company, Toronto.

ANCHOR BELTS
Steel Co. of Can. Ltd., Hamilton, Ont

ANGLE BARS
Steel Co. of Can. Ltd., Hamilton, Ont.

ANVILS
Aikins & Co., Inc., E.C., Indianapolis, I.
Petrie, Ltd., H. W., Toronto, Ont.

ANCHOR BOLTS
Steel Co. of Can., Ltd., Hamilton, Ont.

ANGULAR HOLE DRILLING TOOL
Globe Engineering Co., Ltd., Hamilton, Ont.

ARBORS
Atkins & Co., Inc., E. C., Indianapolis,
Brown & Sharrpe Mfg.Co., Providence,R.I
Jacobs Mfg. Co., Hartford, Con.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.

BELLS, BRASS, BRONZE and STEEL
Canada Foundries & Forgings Co., Welland, Ont.
Canadian SKF Co., Toronto, Ont.

BARRELS, TUMBLING
McDougall Co., Ltd., R., Galt, Ont.

BARS, BORING
Armstrong Bros. Tool Co., Chicago, Ill.
Bertram & Son Co., td., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

BARS, BORING, PORTABLE
Underwood Corp., H. B., Philadelphia.

BARS, STEEL
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
British Empire Steel Corporation, Montreal, Que.

BEARINGS, BALL
Canadian SKF Co., Toronto, Ont.

BEARINGS, ROLLER
Can Fairbanks-Morse Co., Ltd., Montreal, Que.

BELT CEMENT
D K McLaren Co., Ltd., Montreal, Que.
McLaren Belting Co., J. C., Montreal, Que.

BELT DRESSINGS AND FILLERS
Dom Belting Co., Ltd., Hamilton, Ont.
D K McLaren Co., Ltd., Montreal Que

BELT FASTENERS
Bristol Company, Waterbury, Conn.
D K McLaren Co., Ltd Montreal, Que
McLaren Belting Co., J.C., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

BELT HOOKS
Bristol Co., Waterbury, Conn.
D. K. McLaren Co., Ltd., Montreal, Que

BELT LACING
Bristol Company, Waterbury, Conn.
D. K. McLaren Co., Ltd., Montreal, Que.
McLaren Belting Co., J. C., Montreal,

BELT LACING, STEEL
Bristol Company, Waterbury, Conn.

BELT LACING MACHINES
D. K. McLaren Co., Ltd., Montreal, Que.
McLaren Belting Co., J. C., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

BELTING, CHAIN
Can. Link-Belt Co., Toronto, Ont.
Fittings, Limited, Oshawa, Ont.
Jones & Glassco, Montreal, Que.
Renold (Hans) of Canada, Ltd., Montreal, Que.

BELTING, FABRIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Dom. Belting Co., Ltd., Hamilton, Ont.
D K McLaren Co., Ltd., Montreal, Que
McLaren Belting Co., J. C., Montreal, Que.

BELTING, LEATHER
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Can. Fairbanks-Morse Ltd., Montreal, Q.
D K McLaren Co., Ltd., Montreal, Que
McLaren Belting Co., J. C., Montreal, Que.
Smith Belting Co., Toronto, Ont.

BOLTS AND NUTS
British Empire Steel Corporation, Montreal, Que.
Fittings, Limited, Oshawa, Ont.
National Acme Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont

BOLT THREADING DIE HEADS
Landis Machine Co., Inc., Waynesboro Pa.

BOLTS, TRACK
Steel Co. of Canada, Ltd., Hamilton, Ont.

BORING and TURNING MILLS, Vertical
Bertram & Sons Co., Ltd., The John Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

BORING, DRILLING and MILLING MACHINES, Horizontal.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
Landis Tool Co., Waynesboro, Pa.
Vertical
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
McDougall Co., Ltd., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont
Rockford Drilling Machine Co., Rockford,

BORING TOOLS
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.

CASTINGS, ALUMINUM, BRASS, BRONZE, COPPER, DIE-MOLDED, FERRO-ALLOY, IRON, SEMI-STEEL, STEEL.
See "Where to buy your castings" Section. Page number may be found by turning to Advertisers' Index.

CHAINS, DRIVING
Can. Link-Belt Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont
Jones & Glassco, Montreal, Que.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

CHASERS
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, a.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CHUCKING MACHINES
Acme Machine Tool Co., Cincinnati, O.
Brown & Sharpe Mfg. Co., Providence, R. I
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

CHUCKS, DRILL AND TAP
Can Fairbanks-Morse Co., Ltd., Montreal.
Canadian SKF Co., Toronto, Ont.
Cushman Chuck Co., Hartford, Conn
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Skinner Chuck Co., New Britain, Conn
Union Mfg., New Britain, Conn.

CHUCKS, LATHE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Cushman Chuck Co., Hartford, Conn
Geometric Tool Co., New Haven, Conn
Gisholt Machine Co., Madison, Wis.
Ker & Goodwin Machine Co., Brantford Ont.
Petrie, Ltd., H. W., Toronto, Ont
Pryibil Machine Co., New York, N Y
Skinner Chuck Co., New Britain, Conn
Union Mfg. Co., New Britain, Conn

CHUCKS, MAGNETIC
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CHUCKS, PLANER
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cushman Chuck Co., Hartford, Conn
Skinner Chuck Co., New Britain, Conn
Union Mfg. Co., New Britain, Conn

CHUCKS, TAPPING
William L. Procunier, Chicago, Ill

CHUCKS, VERTICAL BORING MILL
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis
Skinner Chuck Co., New Britain, Conn
Union Mfg Co., New Britain, Conn

CLAMPS, MACHINISTS'
Brown & Sharpe Mfg Co., Providence.
Starrett Co., L. S., Athol, Mass.

CLEANERS, METAL, WASTE, GENERAL
Oakley Chemical Co., New York, N Y

CLOCKS
Chicago Watchman's Clock Co Chicago.
Hardinge Bros., Limited, Toronto, Ont

CLOCKS, TIME
Gisholt Machine Co., Madison, Wis.

CLOCKS, WATCHMEN'S
Chicago Watchman's Clock Co., Chicago, Ill.
Hardinge Bros., Limited, Toronto, Ont.

For list of Dealers see the last page of This Buyers Directory

BELTS, ABRASIVE
Oakey & Sons, Ltd., John, London, S.E., Eng.

BENDING MACHINES, POWER
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bertrams Ltd., Edinburgh, Scotland.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

BILLETS, BLOOMS and SLABS
Steel Co., of Can. Ltd., Hamilton, Ont.

BLOCKS
Wright Mfg Co., Lisbon, Ohio.

BLOCKS, CHAIN (See Hoists, Hand)
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

BLOCKS, DIE
Canada Foundries & Forgings Co., Welland, Ont.

BLOCKS, PILLOW
Can. Link-Belt Co., Toronto, Ont.

BLOWERS
Can Blower & Forge Co., Ltd., Kitchener, Ont.
Petrie, Ltd., H. W., Toronto, Ont

BOILERS, LOCOMOTIVE
Goldie & McCulloch Co., Ltd., Galt,

BOLT AND NUT MACHINERY
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Montreal, Que.

BOLT AND NUT MACHINERY, Automatic
National Acme Co., Cleveland, Ohio.

BUCKET CARRIERS, Pivoted
Can. Link-Belt Co., Toronto, Ont.

BUFFERS
Pryibil Machine Co., New York, N Y

BUFFING OR POLISHING MACHINES (See Polishing and Buffing Machines)
Blount Co., J. G., Everett, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Pryibil Machine Co., New York, N Y
U. S. Electrical Tool Co., Cincinnati, O.

BUILDING MATERIALS
Bertram & Son Co., Ltd., The John Dundas, Ont.

BURNERS, OIL AND GAS
Rockwell Co., W S., New York City.

BURRS
Steel Co. of Can. Ltd., Hamilton, Ont

CABINETS, OIL
S. F. Bowser & Co., Ltd., Toronto, Ont

CALIPERS
Brown & Sharpe Mfg Co., Providence, R. I.
Starrett Co., L. S., Athol, Mass.

CAMS
Canada Foundries & Forgings Co., Welland, Ont.

CAN-MAKING MACHINERY (See Sheet Metal Working Machinery)
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Bliss Co., E. W., Brooklyn, N Y
Smooth Mfg. Co., Jersey City, N. J.

CARBONIZING
Chapman Double Ball Bearing Co., Toronto.

CEMENTS, IRON CENTERING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.

CHAINS (See Sprockets and Chains)
Reynold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg Co., Lisbon, Ohio

CHUCKS, DRILL
Jacobs Mfg Co., Hartford, Conn.

CARD CLOTHING
D K McLaren Co., Ltd., Montreal, Que

BUYERS' DIRECTORY

CLUTCHES, FRICTION
Can.-Link-Belt Co., Toronto, Ont
Johnson Machine Co., Carlyle, Manchester, Conn.

COAL AND ASH HANDLING MACHINERY
Can.-Link Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

COAL-STORAGE SYSTEMS
Can. Link-Belt Co., Toronto, Ont.

COLLARS, SHAFT OR SET
Canada Foundries & Forgings Co., Welland, Ont.
Can. Link-Belt Co., Toronto, Ont.

COLLETS
Butterfield & Co., Inc., Rock Island, Que.
Hardinge Bros., Inc., Chicago, Ill.
Hendley Machine Co., Torrington Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

COMPOUNDS, CLEANING
Oakley Chemical Co., New York, N.Y.

COMPOUNDS—CUTTING, DRILLING, GRINDING, SCREW CUTTING
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Oakley Chemical Co., New York, N.Y.

COMPRESSORS, AIR AND GAS
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.

CONES, FRICTION
Norton Co., of Can. Ltd., Hamilton, Ont.

CONNECTING RODS AND STRAPS
Canada Foundries & Forgings Co., Welland, Ont.

CONTRACT WORK
Victoria Foundry Co., Ltd., Ottawa, Ont.

CONVEYORS AND ELEVATORS (SEE ELEVATORS)
Jones & Glassco, Montreal, Que

COTTERS
Steel Co. of Canada, Ltd., Hamilton, Ont.

COUNTERBORES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

COUNTERS, REVOLUTION
Starrett Co., L. S., Athol, Mass.

COUNTERSHAFTS
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Johnson Machine Co., Carlyle, Man-
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

COUNTERSINKS
Butterfield & Co., Inc., Rock Island, Que.
Pratt &Whitney Co., of Canada, Ltd., Dundas, Ont.

COUPLERS, CAR AND LOCOMOTIVE
Can. Steel Foundries, Montreal, Que.

COUPLINGS
Steel Co. of Canada, Ltd., Hamilton, Ont.

COUPLINGS, PIPE
Fittings, Limited, Oshawa, Ont.

COUPLINGS, SHAFT
Can. Link-Belt Co., Toronto, Ont.

CRANES, ELECTRIC
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can.-Link-Belt Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls Ont.
Northern Crane Works, Walkerville, Ont.

CRANES, LOCOMOTIVE
Can. Link-Belt Co., Toronto, Ont.

Bertram & Son Co., td., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

CRANK PIN TURNING MACHINE
Underwood Corp., H.B., Philadelphia, Pa.

CUTTERS, GEAR
Brown & Sharpe Mfg. Co., Providence, R. I.
Butterfield & Co., Inc., Rock Island, Q. Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CUTTERS, HIGH SPEED
Atkins & Co., Inc., E. C., Indianapolis.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CUTTERS, MILLING
Brown & Sharpe Mfg. Co., Providence, R. I
Butterfield & Co., Inc., Rock Island. Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.

CUTTERS, STAY BOLT
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.

CUTTING-OFF MACHINE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

CUTTING OFF MACHINES, PIPE (SEE PIPE-CUTTING AND THREADING MACHINES)
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.

CUTTING-OFF TOOLS
Armstrong Bros. Tool Co., Chicago, Ill.

CUTTING OIL FILTERS (SEE OIL FILTERING SYSTEMS
Bowser, S. F. & Co., Ltd., Toronto.

CUTTING, OXY-HYDROGEN
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Ltd., Toronto, Ont.

DEALERS, MACHINERY (SEE SEARCHLIGHT SECTION)
Petrie, Ltd., H. W., Toronto, Ont.

DETACHABLE CHAIN
International Malleable Iron Co., Guelph, Ont.

DIAMONDS, BLACK AND ROUGH
Can. Desmond-Stephan Mfg Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

DIAMOND TOOLS
Can. Desmond-Stephan Co., Hamilton,
Wheel Trueing Tool Co., Windsor, Ont.

DIAMOND CROSSINGS
Can. Steel Foundries, Montreal, Que.

DIAMONDS, IMPORTERS
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Co., Windsor, Ont.

DIES, SCREW AND THREAD CUTTING
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.

DIES, SHEET-METAL AND SUB-PRESS (See Tool Work)
Brown, Boggs & Co., Ltd., Hamilton, Ont.

DIES, FORGING
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

DIES, SELF-OPENING, ADJUSTABLE
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Landis Machine Co., Inc., Waynesboro,
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DIES, THREADING-OPENING
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DIVIDING HEADS
Burke Machine Tool Co., Conneaut, Ohio.
Hendey Machine Co., Torrington, Conn.
Kearney & Treacker Co., Milwaukee, Wis.
Petrie, Ltd., H. W. Toronto, Ont.

DOGS, LATHE AND MILLING MACHINE
Armstrong Bros. Tool Co., Chicago, Ill.

DRAFTING MATERIALS
American Lead Pencil Co., New York City, N.Y.

DRESSERS, GRINDING WHEEL
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ont.
Norton Co., of Can., Ltd., Hamilton.
Wheel Trueing Co., Windsor, Ont.

DRESSING TOOLS
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Co., Windsor, Ont.

DRILL HOLDERS
Armstrong Bros. Tool Co., Chicago, Ill

DRILLING MACHINES, BENCH
Burke Machine Tool Co., Conneaut,, Ohio.
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Hardinge Bros., Inc., Chicago, Ill.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
U. S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, ELECTRIC AND HAND
Can. Fairbanks-Morse Co., Ltd, Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, GANG
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd, Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

DRILLING MACHINES, HEAVY DUTY
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
Rockford Drilling Machine Co., Rockford, Ill.

BORING, DRILLING AND MILLING MACHINES, (HORIZONTAL.)
Gisholt Machine Co., Madison, Wis.

DRILLING MACHINES, Multiple Spindle
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
National Acme Co., Cleveland, Ohio.

DRILLING MACHINES, Pneumatic
Cleveland Pneumatic Tool Co., Toronto. Ont.

DRILLING MACHINES, PORTABLE
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, RADIAL
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto,

DRILLING MACHINES, SENSITIVE
Burke Machine Tool Co., Conneaut, O
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Williams Machinery Co., A. R., Toronto.
Wisconsin Electric Co., Racine, Wis

DRILLING MACHINES, TURRET
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wisconsin.
Williams Machinery Co., A. R., Toronto.

DRILLING MACHINES, VERTICAL
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

DRILLS, CENTRE
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DRILLS, HIGH SPEED TWIST
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Cleveland Twist Drill Co., Cleveland, O
Greenfield Tap & Die Corp., Galt, Ont
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DRILLS, RATCHET
Armstrong Bros. Tool Co., Chicago, Ill
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

DRILLS, TWIST AND FLAT
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.

DROP FORGINGS
Steel Co. of Canada, Ltd., Hamilton.

DUST HANDLING EQUIPMENT
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

ELECTRICAL INSTRUMENTS
Bristol Co., Waterbury, Conn.

ELECTRICAL SUPPLIES
Atkins & Co., Inc., E. C., Indianapolis
Diamond State Fibre Co., Toronto, Ont
U.S. Electrical Tool Co., Cincinnati, O.

ELEVATING TRUCKS (See Trucks)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

ELEVATORS AND CONVEYORS
Can. Link-Belt C., Toronto, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q

EQUIPMENT, ELEVATOR SAFETY
Jones & Glassco, Montreal, Que.

EMERY WHEELS (See Grinding Wheels)
J. R. Baxter & Co., Ltd., Montreal, Que.
Atkins & Co., E. C., Indianapolis, I
Norton Co., of Canada., Ltd., Hamilton.

ENGINES, CAPSTAN
Kennedy & Sons, Wm., Owen Sound, Ont.

ENGINE LATHE MANUFACTURERS
Oliver Machinery Co., Grand Rapids, Michigan.

ENGINEERS, MECHANICAL
Dominion Engineering Works, Limited. Montreal, Que.
Gisholt Machine Co., Madison, Wis.
Hamilton Gear & Machine Co., Toronto.

EXPANDERS, TUBE
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

FANS, ELECTRIC
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

FANS, EXHAUST
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Petrie Ltd., H. W., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass

FANS, VENTILATING
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

FIBRE
Diamond State Fibre Co., of Can. Ltd., Toronto, Ont.

FILES AND RASPS
Nicholson File Co., Port Hope, Ont.
Simmons Canada Saw Co., Montreal, Que.

FILLER, IRON (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J.

FIRE ESCAPES
Roelofson Elevator Co., Galt, Ont.

FITTINGS, PIPE
International Malleable Iron Co., Guelph
Fittings, Limited, Oshawa, Ont.

FLEXIBLE SHAFTS
Strand & Co., N. A., Chicago, Ill

FLUXES, WELDING
Carter Welding Co., Ltd, Toronto, Ont
Dominion Oxygen Co., Ltd, Toronto
Liquide Air Company, Toronto, Ont.

FORGING MACHINERY
Acme Machinery Co., Cleveland, Ohio
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown Boggs & Co., Ltd., Montreal.
National Machinery Co., Tiffin, Ohio.
Steel Co. of Canada, Ltd, Hamilton

BUYERS' DIRECTORY

FORGINGS, DROP
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Ltd., Toronto, Ont.

FORGINGS, HAMMER
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Hepburn Ltd., John T., Toronto, Ont.

FOUNDRY EQUIPMENT
McDougall Co., Ltd., R. Galt, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

FOUNDRY SUPPLIES
Rice Lewis & Son, Ltd., Toronto, Ont.

FROGS, SPRING OR RIGID
Can. Steel Foundries, Montreal, Que.

FURNACES, ELECTRIC
Rockwell Co., W. S. New York City.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

FURNACES, HEAT TREATING COAL
Rockwell Co., W. S., New York City.

FURNACES, HEAT TREATING OIL OR GAS
Bellevue Industrial Furnace Co., Detroit, Michigan.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Rockwell Co., W. R., New York City.

FURNACES TEMPERING AND ANNEALING
Bellevue Industrial Furnace Co., Detriot, Mich.
Brown & Sharpe Mfg., Co., Providence R. I.
Rockwell Co., W. S., New York City.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

FURNACES AND OVENS, ELECTRIC
Petrie, Ltd., H. W., Toronto, Ont.
Rockwell & Co., W. S., New York city.
Starrett Co., L. S., Athol, Mass.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

GAGES, MEASURING (See Tool Work)
Brown & Sharpe Mfg. Co., Providence, R. I.
Greenfield Tap & Die Corp., Galt, Ont
Lufkin Rule Co., Windsor, Ont.
Starrett Co., L. S., Athol, Mass.

GAGES, RECORDING
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Brown & Sharpe Mfg Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont

GAGES, SPECIAL MEASURING (See Tool Work)
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GAGES, THREAD
Brown & Sharpe Mfg Co., Providence R. I
Starrett Co., L. S., Athol, Mass.

GALVANIZING
Fittings, Limited, Oshawa, Ont.

GAS, COAL COMPRESSED
L'Air Liquide Society, Toronto, Ont.

GAS, COMPRESSED
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

GASKETS
Diamond State Fibre Co. of Ca., Ltd., Toronto, Ont.
Smooth Mfg. Co., Jersey City, N. J.

GAUGES VACUUM AND PRESSURE
Taylor Instrument Co., Toronto, Ont.

GEAR BLANKS
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.
Dominion Engineering Works, Limited, Montreal, Que.

GEAR COUNTERS
Hart Mfg. Co., R. A., Battle Creek, Michigan.

GEAR-CUTTING MACHINES
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Fellows Gear Shaper Co., Springfield, Vt.
Petrie, Ltd., H. W., Toronto, Ont.
Whiton Machine Co., D. E., New London, Conn.

GEAR TESTING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.

GEARS, CAST
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Hull Iron & Steel Foundries, Hull, Que.
Dominion Engineering Works, Limited, Montreal, Que.

GEARS, CUT
Brown & Sharpe Mfg. Co., Providence, R. I.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Gardner & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto, Ont.
Hepburn Ltd., John T. Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

GEARS, DRESSED
Kennedy & Sons, Wm., Owen Sound, Ontario.

GEARS, FORGED
Canada Foundries & Forgings Co., Welland, Ont.

GEARS, HERRINGBONE
Hamilton Gear & Machine Co., Toronto, Ont.

GEARS, RAWHIDE (See Gears, Cut)
Hamilton Gear & Machine Co., Toronto.

GEAR, SILENT CHAIN
Gardner & Son, Robt., Montreal, Que.
Can. Link-Belt Co., Ltd., Toronto, Can
Hans Renold of Canada, Ltd., Montreal, Quebec.

GEARS, WORM
Hamilton Gear & Machine Co., Toronto

GENERATORS, ACETYLENE
L'Air Liquide Society, Toronto, Ont

GLOVES, PROTECTIVE
Industrial Glove Co., Toronto, Ont.

GOGGLES, SAFETY
Carter Welding Co., Ltd., Toronto
Dominion Oxygen Co., Ltd., Toronto
Liquide Air Company, Toronto

CRAB BUCKETS
Can Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Cleveland Twist Drill Co., Cleveland, O.

GREASE CUPS, PRESSED STEEL AND BRASS
Can Winkley Co., Ltd., Windsor, Ont.

GREASES, LUBRICATING
Canadian SKF Co., Toronto, Ont.

GRINDING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Norton Co., of Canada, Ltd., Hamilton.

GRINDING MACHINES, ABRASIVE BELT
Norton Co. of Can. Ltd., Hamilton, Ont.

GRINDING MACHINES, AUTOMATIC
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, BENCH
Blount Co., J. G., Everett, Mass.
Geometric Tool Co., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
McDougall Co., Ltd., R., Galt, Ont
Norton Co. of Canada, Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, CENTER
U. S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES, CUTTER AND REAMER
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Petrie Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, CYLINDRICAL
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.
Norton Co., of Canada, Ltd., Hamilton.

GRINDING MACHINES, DIE
National Acme Co., Cleveland, O.
National Machinery Co., Tiffin, Ohio.

GRINDING MACHINES, DRILL
Bellevue Industrial Furnace Co., Detroit, Mich.
Bertram & Son Co., Ltd., The John, Dundas, Ont.

GRINDING MACHINES, ELECTRIC
Strand & Co., N. A., Chicago, Ill.

GRINDING MACHINES, FLOOR AND TOOL
Blount Co., J. G., Everett, Mass.
National Acme Co., Cleveland, Ohio.
Norton Co. of Canada, Ltd., Hamilton, Ontario.
Petrie, Ltd., H. W., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.

GRINDING MACHINES, INTERNAL
Garlock Machinery Ltd., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Cleveland Pneumatic Tool Co., Toronto Ont.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES PORTABLE
Strand & Co., N. A., Chicago, Ill.

GRINDING MACHINES, SNAGGING
Blount Co., J. G., Everett, Mass.
Norton Co., of Can. Ltd., Hamilton, Ont.

GRINDING MACHINES, SURFACE
Brown & Sharpe Mfg Co., Providence, Rhode Island.
Petrie, Ltd., H. W., Toronto, Ont
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, THREAD
Pratt & Whitney Co., of Canada, Ltd.,

GRINDING MACHINERY, TOOL POST
Gisholt Machine Co., Madison, Wis.
Grenfield Tap & Die Corp., Galt, Ont
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES, UNIVERSAL
Brown & Sharpe Mfg Co., Providence, Rhode Island.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Landis Tool Co., Waynesboro, Pa
Morse Twist Drill & Machine Co., New Bedford, Mass
Norton Co., of Canada, Ltd., Hamilton, Ontario.
Petrie, Ltd., H W., Toronto, Ont

GRINDING WHEELS
J. R. Baxter & Co., Ltd., Montreal, Que.
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Can Fairbanks Morse Co., Ltd., Montreal.
Norton Co. of Can., Ltd., Hamilton, Ont.

GUN-BARREL MACHINERY
Steinle Turret Machine Co., Madison, Wisconsin.

HACK SAWS, POWER
Atkins & Co., Inc., E C., Indianapolis, Indiana.
Petrie, Ltd., H W., Toronto, Ont
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.

HAMMERS, CHIPPING
Cleveland Pneumatic Tool Co., Toronto, Ont.
High Speed Hammer Co., Rochester.

HAMMERS, DROP
Bertram & Son Co., Ltd., The John Dundas, Ont.
Pliss Co., E. W., Brooklyn, N Y
Brown Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

HAMMERS, ELECTRIC
Brown, Boggs & Co., Ltd., Hamilton, Ont.

HAMMERS, PNEUMATIC
Can. Steel Foundries, Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto Ont.

HANGERS, SHAFTING
Canadian SKF Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Hamilton Gear & Machine Co., Toronto.

HOBBING MACHINES
Shore Instrument Co., Jamaica, N.Y

HARDENING, CASE-HARDENING AND TEMPERING
Barnes Company, Wallace, Hamilton.
Chapman Double Ball Bearing Co., Toronto.
Petrie, Ltd., H. W., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Cleveland Pneumatic Tool Co., Toronto Ont.

HAMMERS, POWER
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Jardine & Co., A. P., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

HOBS
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Tap & Die Corp., Galt, Ont
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

HOISTS, ELECTRIC
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

HOISTS, ELECTRIC
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

HOISTS, HAND
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg Co., Lisbon, Ohio

HOISTS, PNEUMATIC
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont

HOLDERS-ON, PNEUMATIC
Cleveland Pneumatic Tool Co., Toronto Ont.

HYDRAULIC MACHINERY
Bertram & Son Co., Ltd., The John Dundas, Ont.
Dominion Engineering Works, Limited Montreal, Que.

IGNITERS, GAS ENGINE
Canada Foundries & Forgings Co., Welland, Ont
Burke Machine Tool Co., Conneaut, O

INDICATORS, SPEED AND TEST
Brown & Sharpe Mfg Co., Providence R.I.

INSULATION
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.

IRON BARS
Steel Co. of Canada, Ltd., Hamilton, Ont.

JACKS, HYDRAULIC
Norton, A. O., Boston, Mass.

JACKS, PLANER
Armstrong Bros Tool Co., Chicago, Ill
Starrett Co., L. S., Athol, Mass.

JAPANNING AND VARNISHING OVENS
Brantford Oven & Rack Co., Brantford Ont

JIGS AND FIXTURES (SEE TOOL WORK)
Fisher Motor Co., Ltd., Orillia, Ont
Gisholt Machine Co., Madison, Wis
Preston & Schwartz, Galt, Ont

KEYSEATING MACHINES
Morton Mfg Co., Muskegon, Mich

BUYERS' DIRECTORY

Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

KEYS, MACHINE
Can. Dranw Steel Co., Hamilton, Ont.
Morton Mfg. Co., Muskegon, Mich.

KNIVES, MACHINE
Atkins & Co., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

KNURL HOLDERS
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

LATHE ATTACHMENTS
Hendey Machine Co., Torrington, Conn.
Petrie, Ltd., H. W., Toronto, Ont.

LATHE TOOLS
Armstrong Bros. Tool Co. ,Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

LATHES, AUTOMATIC AND SEMI-AUTOMATIC
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, BENCH
Hardinge Bros., Inc., Chicago, Ill.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

LATHES, BORING
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, CHUCKING (SEE LATHES, HORIZONTAL TURRET, AND LATHES, VERTICAL TURRET)
Acme Machine Tool Co., Cincinnati, O.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, ENGINE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont
Rockford Lathe & Drill Co., Rockford, Illinois.

LATHES, EXTENSION AND GAP
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, O.
Petrie, Ltd., H. W., Toronto, Ont.
Steinle Turret Machine Co., Madison, Wis.

LATHES, PRECISION
Hardinge Bros., Chicago.

LATHES, RELIEVING
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.

LATHE, UNIVERSAL HAND
Brown & Sharpe Mfg. Co., Providence, Rhode Island.

LATHE, SPEED AND HAND
Blount Co., J. G., Everett, Mass.

LATHES, SPINNING
Pryibil Machine Co., Torrington, Conn.

LATHES, VERTICAL TURRET
Bertram & Son, Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

LATHES, WOOD TURNING
Blount, Co., J. G., Everett, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.

LEAD PIPE
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

LEATHER FILLET
D. K. McLaren Co., Ltd., Montreal, Que.

LIGHTING AND GENERATING SETS
Beardmore & Co., Ltd., Wm., Montreal, Que.

LINOLEUM MILL MACHINERY
Bertrams, Ltd., Edinburgh, Scotland.

LIQUID AIR PLANTS
L'Air Liquide Society, Toronto, Ont.

LOCKERS, CLOTHES
Dennis Wire and Iron Works, London, Ont.

LUBRICANTS
Oakley Chemical Co., New York, N.Y.

LUBRICATING SYSTEMS
Bowser, S. F., & Co., Ltd., Toronto, Canada.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Ltd., Welland, Ont.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R. Toronto Ont.

MANGANESE STEEL
Can. Steel Foundries, Montreal, Que.

MANDRELS, EXPANDING
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MANDRELS, SOLID
Greenfield Tap & Die Corp., Galt, Ont.
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Pratt & Whitney Co., of Canada. Ltd., Dundas, Ont.

MEASURING MACHINES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MECHANICS' FINE TOOLS
Lufkin Rule Co., Windsor, Ont.

METALS, ALLOY
Canada Metal Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.

METAL WORKERS
Parker Co., Charles, Meriden, Conn.

MICROMETER CALIPERS
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Rice Lewis & Son, Ltd., Toronto, Ont.

MILLING ATTACHMENTS
Burke Machine Tool Co., Conneaut, O.
Hendey Machine Co., Torrington, Conn.
Hinckley Machine Works, Hinckley, Ill.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

MILLING MACHINES
Brown & Sharpe [illegible] R. I.
Burke Machine Tool Co., Conneaut, O

MILLING MACHINES, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence, R. I.
Hardinge Bros., Inc., Chicago, Ill.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

MILLING MACHINES, BENCH
Burke Machine Tool Co., Conneaut, O.
Hardinge Bros., Inc., Chicago, Ill.

MILLING MACHINES, HAND
Brown & Sharpe Mfg. Co., Providence
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MILLING MACHINES, HORIZONTAL PLANER TYPE.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Kearney & Trecker Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto.

MILLING MACHINES, PLAIN
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, O.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

MILLING MACHINES, THREAD
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MILLING MACHINES, UNIVERSAL
Brown & Sharpe Mfg. Co., Providence,
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

MILLING MACHINES, VERTICAL
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, O.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto.

MOTORS, ELECTRIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Roelofson Elevator Co., Galt, Ont.
Williams Machinery Co., A. R., Toronto,
Wisconsin Electric Co., Racine Wis.

NAILS AND STAPLES
Canada Metal Co., Ltd., Toronto, Ont.

NIPPLES
Canada Metal Co., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton,

NITROGEN
Carter Welding Co. Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

NUT TAPPERS
(See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
National Acme Co., Cleveland, Ohio.

NUTS, FINISHED and SEMI-FINISHED
Galt Macine Screw Co., Galt, Ont.
National Acme Co., Montreal, ue.

NUTS (Up to 4-in.)
Steel Co. of Canada, Ltd., Hamilton.

NUTS, S.A.E., PLAIN AND CASTELLATED
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

OIL FILTERING AND STORAGE SYSTEMS
Bowser, S. F., & Co., Ltd., Toronto,

OIL STORAGE ENGINEERS
Bowser, S. F., & Co., Ltd., Toronto,

OIL HOLE COVERS
Can. Whitney Co., Ltd., Windsor, Ont.

OILS, SOLUABLE
Brantford Oven & Rack Co., Brantford, Ontario.

OXYGEN
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

OXY-ACETYLENE APPARATUS
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
Can. Fairbanks-Morse Co., Ltd., Mon[illegible]eal, Que.
[illegible] Press Co., Kalamazoo, Mich.

PA[illegible]
B[illegible]

PATTERNS, WOOD AND METAL
Fittings, Limited, Oshawa, Ont.
Victoria Foundry Co., Ltd., Ottawa.

PHOSPHOR TIN
Canada Metal Co., Ltd., Toronto, Ont.

PHOTOGRAPHIC DUPLICATING MACHINES
Photostat Corp., Providence, R. I.

PIPE BENDING MACHINES
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Underwood Corp., H. R., Philadelphia, Pa.
Williams Machinery Co., A. R., Toronto.

PIPE CUTTING AND THREADING MACHINES
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

PIPE
Canada Metal Co., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.

PIPE FITTINGS
Canada Metal Co., Toronto, Ont.
Fittings, Limited, Oshawa, Ont.
International Malleable Iron Co., Guelph Ont.

PIPE AND NIPPLE THREADING MACHINES
Landis Machine Co., Inc., Waynesboro, Pa.

PIPE FITTERS' TOOLS
Rice Lewis & Son, Ltd., Toronto, Ont.

PIPE THREADING DIE HEADS
Landis Machine Co., Inc., Waynesboro, Pa.

PISTON-RING MACHINES
National Acme Co., Cleveland, Ohio
Steinle Turret Machine Co., Madison, Wis.

PLANING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont
Morton Mfg. Co., Muskegon, Mich.
Williams Machinery Co., A. R., Toronto

PLANING MACHINES, ROTARY
Bertram & Son Co., Ltd., The John, Dundas, Ont.

PLATE ROLLS
Bertram & Son Co., Ltd., The John, Dundas, Ont.

PNEUMATIC TOOLS
Cleveland Pneumatic Tool Co., Toronto.

POLISHING AND BUFFING MACHINES
J. R. Baxter & Co., Ltd., Montreal, Q.
Blount Co., J. G. Everett, Mass.
Brown & Sharpe Mfg. Co., Providence.
Pryibil Machine Co., New York, N.Y.

PRESSED STEEL PARTS
American Pulley Co., Philadelphia, Pa.
Fisher Motor Co., Ltd., Orillia, Ont.

PRESSES, ARBOR
Atlas Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

PRESSES, DROP AND FORGING
Brown, Boggs & Co., Ltd., Hamilton.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

PRESSES, FOOT AND HAND
Brown, Boggs & Co., Ltd., Hamilton.

PRESSES, HYDRAULIC
Bertram & Son Co., Ltd., The John, Dunidas, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Perrin Ltd., W. R., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

PRESSES, POWER
Bliss Co., E. W., Brooklyn, N. Y.
Brown, Boggs, & Co., Ltd., Hamilton.
Hepburn Ltd., John T., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Stoll Co., Inc. [illegible]

[illegible] H. W., Toronto, Ont.

PROFILING MACHINES
Prtt & Whitney Co., of Canada, Ltd., Dundas, Ont.

PROTRACTORS
Brown & Sharpe Mfg. Co., Providence
Lufkin Rule Co., Windsor, Ont.

PROPELLERS
Kennedy & Sons, Wm., Owen Sound Ontario.

PULLEYS, CORK INSERT
American Pulley Co., Philadelphia, Pa

PULLEYS, METAL AND FIBRE
American Pulley Co., Philadelphia, Pa.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.
D. K. McLaren Co., Ltd., Montreal, Que.

PULP AND PAPER MILL EQUIPMENT
Dominion Engineering Works, Ltd., Montreal, Que.

PUMPS, HYDRAULIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Dominion Engineering Works, Ltd Montreal, Que.
Hepburn Ltd., John T., Toronto Ont.

BUYERS' DIRECTORY

PUMPS, LUBRICANT AND OIL
Bowser, S. F., & Co., Ltd., Toronto.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Hepburn Ltd., John T., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.

PUMPS, POWER
Bowser, S. F., & Co., Ltd., Toronto.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hepburn Ltd., John T., Toronto, Ont.

PUNCHES, CENTER
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

PUNCHES, HAND
Brown Boggs & Co., Ltd., Hamilton.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Jardine & Co., A. B., Hespeler, Ont.

PUNCHES, POWER
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

PUNCHING MACHINES, HORIZONTAL
Bertram Ltd., Edinburgh, Scotland.

PYROMETERS, ELECTRIC
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Hiram Walker & Sons Metal Products Co., Walkerville, Ont.

RACKS, CUT
Hamilton Gear & Machine Co., Toronto.

RACKS, STORAGE
(See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ontario.

REAMER HOLDERS
Simonds Canada Saw Co., Montreal, Q.

REAMERS, EXPANDING
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

REAMERS, SOLID
Butterfield & Co., Inc., Rock Island, Q.
Morse Twist Drill & Machine Co., New Bedford, Mass.

REAMERS, TAPER
Brown & Sharpe Mfg. Co., Providence, R. I.
Butterfield & Co., Inc., Rock Island, Q.
Cleveland Twist Drill Co., Cleveland, O.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

RECORDERS, TEMPERATURE
Taylor Instrument Co., Rochester, N. Y.

RECORDERS, TIME
Gisholt Machine Co., Rochester, N. Y.
Taylor Instrument Co., Toronto, Ont.

REGULATORS, TEMPERATURE
Taylor Instrument Co., Toronto, Ont.

RIVETS AND BURRS
Parmenter & Bulloch Co., Gananoque, Ont.
Steel Co., of Canada, Ltd., Hamilton.

RIVETS, CHAIN
Pittings, Limited, Oshawa, Ont.

RIVET-MAKING MACHINERY
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

RIVETING MACHINES
Can. Fairbanks-Morse Ltd., Montreal Q
High Speed Hammer Co., Rochester, N.Y.
Parmenter & Bulloch Co., Gananoque Ont.
Petrie, Ltd., H. W., Toronto, Ont.

RUDDER FRAMES, STEEL
Can. Steel Foundries, Montreal, Que.

RUBBER MILL MACHINERY
Bertram Ltd., Edinburgh, Scotland.

RULES, STEEL AND WOOD
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Windsor, Ont.

RUST PREVENTATIVES
Oakley Chemical Co., New York, N. Y.

SAND EQUIPMENT
Can. Link-Belt Co., Toronto, Ont.

SAND RAMMERS, PNEUMATIC
Cleveland Pneumatic Tool Co., Toronto.

SAW FRAMES AND BLADES, HACK
Atkins & Co., Inc., E. C., Indianapolis.
Diamond Saw & Stamping Works, Buffalo, N. Y.
Rice Lewis & Sons, Ltd., Tornto, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWING MACHINES, POWER HACK
Atkins & Co., Inc., E. C., Indianapolis.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

SAW SHARPENING MACHINES
Atkins & Co., Inc., E. C., Indianapolis.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

SAW SHARPENING MACHINES
Atkins & Co., Inc., E. C., Indianapolis.

SAW TABLES, UNIVERSAL
Petrie, Ltd., H. W., Toronto, Ont.

SAWS, CIRCULAR METAL
Atkins & Co., Inc., E. C., Indianapolis.
Pryibil Machine Co., New York, N. Y.
Gisholt Machine Co., Madison, Wis

SAWS, HAND
Atkins & Co., Inc., E. C., Indianapolis
Simonds Canada Saw Co., Montreal, Q.

SAWS, HOT AND COLD
Atkins & Co., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Q.

SAWS, HIGH SPEED STEEL
Atkins & Co., Inc., E.C., Indianapolis, I.
Butterfield & Co. Inc., Rock Island, Q
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWS, METAL BAND
Atkins & Co., E. C., Indianapolis, I.

SAWS, METAL CUTTING
Brown & Sharpe Mfg. Co., Providence.
Butterfield & Co., Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.
Starrett Co., L. S., Athol, Mass.

SAWS, SCREW SLOTTING
Atkins & Co., Inc., E., C., Indianapolis.
Butterfield & Co., Inc., Rock Island, Q.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canda, Ltd., Dundas, Ont.

SAWS, SCREW SLOTTING
Atkins & Co., Inc., E. C., Indianapolis.
Butterfield & Co., Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q

SAWS, WOOD
E. C. Atkins & Co., Indianapolis, Ind

SCALES
Brown & Sharpe Mfg. Co., Providence
Can. Fairbanks-Morse Ltd., Montreal, Q
Lufkin Rule Co., Windsor, Ont.

SCREENS
Dominion Engineering Works, Ltd., Montreal, Que.

SCREW DRIVERS, OPTICAL, JEWELRY AND NOVELTY
Strand & Co., N. A., Chicago, Ill.

SCREW MACHINE WORK
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Montreal, Que.

SCREW MACHINERY, WOOD AND LAG
Cook Co., Asa S., Hartford, Conn.

SCREW MACHINES
Brown & Sharpe Mfg. Co., Providence, Rhode Island.

SCREW MACHINES, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co of Canada, Ltd., Dundas, Ont.

SCREW MACHINE PRODUCTS
National Acme Co., Montreal, Que.

SCREW PLATES
Butterfield & Co., Inc., Rock Island. Que.
Jardine & Co., A. B., Hespeler, Ont

SCREWS, CAP AND SET
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que

SCREWS, SAFETY, SET
Galt Machine Screw Co., Galt, Ont.

SECOND-HAND MACHINERY
See last page of directory.
Petrie, Ltd., H. W., Toronto, Ont.

SEPARATORS, MOISTURE AND OIL
Bowser, S. F., & Co., Ltd., Toronto, Canada.

SEPARATORS, OIL AND WASTE
Bowser, S. F., & Co., Ltd., Toronto.

SHAFTS, FLEXIBLE
Strand & Co., N. A., Chicago, Ill.

SHAFTING
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
Williams Machinery Co., A. R., Toronto.

SHAPES, COLD-DRAWN SPECIAL STEEL
Union Drawn Steel Co., Hamilton, Ont.

SHAPING MACHINES
Hendey Machine Co., Torrington, Conn.
Morton Mfg. Co., Muskegon, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Williams Machinery Co., A. R Toronto.

SHEARS HAND
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

SHEARS, POWER
Bliss Co., E. W., Brooklyn, N. Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Stoll Co., Inc., D. H., Buffalo, N. Y.
Williams Machinery Co., A. R., Toronto, Ont.

SHEARING MACHINES, ANGLE, IRON BAR AND GATE
Bertrams Ltd., Edinburgh, Scotland.

SHEET LEAD
Canada Metal Co., Ltd., Toronto, Ont.

SHEET METAL WORKING MACHINERY
Bliss Co., E. W., Brooklyn, N. Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Stoll Co., Inc., D. H., Buffalo, N. Y.

SHEETS, NICKEL, MONEL AND FIBRE
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.

SHEETS, O.P.C.R. & B. A. AND BLUE ANNEALED
Steel Co., of Canada, Ltd., Hamilton, Ont.

SIDE FRAMES, LOCOMOTIVE
Can Steel Foundries, Montreal, Que.

SLOTTING ATTACHMENTS
Brown & Sharpe Mfg. Co., Providence, R.I.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

SLOTTING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.

SOLDERS
Canada Metal Co., Ltd., Toronto, Ont.

SPECIAL MACHINERY AND TOOLS
Brown Engineering Corp., Ltd., Toronto.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Cleveland, O.

SPIKES, RAILWAY AND PRESSED
Steel Co. of Canada, Ltd., Hamilton, Ont.

SPINNING LATHES
Prybil Machine Co., P., New York City.

SPRING, MILLED
Barnes & Co., Wallace, Hamilton, Ont.

SPRINGS, SMALL SPIRAL HELICAL, COMPRESSION, EXTENSION, TORSION AND SPECIAL
Barnes Company, Wallace, Hamilton,

SPRINGS
Barnes Company, Wallace, Hamilton.
Cleveland Wire Spring Co., Clevleand, O
Steele Ltd., James, Guelph, Ont.

SPRINGS, FLAT STEEL, BRUSH HOLDER, CLOCK, SMALL FLAT SPRINGS
Barnes Company, Wallace, Hamilton.

SPROCKETS AND CHAINS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Renold Hanson of Canada, Ltd., Montreal, Que.

SQUARES
Brown & Sharpe Mfg. Co., Providence, R.I.
Lufkin Rule Co., Windsor, Ont.
Steel Co. of Canada, Ltd., Hamilton. Ont.

STAMPING, METAL
American Pulley Co., Philadelphia, Pa.
Barnes Company, Wallace, Hamilton.
Diamond Saw & Stamping Works, Buffalo, N. Y.
Parmenter & Bulloch Co., Gananoque, Ont.

STAMPS, STEEL
Diamond Saw & Stamping Works, Buffalo, N. Y.

STEEL CONCRETE REINFORCEMENT
Steel Co. of Canada, Ltd., Hamilton.

STEEL PLATE
British Empire Steel Co., Montreal, Que

STEEL AND IRON BARS
Steel Co. of Canada, Ltd., Hamilton.

STEELS TOOL
British Empire Steel Co. Montreal Q

STEEL, COLD-ROLLED STRIP
British Empire Steel Co., Montreal, Q.
Barnes Company, Wallace, Hamilton.

STEEL, CRUCIBLE, SPRING
Barnes, Company, Wallace, Hamilton.
British Empire Steel Co., Montreal, Q

SHEETS, OPEN HEARTH STEEL
Steel Co., of Canada, Ltd., Hamilton.

STEEL, SHAFTING AND FREE CUTTING SCREW
Union Drawn Steel Co., Hamilton, Ont.

STEEL, SHEET
British Empire Steel Co., Montreal, Q
Rice Lewis & Son, Ltd., Toronto, Ont

STEEL, STAINLESS
Steel Co., of Can. Ltd., Hamilton, Ont

STEELS, ALLOY AND CARBON
Algoma Steel Corp., Ltd., Sault Ste Marie, Ont.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Can. Steel Foundries, Montreal, Que
Rice Lewis & Son, Ltd., Toronto, Ont
Steel Co., of Canada, Ltd., Hamilton. Ont.

STEELS, HIGH-SPEED
Armstrong Bros. Tool Co., Chicago, Ill
Atkins & Co., Ltd., Wm., Sheffield, England.
British Empire Steel Co., Montreal, Q
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton

STEEL TUBING, CLOSE JOINT AND WELDED
Standard Tube & Fence Co., Ltd., Woodstock, Ont.

STERN FRAMES, CAST STEEL
Can Steel Foundries, Montreal, Que.

STRAIGHTENING MACHINERY
Bertram Ltd., Edinburgh, Scotland
Williams & Co., J. H., Brooklyn, N.Y.

STUDS
Galt Machine Screw Co., Galt, Ont.

Geometric Tool Co., New Haven, Conn.

SWAGING MACHINES
Atkins & Co., Inc., E. C., Indianapolis, Indiana.

SWITCHES, RAILWAY
Can. Steel Foundries, Montreal, Que.

TACHOMETERS
Bristol Co., Waterbury, Conn.

TANKS AND PUMPS, OIL
Bowser, S. F., & Co., Ltd., Toronto.

TAP HOLDERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
William L. Procunier, Chicago, Ill.

TAPER PINS
Galt Machine Screw Co., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

TAPES, MEASURING
Starrett Co., L. S., Athol, Mass.
Lufkin, Rule Co., Windsor, Ont.

TAPPING MACHINES AND ATTACHMENTS
Burke Machine Tool Co., Conneaut, O.
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Wm. L. Procunier, Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

TAPS AND DIES
Butterfield & Co., Inc., Rock Island, Q.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

TAPS, COLLAPSING
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.

TEETH, DREDGE BUCKET
Kennedy & Sons, W., Owen Sound, Ont.

THERMOMETERS
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Greenfield Tap and Die Corp., Galt, Ontario.

THREAD-CUTTING TOOLS
Butterfield & Co., Inc., Rock Island, Q.
Greenfield Tap and Die Corp., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

THREAD CUTTING MACHINES
Landis Machine Co., Inc., Waynesboro, Pa.

THREADING MACHINES
Acme Machinery Co., Cleveland, Ohio.
Geometric Tool Co., New Haven, Conn.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Williams Tool Corp., of Can. Ltd., Brantford, Ont.

THREAD LEAD TESTING MACHINES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

THREAD-ROLLING MACHINES
Bliss Co., E. W., Brooklyn, N. Y.

BUYERS' DIRECTORY

TIE PLATES
Steel Co. of Canada, Ltd., Hamilton.

TIME RECORDERS
International Business Machine Co., Ltd., Toronto, Ont.

TONGS
Hepburn Ltd., John T., Toronto, Ont.

TOOL CASES
Rice Lewis & Son, Ltd., Toronto, Ont.

TOOL HOLDERS
Armstrong Bros., Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Bertrams Ltd., Edinburgh, Scotland.

TOOL POSTS, LATHE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Williams & Co., J. H., Brooklyn, N. Y.

TOOLS, SMALL
(See Machinists' Small Tools)
Armstrong Bros. Tool Co., Chicago, Ill.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Lufkin Rule Co., Windsor, Ont.
National Machine Tool Co., Racine, Wis.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S. Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A.R., Toronto,

TOOL WORK
Brown Engineering Corp., Ltd., Toronto, Ontario.

TORCHES, BLOW
Rice Lewis & Son, Ltd., Toronto, Ont.

TRACKWORK, RAILWAY
Can. Steel Foundries, Montreal, Que.

TRACKWORK, MANGANESE STEEL
Can. Steel Foundries, Montreal, Que.

TRANSMISSION MACHINERY
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound.
Petrie, Ltd., H. W., Toronto, Ont.
Renold, (Hans) of Canada, Ltd., Montreal, Que.

TROLLEYS AND TRAMWAYS
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Wright Mfg. Co., Lisbon, Ohio.

TROLLEY WHEELS
Langley & Austin, Galt, Ont.

TROWELS, PLASTERING
E. C. Atkins & Co., Indianapolis, Ind.

WRENCHES, MACHINISTS'
Armstrong Bros. Tool Co., Chicago, Ill.

TRUCKS
Can. Fairbanks-Morse Ltd., Montreal, Q.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

TUBING, SEAMLESS STEEL, BRASS AND COPPER AND FIBRE
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Goldstein Mfg. Co., Ltd., Toronto, Ont.

TURRET HEADS
Bertram & Son Co., Ltd., The John Dundas, Ont.

TURRET MACHINES
(See Lathes, Horizontal Turret)
Acme Machine Tool Co., Cincinnati, O.
Cook Co., Asa S., Hartford, Conn.
Gisholt Machine Co. Madison Wis.
National Acme Co. Cleveland O.
Pratt & Whitney Co. of Canada Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin

TURRETS, TOOL POST
Gisholt Machine Co. Madison, Wis.

UNIONS, PIPE
Fittings, Limited, Oshawa, Ont.

VALVES
Canada Metal Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Mon-
Dominion Engineering Works, Limited. Montreal, Que.

VISES, DRILLING MACHINE
Burke Machine Tool Co., Conneaut, Ohio.
Charles Parker Co., Meriden, Conn.
Cleveland Pneumatic Tool Co., Toronto, Ontario.
Kempsmith Mfg Co., Milwaukee, Wis.

VISES, PIPE
Charles Parker Co., Meriden, Conn.

VISES, PLANER AND SHAPER
Bertram & Son Co., Ltd., The John Dundas, Ont.
Philip Gies Foundry, Kitchener, Ont.
Hendley Machine Co., Torrington, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

VISES, WOOD WORKERS'
Charles Parker Co., Meriden, Conn.
Parmenter & Bulloch Co., Gananoque, Ontario.

VOLTMETERS
Bristol Co., Waterbury, Conn.

WAGON LEADERS
Can. Link-Belt Co., Toronto, Ont

WASHERS, LOCK, SPLIT AND SPRING
Barnes Company, Wallace, Hamilton.

WELDING APPARATUS, OXY-ACETYLENE
L'Air Liquide Society, Toronto, Ont.
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto, Ont.

WELDING APPARATUS
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.

WELDING, ELECTRIC, ARC, SPOT AND BUTT
International Malleable Iron Co., Guelph, Ont.

WELDING MACHINES, OXY-ACETYLENE
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.

WELDING, ELECTRIC
McLaren Belting Co., J. C., Montreal, Que.
Steel Co. of Canada, Ltd., Hamilton.

WELDING ROD, TOBIN, MANGANESE, BRONZE AND ALUMINUM
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto, Ont.

WELDING SUPPLIES
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.

WHEELS, INDUSTRIAL
American Pulley Co., Philadelphia, Pa
Hull Iron & Steel Foundries, Hull, Que.
Kennedy & Sons, Wm., Owen Sound, Ontario.

WINCHES, HEADGATE
Kennedy & Sons, Wm. Owen Sound, Ontario.

WINCHES, STOPLOG
Kennedy & Sons, Wm., Owen Sound, Ontario.

WIRE
Barnes Company, Wallace, Hamilton.
Canada Metal Co., Ltd., Toronto, Ont.
Dennis Wire & Iron Works, London, Ontario.
Greening Wire Co., B., Hamilton, Ont.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

WIRE, BLACK TEMPERED, MUSIC PHOSPHOR BRONZE AND PREMIER
Barnes Company, Wallace, Hamilton.

WIRE, COPPER AND BRASS, FINE AND HEAVY
Steel Co., of Canada, Ltd., Hamilton, Ontario.

WIRE STRAIGHTENING AND CUTTING MACHINERY
Brown, Boggs & Co., Ltd., Hamilton, Ontario.

WIRE, WELDING
L'Air Liquide Society, Toronto, Ont.
Carter Welding Co., Ltd., Toronto, Ont
Dominion Oxygen Co., Ltd., Toronto.

WIRES, SPECIAL
Dennis Wire & Iron Works, London, Ontario.
Greening Wire Co., B., Hamilton, Ont.

WOODWORKING MACHINERY
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Williams Machinery Co., A. R., Toronto, Ontario.

WRENCHES, DROP FORGED
Armstrong Bros. Tool Co., Chicago, Ill
Canada Foundries & Forgings Co., Welland, Ont.

List of Directory of Dealers will be Found above Advertising Index

When answering advertisements kindly mention Canadian Machinery

DIRECTORY OF DEALERS

THE Buyers' Directory of CANADIAN MACHINERY was originally intended to contain information regarding lines actually manufactured by our advertisers. We now carry the advertising of leading machinery dealers, some of whom represent scores of manufacturers in addition to being manufacturers themselves in some cases. We recommend, therefore, if our subscribers cannot find what they want in our Directory that they communicate with the dealers whose names appear herewith.

MACHINE TOOLS, ETC.

Bertram & Sons, Ltd., John, Dundas, Ont.

The Canadian Fairbanks-Morse Co., Montreal, Que.

Garlock Machinery Ltd., Toronto.

H. W. Petrie, Ltd., Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

Yeates Machinery Co., London, Ont.

SHOP and FACTORY SUPPLIES

The Canadian Fairbanks-Morse Co., Montreal, Que.

Garlock Machinery Ltd., Toronto.

H. W. Petrie Ltd., Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

Yeates Machinery Co, London, Ont.

POWER EQUIPMENT, ETC.

The Canadian Fairbanks-Morse Co., Montreal, Que.

H. W. Petrie, Ltd., Toronto, Ont.

WOODWORKING MACHINERY

The Canadian Fairbanks-Morse Co., Montreal, Que.

Garlock Machinery Ltd., Toronto.

H. W. Petrie Ltd., Toronto, Ont

A. R. Williams Machinery Co, Toronto, Ont.

Yeates Machinery Co., London Ont.

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COAL AND COKE
BRITISH-AMERICAN FUEL & METALS LIMITED
McKINNON BUILDING TEL. MAIN 7815 TORONTO

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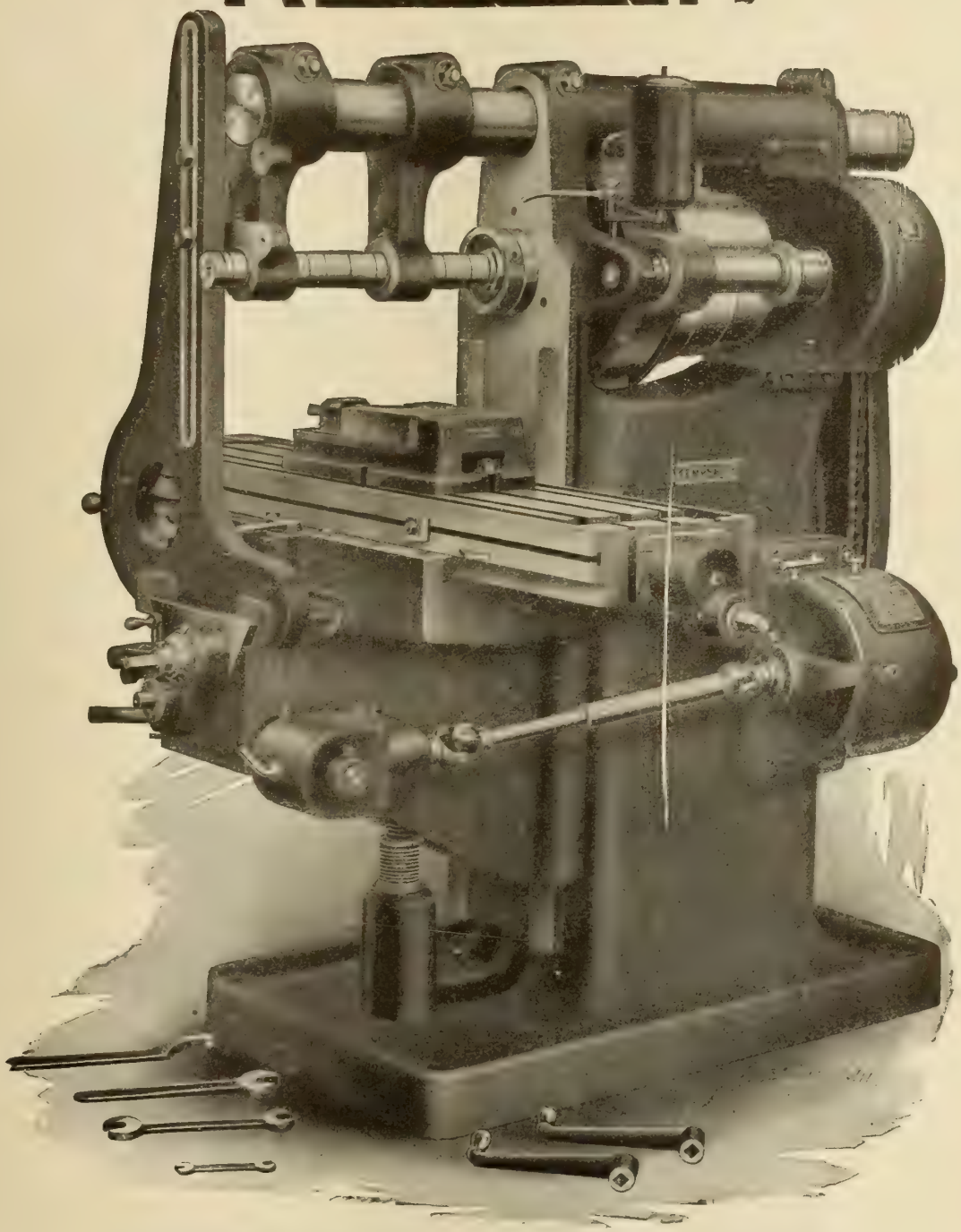
MEADOWLANDS, PA.
CANONSBURG, PA
CONNELLSVILLE, PA.

KEMPSMITH



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Double Back Geared

A heavy, powerful tool with double back gears and wide driving belt running on a three-step cone of large diameter. Our catalogue "B" describes and illustrates many notable features of the Kempsmith Miller. Write for a copy today.

THE KEMPSMITH MANUFACTURING CO.

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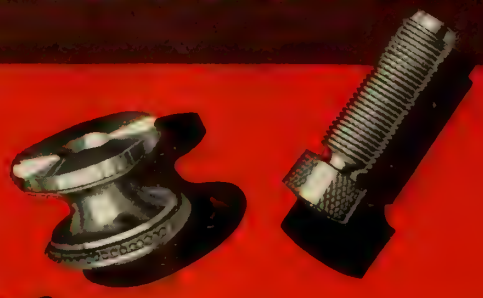
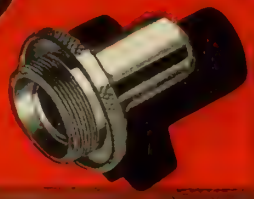
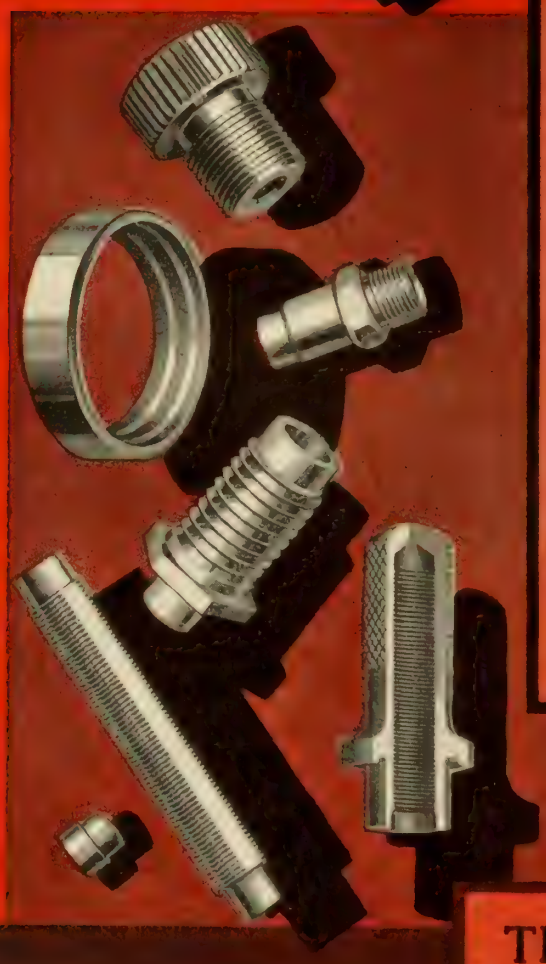
CANADIAN DEALERS:—The Geo. F. Foss Machinery & Supply Co., Limited, 305 St. James St., Montreal, Canada; General Supply Co., 38 Toronto St., Toronto, Canada.

Namco Parts
For Auto Accessories







It makes no difference whether you need—One thousand tiny Adjusting Screws—Ten thousand Hardened and Ground Spring Bolts—or any other kind of milled parts up to 2¼ in. diam. Our well-equipped product plant is at your service.

Extensive knowledge of special operations and a mechanical equipment for practically every variety, enables us to take care of new and highly specialized products without the loss of time caused by slower methods, or the cost of experimenting to find quicker ones.

Standard Cap and Set Screws, also Finished Nuts and Studs from stock.

THE NATIONAL ACME CO.
MONTREAL, P.Q.

CANADIAN MACHINERY
AND MANUFACTURING NEWS

Vol. XXVIII. No. 7 | Published Weekly by the MacLean Publishing Company, Limited, Toronto, Ont. | August 17, 1922 | $4.00 a Year Subscription Price

READ AND PASS TO	Check	See Page	READ AND PASS TO	Check	See Page

Genuine Oak Tanned Leather Belting

OF ALL the factors that enter into the making of D. K. McLaren's Belting, there is one of first importance—the tanning. Money will buy machinery, buy tools, men and raw materials, all, perhaps, of the best. But only experience can buy the right process. Only years of doing, of testing, investigating and proving, can determine how leather should be treated.

Service on the pulley, hard work under adverse conditions, have demonstrated the value of the D. K. McLaren's process of Genuine Oak Tanning.

Genuine Oak Tanning—the long-time process—is the secret of our success, and on any drive and every drive you designate will prove the secret of service to you.

D. K. McLaren, Limited

GENUINE OAK TANNED

Leather Belting

Head Office and Factory:

351 St. James St., Montreal, Can.

VANCOUVER, B.C. Gormans, Limited, 1158 Homer St.

TORONTO, ONT. 194 King St. West

ST. JOHN, N.B. 90 Germain St.

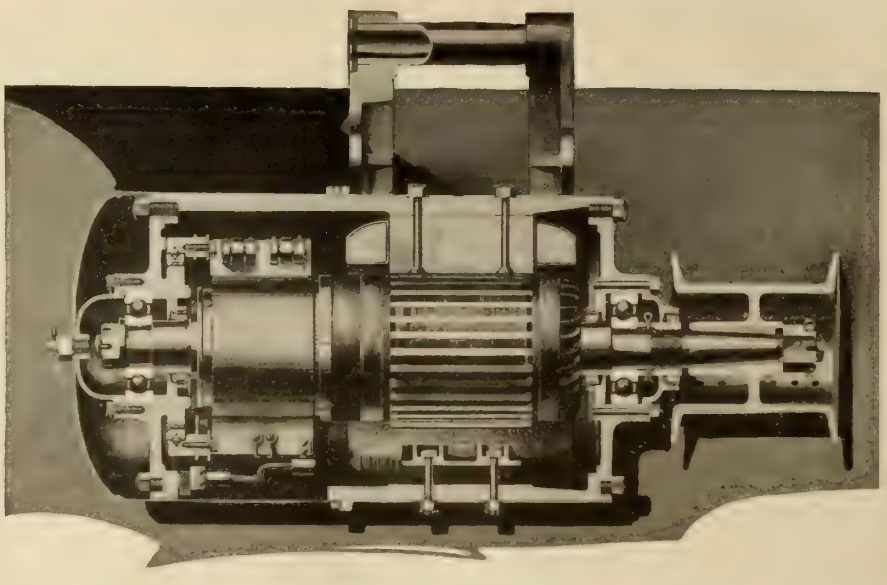
EDMONTON, ALTA. Gormans, Limited

CALGARY, ALTA. Gormans, Limited

Look for this

Oak Leaf

SKF



Uninterrupted Car Lighting Generator Service Depends Largely on Bearing Performance

One of the biggest single factors in the successful lighting of railway cars is the use of ball bearings in car lighting generators. Shocks and jolts caused by passing switches and crossovers and the continual jar of heavy truck suspension tend to play havoc in all but the best of bearings.

SKF marked deep groove ball bearings have demonstrated their ability to stand these severe operating conditions and to thereby maintain generator service. The construction of the deep groove ball bearing furnishes exceptionally high carrying capacity for both radial and thrust loads. Friction is practically eliminated, lubrication is needed only once in six months, and after years of operation wear is negligible so that the armature position is permanently maintained and the danger of burnouts caused by armatures falling on the pole pieces is removed.

In fact standard equipment in car lighting generator bearings to-day is recognized as meaning equipped with **SKF** marked bearings.

CANADIAN **SKF** COMPANY, LIMITED

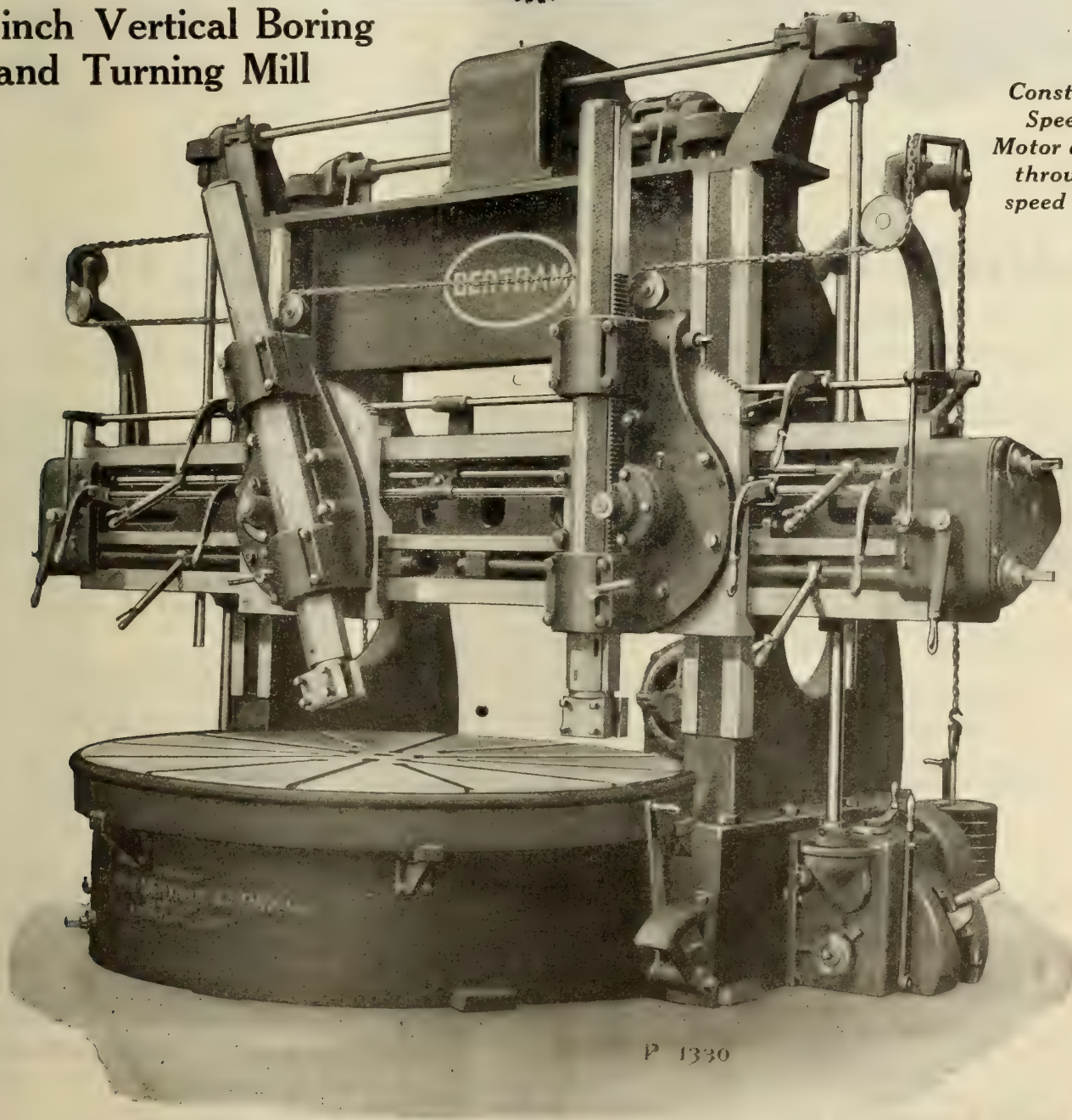
TORONTO-MONTREAL

The BERTRAM Page

MACHINE TOOLS

84-inch Vertical Boring and Turning Mill

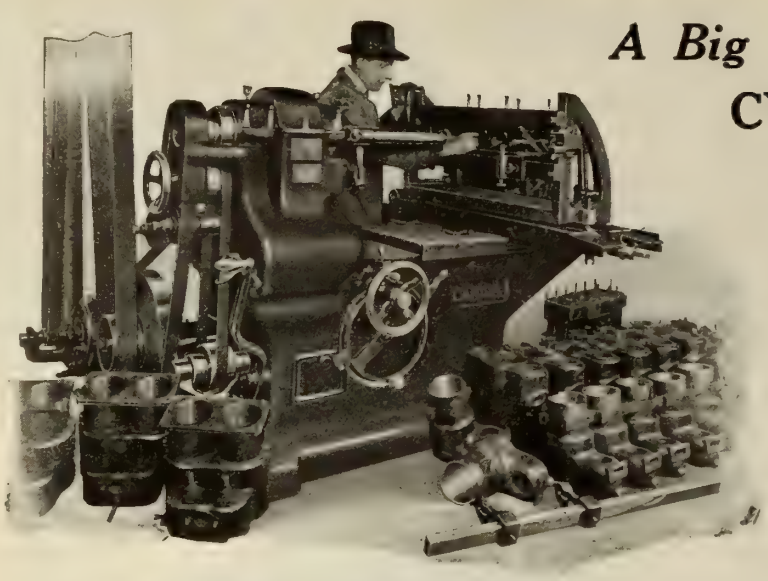
Constant Speed Motor drive through speed box



The John Bertram & Sons Co., Limited

DUNDAS, ONTARIO, CANADA

MONTREAL Drummond Bldg. | TORONTO 32 Front St., W. | VANCOUVER 609 Bank of Ottawa Bldg. | WALKERVILLE 103½ Sandwich St. | WINNIPEG 1205 McArthur Bldg. | HALIFAX Roy Bldg.



No. 5 Cylinder Grinding Machine in the plant of H. E. Bourassa, Montreal

A Big Wide Open Opportunity

CYLINDER REGRINDING

Think of all the cars in your territory that have gone sluggish and pepless because of worn, leaky, out-of-round cylinders. When there's loss of motor power, it's to your advantage to suggest regrinding.

This is your opportunity. If equipped with a Landis cylinder grinding machine you can see that the work is done quickly and economically and besides you can branch out with a side line that would make a profitable business in itself alone.

Many men are doing it all over the country and have built up a profitable business and furnished real service to the motoring public.

Now is your opportunity. Ask for further details.

LANDIS TOOL CO., Waynesboro, Pa., U.S.A.

New York Office, - 51 Chambers St.

CANADIAN AGENTS: F. F. Barber Machinery Co., Ltd., Toronto; Williams & Wilson, Ltd., Montreal; A. R. Williams Machinery Co., Ltd., Nova Scotia, New Brunswick, Manitoba and British Columbia.

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FORGED SHAFTINGS

Up to
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Smooth Forged Rough Turned
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Send Blue Prints for Prices
Prompt Delivery

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MORSE REAMERS

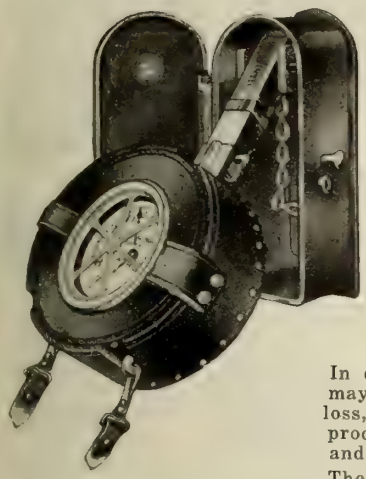
PRODUCE ACCURATE HOLES

NOT OCCASIONALLY BUT CONSTANTLY.

Any work requiring precision can employ the Morse Reamers to advantage.

MORSE TWIST DRILL & MACH. Co.
New Bedford, Mass., U. S. A.

Why Take Chances ?



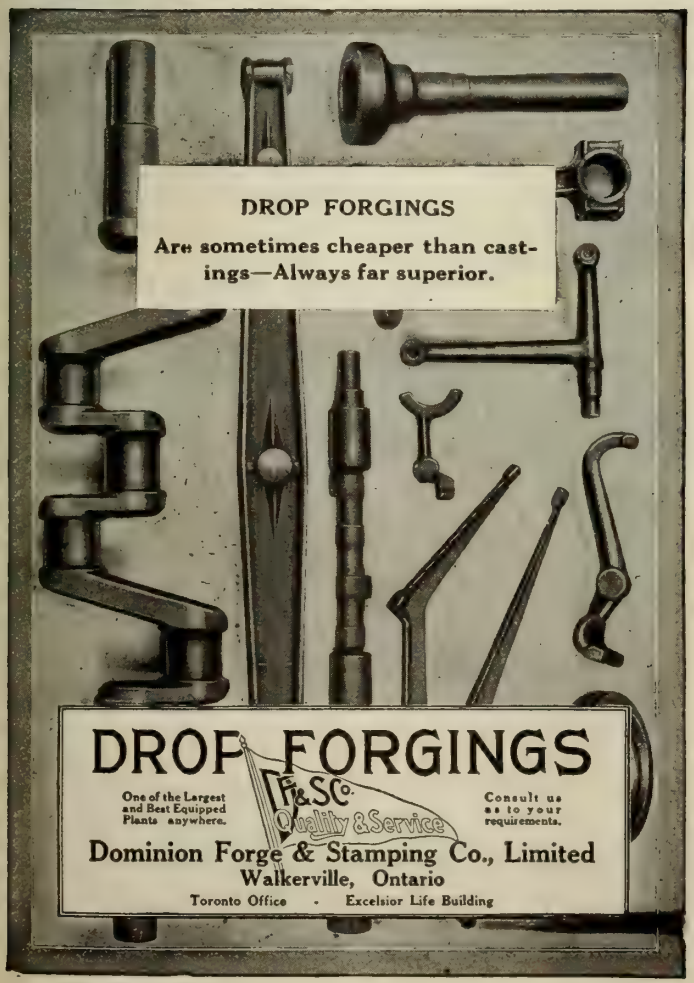
The HARDINGE SYSTEM Protects You

In case of fire, full insurance may pay you for your property loss, but what about loss of production — the laid-off men and general disorganization?

The thing to do is to **prevent** loss and that is just what the Hardinge Watchman's Clock does. It keeps your watchman "on the job" whatever his inclination. With the Hardinge System installed you can rest easy knowing you are taking no chances. It's an **assurance against** fire or robbery and **insurance for** your steady income and production.

Write for our free trial offer.

Hardinge Bros. of Canada, Ltd.
47 Wellington St. E. TORONTO 50 Front St. E.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Are sometimes cheaper than castings—Always far superior.
DROP FORGINGS
One of the Largest and Best Equipped Plants anywhere.
F & S Co.
Quality & Service
Consult us as to your requirements.
Dominion Forge & Stamping Co., Limited
Walkerville, Ontario
Toronto Office - Excelsior Life Building

Three Necessary File Virtues

Properly cut, uniform teeth; proper "balance"; thoroughly hardened steel of the right kind—these are the necessary file virtues.

Fifty years' experience has taught us how to incorporate these virtues in every style and size of file.

You make no mistake when you specify one of these standard brands.

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Great Western
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Arcade
Globe

NICHOLSON FILE COMPANY
PORT HOPE ONTARIO

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STEEL CORPORATION Limited

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CHROME-VANADIUM
CHROME-NICKEL
NICKEL

All of these steels we supply in

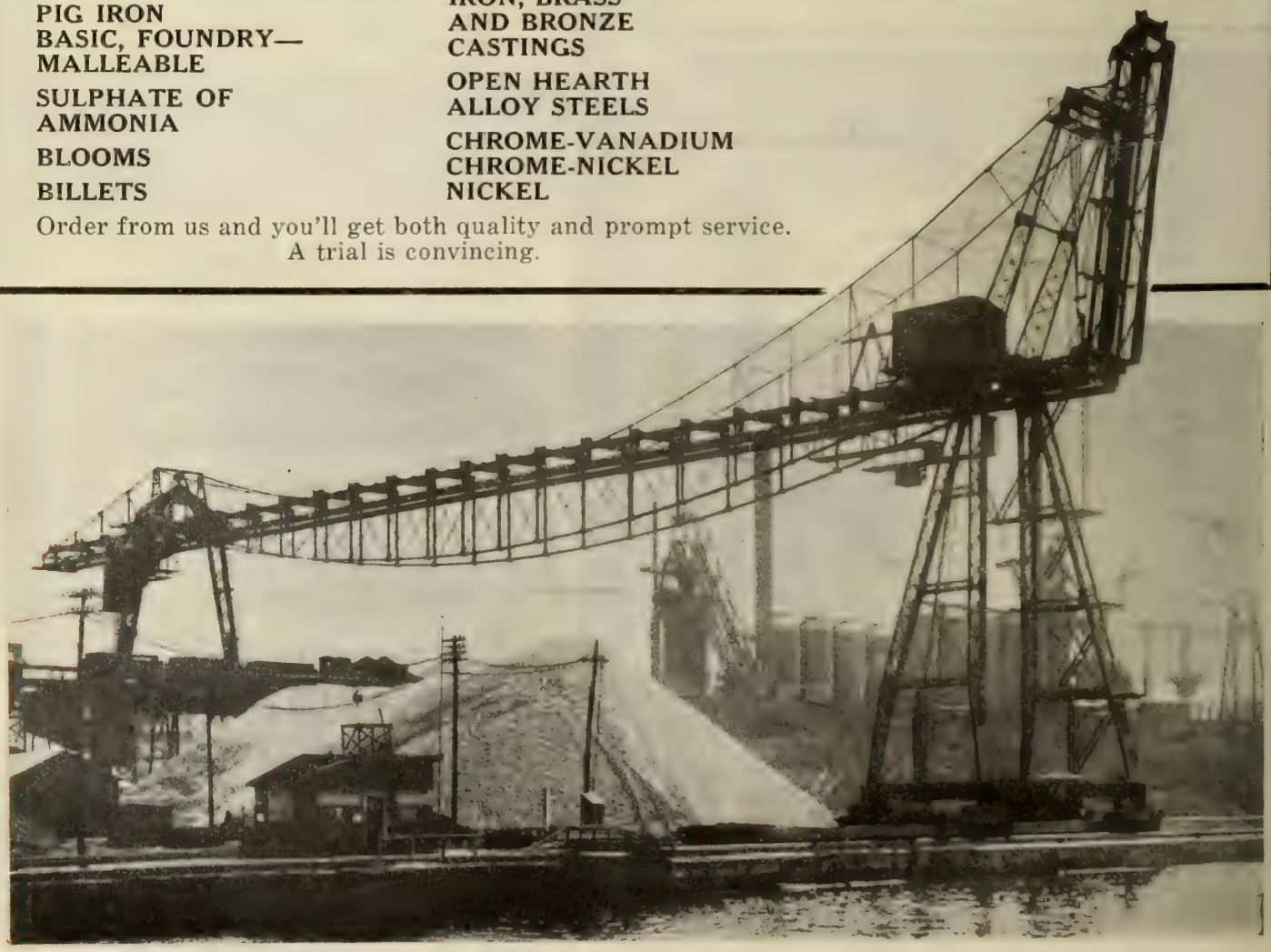
HOT ROLLED BARS

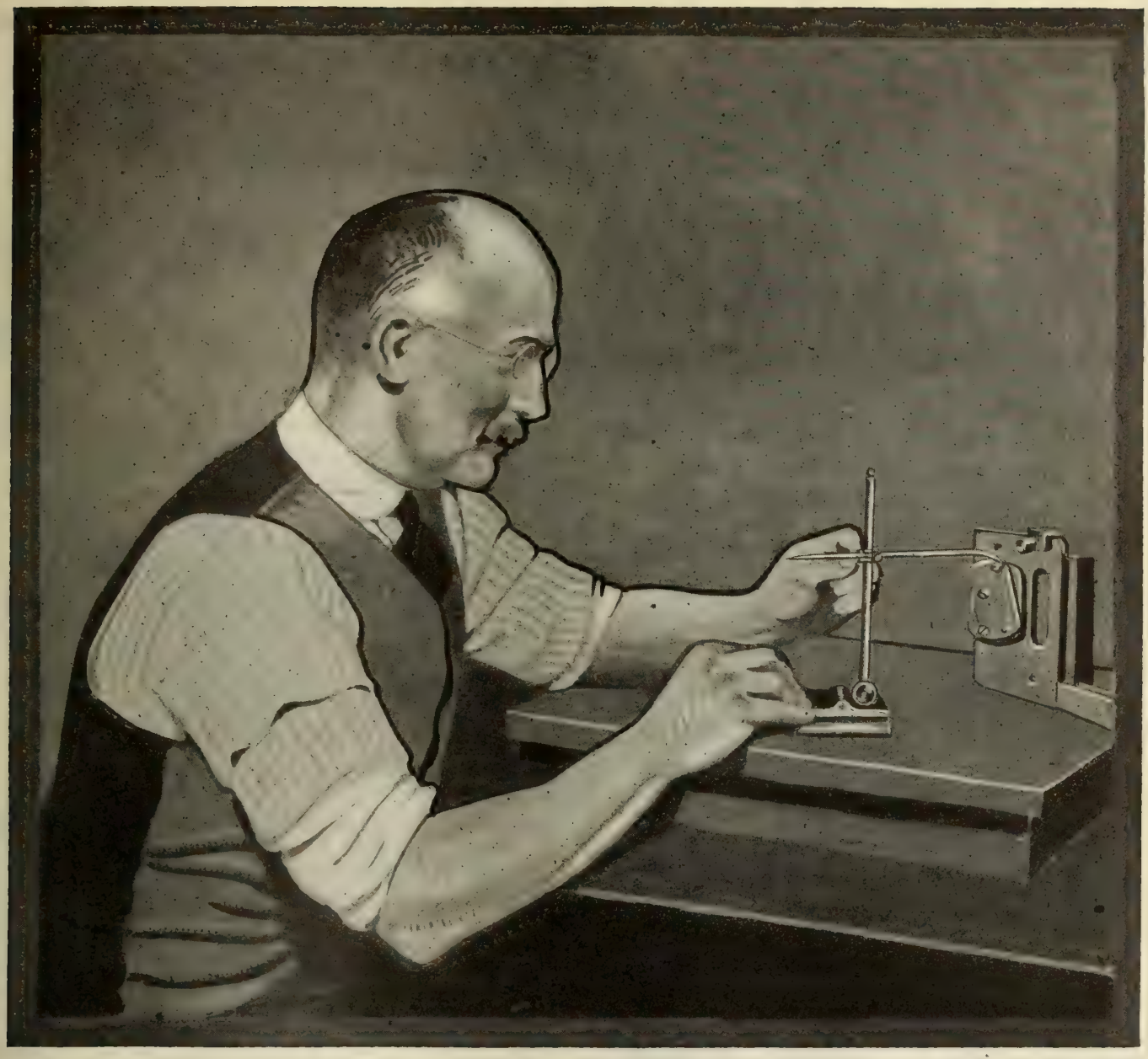
We also furnish in

BLOOM, BILLET AND SLAB FORM

SULPHURIC ACID
NITRE CAKE

Order from us and you'll get both quality and prompt service.
A trial is convincing.





Keeping pace with the amazing industrial progress of the last 40 years, the Starrett line has grown to comprise over twenty-two hundred tools. It is a matter of Starrett tradition to ever anticipate the needs of men who work metal within close limits.

There is listed in the Starrett Catalog a tool designed to meet every need of the machinist and mechanic. Write for No.

THE L. S. STARRETT CO.

The World's Greatest Toolmakers
Manufacturers of Hacksaws Unexcelled
ATHOL, MASS.

42-343

STARRETT TOOLS — STARRETT HACK SAWS — CUT QUICKER LAST LONGER

Starrett Tools

TRAFFIC
a science in itself

Only the institution operating on a major scale can maintain that type of fully-manned, thoroughly-experienced Traffic Department which best guards a buyer from shipping delays, needless freight charges and interruption of production-schedules. It is more than a man-sized responsibility—it is an organization-sized job for a specialized staff such as M. A. Hanna & Co. maintain at all times.

HANNA

M.A. HANNA & CO.

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Philadelphia New York Toledo
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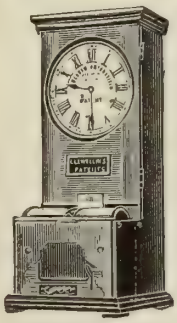
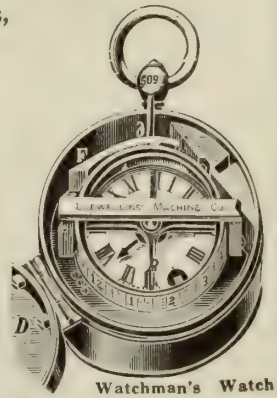
Time Checking Machines, Time Recorders, Watchman's Watches, Recorders for all purposes



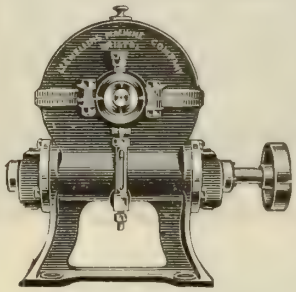
WATCHMAN'S Watches check the rounds of watchmen ensuring less risk from fire etc. with a consequent reduction in insurance premiums



P 18 Class, Patent Card Recorder

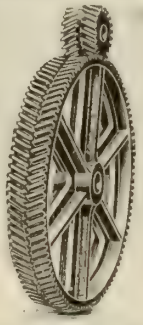
Watchman's Watch

GEARS Machine Cut Machine Moulded All Sizes and Descriptions



Totally enclosed Worm Reduction Gear.

Specialists in High Speed-Reducing and Accelerating Gears.



D.H. Stag Tooth Wheel & Pinion

Llewellin Machine Co., Bristol, Eng.

TELEGRAPHIC AND CABLE ADDRESS: Llewellins, Bristol, Eng.

You're A Mechanic—So You Know

That a Knurling Tool can't be expected to produce uniform work, or even last any length of time, unless it is self-centering (with as little lost motion as possible,) and the Knuckle or Joint has ample bearing to resist the severe strains of both end and side thrust.

As the product of practical men — specialists in fact — the **Armstrong Knurling Tool** naturally embodies these essentials of construction. These, together with excellence of design and high quality material and workmanship, are factors of its wide popularity.

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ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"

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Canadian Agents:

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THE MORSE CHAIN CO.

are the
Largest Manufacturers in the world
of
High Speed Silent Chains

The superiority of Morse Rocker Joint Silent Chain has never been seriously questioned.

They speed up production, cut belt expense and overtime wages.

Catalogue Free.

Jones & Glassco (Reg'd)
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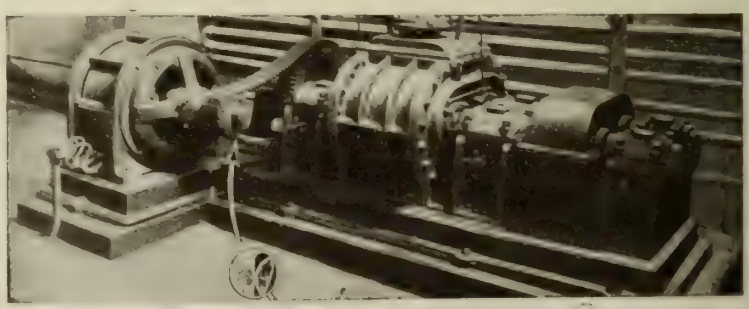

25 H.P. Morse Silent Chain to Positive Blower.

WHEN you buy Hoists—Buy the Wright High Speed.

It's the most reliable, speediest, safest and easiest operated, one-man hoist that you can get.

All steel construction with large overload c. pacity. Built in sizes from 1 to 10 tons. Investigate and be convinced.

We have the proof. Shall we send it?

LISBON OHIO.

Canadian Distributors:
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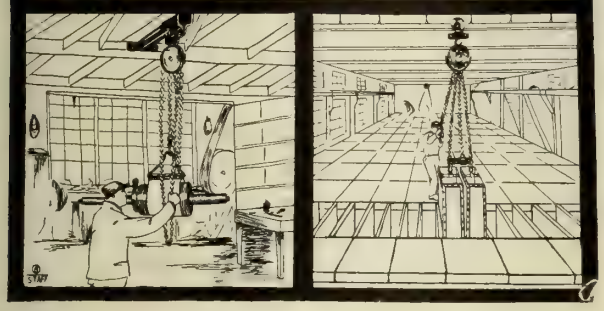
WRIGHT MANUFACTURING COMPANY



THE WALLACE BARNES CO. LIMITED
WIRE
BARNES CANADIAN SPRINGS
STEEL
HAMILTON, ONTARIO
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Precision

Springs

Best Grade Flat Tempered and Annealed Spring Steel;

Phosphor Bronze, Music, Brass and Tempered Spring Wire

MALLEABLES
OF QUALITY SINCE 1878.
SMITH'S FALLS MALLEABLE CASTINGS LTD
SMITH'S FALLS, ONTARIO.

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UNIVERSAL GRINDING MACHINES
THE THOMPSON GRINDER CO.
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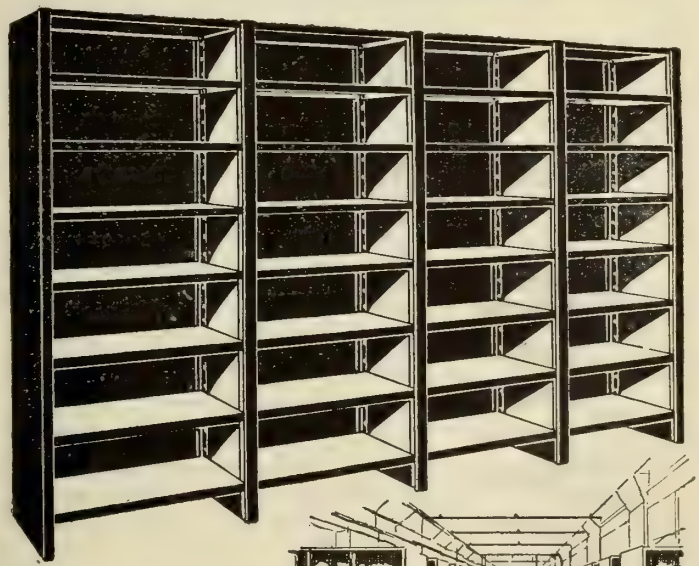

If you buy it from DENNIS', you'll pay no more, but you'll surely get more.

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DENNISTEEL
Steel Shelving
THE DENNIS WIRE AND IRON WORKS CO. LIMITED
LONDON CANADA

Classified Opportunities
on Page 48

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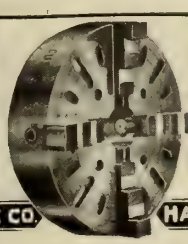
On the Experience of the Past



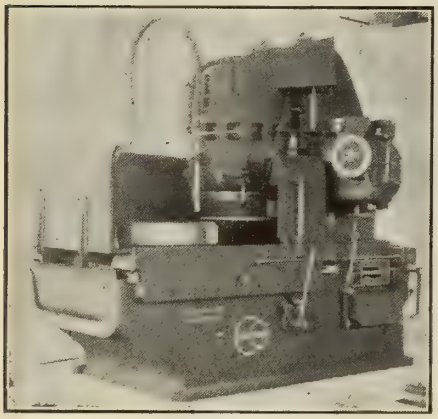
The "Incomparable"

That New Steel Chuck

Style 214

THE CUSHMAN CHUCK CO. HARTFORD, CONN., U.S.A.

THE JOHNSON FRICTION CLUTCH
AS USED ON THE
NEW No. 27-R, BLANCHARD VERTICAL SURFACE GRINDER



Courtesy The Blanchard Machine Co., Cambridge, Mass.

Another advance of progress in abrasive engineering is the use of Johnson friction clutches on this **NEW** machine.

Two No. 6 double clutches provide for rapid raising or lowering of the wheel.

One No. 10 single clutch is located in the gear box for rotating table.

The **AUTOMOTIVE INDUSTRY** demands reliable friction control—the Johnson Friction Clutch is the answer.

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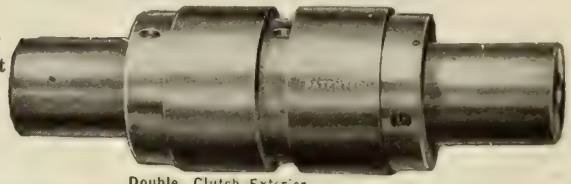

Double Clutch-Exterior

THE CARLYLE JOHNSON MACHINE CO. MANCHESTER CONN

STEEL CASTINGS

QUICK DELIVERIES

High Carbon Steel
Manganese Steel
Chrome Steel
Mild Steel

QUALITY GUARANTEED

Sizes—½lb. to 5,000 lbs.

THE WILLIAM KENNEDY & SONS LIMITED
OWEN SOUND, ONTARIO
ESTABLISHED 1860

SPRINGS
You Can Rely Upon

RAYMOND SPRINGS are built by specialists equipped with the most modern manufacturing and testing equipment. They are **built to order** and are designed and made to give the utmost service in the capacity for which they are needed. That is why Raymond Springs are used where the specifications demand the best material and the highest grade of workmanship.

Send for catalogue.

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TURRET LATHES
Hand Operated
For Chucking and Bar Work
AUTOMATIC TURRET LATHES
For Chucking Work
VERTICAL BORING and TURNING MILLS
UNIVERSAL TOOL GRINDERS
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REAMERS, "SOLID ADJUSTABLE"
Shell and Chucking
BORING BARS
With Adjustable Cutters
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BROWN-BOGGS

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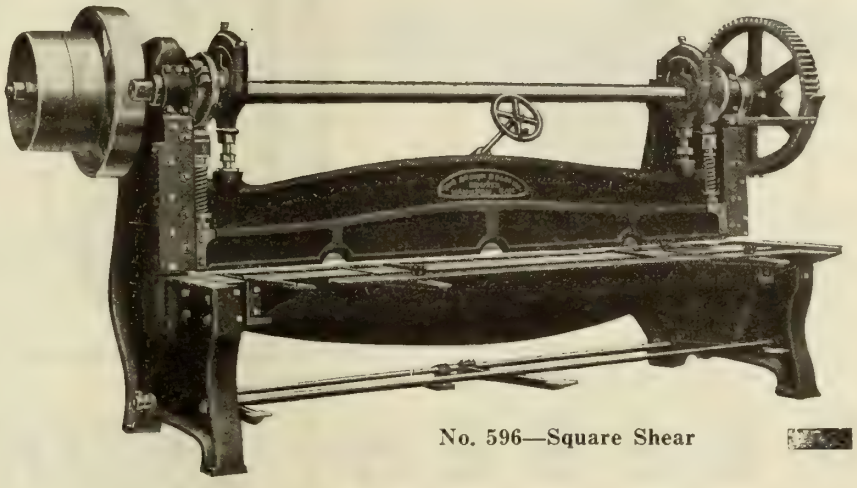
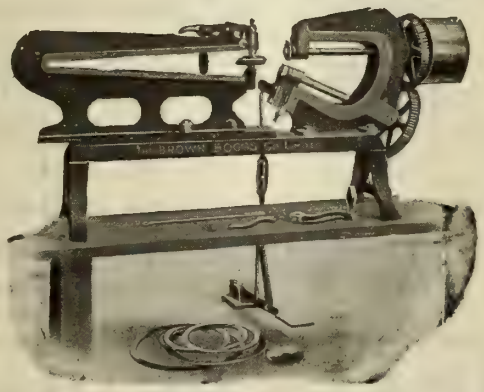


No. 596—Square Shear



No. 36—Ring and Circular Shear

EVERY Brown-Boggs product is manufactured from the highest quality materials, by thoroughly competent workmen, in a fully equipped modern plant. Many years of manufacture and exhaustive experiment have resulted in the invention and improvement of the various "B-B" Tools. Before any article leaves the factory it is rigidly tested to insure a high safety factor.

These are the reasons why the Brown-Boggs trade-mark stands for reliable service!

The "B-B" line comprises tinsmiths' tools and sheet metal working machines of all kinds; canners' and evaporators' machinery; shears of every description; power presses for punching, forming, embossing, blanking, etc.

TORONTO OFFICE:
Holbrook Building

A. B. WALKER
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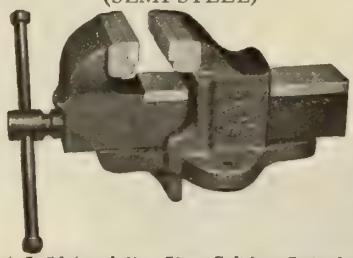
THE BROWN-BOGGS CO. LIMITED
HAMILTON, CANADA.

HINTS TO BUYERS

BEAVER VISES
A Thorough Canadian Product
(SEMI-STEEL)



Super-Strength
Fine Workmanship

Good Appearance
The All-Purpose Vise

4, 4½, 5, 5½ and 6in. Sizes Solid or Swivel Bases
ATTRACTIVE PRICES; Manufactured by
Philip Gies Foundry, Kitchener, Ont.

The CHICAGO
APPROVED PORTABLE
WATCHMAN'S CLOCK

with its special Waltham movement, its lock stations and its superior quality throughout, is especially desirable for mills and factories and for either indoor or outdoor patrol.

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1526 S. Wabash Ave., Chicago

CANADIAN FAIRBANKS-MORSE CO. MONTREAL
BENNETT & WRIGHT, TORONTO

PRESSES
HYDRAULIC SCREW AND FILTER

Hydraulic Wheel Press

Made in Canada

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A BALATA BELTING

Which We Guarantee Second To None And Entirely Satisfactory

Try One And Be Convinced

J.C.McLAREN BELTING CO.
Limited
MONTREAL TORONTO WINNIPEG

TRADE MARK
THE J.C. McLAREN BELTING Co LIMITED

MORTON
Special TRAVELING Head Cylinder Planer

Has complete equipment for machining locomotive cylinders, including special chucks for holding and centering cylinders from the bore.

Reliable because it's Morton made.

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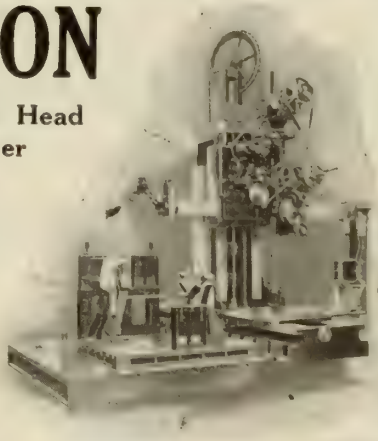

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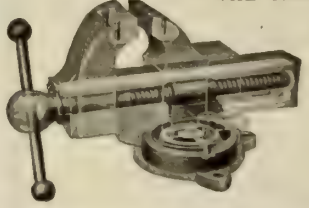

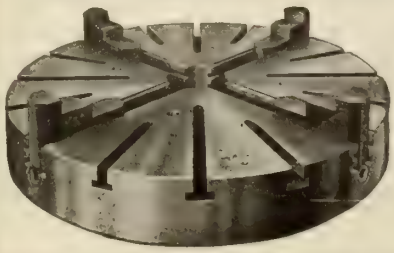

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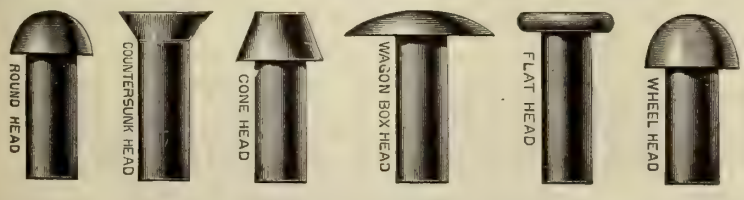

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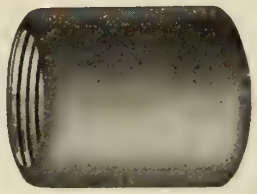

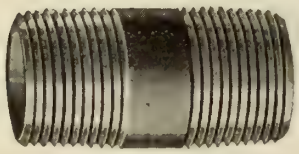

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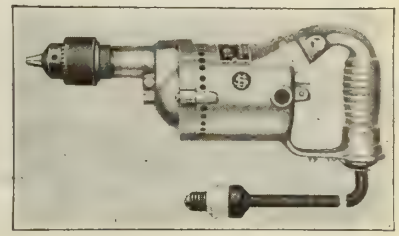

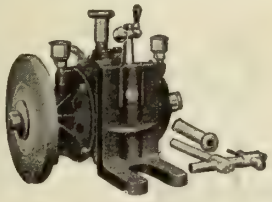

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The same combination of circumstances may never occur in relation to your own gas supply, but this situation which is vouched for by the firm's own figures, actually exists. It may serve to suggest some place in your own plant where a reliable

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can save you money. Gas, air, steam and many liquids are being accurately measured and continuously recorded by one and another of the Bristol pressure gauges.

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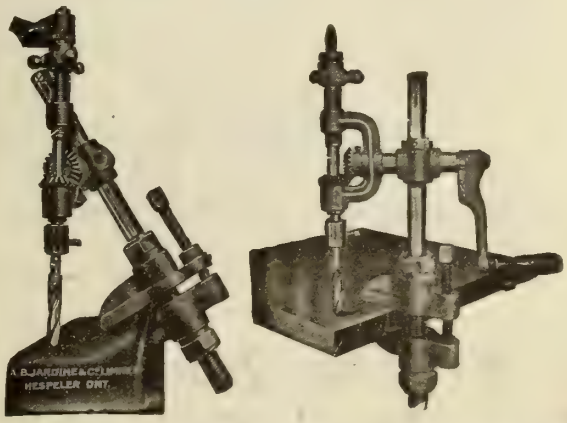
Jardine Universal Ratchet Drill

Time is expensive when a machine is standing idle, waiting for repairs.



On the average repair job, this machine completes the drilling in less than the time required to set an ordinary ratchet to begin.

Weight, 40 lbs. Price, $26.50 net.
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C. P.	39"	52"	63"	79"	9"	1"	1.25"	1 5"	2"	2.5"	3"
D. P.	8	6	5	4	3.5	3.14	2 51	2 09	1.57	1.26	1 04
Face	1 18"	1.57"	1.89"	2.35"	2.7"	3"	3.75"	4 5"	6"	7.5"	9"
Teeth											
12	.031	.055	.079	.124	.162	.201	.314	.452	.804	1.258	1.811
13	.033	.058	.083	.129	.169	.210	.328	.472	.840	1.310	1 890
14	.033	.059	.086	.133	.174	.216	.337	.486	.864	1.350	1.944
15	.035	.062	.089	.139	.182	.225	.352	.506	.900	1 406	2.025
17	.037	.066	.095	.148	.193	.240	.375	.540	.960	1.500	2.160
19	.040	.072	.107	.160	.210	.262	.408	.587	1 045	1.633	2.350
21	.043	.076	.109	.169	.223	.277	.432	.623	1.106	1.726	2.488
23	.044	.078	.111	.174	.228	.282	.440	.634	1 128	1 763	2.538
26	.046	.081	.116	.182	.238	.296	.457	.665	1 183	1.846	2.660
30	.047	.084	.121	.188	.246	.306	.478	.688	1.224	1.913	2.751
35	.049	.086	.124	.194	.253	.314	.491	.708	1.258	1.964	2.828
42	.051	.091	.129	.202	.264	.329	.512	.739	1 299	2.064	2.954
55	.053	.093	.134	.209	.274	.339	.530	.762	1.356	2.118	3.042
80	.055	.096	.138	.215	.281	.349	.545	.786	1.397	2.183	3.134
85	.055	.098	.141	.220	.287	.358	.562	.806	1.402	2 239	3.142

See our advertisement of July 20th for Formula and Aug. 3rd for Chart to use in connection with above

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Hamilton Gear & Machine Co.

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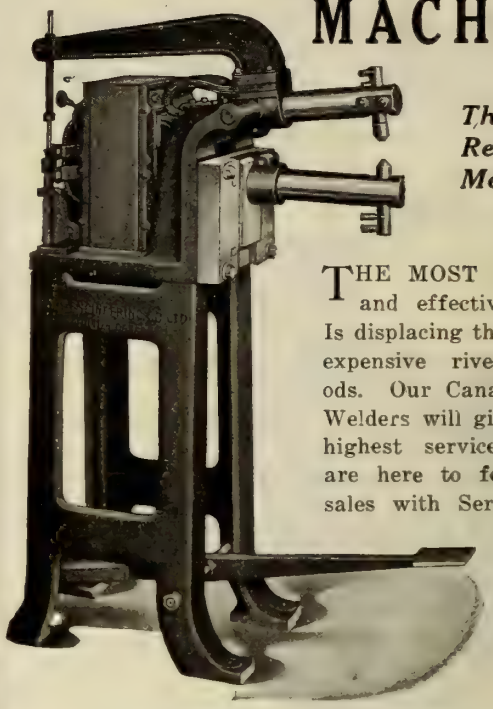

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THE MOST economical and effective method. Is displacing the slow and expensive riveting methods. Our Canadian-made Welders will give you the highest service, for we are here to follow our sales with Service.

Illustration Shows our standard Spot Welder, adaptable for all classes of Spot and Lap welding up to ⅛ in. thick.

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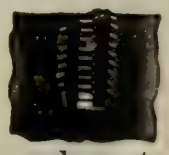

Next time a tap breaks below the surface of a large casting, don't let some makeshift method of removing it injure the thread and waste half an hour of valuable production time. Instead—

Walton it Out in a Jiffy

And save the casting.

Special analysis steel fingers of the Walton Extractor drop into the flutes of the broken tap—and grip. Then a few turns of a wrench applied to the squared end of the Extractor backs out the buried tap.

Sixty-day trial offer proves the Walton Extractor pays for itself. Write.

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Bar, Wire and Ribbon

LEAD PIPE
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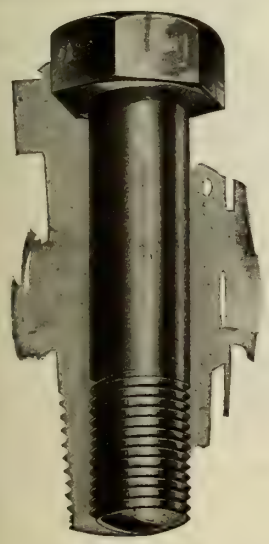

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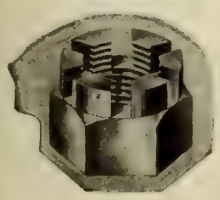
Your rush orders filled promptly by



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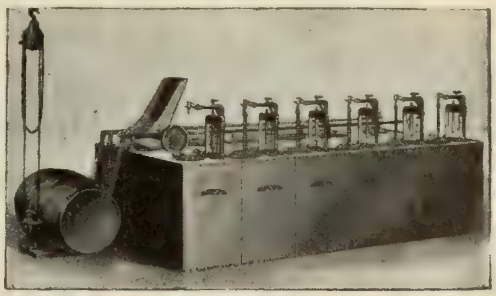

The Bowser Oil Bank Will Give You a Check

"Bill, that chewing gum man has the right idea for oil. You know, he says: 'Sealed tight keeps right!'
"Do you realize, that, since we put in that Bowser equipment to handle oils, our lubrication trouble just disappeared?"
Bowser tanks assure the constant operation of your machines without those expensive shut-downs caused by out-of-service equipment—because the all-metal oil-tight construction of Bowser tanks prevents dirt and grit getting into the oil, robbing it of its lubricating qualities.
Lubrication trouble, thief of time and upsetter of production schedules, can be completely eliminated by Bowser equipment in your plant, just as it has been in hundreds of other plants—names on request, of course! And not only is the oil maintained at its full lubricating efficiency, but all waste and spillage are eliminated—thereby the fire hazard is wiped out.
Booklet C-13 is of vital interest to you. It will be sent upon request. Or, better still, permit one of our engineers to make a survey of your plant—you will find his suggestions worth while if you wish to save money and to increase production.

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Write for Booklets

Snagging the Rough Casting With NORTON Grinding Wheels

THE modern way to remove gates and fins from castings, all sizes and kinds, is to use a grinding wheel of correct abrasive, grit, and grade to remove the surplus metal in the least possible time. A slow cutting wheel raises the overhead cost tremendously.

Use Norton **Alundum** Wheels for snagging all steel and annealed malleable iron castings.

Use Norton **Crystolon** for snagging all gray iron, brass, and aluminum castings.

We will select the proper wheel for you, if we know just what the composition of your metal is, the average size of your castings, and the type of machine you use.

Off-hand grinding on a floor stand.

Grinding with a swing-frame machine.

Try one wheel and draw your own conclusions

Flexible shaft equipped with Norton Wheel.

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CANADIAN MACHINERY
AND
MANUFACTURING NEWS

VOL. XXVIII, No. 7 AUGUST 17, 1922

Emergency Methods that Proved Effective

How Difficult Problems Have Been Solved, Very Often On Short Notice—Repairing a Wooden Tooth Bevel Mortise Gear—Impromptu Internal Grinding—Wooden Centering Devices—Extending a Planer Bend—Shop Ingenuity

IN spite of the best laid plans every shop runs up against an emergency proposition periodically. In the case of a manufacturing plant the nature of these emergencies often is such that it becomes an executive's problem. In the smaller shops, where jobbing and contract work are the only activities, a fairly large proportion of the regular run of work may be classified under the term "emergency," and often these problems have to be solved in the shop and not in the office. The executives of these small shops do not always place at the disposal of their foremen and mechanics the latest and most up-to-date equipment for special jobs. For this reason, the small shopmen need to be able to plan a piece of work on a moment's notice, and then be able to execute it with whatever equipment there is at hand.

It is often the case that such work is placed with the shop by an establishment that has been unfortunate enough to have had a breakdown, and all, or a part, of its operations are suspended until repairs are effected. Furthermore, it is frequently the work is undertaken because the firm in question have been good customers in the past, or that they will have considerable work in the future. Thus one particular job may not be attractive, but is accepted in order to give service to a good customer. The amount that should be charged up to the job to enable that shop to come out even, in many cases would seem excessive, so it is up to the mechanic to complete the work, often under a disadvantage, as economically as possible. Work, in most of these cases, must be started at once, as every hour is valuable. The shopman has no choice but to visualize the job as a whole and plan it on short notice.

Cogging a Mortised Tooth Gear

One of the most common ways of harnessing vertical shaft turbine water wheels, up to about twenty years ago, was by means of wooden teeth bevel mortise gears, mating with cast iron pinions. In a number of isolated plants to-day this form of gearing is still used on the water wheel drives. In this gearing the wooden teeth wear out more quickly than the iron pinion teeth, which necessitates these wooden teeth being replaced at intervals.

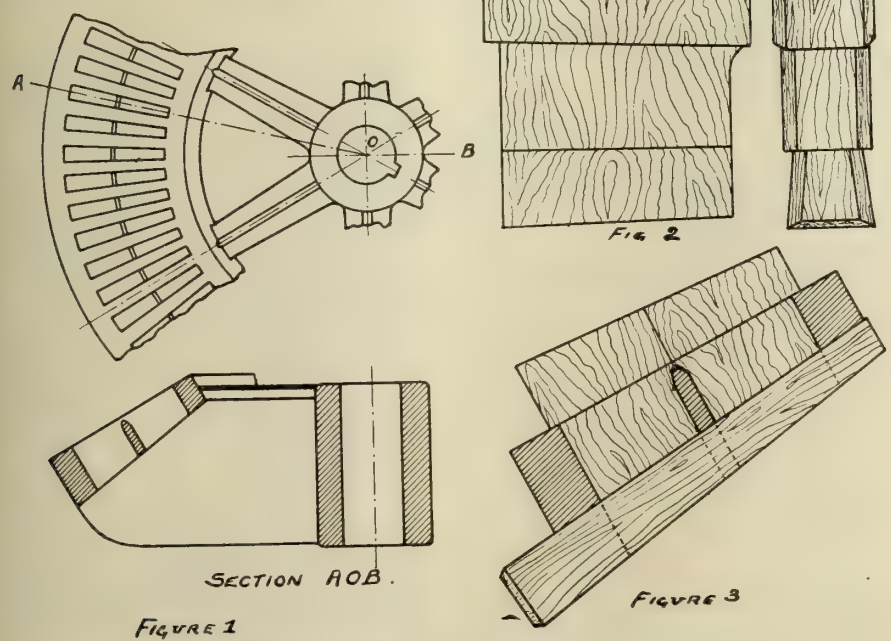


Fig. 1.—Section of bevel mortise gear casting. Fig. 2.—Wooden cog for bevel mortise gear. Fig. 3.—Rim section of bevel mortise gear with cog and gear in place.

In a paperboard mill in Ontario one of these gears was run until the teeth stripped. A local machine shop was immediately called on the phone and the order for the repair of the gear was thus given. The gear was placed on the way freight the same day, and next morning was delivered to the shop.

This particular gear had sixty teeth, four inch circular pitch, with a face of fifteen inches. The slots into which the wooden teeth mortise were cored in when the wheel was cast, and were not machined. Thus they were slightly irregular, and could not therefore be depended upon for the spacing of the teeth. A section of the gear is shown in Fig. 1. The teeth were sawn out of hard maple stock in two sections, the large end finishing up seven inches face and the small end eight inches face. One of the large end cogs is shown in Fig. 2. The small ends were fitted and driven into the casting last. Then the large ends were fitted and riven. The small openings between the solid heads of the cogs were plugged with pine wedges, to prevent the splintering of the heads when turning. Then the gear was placed on a mandrel and then in a lathe where the turning was accomplished. The gear was next mounted on a dividing head which was placed on a planer table. The gear was allowed to overhang the table as shown in Fig. 4. A planed surface was placed in front of the gear just below the centre line of the dividing head arbor. A surface gauge was carefully adjusted so that the point was coinciding with the level of the centre line of the arbor. This surface gauge was used to scratch a line in the centre of each tooth. The ends and face were marked. Then each section of each

tooth, and the slots in the gear, were numbered, and the teeth were driven out for dressing. Templates of sheet zinc had been filled and the profile of the teeth was scratched on each end of each section of the wooden cogs. A formed fly cutter had been made to conform to the profile of the zinc templates. This cutter was attached to a vertical shaft. A special vise was rigged up and placed on a planer table. The teeth with solid heads were clamped in the vise, which was set at such an angle that when they passed the revolving fly cutter, one side of the tooth profile was formed. Fig. 5 diagrammatically shows the general arrangement. The vise was arranged so that a slight vertical adjustment was possible, so that each tooth would be formed symmetrically about the surface gauge centre line. Small wooden stops were placed in the vise which permitted the quick clamping of successive wooden teeth or cogs, with only the vertical adjustment to be made. The shaft driving the cutter was belted to the planer counter shaft through the medium of a special counter shaft mounted on the floor, and a quarter turn belt. The speed of the cutter was approximately 1,200 r. p. m. The planer was used to feed the work past the tool, the regular cutting speed of the planer not being changed. It may be here stated that the machine was not a high speed tool, and the table travelled at about thirty feet a minute. Two cuts, one on each side of the cog, were necessary on each section of the two-piece teeth. When the cutting of the profile on the teeth was accomplished, the teeth were redriven into the wheel. Then the keys of Norway pine were fitted and driven. Fig. 3 shows a section of the gear with a key in place. The profiles of the teeth were then smoothed up with sandpaper, and finally were given a coat of linseed oil. Fig. 6 shows details of the vertical shaft, fly cutter, block and special collars. Fig. 7 shows the gear skidded and ready to be shipped out.

It may be here questioned why the gear teeth were not cut when the gear was on the dividing head. It was found to be very difficult to rig up a cutter to get at the teeth when they were in the wheel. This could have been done very nicely had there been time to have obtained one or two castings and to have machined them. Then again there was very little provision in the apparatus used to prevent the gear slipping on the mandrel of the dividing head while the cutting was actually taking place, and if this occurred, the teeth would be improperly spaced. The simple scratching of the line on the teeth exerted no pressure, or tendency to turn, to speak of, and thus it appeared reasonable to assume that the indexing thus obtained was proportionately as accurate as the spacing of the worm wheel in the head.

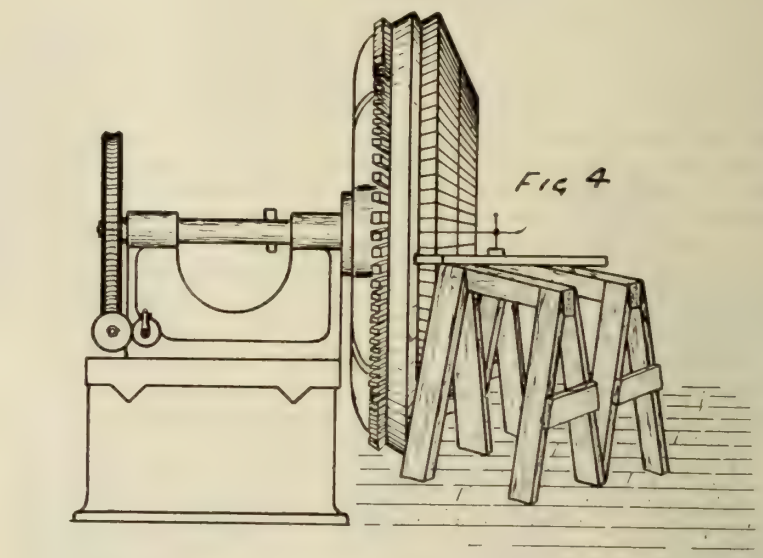
The gear was rushed back to the paperboard mill and was immediately placed in commission. Reports some months afterward stated that it had given perfect satisfaction.

Impromptu Internal Grinding

During the period when shell manufacturing was at its height and all kinds of material and supplies were in heavy demand, many emergency methods were employed. In one shop, chilled cast iron dies for nosing the 4.5in. shell were used. On one occasion when it became necessary to change dies there was only one extra die in stock. Upon placing this die in the hydraulic nosing press it was found to be a little rough, causing it to be somewhat difficult to quickly release a shell after nosing. The die was taken out and chucked in a lathe. An aloxite grinding wheel was placed on an arbor, which was clamped in the boring bar holder of the lathe. The grinding wheel was secured so that it could not turn on the arbor. The lathe was revolved at top speed with the open belt. By manipulating the compound rest, the die profile was ground and polished in a short time, and when again placed in service functioned properly.

In the case of a small lot of fifty bevel gear castings which were being bored, a very useful wooden device was designed. The work was executed on an engine lathe. The face plate was placed on the machine, and two pieces of hard wood were bolted to it. The wood was 2½ inches thick, and covered a space somewhat larger than the diameter of the gears to be bored. The wooden pieces were bored out to fit the bevel of the teeth in the gear castings. The castings were simply placed in the wooden fixture and a clamp was used to hold them securely, the centering being accomplished by the pieces of wood. The result was that the time consumed in placing castings in the lathe was reduced to a minimum.

Wood can often be used to good advantage in making special steady rests for work that cannot be taken care of by the regular form of equipment. Templates for small lots of drilling can be made of wood. Of course, wooden jigs and fixtures will not have permanent accuracy, but they do good work when it is only required to machine small lots of work quickly in a repair shop.



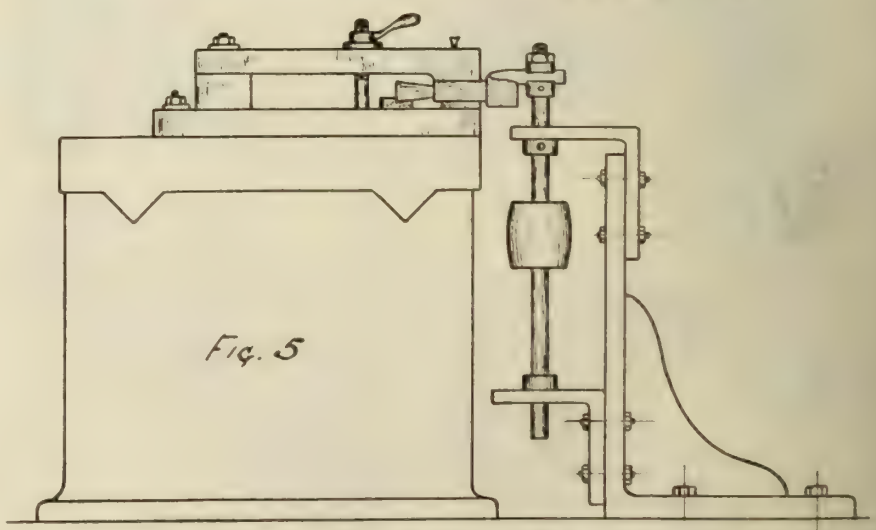


Fig. 4.—Indexing teeth in a bevel mortise gear previous to cutting same. Fig. 5.—Cutting profile in wooden teeth.

A short time ago there came to a small shop a cast iron solid pulley eighty inches in diameter, in which it was necessary to cut a second keyway on the quarter with one already cut. The job caused the foreman some thought before he finally solved the problem. He removed the table from his largest shaper, which was only a small machine, and proceeded to bolt the pulley to the shaper frame. Cast iron blocks were placed between the pulley hub and the shaper column. These blocks were planed thinner at one end than at the other. This secured the pulley slightly out of the vertical, so that when a bar and keyseating tool were used in the ram, the keyway was cut slightly deeper at one end than the other. It was only necessary to block the pulley at the proper height, and the cutting of the keyway became a simple matter.

Extending a Planer Head

A machine shop is often up against the problem of planing a piece that is too wide to go between the uprights. This type of job is sometimes handled by placing a tool in a bar and thus extending it in front of the head some little distance. This necessitates slow work as the bar tends to spring upward when the tool enters the work, if the cut is at all heavy. When this occurs the cutting edge of the tool is dragged over the work on the return stroke and its edge ruined. This condition of affairs is further aggravated if the planer takes its feed on the return stroke.

A rather good device, which was noted not long ago in a Montreal shop, was one that carried the entire head, hinged block, tool holder and all, out from the cross rail about thirty inches. The device was seen on a 36 x 36 inch planer. The extension block was a hollow cylinder flanged at both ends. It was drilled to fit the bolts that slide in the circular ways in the head, and the regular planer bolts were used. All of the power horizontal feeds were still available. The vertical feed could only be operated by hand, however. The device only increased the capacity of the planer to a nominal extent, but this shop found it very useful on a large number of jobs. The cylindrical shape of the cast iron extension block was such that it resisted distortion. Of course, with a thirty-inch extension there was some deflection or spring, as each piece of the machine was susceptible to this influence and the net cumulative effect was present. At the same time it was far more rigid than such devices as a tool on a bar.

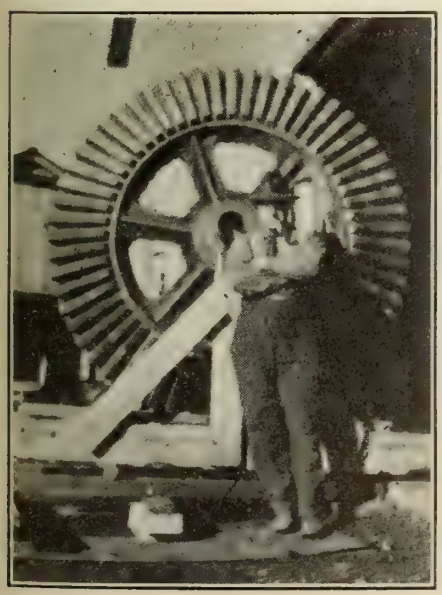


Fig. 7.—Gear ready for shipment.

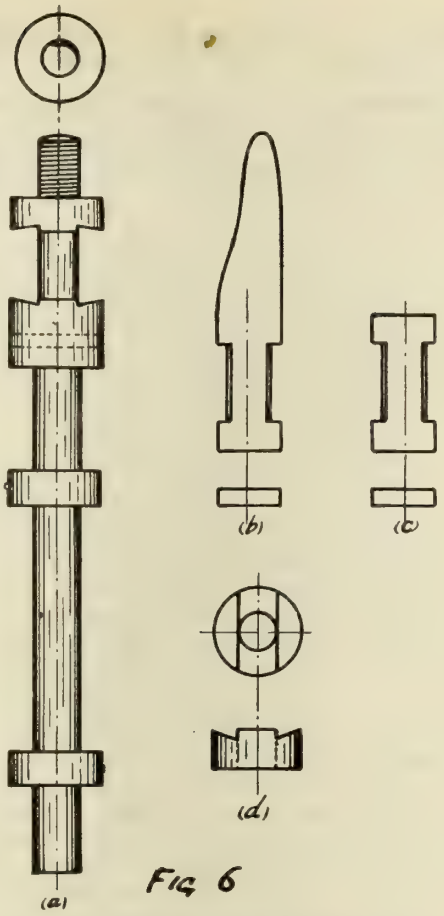


Fig 6—Details of spindle shown in Fig. 5. (a) spindle. (b) fly cutter. (c) block. (d) special form of collar to secure cutter.

Shop Ingenuity

From day to day many such jobs are done, and unfortunately most of them do not receive more than passing attention, as they are usually considered all a part of a day's work. The ingenuity displayed in our machine shops to-day is greater than ever before, as a wider range of work is presented to them. Machine shop equipment is also covering a wider field. But after all is said and done, it is often the small shop that displays the greatest originality in extracting itself from emergency situations, as it must do so with comparatively meagre equipment.

There are two classes of employees—those who ought to be "let out" in time of depression, and those who take on additional work.

CANADA'S MOTOR EXPORTS GROWING

IT is predicted that within a decade Canada will be the greatest automobile exporting country in the world, says The Industrial Digest, New York. Several of the world's largest producers of motor vehicles, according to recent reports, are now handling all their export business from the Dominion, while the largest individual manufacturer of motor cars has for some years filled all orders from the British Dominions and possessions from his plant on the Canadian side of the St. Clair river.

The progress of the automobile export business in Canada has been comparable to the remarkable development which has taken place in the home market. With a population of about 9,000,000, Canada owns and operates over 400,000 automobiles and trucks. A decade has witnessed an increase in automobile ownership of twenty fold. While such a phenomenal advance is not to be expected again, continuous replacement of motor vehicles is assured. Within the next ten years, Canada will offer a home market for more than 500,000 motor vehicles for replacement purposes only. In that time, it is believed the market will expand its demand from 50,000 to 60,000 motor vehicles per annum, which it now offers, to beyond 100,000 motor vehicles.

In the automobile manufacturing concerns alone, employment is given to about 8,000 wage earners and 1,200 or 1,500 salaried hands. Wages paid total about $10,000,000 and salaries about $3,000,000. Manufacturers of automobile supplies pay salaries amounting to nearly $1,000,000 every year and wages of more than $5,000,000.

In many cases, however, automobiles are assembled rather than manufactured by the Canadian companies sponsoring them, so as the volume of automobiles imported falls off, in proportion to sales of cars made in Canada, the volume of automobile parts imported manifests a decided increase.

The most recent information compiled about the Canadian automobile industry is that contained in a preliminary report on the automobile industry in Canada for 1920, which has just been published by the Dominion Bureau of Statistics. It shows that $67,157,045 worth of material was consumed by that industry during the year 1920. The largest individual item was $12,972,801 for automobile bodies, the next largest, $8,810,486 for automobile engines. In raw materials the principal item of consumption was steel, figured at $1,006,848. Iron and steel castings consumed are stated at $1,763,812 and $1,875,358 respectively.

A Swedish engineer is said to have worked out a method which makes it possible to obtain a very cheap fuel from the residue or lye which results from the manufacture of cellulose.

Does Acid Pickling Cause Brittleness in Steel?

Light Scratches Will Impair Cold Working Properties—May Be Removed By Taking Off a Thin Layer of Material—Heat Treatment Also Beneficial—Excessive Pickling Decreases Toughness

THIS question appeared some time ago in the monthly transactions of the American Society of Steel Treating. In the reply it was stated that one writer claims that the embrittling action of pickling is due to an eating out of the grain boundaries in steel. In a previously printed treatise on the subject the contention of the author was that aid by three micrographs which represented the following conditions:

1. Normal steel before pickling; 2. Steel made brittle by pickling and 3. Steel made brittle by pickling and restored by heat treatment. In these micrographs the grain boundary lines were shown to be widest in the brittle material and of less but about equal width in the other two samples. Measurements were given stating that the grain boundaries are about three times as wide in the brittle steel as in the others.

Pickle brittleness cannot be attributed to widening of the grain boundaries on the basis of the evidence given in this article. This does not mean necessarily that a selective attack on the grain boundary material by the pickling acid is not a factor in causing the brittleness. It would be important to establish whether the fracture follows the grain boundaries in steel which has been made brittle by pickling. If it does not, then the brittleness cannot be attributed to this cause. If it does follow the grain boundaries, brittleness can be attributed to some grain boundary condition which may or may not be a widening caused by corrosion. In looking for information on this point it was pointed out that most of those who have had experience with this difficulty have not observed the path of rupture. One metallurgist says, however, "furthermore the brittleness caused seems to be an intercrystalline one, that is, the fracture seems to follow the grain boundary."

Another writer has suggested that the brittleness may be due to a notch effect consisting in the formation by the pickle acid of minute grooves or notches on the surface of the steel especially at the grain boundaries. This would cause the metal to begin to tear at the grain boundaries. The suggestion is quite logical inasmuch as it is well known that even very light scratches on the surface of steel sheet seriously impair its cold working properties. If the idea of surface notches is correct then the brittleness should be confined chiefly to the surface of the metal and should disappear after the surface layer is removed. There are many indications that pickle brittleness is a surface phenomenon. To begin with it is practically unnoticed except in material of small cross section chiefly sheet and wire. This may be explained in part by the fact that heavier sections such as bar stock and steel forgings are as a rule not subjected to any deforming process, which would reveal brittleness even if it exists. Steel sheet and wire are especially apt to show up this defect, because of the severe deformation they are subjected to in fabrication.

Still another authority states that pickle brittleness can be removed by taking off a very thin layer from steel sheet, perhaps not over about 0.003 inch. This certainly indicates that the surface layers are at least the most affected, which is bound to be the case since the acid begins its attack on the surface. Opinions have also been expressed that brittleness permeates the entire cross section, especially in the case of sheets. The truth of the matter is probably that the action is similar to that of carbonizing, beginning at the surface of the metal and penetrating to a greater depth the longer the pickling is continued.

There is general agreement that this type of brittleness can be removed readily by heating and a common heat treatment seems to be about 10 hours at 400 degrees Fahr. It has also been brought out that no trouble is encountered from pickle brittleness when the metal is heated in the natural course of fabricating operations after the pickling process.

The orthodox theory is that the brittleness is due to the absorption by the steel of the hydrogen liberated in the pickling process. The removal of brittleness by heating is then supposed to be due to the expulsion of hydrogen. If we accept the "notch theory" of brittleness then we must find some other explanation of the removal of brittleness by heating. It has been suggested that this is due to the removal of a small amount of metal by oxidation thereby rounding the corners of the notches or removing them altogether. It appears, however, that pickle brittleness can be removed by heat treatment at a temperature so low that no visible oxidation occurs, and even disappears slowly when the steel is allowed to stand or age at ordinary temperatures. This can be explained on the basis of a slow loss of absorbed hydrogen, but it is difficult to explain on the basis of removal of notches from the surface.

It is still more difficult to account for the restoration of ductility if we consider that the brittleness is due to the actual removal of grain boundary metal. The most that we can concede the grain boundary theory is that the grain boundaries are particularly affected either because of a local penetration of hydrogen or because of the notch effect mentioned.

In connection with this question the writer answering the question stated that he had made some inquiries as to the prevalence of pickle brittleness and found that the largest producers of material in which this defect might be expected do not seem to have much trouble with it. One large company reports that much of its product is not heat treated subsequent to pickling and is subjected to severe deforming operations by customers without any difficulty. It is to be expected that the effect of the brittleness developed will depend considerably on the pickling conditions. Some alternating bend tests by Prof. H. O. Arnold on steel bars showed that doubling and trebling the time of pickling continuously decreased the toughness of the steel. It seems, therefore, that if proper care in pickling is exercised and especially if some time elapses between pickling and use, brittleness is the exception rather than the rule.

BETTER DEMAND FOR ELECTRIC TRUCKS

What appears to be a sign of the times is a statement recently made in the Electrical World to the effect that increased activity is developing in the industrial truck field. This demand for trucks and tractors will be stimulated by a possible tie-up of railroad transportation facilities especially for short haulage. The report states that:—"The resumption of production on a substantial scale by large manufacturing plants in many industries has resulted in the putting into service of internal transportation equipment which in not a few cases has been but partly used since the close of the post-war boom. The pressure upon factory managers to reduce unit costs is leading to more inquiries as to the applicability of trucks and tractors in labor and time-saving tasks. Some of the older units of equipment also have approached the point where replacement is worth considering and the demonstration by manufacturers' engineers that trucks can be economically justified in much smaller plants than used to be the case is helping this business. Some difficulty is being encountered at present in the supply of steel for truck and tractor frames but this is believed to be only temporary.

Prices on several well-known makes have been substantially reduced from the war-time levels and a better understanding of the limitations and use of such equipment is helping to establish a much more stable market for this important accessory.

Electric Control of Planer Table Movement

Small Pendent Push-Button Station for Setting-Up Period—Magnetic Contactors Mounted in Sheet Steel Enclosed Case—Armature Resistance in Rear—Speed Adjusted Without Opening Door

THE CONTROL of the planer by means of electricity is now being recognized as efficient practice. The following description of the Cutler-Hammer full-Magnetic planer controller should be of special interest to many readers.

"The drum type master is designed for operation from the planer table, the small pendent push-button station is used for operating during the setting-up period, the start and stop station is combined with a transfer switch for changing the control from the drum master to the pendent push-button station. It is also possible to provide a separate start and stop station for mounting on the opposite side of the planer from the combined station. A description of the full magnetic planer controller follows:

Main Controller

The main controller consists of a slate panel containing the magnetic contactors mounted in a sheet steel enclosing case with the armature resistance mounted in the rear and the field rheostats mounted on the inside of the door. On the panel are mounted two single-pole Cutler-Hammer circuit breakers with instantaneous trip coils and a manually-operated latch for tripping both breakers at the same time. Two field relays, a low-voltage release relay, a field knife switch with field discharge clips, four single-pole contactors with carbon contacts and mechanical interlocks for reversing, three lockout accelerating contactors and a spring-closed dynamic contactor. The field rheostats are mounted with the operating handle projecting through the door so that the speed can be adjusted without opening the door of the case. The starting resistance consists of cast iron grids mounted on rods and supported by the sides of the case. The protecting resistance consists of "S9" units mounted on an asbestos lumber board. The removable back makes it easy to inspect these resistances at any time.

The accessories consist of a drum type master for operation from the planer table, a pendent push-button station for operation during the setting-up period a "start" and "stop" station combined with a transfer switch for changing the control from the drum master to the pendent and also a separate "start" and "stop" station for mounting on the opposite side of the planer from the combined station.

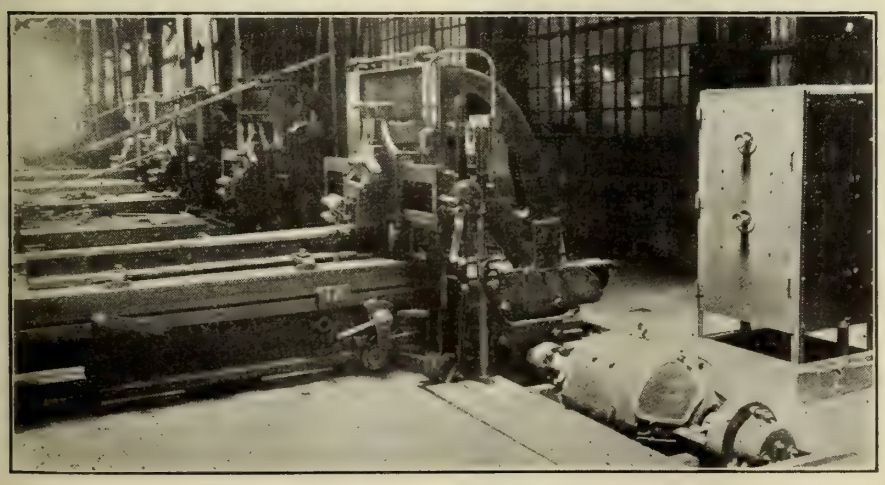
Operation Features

For normal operation, the transfer button is moved to the drum position and the start button pressed. This closes the low-voltage release relay and one set of reverse contactors will close, depending upon the position of the drum master, if this is in the cut position. The cut reverse contactors will close and the motor will start with three steps of starting resistance in circuit. These will be cut out successively by the three accelerating contactors as the current comes down to normal. With the closing of the last accelerating contactor, the field relay opens up and puts the cut rheostat in series with the shunt field and the motor comes up to the speed for which the rheostat is set. At the end of the cut stroke, the drum master will be thrown over by the planer dog and the cut reverse contactor opened and the return reverse contactor immediately closed. This results in plugging the motor which is the fastest method of reversing it. At this time only the last two steps of accelerating resistance are in circuit. These are cut out by the last two accelerating contactors and the motor comes up to the speed for which the return rheostat is set. The reason that the two steps of resistance are used for plugging at the end of the cut stroke, while three are used at the end of the return stroke, is due to the fact that a voltage equal to twice normal is developed when the motor is plugged at the end of the cut stroke while three times normal voltage is obtained at the end of the return stroke, and the current must be held at a safe value in each case. This of course means a different value of resistance for the two strokes and is obtained in the manner described above. The equipment can be stopped at any time by pressing the "stop" button. This cuts the motor from the line and applies dynamic brake which quickly stops it. If the voltage fails at any time, the low-voltage relay releases at 70 per cent. of normal voltage and applies dynamic braking. This becomes an important function if the voltage should fail at the instant the table was about to reverse.

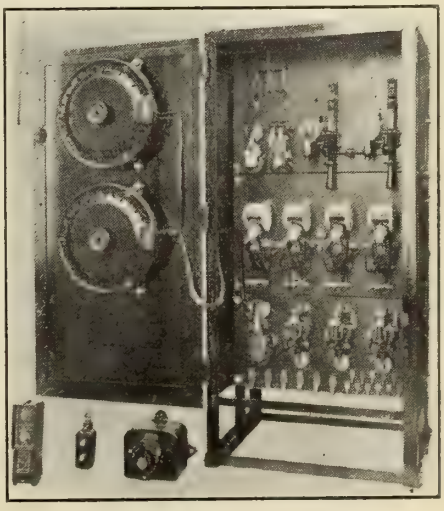
Setting Up a New Job

During the setting up of a new job, the pendent button is used. The control is transferred to this station by means of the transfer button. With this button the table can be operated in either direction by pressing the corresponding button, the motor running only so long as the button is held depressed. Dynamic brake is applied every time the button is released. Operation of the stop button opens the control relay which cuts resistance in series with the

(Continued on page 39)



Showing the equipment of the electrically operated planer



Interior view of control box.

Present Day Problems in Industrial Accounting

Questions Relating to Profit and Loss—Balance Sheet of Paramount Importance—Checking Inventories—Arriving at a Proper Working Basis—Value of Depreciation

BY STANLEY G. H. FITCH.

BROADLY SPEAKING, most accounting problems which we have to solve may be viewed from the standpoint of the balance-sheet. It may be argued that questions relating to the profit-and-loss statement should be separately grouped, but, after all, any transaction affecting the profits necessarily affects also some balance-sheet item, either an asset or a liability. The balance-sheet itself as to form and arrangement presents at once a problem of paramount importance, and in developing the subject we might naturally proceed to take up questions relating to the treatment of the several balance-sheet groups. Some may be wondering how such a treatment of the balance-sheet is going very far toward the discussion of problems in industrial accounting, that cost accounting, a highly important branch of industrial accounting involving the application of overhead expense to the cost of product, has a direct effect upon the subject of inventory valuation, which brings us back at once to the balance-sheet.

Form of Balance-sheet

Much has been written on the subject of a standard form of balance-sheet, but a casual reference to a few forms prepared by banks and bankers, which have been selected at random, discloses a striking lack of uniformity among those commonly used. In submitting a certified balance-sheet, should the accountant follow the form prescribed by the client's bank or by the broker who handles his paper, or should he adopt a form of his own, which in his judgment, owing to the peculiar circumstances of the case, sets forth clearly the client's financial condition, with particular emphasis upon certain outstanding features disclosed by the audit?

The author did not answer the question, but for the purpose of laying the foundation for discussion, mentioned some of the significant variations in three selected balance-sheet forms, designated for convenience as "A," "B", and C."

Current Assets

Balance-sheet "A" classifies as current assets, cash, notes and accounts receivable, inventories, quickly marketable securities and notes and accounts due from officers, stockholders and employees. Balance-sheets "B" and "C" include as current all of the foregoing assets except notes and accounts receivable from officers, stock-holders and employees. Such items in many instances may be slow in realization, but in the other cases they may be quick assets and, for the purpose of setting forth the assets available for meeting current liabilities, they should be included under those conditions as current assets.

Balance-sheets "A" and "B" make no provision for subdividing the asset items for notes, accounts receivable, merchandise or securities, so as to show what has been pledged as security for loans, while balance-sheet "C" assembles in a separate group all pledged current assets (notes and accounts receivable, acceptances, merchandise and securities). This arrangement shows at a glance the total amount of such assets pledged but, on the other hand, makes it impossible without recasting the balance-sheet to state the total amount of each asset, pledged and unpledged. Balance-sheet "A" very properly indicates that reserves for bad debts, discounts, allowances, etc., should be deducted from the asset, while balance-sheets "B" and "C" provide for reserves upon the liability side of the balance-sheet. Inasmuch as the purpose of the balance-sheet is to show the net amount likely to be realized from the liquidation of any current asset, the former method is to be preferred.

Balance-sheet "A" does not provide, however, for a separate classification of notes and accounts due from controlled or subsidiary concerns, and, while such a subdivision is made on balance-sheets "B" and "C," the items are not classified as current assets. It may be pertinent to remark, however, that a scrutiny of the balance-sheets of the subsidiaries might disclose that the balances due the parent company were offset almost wholly by current accounts and notes receivable from customers, so that in reality the balances due from the subsidiaries on the parent company's books actually represent assets more "current" from the standpoint of quick realization in cash than inventories classified as current assets on the balance-sheet forms in question.

Current Liabilities

All three balance-sheets ("A," "B" and "C") include as current liabilities notes payable, accounts payable and accrued items (taxes, interest, etc.), while on balance-sheets "B" and "C" are set forth as separate items dividends declared and payable. Balance-sheets "A" and "B" clearly indicate the separation of notes payable as unsecured and secured respectively, but the amounts are grouped so as to show the total notes payable, while balance-sheet "C" shows notes payable, secured by notes receivable, accounts receivable, trade acceptances, merchandise and securities as a separate group. This arrangement is open to the same criticism as applied to the relative pledged assets: that it does not disclose at first glance the aggregate of an important liability, viz., notes payable, including both unsecured and secured notes.

It is worthy of note also that in balance-sheets "B" and "C," notes and accounts payable to controlled or subsidiary concerns are included in current liabilities, while, as previously mentioned, notes and accounts receivable of similar concerns are excluded from current assets. If such accounts and notes payable by the parent company to the subsidiaries represent deferred liabilities, they can properly be excluded from the current liability classification.

Fixed Assets

While the three balance-sheets under discussion differ as to degree of detail in stating the fixed assets, there are two important variations calling for comment: first, balance-sheet "A" provides for the deduction from the fixed assets of the reserve for depreciation, while balance-sheets "B" and "C" indicate no such application of depreciation reserves in reduction of the respective assets but show the reserves on the liability side of the balance-sheet. The former method is to be preferred in that it shows at once the net book value of the fixed assets and precludes the inclusion of the reserves with surplus. Secondly, on balance-sheet "A" goodwill is deducted from the total of capital stock and surplus in stating net worth, while on balance-sheets "B" and "C" goodwill is shown in the usual way on the asset side of the balance-sheet. In some circumstances, where goodwill is carried at an inflated value, the former method would no doubt be justifiable, but in other cases, where goodwill has a clearly demonstrated value, the virtual writing off of the goodwill value would be far from a correct procedure.

Valuation of Inventories

The valuation of the inventory at the balance-sheet date determines to a great extent the profit or loss for the prior fiscal period and the financial condition at the close. Consequently, the inventory is rightly subject to close scrutiny on the part of those concerned in granting credit on the basis of the balance-sheet submitted.

Some of the questions usually asked are these: Was a physical inventory taken or does the inventory reported represent a book balance with or without supporting perpetual inventory records? If a physical inventory was

taken, did the auditor assist in or supervise the actual counting, weighing and listing of the stock? How was the inventory valued, i.e., at cost or at cost or market whichever was lower? How were values and market values ascertained and does the company operate a cost system? Were the calculations and footings carefully checked to obviate clerical errors, which, while unintentional, have the same effect as deliberate falsification of the inventory? And, finally, to what extent did the auditor verify the work of the client's force, and how far is he responsible for the value reported? The manner in which the inventory is shown on the balance-sheet, in conjunction with the auditor's certificate thereto, should be a satisfactory answer to the last question.

Cost Accounts in Relation to Inventories

An allowance for overhead should be included and opinion is fairly unanimous that overhead so included should be limited to that relating to manufacturing or production, as distinct from selling and general expenses. But in times of depression, overhead costs soar, while the increase in direct costs is relatively small. In the case of merchandise manufactured under such conditions, should it be inventoried at actual cost, which means virtually the absorption of losses directly attributable to idle capacity?

Aside from the accounting aspect of the case, what is the effect on the balance-sheet offered for credit purposes? Balance-sheets of borrowers are now perhaps more than ever before subject to searching scrutiny by bankers and credit-men, and in a great number of cases their attention is focused upon the inventory as the key to the borrower's financial condition. The familiar phrase describing the valuation of the inventory as "cost or market whichever is lower" may possess special significance. What does "cost" mean, especially with reference to finished product manufactured when production is far below normal? Does "cost" mean that actual overhead charges have been loaded upon the merchandise, thereby inflating the book value by inclusion of unearned overhead which should have been charged to profit-and-loss? Is it truthful to say "merchandise is valued at cost," when in effect the inventory includes deferred charges to profit-and-loss, which should have been written off in the period just closed, instead of being carried forward as a burden to be taken up in the ensuing periods?

Obviously the only fair cost to use in the valuation of an inventory is a normal or standard cost. If that basis has been used, supported by details drawn from the cost records, the borrower will be in a strong position to maintain his credit with his banker, while if the other basis has been used, i.e., inflated values arising from excessive overhead in costs, the credit-man's mind is at once charged with doubt as to the soundness of the borrower's balance-sheet.

In the operation of a highly developed cost system, which recognizes interest on capital as an element of cost, it is customary to allocate to each manufacturing department its proportion of such interest and to include that interest in the departmental overhead which is distributed to production centres or to individual machines. Such overhead (including interest) is absorbed in the cost of the product which passes through the several departments. Consequently, if we take as an example a finished machine, the product of a textile machinery plant, the cost is represented by the aggregate of the costs of a multiplicity of parts, made in different departments, including a proportion of the charges for interest on capital allotted to the respective departments but merged with other overhead charges.

If the interest charge is allowed to remain in the cost of that machine for inventory purposes, we have an inflated value arising from the inclusion of an unrealized profit. This is generally recognized by the proponents as well as the opponents of interest as an element of cost. In arriving at a proper inventory basis there remains, then, only one further step, and that is to eliminate the interest from the cost of the finished product. That sounds very simple, but actually it is practically impossible because the identity of the charges has been lost in the distribution of the overhead, and the process can be reversed only with extreme difficulty.

Purchase Commitments for Future Delivery

Recently many losses entailed in deflating inventory values were recognized and taken into account in preparing annual balance-sheets, but other similar losses arising from purchase-contract commitments for future delivery could only be approximated. During the period of deflation in commodity prices, through which we have just passed, great stress was rightly laid upon the borrower's purchase commitments and their probable effect upon his ability to meet his obligations or perhaps even his prospects of continuing in business. In order to obtain supplies of materials it was necessary to make purchase contracts, and in a period of falling prices losses were in many cases unavoidable. Bankers justly required full information bearing upon the borrower's liabilities of that nature. With the return to a period of stable prices, losses on commitments become less a cause for anxiety. We as accountants face the problem as to what extent we shall inquire into and report upon purchase commitments which are made in the ordinary course of business. One banker expressed the opinion that he was not interested in contracts made under such conditions; but others held opposite views.

Obligations of the Auditor

The public accountant must always be on the alert for clauses in bond indentures and capital-stock certificates, which delegate to him definite responsibilities. Certified statements are frequently required under such conditions, but a study of the documents may develop the need for a legal interpretation of the meaning of a clause which may be construed in more than one way. Whose advice shall the auditor take in order to meet his responsibilities intelligently and properly?

In one case recently under consideration the definition of "quick assets" required careful interpretation. In another case the basis of the inventory valuation, as set forth in the indenture, could be construed in more than one way. In a third case the auditor was charged with the responsibility of determining what constituted "adequate" depreciation before certifying the profits available for dividends, and in a lean year he was forced to take issue with the corporation officers. The foregoing illustrations demonstrate the need that the auditor inform himself as to what his responsibilities are before he affixes his signature to a certificate.

The ideal conditions leading up to an unqualified certificate cannot always be realized. But the practice of issuing a statement which is merely a condensed copy of a trial balance, with a certificate stating in effect that the balances agree with the books and have not been otherwise verified, should in my opinion be discouraged, not because the accountant says he has done anything which he has not done, but because of the failure of many bankers and business men to read the certificate and to understand its significance. They see merely a balance-sheet statement over the auditor's signature and assume that it is an audited statement.

Not long ago, a banker expressed himself as unable to understand why a certain corporation had gone into the hands of a receiver within three months after issuing a satisfactory statement of condition over an auditor's certificate. Upon inquiry as to the form of certificate, the statement was produced which showed a "certificate" to the effect that the statement was only a condensed copy of the trial balance and that no audit whatever had been made. The fact was that the banker either did not read the certificate or did not realize its significance.

A problem which is only indirectly related to the balance-sheet is the conflict bewteen established accounting procedure and federal tax regulations. Many of us have frequently been asked by clients for counsel as to the advisability of adjusting their books to conform to the results of audits of tax returns according to federal tax regulations. Charges for depreciation and repairs have been a constant cause of dispute between the taxpayer and the treasury department, resulting in disallowances of such charges in many cases. Should the asset account, surplus account and depreciation reserve account then be adjusted upon the books? Obviously the book-keeping would be simplified for future years by maintaining only one set of accounts, without the

(Continued on Page 39)

Drilling Operations in Automobile Axles

Jigs and Fixtures Used in Front and Rear—Bringing Axles Into Proper Alignment—Machining the Housings—Adapting Tools to the Required Work—Following Each Step Through to Completion

By ROBERT MAWSON

SOME of the machining methods followed in the manufacture of axles for automobiles of different types are shown and described in this article.

The first illustration, Fig. 1, shows the drilling of the rear axle sub-assembly. The axle housing, spring support and brake arm have been assembled in previous operations, the face of the housing having also been faced in a lathe. This assembled set of units is then placed in the jig being located by means of a turned register which fits into a machined recess in the flange A, and a pin B, which fits into a reamed hole in the brake arm. When the piece is in position as shown 8-29/64 inch holes are drilled.

The half tone, Fig. 2, shows the jig used when machining the differential housing. This element has been turned and faced, also the center hole bored and reamed in previous operations. The piece is then placed on the plug A and forced into the jig with the nut and washer as shown. Four 47/64 inch holes are then drilled in the piece, the jig being indexed around to the several positions by means of the index pin B which fits into bushings in the revolving part of the tool.

Under the jig C may be seen a latch handle which also fits into notches, the inner end of the latch being machined for that purpose, the duty of this attachment is to assist the man operating the tool to find the indexed positions more readily than if he depended solely on the indexing pin. After the four holes have been drilled, they are reamed out to ¾ inch, the tool being guided in bushings similar to the drilling operation.

Drilling the Front Axle

The illustration, Fig. 3, shows the special machine set up and jig used when drilling the front axle. It will be seen that this tool is made in the form of a base A which is fastened securely to the machine table. At each end of this base are movable members, as B, which are made with vee blocks C used to bring the ends of the axle into the correct alignment. This is performed by means of the hand wheel D which operates a screw with left and right hand threads, so that as the hand wheel is turned the sliding members are either brought nearer together or forced out according to the motion imparted to the hand wheel. The hand wheel, therefore, brings the axle into the proper alignment and by reason of the vee blocks also holds it in that position. Knurled head screws are then tightened against the forging to assist in holding it and also force it down onto the lower seat of the sliding fixture members. The spring seat bolt drilling jigs F are separate jigs held to the main base of the fixture and may be adjusted if desired to obtain any spring distance desired within the range of the fixture. The spring seat drills are driven by means of multiple heads held and driven with the spindles G. All the holes are machined together, in other words four spindles are in operation together and as can be readily seen such a set up is a great time saver and can be truly called a production operation. With this fixture two holes are drilled, one at each end, 1-21/32 inch diameter. The guide bushing is then changed and these holes reamed to 1-11/16 inch. In each spring pad four 17/32 inch holes are drilled, and it may be added that this set up not only machines axles quickly but what is of more importance of an interchangeable nature.

Drilling Gear Housing

The next illustration, Fig. 4, shows the jig used when drilling the pinion gear housing. This casting has been faced and a register machined on the same surface in a previous operation.

The piece is then placed into the jig and located by means of a recess which is made to suit the turned register on the housing face. It will be noticed that this part is made with bosses through which it is desired to drill the holes both for appearance and also to obtain the necessary strength as a holding medium for the bolts.

This is done in rather a novel manner on this jig. On the face of the tool at A are made a series of marks and the

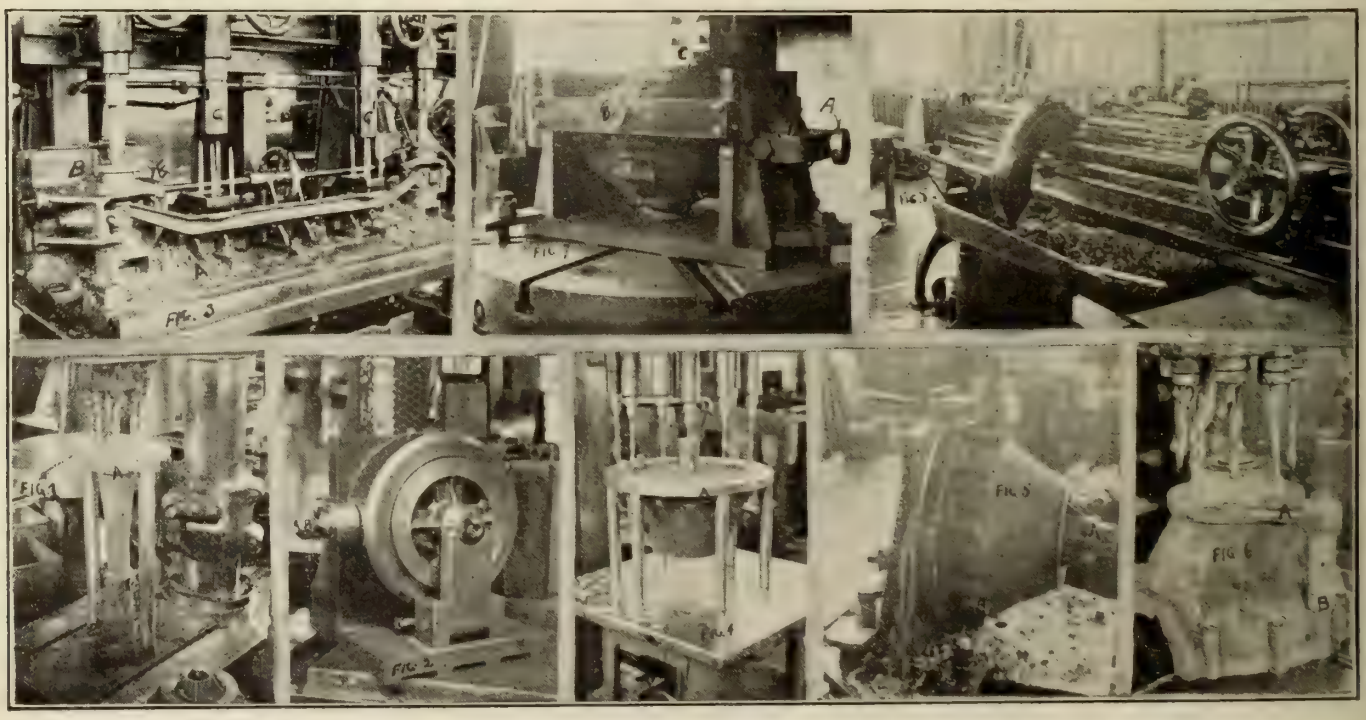


Fig. 1.—Drilling rear axle sub-assembly. Fig. 2.—Machining differential housing. Fig. 3.—Drilling front axle. Fig. 4.—Drilling pinion gear housing. Fig. 5.—Drilling holes in side. Fig. 6.—Drilling axle end. Fig. 7.—Assembling rear axle housing. Fig. 8.—Gun rifling machine.

operator revolves the casting until these graduations come in the center of the bosses when the holes will be drilled in the proper positions as the marks are opposite the bushings.

Ten 21/64 inch holes are then drilled in the housing, the drills being driven simultaneously as this machine is of the multiple spindle type.

Machining Rear Axle Housings

The next operation on the housing is performed with the jig shown in Fig. 5. The casting is located on the pin A and held with the nut as shown. In this tool the housing is revolved to the various positions where it is drilled, namely three, these in each case being determined by the man who machines the hole in the center of a boss as at B.

In this operation the following holes are machined, one hole for 1-1/2 inch 16 pipe tap, one hole for ¾ inch 16 pipe tap, one 1 inch drill this latter hole being also faced. For these operations the man revolves the casting and changes the guide bushing and drill for the proper size in question. Fig. 6 shows the next operation on the axle, namely, drilling at the axle end. The jig is placed onto the casting being again provided with a recess which fits into the turned register on the piece. The jig is then turned around on this register until the locating pin B will fit into the hole as shown, which was drilled in the previous operation; the jig is then in the correct relative position for the drilling.

Eight ⅜ inch holes are then drilled and as may be seen by referring to the illustration as the machine is of multiple head drilling type all holes are produced at once. Two of the elements that form a rear axle housing are then fastened together by means of a number of bolts and the assembled unit placed in the fixture shown in Fig. 7. The part is located with four dowels, two at each end, these locating mediums fitting holes drilled at the axle ends, this operation being illustrated in the previous half tone. Two large plugs are then tightened into the large holes at the axle ends and these plugs may be seen at A, the other at the opposite end of the housing. Screws at B, one on each side, are then tightened against the housing to assist in holding it securely against the machining stresses. With the piece located and held as described the upper face is machined with the tool C, the operation being performed in a boring machine as may be seen by referring to the illustration.

Boring the Axles

The half tone, Fig. 8, shows a gun rifling or boring machine which is used to bore out the axles. These forgings have been previously faced at each end and machined to the correct length.

At the same time in which the facing operation is performed each end is turned for a length of about three inches. The axles, the machine drilling two at once, are then placed in locating fixtures as at A being centered by the turned portions.

The axles are held and revolved by the machine in the usual manner by means of belts which may be seen at the rear end of the machine. The drills are fed into the axles and a 13/16 inch hole machined in each.

The drills are of the forced lubrication type which not only helps them to cut more freely but also tends to remove the chips from the hole. The length of hole is 36 inches, being through the entire length of the axle, lightening and strengthening the elements very considerably.

Construction Work of All Kinds On the Increase Throughout Canada

SINCE the beginning of the year, Canada has experienced a distinct revival in the building industry after a virtual stagnation which existed throughout the war years and into the post-war era. Prices of building materials as well as the high cost of labor seriously curtailed construction of all kinds, and confined it to such as was absolutely necessary. With the establishment of a new level in the price of material and the readjustment of the cost of labor a decided impetus was given to the building industry from the opening of the building season. There has been unsurpassed activity, and the figures for the first six months indicate the accomplishment of a volume of construction unequalled in any year since 1914.

For the first six months of the year 1922, says a recent C.P.R. report, building permits in Canada had an aggregate value of $132,452,000 as compared with $111,763,500 in the first half of 1921, $144,747,100 in 1920 and $78,118,300 in 1919. In 1922 the Province of Ontario accounted for $74,586,900 of the total permit value; Quebec $31,294,200; the Maritime Provinces $5,521,700; and the Western provinces $21,049,200. Of the total the sum of $53,435,300 is accounted for by residential building; $39,660,900 by business construction; $10,050,700 in industrial erections; and $29,305,100 in engineering construction.

Increase of Over Twenty Million

Compared with the year 1921, the total value of permits throughout Canada shows an increase of $20,688,500 over the value of the same period. In Ontario the value of construction undertaken has practically doubled, and Toronto has led all Canadian cities in the building undertaken so far this year. The even distribution of the kinds of building undertaken is clearly illustrated in the figures for June 1922, the value of permits, $35,620,400, being the second largest monthly figure since May, 1914. Of the total, residential building accounted for 36.4 per cent.; business, 29.1 per cent.; industrial, 13.8 per cent.; and public works and utilities, 20.7 per cent. The amount of contemplated new work throughout the Dominion at the end of June was $26,117,400.

The buildings undertaken during the first six months, from coast to coast, are summarized as follows:—69 apartments, 95 churches, 124 factories, 195 public garages, 23 hospitals, 54 hotels. 103 office buildings, 46 public buildings, 10,725 residences, 243 schools, 823 stores, 24 theatres, 88 warehouses, 79 bridges, 19 dams and wharves, 103 sewers and water mains, 161 roads and streets and 138 general engineering.

Activity in General

The resumption of building in Canada is not confined to certain sections but is general, and exceptional construction activity is evidenced in all cities from coast to coast. According to the reports received from 56 Canadian cities there is a building increase of over 30 per cent. in comparison with 1921. Quebec Province reports an increase of more than fifty per cent.; and Saskatchewan shows an increase of more than 300 per cent. Montreal and Toronto, particularly the latter, have exceeded by a wide margin the value of permits for the same time last year. In Winnipeg the permits for the first six months of 1922 shows an increase of practically $1,000,000 over the corresponding period in 1921. In Calgary, for the same space of time, the million dollar mark was passed. Improvements are noted in Regina, Moose Jaw, Brandon, Lethbridge, Edmonton and other western centres, as well as Halifax, Moncton, Sherbrooke, Westmount, Fort William, Kitchener, Oshawa, Peterborough, and other cities of the East. In construction already accomplished this year, the leading cities in order are Toronto, Montreal, Winnipeg, Hamilton, Windsor, Ottawa, Vancouver, Quebec, London, Saskatoon, Port Arthur and Calgary.

The resumption of building in Canada on a substantial scale, more so than perhaps any other factor, may be taken as an indication of the return of brighter and more settled times and a further emerging from post-war depression, for building in the Dominion is so indicative of progress and expansion that it has come to be a gauge which marks, in a fairly accurate manner, the trend of economic affairs; it estimates the status of business and reflects the prosperity of other industries. In a resumption of building is reflected the downward trend in the price of all materials used in building, and a decline in the cost of labor to a level closer approximating the pre-war level. More building is indicative of hope and faith in the immediate future. No other disturbance of the years following the war caused such inconvenience and upheaval as the cessation of building, and, in view of all it portends, nothing is so gratifying as the return to a normal amount of construction.

Rapid Production of Gears by Hobbing Process

Continuous Cutting Movement—Even Distribution of Generated Heat—One Passage of Hob Completes the Gear—Special Arbors for Different Types of Blanks—Automatic Indexing

PRODUCTION of gears by the hobbing process requires the employment of a hob cutter, which has the form of a worm. When the hob is set at the angle of its helix, the teeth on the front or cutting side are parallel with the axis of the gear being cut. When the machine is operating both the gear blank and the hob are rotated together at the ratio required by the number of teeth in the gear and the pitch of the threads on the hob. The cutter feeds through from side to side, the hob cutting its path through the blank, and generates the tooth form on the entire periphery. The work is completed at one passage of the hob. A hob of a given pitch can be used on any size gear where the teeth are of that pitch.

The continuous cutting action of the hobbing process has the advantage of an even distribution of the heat generated around the entire periphery of the blank. This condition permits of high production owing to the fact that greater operating speeds can be used. Where gears are made in large quantities, this method proves highly efficient. It is essential however, to provide the necessary facilities for producing accurate work. Rigidity of the blanks being cut is a very important factor, and due consideration must be given to the class of arbor on which the gears are held during cutting operations. In the construction of the work holder care should be taken to see that the gear blanks are supported just below the root of the tooth; this is necessary to reduce the possibility of chatter and provide adequate resistance to the thrust of the cutter.

Arbor for Thin Blanks

Fig. 2 is a line sketch of a built-up arbor for carrying a number of thin gear blanks. Those shown in the cut are 8.222 in. outside diameter, 9 pitch diameter, 72 teeth. Twelve gear blanks are mounted on the one arbor and large washers are provided, the outer edge of which comes just inside the bottom of the tooth space. These gears are for automobile cam shafts, on half inch face and made of machine steel. The diameter of the hob used was 3 in. and operated at a speed of 146 r. p. m. with a feed of .070 in. for every complete turn of the work. The time required to reload the arbor was 2 min. while the actual cutting time was 49 min., giving a production of 113 gears in a day of 8 hours.

Data and cuts through courtesy of the Cincinnati Gear Cutting Machine Co.

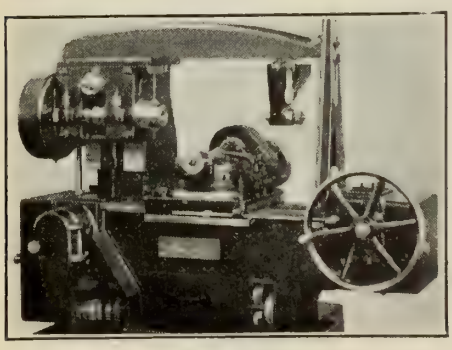


Fig. 1.—The hobbing machine.

Chain Sprockets

The sketch Fig. 3 shows the type of arbor used for the cutting of chain sprockets for 1¼ in. pitch, ⅝ in. dia. rollers, this chain being ⅝ in. wide. The outside diameter of the blanks is 4.671 in. and the number of teeth is 10, and 1¼ in. pitch. The sprockets were made of .20 carbon cast steel with a small percentage of nickel. Two blanks were mounted on the one arbor, which gave a length of cut of 2¾ in., with an over travel of .31 in. The over travel was small owing to the fact that the teeth were cast in, thus leaving about ⅛ in. metal to remove on each side. The hob used was 3½ in. dia. with an angle of 7 deg. 26 min., operating at a speed of 170 r. p. m., or 156 ft. per min. The feed per rev. of the work was .60 in. The time required for finishing two sprockets was approximately three minutes against four minutes for the former method. Hobs were ground every 8 hours. Note the intermediate washer used for supporting the tooth portion while being cut.

Cutting Ring Blanks

An interesting job for the gear hobber is shown in Fig. 4. This shows 12 ring blanks mounted on a special arbor, the outer portion being made of cast iron of the box pattern, giving maximum rigidity with minimum weight. The gear blanks are made of soft steel with a bore of 13.9485 in. dia., 11/16 in. face, 120 teeth of 8.10 pitch. These gears were cut with a 3 in. hob operating at a speed 170 r. p. m., or 134 ft. per min. The feed per rev. of work was .060 in. The time required for reloading was approximately 5 minutes per string, and 106 minutes required for the actual cutting of the 12 gears; this figured out at 9.25 minutes per gear. Thus, the production per day of 8 hours came to 52.

Production Record

Fig. 5 shows a group of gears, all of which have been produced on the hobbing machine. Fig. 6 is a tabulated record for each of the gears indicated by the respective numbers. For instance, No. 9 is a tough steel gear 10.-566 in. outside diameter, 1¾ in. face, 21 teeth. The hob has an angle of 45 deg. R. H. spiral and operates at a speed of 59 r. p. m. The feed per rev.

GEAR NO.	OUTSIDE DIAM	PITCH	NUM. OF TEETH	WIDTH OF FACE	SPUR OR SPIRAL	R.P.M. OF HOB	FEED PER REV. OF WORK	MATERIAL	TIME EACH GEAR
1	7.737	3	15	2¼"	45° R.H. SPIRAL	69	.030	C.I	33 MIN
2	11⅓	3	32	2"	SPUR	59	.0550	TOUGH STEEL	37 MIN.
3	16.694	3	34	2¼"	45° R.H. SPIRAL	69	.04485	C.I	70 MIN.
4	2.392	10	16	⅞"	43° 11' 21½" L.H. SPIRAL	200	.05555	BRONZE	7 MIN
5	8.99+	8-10	68	2¼"	15° SPIRAL R.H. & L.H.	108	.070	C.I.	29 "
6	3 11/12	6-8	20	1⅜"	SPUR	108	.070	C.I.	4⅓ "
7	5¼	6-8	30	1⅜"	SPUR	108	.070	C.I.	6⅓ "
8	5 7/12	6-8	32	1⅜"	SPUR	108	.070	C.I	6 7/10 "
9	10.566	3	21	1¾"	45° R.H. SPIRAL	59	.03867	TOUGH STEEL	48 "
10	7.33	10	52	⅝"	43° 11' 21½" R.H. SPIRAL	92	.05349	C.I.	11 "
11	2.392	10	16	⅝"	43° 11' 21½" L.H. SPIRAL	92	.05555	C.D. STEEL	2¼ "
12	3.764	10	26	1"	43° 11' 21½" L.H. SPIRAL	92	.05349	C.D. STEEL	3 "
13	6.2"	10	60	1"	SPUR	108	.070	C.I.	9 "
14	5.6"	10	54	1"	SPUR	108	.070	C.I.	8.1 "
15	5.1"	10	49	1"	SPUR	108	.070	C.I	7.3 "
16	4.8"	10	46	1"	SPUR	108	.070	C.I	6.9 "
17	4.2"	10	40	1"	SPUR	108	.070	C.I	6. "
18	3.5"	10	33	1"	SPUR	108	.070	C.I	4.9 "
19	2.6"	10	24	1"	SPUR	108	.070	STEEL	6.3 "
20	7.4"	10	72	1"	SPUR	108	.070	C.I.	10.8 "

Fig. 6.—Tabulated records, of gears shown in Fig. 5.

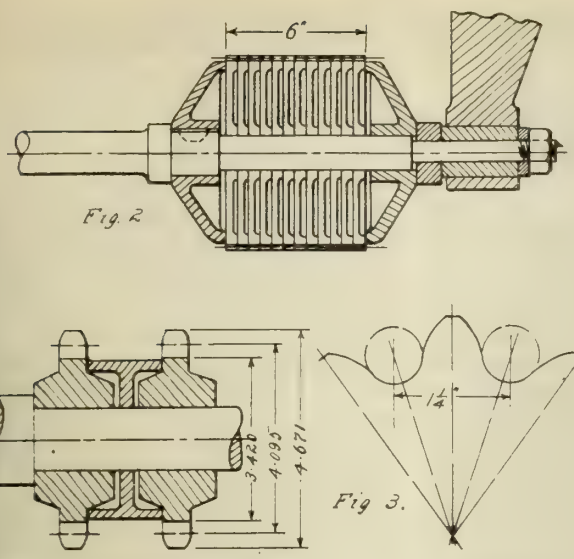


Fig. 2.—Method of holding thin blanks. Fig. 3.—Cutting pair of sprockets.

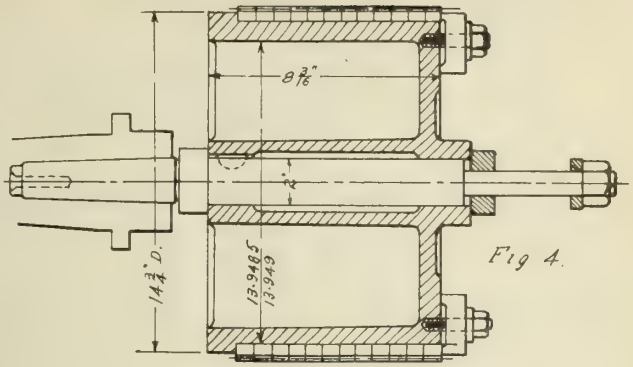


Fig. 4.—Special arbor for large ring gears.

of work is .03867 in. and the approximate time required for each gear is 48 min. While the time given is for individual it does not mean that these are cut singly; in the majority of cases they are cut in strings of from four to twelve.

The Hobbing Machine

The machine on which these gears were cut is shown in Fig. 1. This tool is readily adapted to all spur gears within its range. This hobber will take care of right and left hand spirals up to an angularity of 45 deg. The setting up for spiral cutting, however, is of such a character that rapid production is not attained when making single gears, but when large quantities of one style of gear are required the advantages are amply evident. The metal in the frame is so distributed as to provide the greatest stiffness possible, a factor that contributes to the accuracy of the machine, increasing the life both of the machine and the cutting hob, as vibration is one of the greatest destructive forces of metal-working tools and equipment.

The work spindle is made of hammer-forged steel, accurately ground, and supported in two long bearings in the work saddle. The work arbor is supported by a bracket that is carried by an overhanging arm, which in turn, is supported by a triangular brace extending up from the bed of the machine. An auxiliary bracket is suspended from the overhanging arm to assure alignment of the arbor support after reloading. The vertical movement of the work saddle is adjusted to height by means of a crank handle, the position being accurately determined by means of a graduated dial reading in thousandths.

The hob slide is supported on a wide base with a long narrow guide which reduces the tendency for the slide to build. The hob spindle may be swiveled in either direction from its normal position to an angularity of about 50 deg. for spiral cutting. The hob spindle is bronze bushed and adjustable for wear. Provision is made for lateral movement of the hob to use all cutting positions before regrinding. Automatic stops are provided by which the machine or the feed mechanism may be stopped at any point.

PROPERTIES OF MATERIALS

Under modern practice it is now possible to investigate materials by X-rays to a thickness of 4 or 5 mm. for lead; 12 mm. for tin; 7.5 cm. for carbon steel or iron; 12 to 15 cm. for aluminum and its alloys, and from 20 to 40 cm. for wood. Progress in this direction is rapid. Major G. W. E. Kaye, in his Cantor lecture at the Royal Society of Arts mentioned that it is now possible to get a photograph through an inch of steel in rather less than a minute using 130,000 volts with a few milliamperes through a Coolidge tube. Investigation by X-ray is of special value in electric and oxy-acetylene welding, of which it is a severe critic. Again, X-ray investigation promises to be exceedingly useful for the detection of hidden cracks; also for diagnosing defective soldering or brazing; the substitution of one metal for another, the hidden corrosion and defects in gas cylinders, ferro-concrete, the armouring of cables, and so on. The ideal aimed at to-day is to make X-ray photographs as easy and automatic as taking an ordinary photograph. But great improvements will have to be made before it can become a commercial process in heavy engineering. The great merit of the process is that it enables a much clearer idea of the properties of materials to be obtained without damaging the specimen in any way. Furthermore, it provides in some cases the only means of detecting concealed defects in the material without sacrificing any part of the structure, and also of ascertaining the accuracy of assembly of component parts of structures.

THE GOVERNMENT'S CONVERSION SCHEME

The attention of the holders of the five and a half per cent. war loan bonds maturing December 1, 1922, is directed to the offer of the Minister of Finance to renew the loan on favorable terms. The last Canadian loan was placed in New York at a satisfactory price. The Minister is making his present financial operation entirely a domestic one by offering to exchange the maturing bonds for new bonds bearing the same rate of interest, running for either five years or ten years as the bondholder may prefer. A further inducement to the investor is that he receives a bonus of one month's interest. The terms offered are decidedly favourable to the investor and it is probable that a large part of the maturing loan will be renewed. Arrangements for the exchange of the bonds can be made at any branch of the chartered banks. Holders who do not wish to reinvest will be paid in cash on the 1st December.

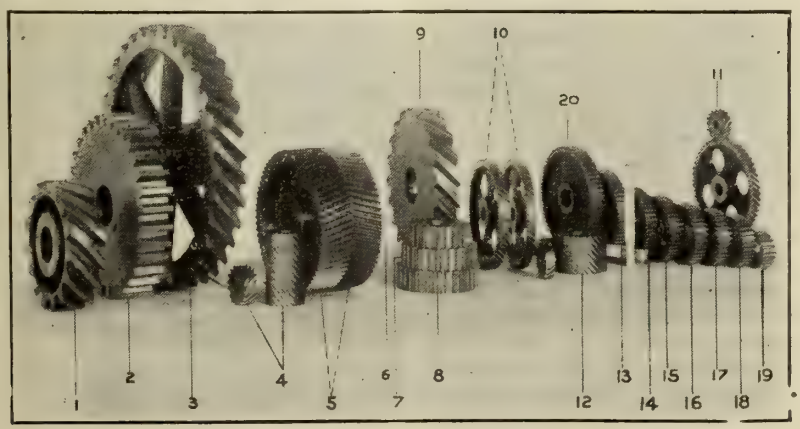


Fig. 5.—Various gears produced on gear hobber—time records shown on Fig. 6.

Improved Business Expected in Many Centres

Steady Improvement Reported From Different Boards of Trade —Industrial Commissioners Review the Situation—Unemployment Less Acute—Farms Absorb Labor—New Industries Locate

ENCOURAGING reports continue to come in from all parts of Canada, regarding the industrial improvement of the past few months and the prospects for steady betterment during the fall and winter season. The automotive industry apparently is the pivot around which general business is turning to-day, as there has been a more than normal activity in all motor lines. The coal and rail difficulties have caused a noticeable slowing up in different quarters, but the better tone of recent negotiations gives reason for a more optimistic feeling throughout trade circles. The following statement received from F. Maclure Sclanders, Commissioner of Industries for the Border Chamber of Commerce, is typical of others from different centres.

"It is questionable," states Mr. Sclanders, "if the industrial development of any other Canadian community has ever exceeded or even paralleled that of the Border Cities during the past five years. For instance, on 31st December, 1917, the total number of our industrial power consumers was merely ninety; whereas, on the thirty-first of last month this total had expanded to no fewer than three hundred and fifty. In other words, the number of power-using industries in the Border Cities has practically quadrupled well within five years.

"Many of our larger concerns commenced here on quite a humble and obscure scale. Apparently, however, their experience demonstrated the advantages of the Border Cities from a manufacturing standpoint, for the whole history of our industrial life has been one of expansion after expansion. The obscure industry of yesterday has become the great one of to-day.

Big Increase in Population

"Of course, you remember that the Dominion census of 1921 gave these Border Cities a population increase of over 138 per cent. for the decade. As a matter of fact, however, practically all of such increase occurred during merely half of that period. It is well within the mark to say that our population, which is now about sixty-two thousand, five hundred, has doubled within the lifetime of a child scarcely old enough for the kindergarten class. Correctly speaking, ours has not been development in the ordinary acceptance of the term: it has been transition swift, substantial and astonishing. This circumstance renders one just a little diffident in any attempt to indicate, even in the most conservative manner, the actual facts of our phenomenal unfolding. Why? Because the general public is inclined to look upon one in my position as a wildly optimistic booster whose utterances must be drastically discounted. In this regard, I can only say, on the threshold of my sixteenth year in the present line of work, that I have never yet made one statement that was not less and not more than the literal truth. Exaggeration is poor policy. It is wiser to understate so that when those who are interested visit your community and see everything for themselves they are agreeably surprised rather than disappointed, because in most cases, such people assume exaggeration.

"Our present activities compared with those of a year ago, show marked improvement — an improvement which steadily continues. Most of our factories are quite busy; some of them exceedingly so. Retail business is also brighter than for some considerable time, although it is not yet quite so active as we could wish. There is a great deal of building going on, just as has been the case for a number of years past. For instance, during the last three years, miles upon miles of entirely new paved streets, boulevarded and lined with nice houses, have come into existence; and the whole aspect of things here has changed in a sense that almost baffles.

Bustle and Life

"Further, and on every hand, there is an atmosphere of bustle and life and go —just such an atmosphere as one might have seen on the streets and within the stores of certain of the more progressive cities of our Northwest during the boom of 1910 to '12. The spirit of optimism prevails everywhere. It is an optimism not based upon real estate hysteria, but absolutely upon the sane, sound substantial foundation of industrial expansion—of actual weekly payrolls. Of course, our immediate propinquity to Detroit and many other neighboring United States industrial centres renders these border communities the logical Canadian location for United States plants, particularly such as have their headquarters in Michigan, Ohio, Wisconsin, Illinois and Indiana. As a matter of fact, almost all of our established industries are American. Consequently, it is United States capital and enterprise that is building here what will be, within a comparatively short time, one of Canada's few truly great metropolitan centres.

"Probably, it is because our development emanates from the United States that so many of our own people of the further east are still apparently blind to the wonderful things happening at this southern extremity of the Dominion. Only the other day, I encountered a rather emphatic example of such ignorance on the part of an ex-Dominion Minister—a gentleman popularly credited with a rather exhaustive fund of general information. He had visited the Border Cities some years ago, and it seemed the hardest thing in the world to convince him that, in the interval, everything had changed. As a matter of fact, the term 'changed' but inadequately indicates the situation. Complete metamorphosis is what really has happened. The things of yesterday and the long-familiar landmarks are now passed away, and have become little more than a memory and a dream. It is all wonderful.

Factories To Locate

"As to our industrial prospects—we always have probably eighty of these on hand upon which we are working thoughtfully and continuously. That a comfortable percentage of such will materialize sooner or later, we have every hope. It often takes a long time to bring in a new industry. Quite recently, we secured one upon which I had been working for five years. It is strange so many municipalities seem to think that all an industrial commissioner has to do is to throw his tooth brush and pyjamas into a handbag, rush down to the United States, and in forty-eight hours, return with several new industries duly signed up for his particular town. The industrial development of any community takes time. Such work is largely cumulative; not sensational. It is very thoughtful work.

"As to the outlook for the coming winter—we are in no sense discouraged. For the past five years, we have patiently and successfully developed an exceedingly nice export trade. Thus, our eggs are by no means restricted to one basket. In no sense, are we wholly dependent upon Canada's comparatively trifling domestic market of merely 8,788,483 prosperous people. We are feeling out into all the markets above which the British flag flutters and upon which the sun never sets—markets involving one-quarter of the inhabited globe and possessing a population which, according to the latest estimate, is placed at 445,388,500 souls.

"I contend that the solution of Canada's annual unemployment problem is the development of her export trade. Some day, this fact will be generally recognized. In this country, as in most other countries, domestic business is largely seasonal. Our factories are busy for certain portions of the year and quiet for the rest of the time. But, it is always summer somewhere. Our two coldest months are South Africa's two hottest and so forth.

"In conclusion, we have no apprehensions as to next winter. On the contrary, our whole outlook for many summers and winters to come—in fact, our entire

horizon—is far brighter than I have cared or, perhaps, dared to indicate."

Better Than a Year Ago

"While manufacturing and employment conditions are still below normal," states C. W. Kirkpatrick, Commissioner of Industries and Publicity, Hamilton, Ont., "they unquestionably show considerable improvement over the conditions of a year ago, with every prospect that, with the exception of some fluctuations during the winter months, the gradual improvement will continue and that by the spring of 1923, normal conditions will have been restored, to be followed by a period of prosperity.

"This appears to be the consensus of opinion of Hamilton's manufacturers, who are undoubtedly in a more optimistic frame of mind than they have been since the industrial depression began to set in about two years ago. This optimism is partly due to increasing orders, and largely due to the prospect of a bumper crop, not only in the western provinces, but throughout the whole country.

"Unemployment is not nearly so acute as it has been, but it is scarcely expected that there will be abundant work for all during the coming winter months. Since early spring the majority of industries have been slowly but steadily increasing their working forces, but they have not been able to absorb all of those who were idle during last winter. Many of the latter have found temporary employment on the farms and in the building trades, which have been unusually busy, but with the coming of winter these will again become shop workers, providing there is work for them to do.

Rapid Recovery in Textiles

"The textile industries have probably made the most rapid recovery, the majority of them having been quite busy for some considerable time, with no indications of an immediate falling off. On the other hand, the steel and iron industries have not yet shown any great activity, although even with them there are promising signs of improvement. Agricultural implement manufacturers are looking forward to the busiest winter they have had since 1918-1919. The majority of them have allowed their manufactured stocks to become almost depleted, and with the prospect of a rich harvest ahead they are beginning to give consideration to the restocking of their warehouses, in order that they may be in a position to reap the fruits of the harvest when the crop is marketed.

"An early settlement of the United States coal and railway strikes would unquestionably go a long way toward restoring confidence in Canada, they constituting the darkest cloud Canadian manufacturers see in the horizon at the present time.

"Like most other places, Hamilton has not enjoyed a particularly good year for industrial expansion. Fourteen new industries have been located since the beginning of 1922, but nearly all are operating, or getting ready to operate in a comparatively small way, and with but a few exceptions, they represent the investment of Canadian capital only. Few new industrial buildings have been erected, the manufacturer hesitating about making unnecessary capital expenditures until conditions become more settled. There have also been fewer inquiries from American manufacturers who are figuring on locating branches in Canada. So long as conditions are below normal at their parent plants, the American manufacturers are not likely to give much thought to expansion in the Canadian or other distant markets. Those American manufacturers who have investigated Canadian manufacturing conditions and the Canadian market this year, invariably make it clear that they were merely taking advantage of the dull times at home to gather information for their later guidance.

"One promising feature of the industrial situation is the increasing number of inquiries being received from British manufacturers and investors, there being many indications of an early influx of British capital to Canadian industrial centres. Taking all in all, industrial and employment conditions are much better and the future outlook much brighter than was the case at this time a year ago."

Better Trade in the East

In a statement received from R. E. Armstrong, secretary of the St. John, N. B., Board of Trade, the following extracts appeared:

"Industrial conditions in this locality are showing improvement in several lines. Lumber shipments throughout the province have been greater than for several years. It is expected that about all the surplus lumber that has been piled up everywhere awaiting shipment will be cleaned up. This means more activity in the saw mills and the promise of a fairly large lumber cut the coming winter. The pulp mills are beginning to function, but there is still a large surplus of pulpwood scattered throughout the province. Building conditions have considerably improved. Many summer dwellings have recently been built in the attractive suburban centres, and in the city itself there is an increase. Building permits for the first half of 1922 in the city proper reached a total of $308,000 as compared with $80,400 in 1921.

"Last month the Stephens Brick Co. reopened the old Lee Bros. brickyard on Little River road, East St. John. This plant, which years ago was recognized as one of the best in the province, has not been functioning for several years past, owing to the extreme age of the operators and the light demand for brick. The Stephens Co. purchased the whole outfit recently and have supplied it with modern and efficient equipment. The plant was formally re-opened July 28 by a banquet which was presided over by Lt. Governor Pugsley. Its prospects are good. The plant is capable of turning out 50,000 bricks per day.

"The sugar refining business of the Atlantic Sugar Refineries has greatly improved this year. About 600 hands are now employed. During the first six months of this year 34 steamers with raw sugar cargoes, amounting to 99,623 tons, have been discharged at the refinery pier. For the same period last year 9 ships, carrying 18,905 tons raw sugar reached the port. The quantity of refined product exported the first half of 1922 amounted to 48,904 tons, which required 49 steamers, while in the same period last year 5 ships carried out 16,128 tons. For the twelve months from June 1, 1921, to June 1, 1922, the total number of steamers that the Atlantic Refineries were responsible for at the port numbered 114, of which 47 landed 124,331 tons of raw sugar, 9 landed 38,622 tons coal, and 51 carried out 66,531 tons of refined sugar. This is a good showing and the refinery is still functioning actively.

"Development work is proceeding along active lines in Courtenay Bay, where the concreting of the new dry dock and the dredging of basin and channel are giving employment to about 350 hands. Crop conditions throughout the province are very favorable. On the whole, the industrial situation here is encouraging."

Sarnia Trade is Fair

Writing from Sarnia, Ont., Geo. P. France, manager of the Sarnia Chamber of Commerce, writes:

"Conditions for the past month in this district are fair, although there has been a reduction in the number of employees reported by two or three industries.This reduction was probably caused by the effect of the coal and rail strikes on the general marketing conditions. The industries working at normal capacity, compared with the same period last year, include petroleum products, structural steel, gray iron castings, threshing machinery, lumber and sawing, brass forgings.

"The labor turnover has been greater than last year for the month of July, and the turnover for the seven months of this year is greater than for the same time in 1921. There have been more men employed in the building trades and in the groups covered by shipping, but the manufacturing trades have been about the same, while the number of men registered as unplaced are not great as compared with the same period of 1921. The building permits for July are 38 with a valuation of $76,701, as compared with $85,000 for the same period in 1921. The building this year will show more small residences have been built and more local improvement to private homes than last year. Conditions in the building trades are quiet at present."

The Port of Oshawa on Lake Ontario may soon be a port of call for large vessels, as the Government has practically announced its willingness to vote the sum of $500,000 for the improvements to the harbor and docking facilities.

News From the Welding Field

Autogenous Welding Standards in Railway Practice

General Rules for Using Apparatus—Five Important Factors Are Condition of Surfaces, Bevel of Sheets, Position of Sheets, Expansion and Contraction, and Proper Filling Metal

By J. M. CALMBACH

IN order that greater uniformity and better results may be obtained in preparing work and making welds, the following methods and practices have been selected after considerable study, experiments and personal observation of the welding work in many shops throughout the country. They are considered the best and most practical methods in use to-day and are recommended as standard practices, to be followed as closely as local conditions will permit. Each foreman and welder who follows these instructions will find his work more reliable and satisfactory.

In welding cast iron, brass, cast steel and forgings, all such work should be fire heated whenever possible to insure a better weld, as well as to save gases. That is to say, all parts that take considerable time to heat with the torch sufficient to commence welding should be pre-heated so that when the welding flame is applied the part to be welded will respond almost immediately. As the oxy-acetylene torch cost per hour is extremely high it is easy to see that the heating of ordinary heavy parts with the oxy-acetylene flame is a very expensive operation and should be eliminated as far as practicable.

All foremen in charge of such work should use good judgment and take a personal interest in this matter and see that the proper provisions are made and work carried out accordingly. The preheating of cast iron, brass and other heavy castings is not only necessary for the saving of gases and time, but is also necessary in many cases to take proper care of expansion and contraction.

Five Essential Factors

In making a successful weld there are five very essential and important things to consider: (1) the condition of surfaces; (2) the bevel of sheets; (3) the position of sheets; (4) provision for expansion and contraction, and (5) proper filler metal.

The importance of these points cannot be overestimated and the failure to comply with the instructions covering any one of them will result in a questionable or bad weld. The success of a weld depends on the rigid observation of these items.

When sheets and patches are to be applied extreme care should be taken that all defective parts are cut out and also that they are cut so there will be a good foundation for the weld.

All sheets and patches should be cut on a straight or uniform line, avoiding staybolts wherever possible so that staybolt threads may be cut in unwelded plate.

Never cut out sheets or patches through the old weld where sheets have been welded previously. For side sheets or three-quarter door sheets, extend the new sheets at least one staybolt row higher; for crown sheet, one staybolt row lower; for patches, at least one row of staybolts larger; for the flue sheet, extend the weld to one row of staybolts lower.

Do not cut out sheets or patches and bevel sheets at the same time. If the sheets are to be beveled with the torch before chipping, this can be done after the parts are cut out; this is necessary to insure a uniform line, as well as a more perfect fit of the new parts.

Clean Surfaces Necessary

Clean surfaces are absolutely necessary for making good welds. If scale, rust, or grease is permitted to remain on the surface to be welded a slag is formed that will make a streaked and seamy weld. All surfaces must be kept free from foreign substances; all welding surfaces must be kept clean and bright.

Experience has proven that the most satisfactory angle of the beveled faces preparatory to making the weld is an angle of 45 degrees with the surface of the sheets. The total angle between bevel faces must be 90 degrees in all cases, even if one sheet has to be beveled more than the other. Improperly beveled sheets prevent the welding flame from penetrating to the bottom of the weld and so prevent the weld from uniformly uniting with the edge of the sheet.

Where horizontal welds are to be made with the electric welder, it has been found good policy to bevel the bottom edge to about 60-degree angle and the top edge to about 30 degrees.

Fit Edges Carefully

All sheets and patches are to be fitted carefully with an opening of $\frac{1}{8}$ inch, no more and no less, between bevel edges. Less than $\frac{1}{8}$ inch opening between the sheets will not permit the welding flame to penetrate the weld properly and a greater opening requires too much filled metal to be used, not only increasing the cost of the weld, but making it impossible to keep the surface of the weld opposite the torch smooth. This rough surface permits lamination and seams on the water side of the sheet, weakening the weld and permitting early corrosion of the metal which tends to part the sheets.

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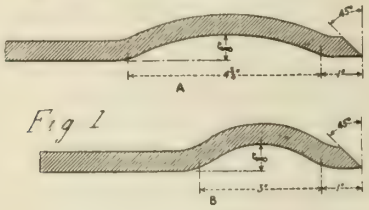
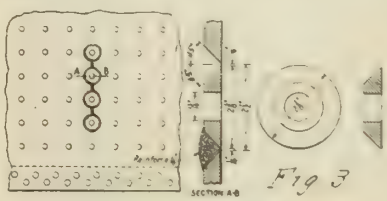
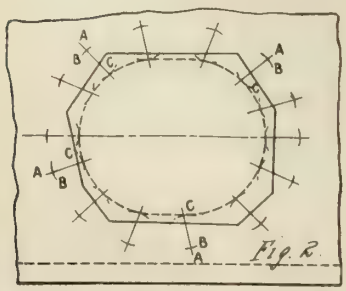






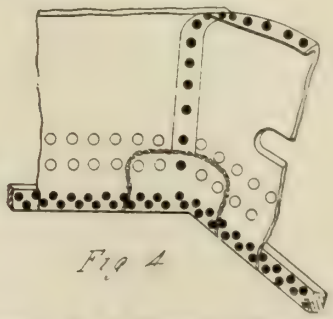


Fig. 1.—Standard corrugations for boiler sheets and patches. Fig. 2.—Method of laying out patches for welding. Fig. 3.—Method of welding cracks through staybolt rows; gas. Fig. 4.—Application of mud ring corner patch; gas or electric.

All other precautions may be carefully made and yet a faulty weld will be made if due care is not taken to allow for expansion and contraction of the sheets. Where it is not possible to obtain the necessary expansion and contraction through curves of the adjacent sheets, it is then necessary to provide some method to take care of expansion and contraction. In this case all sheets and patches will be corrugated, as shown in Fig. 1. A strain on a weld, especially where the new sheet is welded to an old sheet, which is generally the case, is particularly harmful as the old sheet will not stretch as much or as uniformly as the new one.

Bolting Patches In Place

When fitting corrugated sheets or patches, they should be bolted securely in place and when they extend to the mud ring good drift pins should be inserted in the mud ring holes so that the sheet cannot move upward due to the contraction as the contraction should be taken from the corrugation. Bolt the sheets at the welding end as usual. That is to say, insert a ⅝-inch bolt through every fifth staybolt hole and screw in a staybolt from the outside between each of the ⅝-inch bolts, thus holding the sheets in line. Then insert small wedges between the welding edge spaced about 14 inches apart to keep the sheets from pinching together during the welding.

Where side sheets are to be welded at the end it is necessary to remove the adjacent row of staybolts to the edge of the flange of the door of the flue sheet before welding is commenced. It is also advisable to remove all staybolts adjacent to welds after the welding is completed.

When welding corrugated sheets or patches with the oxy-acetylene method the following instructions are to be carried out: With every 12 inches of welding completed, the operator will stop and heat a line 1 inch through the center of the corrugation to a red heat and continue this until the weld is finished.

No firebox welds should be reinforced more than 1-16 inch as too great a re-inforcement is injurious to a weld due to overheating when in service.

Firedoor Patches

For firedoor patches when collars are to be welded they should be cut out at a point where at least one row of staybolts is in the patch and as nearly round as possible. When the patch is cut out at a point 6 inches or more from the firedoor edge it should be corrugated all around as shown in Fig. 5. It will not be necessary to corrugate if the patch is cut out less than 6 inches from the door hole. When firedoor patches are extended to the mud ring and 6 inches or more from the firedoor edge the patch will be corrugated all around. Where patches do not extend to 6 inches from the firedoor edge, it will only be necessary to corrugate both sides of the patch from a point about half way from the firedoor down to the mud ring.

The welding of cracks in side sheets, door sheets, firedoors, crown sheets, bottom and top of flue sheets should never be attempted as such attempts have been a source of much trouble and many engine failures. However, it may be considered necessary at times to weld certain cracks. This practice should be resorted to only in occasional emergency cases and then such work should be classed as strictly temporary and be corrected at the first opportunity. It is, of course, known that such work as welding cracks in the barrel of a boiler, welding over staybolts and welding staybolts is strictly against the law and will not be allowed at any time.

When it becomes necessary to weld seams that have given away, such as those between door or flue sheets and side sheets, the rivets should be removed and the outside of the fire side lap should be cut off through the center line of the rivet holes. Do not cut the side sheet and see that it is cleaned thoroughly before welding is commenced. Weld the holes solid and lap weld sheets.

Fitting, Preparing and Welding Fireboxes

For fitting, preparing and welding a firebox without removing the back end, the firebox should be set up on the floor with all staybolts and mud ring rivet holes drilled, except the mud ring corner holes, which would be drilled after the sheet is up and welded. The welding edge should be chipped to a 45-degree angle and chipped on a straight line so as to insure a uniform opening of ⅛ inch between the welding edges. The lower portion of the sheet from a point about 14 inches from the bottom of the flue and door sheets should not be chipped until the box is in place and the mud ring corners in place.

Bolt the sheet securely in place, being sure that there is a uniform opening of ⅛ inch all around the welding edge. Use a ½-inch drill and drill holes spaced about 14 inches apart, using ½-inch machine bolts with clamps made of boiler plate ½ inch by 2 inches by 4 inches. Use one of these pieces on each side of the sheet, being sure that all bolts are drawn tight. Rivet the top of the flue sheet to a point not less than 12 inches below the center of the crown; start welding at a point about 10 inches below the rivet and weld up to the rivets. Then drop down 10 inches and weld up to the end of the previous weld. Continue this operation until completed, removing clamps when necessary. Weld the entire door sheet.

Examples of Boiler Shop Weldings

The method of making corrugations for side and door sheets to allow for expansion is shown at A, Fig. 1. The corrugation for patches is more pronounced and is shown at B in the illustration. In laying out patches previous to welding it is sometimes difficult to cut them accurately unless some such method as the following is used: After the sheet has been cut out and beveled, the lines A, Fig. 2, are scribed as shown. With the dividers set at about 6 inches arcs B are scribed from the edge of the bevel. When the patch is ready to lay off for size, it is bolted firmly into place, as shown in Fig. 2. The lines A are then scribed back on the patch a short distance. With the dividers set at the same distance used before and with the intersections of lines A and B as centers, arcs C are scribed on the patch. Where these arcs intersect lines A, are points on the edge of the patch. A smooth curve is drawn through these points and the patch cut to the line. It can then be beveled and welded in place in accordance with the standard practice at local shops.

(To be continued.)

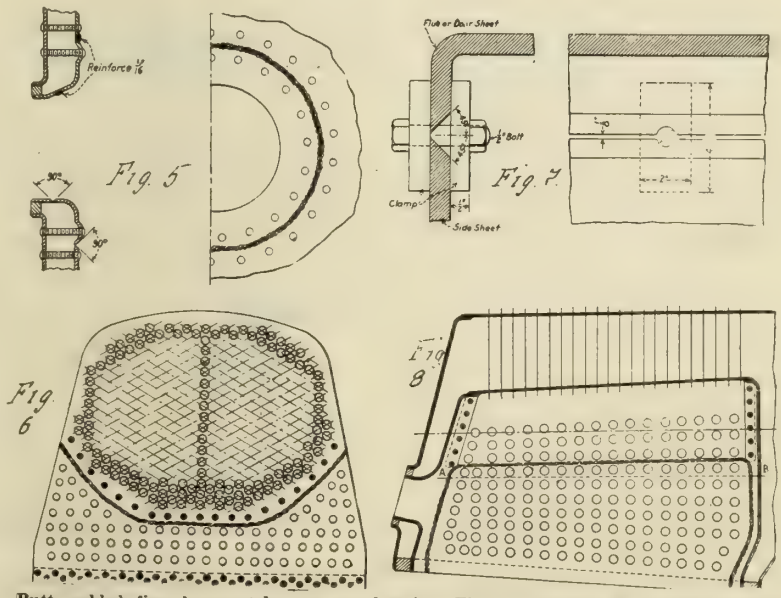


Fig. 5.—Butt welded fire door patch; gas or electric. Fig. 6.—Method of applying new tube sheet sections; gas or electric. Fig. 7.—Clamp for holding fire box sheets in line with welding. Fig. 8.—Side sheet application; gas or electric.

Practical Ideas From Practical Men

REPAIRING A CEMENT FLOOR

By D. A. Hampson

We have a cement floor in our shop —a first-class floor. It has been down nearly twenty years and about the only wear is that at the joints. The floor was laid the full width of each bay, in sections six feet in length. That brings the joints at right angles to the longitudinal aisles, which is naturally the direction of the most trucking.

Now whether the joints are laid with some elastic material between them or not, there always exists a joint and the sides are going to crumble if subjected to blows. Walking over the joints will not do this but trucking will and the joint that is cracked off one-quarter of an inch to-day will show a bell-mouthed top two inches wide in six months. All types of trucks—elevating, push, and hand—with metal wheels add to the ever increasing space at joints and there comes a time when the bump, bump, is more dangerous to the wheels than is the wear to the floor.

We had suffered a moderate amount of wear on our floors but it was not serious until we got in a class of work that was handled on trucks and that imposed wheel loads of from 250 to 500 lbs. each. As the gaps increased, we ran the risk of a serious accident in case a wheel broke. It was not feasible to use rubber-tired wheels on our work even if we were starting in with a brand new floor.

It was decided to make a general repair of worn joints in aisles and to that end a gang was put to work on them one Saturday morning. All the joints in the trucking lanes that showed more than a quarter inch of break were selected for repairs. Parallel lines were scratched on the surface spaced two inches apart, and cuts two inches deep or more were cut the full length of the breaks. The sides and bottom of these cuts were thoroughly dampened to make the new cement adhere better; then, a 3 to 1 mixture of sand and cement wa poured in and smoothed off level or a little above. (Strictly speaking, "cement" floors are "concrete" floors, though the language of the trade does not restrict as closely as in the machine business).

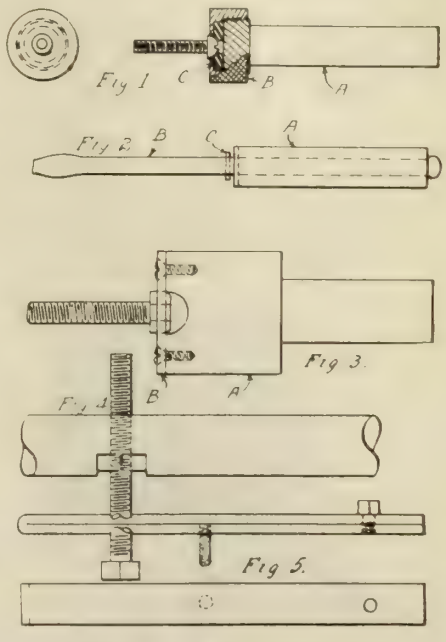
Wherever a joint was broken out more than two inches wide, the cut was swerved to include all of the bell mouth. On Monday morning, the joints were hard. What projected above the general floor level was worked down with emery bricks—it was considered better to do this than to finish off the fresh cement level with a trowel. The resulting job was extremely satisfactory and a year of service finds it, as good as on the first Monday morning. It is quite common to see floors repaired by pouring a little neat cement into the cracks as they are; this will not stay—it has not body enough and it tapers off to thin edges—in fact, the whole thing will be gone in a month's time. Make a good wide, deep cut, chiseling the sides down square from a sharp edge on top—then the job will last under severe daily trucking.

RAPIDLY DRIVING THREADED PARTS

By Harry Moore

If the jig and fixture principle is judiciously applied to the operation of driving nuts, screws, etc., many assembling jobs can be done at a speed proportionate to the rate at which the various parts are usually produced in the shops. Not infrequently, however, the operation of assembling consumes an amount of time out of proportion to the rate of production of the separate pieces and sometimes this is so merely because certain operations have always been performed in one set way and nobody cares to experiment on attempted improvements.

Take, for instance, the everyday job of driving button headscrews; it is rare indeed that anyone attempts to insert these other than by the well-tried screw driver route; yet, the shape of this particular screw head lends itself very nicely to the adoption of a very simple quick-driving fixture, and, where the parts are numerous enough, the one shown in Fig. 1 is well worth making. This is a drill press fixture, the body A being adapted to be gripped in the drill chuck. A knurled packing nut B tightens against a rubber or leather washer C, the hole in the washer being about ⅛ in. for screws over ¼ in. and the hole in the nut being large enough to admit the screw head. To drive a row of button head screws wth this device, the screws are first of all inserted by hand a thread or two, then with the drill press running at a fast speed each screw head is pressed up into the washer. The screws can be driven to seat in this way in a flash, the final tightening being made with a hand screw driver. It will be obvious of course that the screws must be an easy fit in the work to allow a device of this kind to be used and where this is not the case the machine screw driver shown at Fig. 2 is more applicable. In this instance also the body A is turned to fit the drill chuck of a press. Through the centre a hole is drilled to take the screw driver B, this being turned with a ball top and drilled for a pin C which engages in a slot in the bottom of A. In use B is held still while the machine is running and the blade inserted in the screw slot. A quick upward pressure engages C with the slot and drives the screw to the seat, final tightening being effected as before. Due to the fact that a positive drive is obtained in this case, provision is made to upset the driving action in the event of the operator failing to release the screw before it reaches the seat. This is effected by pin C being of light construction and the fact that the slot in which it engages is wide enough to allow it to clear if it bends; which it does if too much strain is put upon it.



Methods of driving threaded parts.

A very simple form of drill press tool is shown at Fig. 3, made for the purpose of driving long cap screws. The body A of this tool fits the drill chuck also, while near the bottom end a hole is drilled through at right angles of a diameter equal to the distance over the corners of screw heads. This piece is then chucked up and faced off until half this hole is left. Next a plate B is screwed to A, this plate having a hole in the centre equal to the distance over the corners of screw heads. This forms a guide for the screw head as it is pushed up, the drive taking place when the head strikes the half hole through the side. The screw is released immediately the upward pressure on the screw is stopped, final tightening being done with a wrench as usual.

Fig. 4 shows a simple tool made to run down a large number of lock nuts. This consists of a length of cold rolled about 12 in., drilled in the centre to clear the screw and slotted across the width of the flat on nuts. With the

screw head gripped in the vise a nut can be run down into a position near the head in a quick manner by merely giving the tool a spin. The weight of the bar will carry the nut over parts where it might have a tendency to stick. In the last example Fig. 5 a stud-driving tool is shown which spins the studs into place in the same manner as the bar shown at Fig. 4. Flat stock is bent double in this case, both ends being brought close together. One part is drilled and tapped for the stud and near the open ends a tightening screw is placed. In use the stud is inserted in the central tapped hole, spun into place and tightened. To release the wrench the screw A is loosened which allows the top leaf of the wrench to spring upward slightly and thus release the work. Screw A must be tightened each time a screw stud is inserted so that, when the latter is being tightened up it forces the head against the top leaf thereby creating a tension between the two leaves which forces them to spring slightly apart when screw A is released.

THE CHISEL AS A CUTTING TOOL

By G. Blake

In these days of machine tools covering every phase of engineering work, the chisel does not hold the position it did in the days of our fathers and grandfathers; yet, notwithstanding all the improvements and machines for dispensing with hand work of every description, there still exists a wide field for the scope of the chisel. But while the chisel is still an indispensable tool in the workshops, it would appear, however, that the workmen of to-day lack that skill (born of years of practice) in using it as did their fore-fathers. It is not the author's intention to descry the capabilities of the present-day mechanic, as he is not in any way responsible for the general conditions in our workshops affecting the adoption of labor-saving appliances; his lack of that adeptness with the chisel merely reflects the march of progress. As previously indicated, there still exists a wide field for the useful chisel, and with that object in view, the author desires to present in this article a few useful hints regarding the cutting angles for different materials. The cutting angle of the chisel is just as important as it is in the case of lathe, planer, and slotter tools, etc.

First let us take for example the chipping of a piece of mild steel or wrought iron. Fig. 1 shows a chisel correctly ground for cutting the above materials; the cutting angle it will be noted is between 30 deg. to 35 deg. included. Now, while this is approximately the best cutting angle for cast steel, mild steel, wrought iron and some kinds of non-ferrous metals, a chisel ground as in Fig. 1 is totally unsuitable for cutting cast iron. While the author was an apprentice in a small jobbing shop, he learnt the art of chipping, and bears on his hands to this day one or two reminders of his early attempts. One of the things he noted was that when chipping mild steel or wrought iron, the chip came away much easier when some form of lubricant was introduced; this lubricant was merely a drop of machine oil kept in a small cut made by the chisel on a block of lead. To apply it, the fitter merely dipped the extreme point of the chisel in the oil every few minutes. It is indeed surprising the difference a small drop of oil makes and how much less power it requires to perform the work. Of course we use lubricants on our cutting tools on the lathe, planer, shaper and drill, etc., for reasons that are too obvious to go into. The chisel is also a cutting tool and requires lubrication as do the others. To those who are familiar with these facts, it may seem rather elementary, yet, on the other hand, there are a great number of mechanics at the present time who are not conversant with these small but important matters.

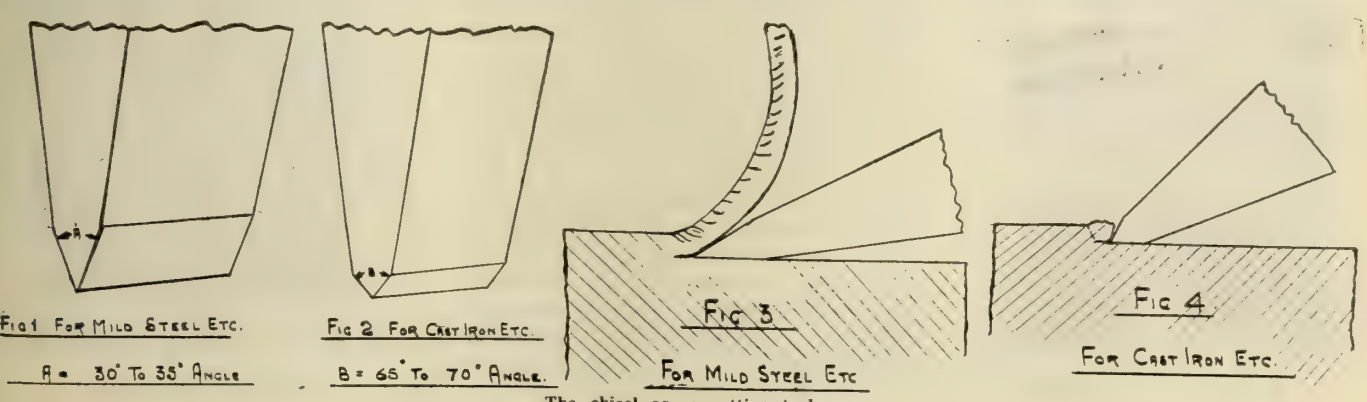
Fig. 2 illustrates the type of chisel suitable for cutting cast iron and some grades of non-ferrous metals such as phosphor bronze, etc. In this case, the best cutting is approximately 65 to 70 degs. included, and this angle, while eminently suitable for the above metals, would not give good results on cast steel or mild steel, etc. No cutting lubricant is required, as, in the case of all machine tools working on these metals; the best results are obtained without the addition of lubricants.

Figs. 3 and 4 diagrammatically show the action of the chisels for cutting mild steel and cast iron respectively. It will be noticed in Fig. 3 the cutting edge resembles a wedge; the angle is between 30 to 35 deg. included. If the angle is less, say 20 to 25 deg. the chisel would cut very much better, but on account of its long taper it would not stand up to the work for any length of time; either it would break or bend up at the cutting edge, so a compromise is effected by adopting the greater angle. The formation of the chip it will be noticed curls up as the work proceeds. Now, if a chisel with a cutting angle of 65 to 70 degs. is used on the same material, the chip would not have room to get away or curl up, it would come off in small lumps, forced off rather than cut off, making the work twice as hard to perform and giving a very poor finish.

Fig. 4 illustrates the chisel for cutting cast iron, etc., the included angle in this case being between 65 and 70 degs. This angle is best suited for the material mentioned, the grain of which, being altogether different, so that it is not possible to be cut off in long chips or shavings like mild steel. The action of the chisel in this instance is more one of forcing or dislodging small lumps from the surface, and the work is consequently harder and slower and requires more effort on the part of the workman. If we increase the angle to 90 deg. it becomes increasingly difficult to dislodge the metal, because it is necessary to have a slight undercutting, as in the case of Fig. 4, so that the metal will come away without as much effort as in the 90 deg. angle chisel point; therefore the most suitable angle is somewhere between 65 and 70 degs. If we come down to 45 deg. and 50 deg. and approach the angle of Fig. 3 we get too much undercutting; the chisel will be apt to rise at the point or to dig in deeper when the blow is applied.

A word now about the grade of steel suitable for chisels. Some people imagine that if the metal is cast steel it will make a chisel; this is not always the case, as one may select a piece of 1.5 per cent. carbon steel which is not at all suitable for making chisels. The best possible chisel steel for general purposes contains approximately .85 per cent. to .90 per cent. carbon; this steel will stand up where a higher carbon steel will fail. Thus it is extremely important to have the correct steel from which to make a chisel. Steel designed to withstand a succession of

(Continued on page 39)



The chisel as a cutting tool.

New Things in Shop Equipment

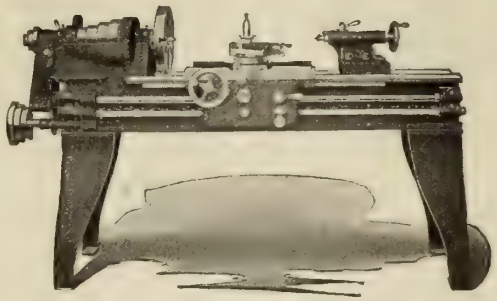
COUNTER WITH MEASURING ATTACHMENT

A counter that can be applied to any machine for recording consecutive moves of any part, or the number of pieces produced or passing a certain point, has been developed and placed on the market. The device can likewise be adapted to machines where it is desired to record the length of material produced, such as thread, twine, tape or wire. The material passes around an aluminum wheel which is secured to a shaft that, through a train of gears revolves a worm wheel secured to the spindle of the machine. A brass plate on the side of the worm wheel is graduated to read in feed—one full turn of wheel records 100 feet.

No lead gear, lock washers, ratchets nor springs are used in its construction. All gears are made of steel and parts subject to wear are hardened. The openings in the case are covered with a transparent fireproof material, which protects the mechanism from dust or dirt. The device can be operated electrically if desired. These small tools are made by the Precision Machine Co., Milwaukee, Wis.

STANDARD ENGINE LATHE

A new series of engine lathes, known as the "Standard," made in sizes from 14 to 20 in. swing, has recently been placed on the market. These tools are made both in plain and quick-change types, the beds being of the box-suction



14 to 20 in. "Standard" engine lathe.

style and recessed to permit tailstock to overhang at extreme end. Feed rods and lead screws are fitted to the lathe so that the lead screw is only in operation when threads are being cut. Accurate alignment of feed shaft and lead screw with the change gear box is assured by brackets being fitted in grooves on the frame. Racks are made in one continuous piece. Box type aprons provide double bearing for feed gear shafts. All apron gears are of steel integral with their shafts. The entire range of feeds and threads are obtained by means of two handles. The regular equipment of every lathe includes two faceplates, steady rest, follow rest, graduated compound rest, gear guards, and countershaft with two friction-clutch pulleys. Thread indicators, draw-in and taper attachments can be supplied when desired. These lathes are made by the John Steptoe Co., Cincinnati, Ohio.

SPECIAL GRINDING GAUGE

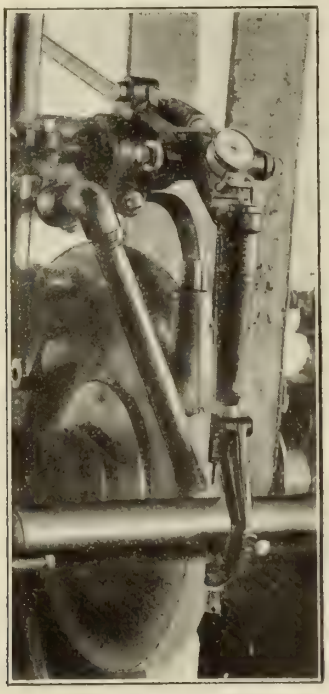
A gauge for determining the size of work being ground, without stopping it to use snap gauges or micrometers has recently been offered to the trade. The instrument consists of a cast iron body which contains a plunger and spring. An indicator is mounted at the upper end of the frame and interchangeable heads can be fitted to the lower end to gauge the different sizes of work. Each head has a sizing range of 1⅛ inches. There are three diamond contact points, two being fitted to the ends of adjustable screws and the third mounted in the end of the spring-actuated plunger. A very light spring pressure is required to keep the gauging points in contact with the work. The gauge is suspended between cone-pointed screws in a fork which is adjustable to any position. The bracket that supports the hanger mechanism is bolted to the grinding machine. The gauge can be used on all cylindrical work and the operation of sizing is quickly performed, because the gauge is always in a position for measuring. These gauges are made by Fred J. Pratt, Detroit, Mich.

EXPANSION HAND REAMER

A new form of expansion hand reamer, known as the "Parop" has recently been placed on the market. The adjustment is made by means of a taper plug regulated by a screw in the end. The end of the pilot is reset to a considerable depth for the protection of the head of the screw, and also to allow of placing the reamer offsetters for regrinding. Lubrication is provided for by an ample flow of oil through the squared end of the reamer through the slot to the cutting edges. The feature of the reamer is the shape of the flute, the alternate lands being parallel while the intermediate ones are set at an angle. It is claimed that this facilitates the honing of the cutting edges without the possibility of rounding over those on the adjoining edges. A short bevel on the end of the pilot is provided with a cutting edge to remove burrs from the holes when the reamer is entering. These reamers are made in standard sizes from one half inch to one and one half inches and are manufactured by the Gammons-Holman Co., Manchester, Conn.

STATIONARY DIE HEAD

There has recently been placed upon the market a stationary type die head with micrometer attachment. This head, with the micrometer attachment, is particularly valuable when cutting threads of special form which require one or more roughing cuts and a finishing cut.

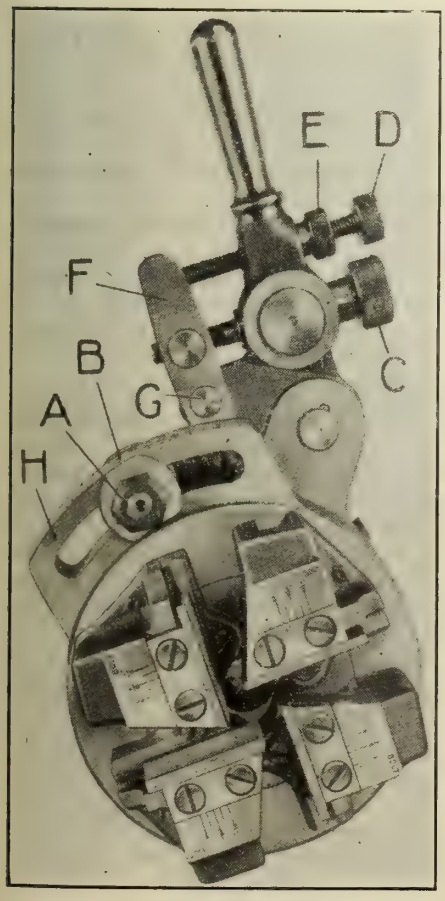


Grinding gauge in working position.

Gauge raised to clear work.

With this attachment it is possible to set the die head so that the same amount of metal is left for the finishing cut at all times. The head is graduated for both right and left hand for all sizes of bolts and pipe within its range. These graduations are stamped on the outer surface of the closing ring above the circular slot. To adjust the die head to size, loosen the clamping nut A, with the left hand and bring the index mark B, opposite the required graduation on the scale with the right hand. Further adjustment can be made, if desired, through the micrometer attachment. To adjust the micrometer attachment back off stop screw D, after first loosening the stop screw lock nut E, then the micrometer screw C can be adjusted for increasing or decreasing the diametrical adjustment. To increase the diametrical adjustment of the die head, turn the micrometer screw C, in a counter clockwise direction. This causes the upper part of the link F to swing to the left about the center G. The swing of the link F to the left pulls the closing ring H to the right and increases the diametrical adjustment. Turning the micrometer screw C in a clockwise direction causes a counter movement of the link F and decreases the diametrical adjustment.

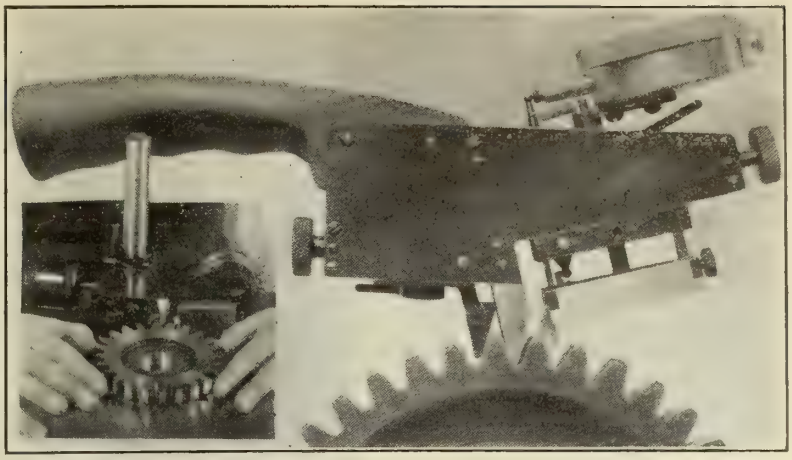
After the micrometer adjustment is made, the stop screw D should be set against the link F and locked in place with the stop screw lock nut E. To adjust the die head for the roughing cut, turn the micrometer screw C in a counterclockwise direction until the desired diametrical adjustment is obtained. The stop screw D should be left in the locked position. Two or more roughing cuts can be made by decreasing the diametrical adjustment of the die head in one or more increments through the micrometer screw C. After the roughing cut has been made, the micrometer screw C should be turned back in a clockwise direction until the link F comes against the stop screw D. The die head is now set to the final diameter and is ready for the finishing cut.



New stationary die head.

The die head with micrometer attachment can be applied to turret lathes, engine lathes, and hand operated screw machines. It may also be applied to all lathe types of threading machines where the work is revolved and the threading head remains stationary. To apply this head to a turret lathe, it is equipped with a shank to conform with the dimensions of the socket of the turret.

The application of this head to the cross slide of an engine lathe is effected by means of a special knee bracket. The front face of the knee bracket must be machined with a centering boss to fit the counterbore on the back of the head. The bore of the knee bracket should be concentric with the centre of rotation. This can best be accomplished by bolting the knee bracket to a cross slide and boring it out with a boring bar swung between centres. A special dead center will be required. The diameter of this special dead center must be such that it will have a neat fit in the bores of both the knee bracket and the die head. The length of the dead center should be sufficient to allow the front end to project through the bores of the knee brackets and the die head when the back end of the knee bracket is against the tail stock castings. This is necessary to enable the work to be swung between the centers in front of the die head. The work can be gripped in a chunk and threaded without the use of the centers, when the shape of the part makes this procedure necessary. These die heads are manufactured by the Landis Machine Co., Waynesboro, Pa.



Pratt and Whitney Odontometer.

ODONTOMETER

An instrument for testing the accuracy of gear teeth has recently been added to the line of precision tools. The Odontometer is a simple and self-contained instrument for testing the accuracy or uniformity of the gear tooth profiles and spacings of the teeth in production work. The instrument illustrated on the gear has a range of from 3 to 10 diametral pitch, may be used to check gears of any pressure angle, and can be applied to a gear while it is in place in the machine. In effect it is composed of a section of a straight-sided rack with two parallel effective faces. one fixed and the other movable. A third face, set at an angle to the two working faces, is used to hold the fixed working face in contact with the flank of the gear tooth. The fixed registering surface is at A, the movable indicating surface at B. The third surface C holds surface A in contact with the involute surface of the gear tooth. The surfaces B and C are adjustable so that gears of various pitches can be tested with the same instrument.

The indicating surface B is mounted on two thin flat springs D, which act as pivots free from backlash. The dial indicator E is actuated by the lever F, which has a ratio of 5 to 1, so that each division on the dial represents a movement of 0.0002 inch of the indicating surface B. In general the instrument is used as a comparator to test the uniformity of interchangeable and mating gears. If actual measurements are required, the distance between the two parallel working faces of the instrument can be measured. Stands are also made to hold the two smaller sizes of Odontometers when gears or pinion shaped cutters are being tested. In this case the gear is placed on the surface plate and rolled by the instrument. The actual cutting edge of cutters is tested, so that errors of whatever nature are detected. These gauges are made to check gears in the following range of sizes—¾ to 4 pitch, 3 to 10 pitch and 10 to 24 pitch. They are manufactured by the Pratt and Whitney Co., New York.

CANADIAN MACHINERY
AND MANUFACTURING NEWS

Published in the Interests of the Machinery, Manufacturing, Iron, Steel, and Metal Working Industries.

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The Official Organ Mistake

WITH a lack of foresight which indicates an old-fashioned ignorance of the successful relations between a trade paper and the members of the trade it represents, the Timber Industries Council of British Columbia has decided to establish a journal of its own and arrangements have been completed under which the Pacific Coast Lumberman becomes the OFFICIAL ORGAN of the Council.

Apart altogether from the fact that the Pacific Coast Lumberman and the Western Lumberman have, in active competition, been giving the lumber trade of the Pacific a splendid service by maintaining healthy relations with the lumber consuming markets and that the manufacturers have now taken a questionable step in taking over one paper to be continued on competitive terms which can hardly be regarded as fair or equitable, is the conclusion born of experience that official organs defeat the very purposes for which they are conducted.

The well conducted trade paper represents various branches of the trade itself as well as the consuming public upon which that trade is dependent. Unless the relations between manufacturer, wholesaler, retailer and consumer are healthy business stagnates. To maintain such relations problems must be continually faced and solved. Many of them are unpleasant but their solution is the function of the trade paper which is properly serving its field.

The official organ must obviously serve selfishly the interests of the particular branch of the trade which controls it. If owned by manufacturers then wholesalers or retailers will not believe that it serves their interests; if owned by wholesalers or retailers, likewise it is regarded as their man Friday. In no case is the public interest likely to be properly respected. The result is that the official organ is conducted to please the people who are paying for its publication —and they usually pay heavily in the long run—and it is ignored by other sections of the trade with whom there should be co-operation and understanding in the interests of all concerned. Printers' Ink has effectively shown "Why Trade Associations Should Stay Out of the Publishing Business," and the following extracts are from articles which recently appeared in that publication:

When an association starts a periodical and goes out in the trade to solicit advertising, it is asking them to support a paper which is not founded on sound publishing principles.

A few associations decide that the independent papers do not "write them up" often enough and start their own publications so as to insure an unlimited flow of puffery.

The circulation is artificial; this circulation is generally mantained by virtue of the subscriber's membership in the association and is kept up regardless of the editorial merit of the paper.

Advertising in such publications is seldom sold on its merits. Seldom will the clever salesman remove the velvet glove from the mailed fist, but the hard iron of the implied threat is nearly always visible to the discerning buyer.

Such publications are of doubtful advertising value because of the difficulty inherent in the proposition of keeping the editorial contents on a par in reader interest with that maintained by a well-edited, independent paper.

When the lumber manufacturers of the Pacific Coast own their own paper they may expect to have their "fur rubbed the right way," but how can they expect this to improve those relations with the dealers which make for good business and mutual advantage? And when they advertise they should appreciate that they are paying to reach other manufacturers rather than the dealers who sell their goods and maintain the all-important connection with the consumer.

Stimulants For Better Business

IF ONE were to judge of general conditions from items appearing in the daily press and elsewhere, he must come to one conclusion and that is, business is improving. The fact forms a background of optimism which helps tone down the serious aspect of temporary labor problems. Here are a few selections from reports having reference to different phases of the industrial trend:—

"Factories get ready to meet big demands; busier day dawning."

"Labor outlook better. In some cases the demand for labor is greater than the supply."

"Western building record active for six months. Building boom reported on Vancouver Island."

"Furniture factories likely to have satisfactory business this Fall. Good demand for woodworking machinery."

"Large tonnages of structural steel moving. Active market for building material of all kinds."

"Boom expected in Canadian mining industry."

"Activity in Sydney mills. Billet and blooming mills now working double shift."

"Prairie crops promise well. One of the best we have ever had. Little else is lacking, but a good crop, to insure prosperity during the coming year."

Thus, it is seen, the general keynote is unmistakably that of prosperity. Slowly but steadily conditions are working back to a more satisfactory basis, and business seems to be doing well as the result of the stimulant. Orders are coming in from sources that have been inactive for months. The readjustments, losses and liquidations that have discouraged industrial effort for the past year or more will now, it is hoped, as the result of aggressive, well planned effort, give way to profit, and a more gratifying record on the other side of the ledger.

The amount paid out in accident claims in 1921 was $6,189,263. This is a large bill against the industrial pocket book and it will be gratifying to note that organization is gradually overcoming any tendency toward malingering or improper claims for compensation.

Premium Prices Indicated in Steel Market

Bars, Shapes and Plates Advance—Policy to Hold Prices Down to Encourage Buyers Has Disappeared—Canadian Furnaces Out of Pig Iron Market—Taking Care of Contract Business—Production Seriously Curtailed

PRICES ADVANCE IN RESTRICTED MARKET

PRODUCTION of pig iron and steel is declining as stocks of coal at steel mills and by-product coking plants play out. It would take weeks to restore the industry to a smooth running basis, no matter what the settlement of the present troubles might be. Shortage of coal naturally cuts down consumption of steel, and some consumers have curtailed their shipments, while others are urging heavier shipments as they see production falling off. When prompt lots are required, premiums of from $2 to $5 a ton are being paid, but the tonnages involved here are not large. This describes the condition in the basic American markets.

The Canadian situation is largely a reflection, or rather a result of the other. Canadian furnaces are practically out of the running so far as new business is concerned. Bookings, it is said, will run them into October, and they have suffiicent material on hand to take care of these. Meantime shortages are developing, not only in pig iron, but also in such urgent lines as steel and iron bars, and sheets of all kinds. Price trends are upward, but as yet the situation has not become so serious as to make advances a matter of unanimity. That is different houses, while apparently agreed that advances are opportune, are not agreed as to the time or extent of advances. It is a very firm market, with a growing demand for larger quantities.

From Pittsburg comes the report that the policy among steel mills to keep prices down, so that buyers would not be afraid to take hold freely after the coal strike, has disappeared. There is, of course, very little autumn business left to be done, and the average mill is pretty well sold up to the end of the year. Restriction of production means restriction of consumption and orders placed will therefore last longer.

It is considered doubtful if present prices of pig iron and steel products will hold for any length of time after industry again recovers its stride. Consumers tried to build up stocks at low prices, and it may develop that they have large tonnages of steel to liquidate. The minimum price on bars, shapes and plates, is now $1.80 or $2 a ton advance in a week, and $4 advance in 30 days. In sheets, some mills are practically out of the market, and the real trading market is confined to premium prices such as 2.60c for blue annealed; 3.40c for black; 4.40c for galvanized, and 4.85c for auto sheets. As to pig iron, there is reported to be scarcely any merchant production and consumption is restricted.

Machine tool business in Canada shows some evidence of improvement, and the demand is said to emanate not so much from large industries as from those whose plants are easily adaptable. This business calls for aggressive selling, but reports indicate a gratifying response. Machine shop supplies continue in good demand.

Toronto

August 16

THAT business is good and that there is a noticeable tendency on the part of buyers to consider larger quantities rather than the recent hand-to-mouth method of purchasing, is the statement of a prominent dealer in iron and steel on the Toronto market. He admitted that there were some inconsistencies in this tendency. It was difficult, for example, to reconcile the fact that prices are advancing, with the unmistakable evidence that bookings were heavier. The rail and coal strikes may, however, have caused an uneasiness as to the future and are naturally responsible for the determination to supply against future requirements. The trade is now confronting shortages, and the market is reaching that stage when anything but advance contract business must consider long prices.

Sheets and bars are in very strong demand, advances are the order of the day, and it is held by some that present prices on the Canadian market do not truly represent actual conditions. In some quarters they are held to be satisfactory while in others, more inclined to comparison with peak prices in American markets, it is the contention that prices must go quite a notch higher. It certainly appears that there is little if any concerted effort to maintain a dead price in certain departments of this market.

Pig iron markets reflect the difficulties of the present situation. So far as new business is concerned, Canadian furnaces, such as Steel Co. of Canada, and Algoma Steel Corporation, are out of the market. Their resources are said to be barely sufficient to cover contract requirements. The Port Colborne furnaces are also out of commission for the time being. The price quoted, $35.65, is said to be slightly better than the Buffalo figure, but as one buyer pointed out, this doesn't mean anything if the market is short, unless the quotation represents a premium on emergency business.

Scrap metal market: It would naturally be supposed that, with the shortage in the pig iron market, some improvement in the demand for scrap metals would be noticed. Reports indicate a decided flatness here, however. "We are governed by the American markets," declared a dealer, "but I will say that we are in a little better condition. There is, on the whole, very little to report. The market is weaker, for manufacturers who cannot get coal are not in the market for other materials. Given coal, the situation would soon right itself." Among purchases within the past few days were 500 tons of No. 1 machine cast iron at $21 for a Montreal account. Current prices are:

Copper, light ... ... per 100 lbs.	8 50
Copper, crucible	11 00
Copper, heavy	11 00
Copper Wire	11 00
No. 1 composition	9 00
New brass cuttings	6 00
Red brass turnings	6 50
Yellow brass turnings ...	4 85
Light brass	3 50
Medium brass ...	4 50
Scrap zinc	4 00
Heavy lead	4 50
Tea lead	3 00
Aluminum	11 00
Boiler plate, per gross ton ...	9 00
Heavy melting steel ...	11 00
Axles (wrought iron) ...	16 00
Rails (scrap)	11 00
Malleable	11 00
No. 1 machine cast iron ...	21 00
Pipe, wrought ...	6 00
Car wheel	16 00
Steel axles	15 00

Iron and steel bars and sheets form a department in which activity may be said to have centred most decidedly. The demand continues to develop strength and prices are upward. Although the market does not appear to be unanimous, some houses give iron and steel bars a range from $3.25 to $3.40; small shops an advance from $3.25 to $3.40 and fine steel $3.15 to $3.40. Premier sheets are now quoted at $6.75, while zinc sheets, small lots, are quoted at $11. Latest quotations from Chicago show an advance of 10 cents on bars, shapes, plates, and small shapes, and it is predicted that there will be further advances. Current quotations are:

Iron bars	3 25	3 40
Steel bars	3 25	3 40
Reinforcing bars	3 25	3 40
Steel hoops		4 25
Tire Steel		3 40
Spring steel		7 00
Band steel, No. 10 gauge and 3-16 in base	3 65 to	3 75
Small shapes		3 40
Sheets, black, No. 28 ...		5 25
Sheets, blue ann., No. 10 ...		4 25
Canada plates, dull, 52 sheets ...		5 25
Canada plates, all bright		6 00
Galvanized Sheets, No. 28...		6 35

Non-ferrous metals, so far as the Canadian markets are concerned, are reported as somewhat inactive, and that the strike situation is making for more difficult conditions. Nevertheless, New

York reports strong consumption of all non-ferrous metals, with lead and zinc leading. France and Germany are reported to have bought large tonnages of copper recently. The zinc market has also been quite strong, with producers unable to extend owing to strike conditions. There have been slight advances in the American markets, where activity has been most pronounced. Tin has fluctuated considerably, but on the whole, there has been a recovery from recent reaction. The Toronto quotation is $36.50, indicating a slight advance. Aluminum is also showing strength with quotations around $22. Current quotations are:

Lake copper	17 25
Electrolytic copper	17 25
Castings, copper	17 00
Tin	36 50
Spelter	7 50
Lead	7 00
Antimony	7 40
Aluminum	22 00

Turpentine again figures in a slight advance from $1.75 to $1.85, while linseed oil, raw, scored a jump from $1.10 to $1.14. Gasoline is reduced to 34 cents.

An order for two hundred and fifty steel refrigerator cars for the C. P. R. is being executed by the National Steel Car Co., Hamilton. This will call for considerable tonnage in material. There has been a recent advance, about $3 a ton, on steel for this class of work.

Some business is being done in machine tools, and there is a feeling that the situation is gradually improving. It is not the kind of business that goes begging, however, but represents keen, aggressive salesmanship. Nor it it coming from the very large industries, but from those who are in a position to easily adapt their plant to opportunities as they occur. The demand for machine shop supplies continues on an encouraging basis.

Pittsburg

August 16

THE monthly report of the American Iron and Steel Institute, giving the steel ingot production of 30 steel companies in July, indicates that the steel industry, as a whole, produced steel ingots in July at a rate of about 36,000,000 gross tons a year, this comparing with rates of 36,600,000 tons in June and 36,400,000 tons in May.

The average rate in July quite misrepresents the rate of production, however. Production increased in the latter part of June, while about the middle of July there began a sharp decline in production, this decline continuing to date and promising to go considerably farther in the next two or three weeks if not for a longer time.

Considering the circumstances, it may be taken that the rate of production to July 1, was about 37,000,000 tons, the rate dropping to say, 34,000,000 tons by the end of July, and to somewhere in the neighborhood of 30,000,000 tons at the present time.

The influence of the combination of the coal strike and the railroad strike has become very serious. The steel industry got along very well during the first three months of the coal strike, which began April 1, increasing its rate of production by fully 5 per cent. Large stocks of coal had been accumulated, and there were heavy drafts upon non-union coal fields, particularly in West Virginia and Kentucky. The unusually heavy movement of coal from those districts began to congest the railroads involved by the middle of June, and when the railroad shopmen's strike began July 1, the condition was greatly accentuated. According to railroad officials the strike has been waning, but the receipts of coal are light as the congestion is not cleared. With these light receipts, and with stocks of coal at steel mills and by-product coking plants playing out at one point after another, production of pig iron and steel goes down. No conceivable settlement of the coal strike would restore the coal movement to the iron and steel industry except after the lapse of several weeks as it takes time to get shipments moving smoothly, and for a time precedence must be given to various consumers. and, in particular, the movement up the lakes to the northwest must be taken care of.

Consumption Restricted

Appearances are that steel has grown scarcer, but appearances are sometimes deceptive, particularly when one is dealing with the human element. The shortage of coal cuts down consumption of steel, but by how much no one is in position to estimate. Some steel consumers have notified mills to curtail or discontinue shipments of steel, on account of impaired consuming ability, but there may be many who wish to pile up steel so as to be safe in case they get supplies of coal sooner than the steel mills can increase production. Steel buyers are very human, and as a rule when they think steel is scarce they are anxious to get more.

Many customers of mills are urging heavier shipments, as they see production falling off. Some consumers are in the market to buy prompt lots, at the delivery premiums that generally have to be paid, say $2 to $5 a ton as a general statement. The tonnage involved in this prompt demand is not large, relatively. The premiums are insignificant compared with those paid in 1920 on large tonnages.

Two months ago the policy was largely in vogue among steel mills, although there were some exceptions, of holding steel prices down, the idea being that a safe market level should be preserved so that buyers would not be afraid to take hold freely after the coal strike. With a high market buyers would be likely to adopt a drastic policy of liquidating stocks, as they did in 1921.

This policy appears to have disappeared, if the present price advances are a criterion. One reason for abandoning the policy would be that there is scarcely any autumn business left to be done, for the simple reason that with production restricted the sales and purchases already made will last longer. The average mill is pretty well sold up to the end of the year, on the basis of its prospective production. If ability of buyers to consume steel is correspondingly restricted by coal and transportation conditions, the buyers in turn are covered for longer periods than they supposed a couple of months ago.

Will Prices Hold?

It is possible that when industry gets in smooth running order again, present prices of pig iron and steel products will hold, but that is extremely doubtful. The issue may not arise before the beginning of the new year and it is quite improbable that it will unless consumers have a considerable tonnage of steel now in stock to liquidate. They do not appear to have, from the way they act, but it is to be noted that for four months, April 1, to August 1, production of steel was at rate of over 36,000,000 tons of ingots a year, or 35 per cent. above the average rate in the first three months of the year and 85 per cent. above the average rate in 1921. Steel consumers were more or less fearful that the coal strike would cut down their supplies of steel, and presumably they tried to build up stocks, particularly as prices early in the year were low. The question is not so much as to their desire as it is as to their success.

The minimum on bars, shapes and plates is now 1.80c, this being $2 a ton advance in the week and $4 advance within 30 days. Prompt lots have gone at prices up to 2.00c and perhaps even higher. In sheets the old prices, based on 3.15c for common black, are still nominally in force by some mills, but these mills are sold up as far as they care to go and are practically out of the market, so that the real trading market is confined to the premium prices, say 2.50c to 2.60c for blue annealed, 3.30c to 3.40c for black. 4.30c to 4.40c for galvanized and 4.75c to 4.85c for automobile sheets. Hoops remain at 2.50c as a general base, but hoops under one-inch width are held at 2.75c, or $5 a ton premium.

Unfilled Tonnages

The Steel Corporation's unfilled tonnage statement shows that the corporation booked more business in July than was commonly estimated, and probably much more, proportionately, than did the independents. The unfilled obligations of the corporation at the end of July amounted to 5,776,161 tons, equivalent to 5½ months' production at 75 per cent. of capacity, the rate the corporation maintained during May, June and July. The increase during July was 140,630 tons, or 11 per cent. of the month's capacity, and estimating shipments at 75 per cent. the total bookings in the month appear to have been about 86 per cent. of capacity, against 103 p. c. in June 86 per cent. in May, 115 per cent. in

April, 90 per cent. in March, and less than 50 per cent. in each of the 17 months preceding, since September, 1920.

The whole pig iron market has dropped out, except for there being a market in small spot and prompt lots, prices for which are higher. Last sales were at $27 for Bessemer, $25.50 for basic, $28 for foundry and $29 for malleable, f. o. b. valley furnaces, freight to Pittsburg being $1.77. There is scarcely any merchant production of pig iron, while consumption is restricted. Neither producers nor consumers are in mood to consider transactions for forward delivery.

PRESENT DAY PROBLEM

(Continued from page 23)

necessity of reconciling annually the figures shown by the books with those shown by the tax returns. On the other hand established bookkeeping procedure, adopted for valid business reasons, would thereby be upset and valuable comparisons rendered impossible.

One client who adopted the "cost or market" basis for his inventory decided to abandon the "cost" basis for bookkeeping, although that basis had been followed for years. He soon found, however, that to operate his cost system using cost or market was a complicated matter. The solution seems to me to be to keep the accounts on a cost basis and to make annual adjustments in the aggregate if it is desired to bring the accounts finally to a basis of "cost or market."

THE CHISEL AS A CUTTING TOOL

(Continued from page 33)

blows or impacts, does not contain more than .90 per cent. carbon at the most; this percentage of carbon just gives the steel that toughness which is essential in a good chisel. Many chisels are made from a higher carbon steel than suggested by the author; this, of course, leads to more frequent grindings, breakages and hardening than would be the case if the steel contained the correct amount of carbon. Chisels are very often overheated in the forging and hardening causing breakages and loss of time and money. With an .85 per cent. to .90 per cent. carbon steel it can be heated to a higher temperature, without affecting the metal, than a 1.25 per cent to 1.5 per steel, as carbon has the effect of making the steel brittle when found in the higher percentages. When hardening a chisel a good method of ascertaining the correct quenching temperature is to use a magnet on the part to be hardened. Carbon steel when heated to a certain temperature loses its affinity for the magnet, and this stage, it has been found, is the correct temperature for quenching. It will surprise one who has previously worked by the color of the steel when withdrawn from the fire, to see the low temperature at which steel will harden. Another method and an old one for hardening a chisel is to get it a dull red, and whilst in that state to drive it (quickly) point downwards into a block of lead; this gives the correct hardness without tempering. In connection with tempering a chisel, if the steel is of the correct carbon content and if heated to its proper temperature, it should be tempered to a deep purple color; this will make the chisel tough and yet hard enough for most kinds of work, but on very hard cast iron it may not stand up so well as on mild steel; in that case a purple with a golden tint will be found more satisfactory.

To sum up. The chief points to be observed in making and using chisels are: 1st. Get the right steel. 2nd. Correct heat treatment. 3rd. Correct cutting angles. A little perseverance and practice on the lines suggested will go a long way towards a better and more intimate knowledge of the "art of chipping."

ELECTRIC CONTROL OF PLANER

(Continued from page 21)

shunt field sufficient to reduce the current to half its maximum value. This prevents the field from over-heating when the motor is not in use. The extra start and stop station makes it possible to control the equipment from either side of the planer.

The general purpose of this, and similar controllers, is to eliminate the difficulty experienced when using the old line shaft method of drive, also to place in the operator's hands a complete and individual control of each piece of machinery by electrical means. This controller is designed to take care of and handle all conditions which may come up in the operation of a large planer, to provide safety for the operator, for the planer itself and the work upon which the planer is engaged. Conditions such as overhead, low-voltage or complete loss of power are automatically taken care of, and resumption of operating is easily and safely made in the simplest possible manner. The speed of the planer and the length of cut may be changed at will by the man in charge of the planer.

BRITAIN TAKES LEAD

In a recent report of trade conditions it was shown that the United States, which in the fiscal year ended June 30, 1921, was Canada's best customer by a wide margin, has been displaced by Great Britain. This was disclosed on June 30 of this year. During the first period Canada's exports to the United States totaled $502,000,000 and those to the United Kingdom $307,000,000. In the year covered by the latest report, Great Britain, with purchases amounting to $301,838,000, won first place from the United States, which shipped only $295,398,000.

MAKING A SCARF WELD

To make a scarf weld, the metal should be reinforced or upset, as far back as it is exposed to the intense heat. This upset allows for wasting away. In case of failure to make a perfect weld at the first heat, then a second heat should be taken. No sign of the scarf should be seen on a perfect weld. For ordinary lap weld the length of the scarf may be made one and one-half times the thickness of the bar. If the scarfs are long, the laps must be long. In welding a round bar, the scarf is made the same as the lap weld except that the scarf should be drawn to a sharp point instead of to a chisel edge. This is done in order that the corners may not project beyond the edge of the bar when welding, thus causing considerable trouble. Place the pieces in the fire with the scarf down, as the under side of the iron is always the hottest. Do not heat the iron too quickly as it will come to a welding heat on the outside and yet not be thoroughly heated, so that when exposed to the air, it will cool too rapidly. When each piece has attained a clean, white heat, remove them, giving each a jar upon the anvil while the scarf is down thus dislodging any dirt which may have adhered. Turn the one in the right hand over and place the other on top of it, bringing them together as quickly as possible. In putting the two pieces together, the point of one scarf should just meet the heel of the other. Hammer rapidly, in order that they may become united before the heat gets below the welding point. The cold anvil very quickly reduces the heat.

BENCH FILING MACHINE

A small motor-driven filing machine, manufactured by the Robinson Tool Works, Waterbury, Conn. has recently been improved in design. The top plate is supported in such a way as to permit of tilting to an angle of 10 deg. in any direction. An improved dust guard has also been added.

NEW STARRETT MICROMETER

The L. S. Starrett Company has out a new micrometer at a low price. This one inch micrometer caliper, No. 435, has a black enameled, drop-forged, rigid construction frame. Decimal equivalents are marked on the thimble. As the screw is .312″ in diameter and the contact points .270″, there is an unusually large wearing surface which insures long life. It is sold with or without ratchet stop.

In the operation of machinery it is very important to keep the slides well lubricated; not with excessive application but light and frequent. The dirt and dust that is generated by the cutting of cast iron soon absorbs the oil on the ways and they do not move freely. Before oiling the slides should be wiped clean.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Toronto price:—	
Silicon, 2.25% to 2.75%	35 65
Grey forge, Pittsburgh	$27 76
Lake Superior, charcoal, Chicago	33 15
Standard low phos., Philadelphia	35 00
Bessemer, Pittsburgh	27 00
Basic, Valley furnace	25 50

IRON AND STEEL

Per 100 lbs. to Large Buyers	Cents
Iron bars, base, Toronto	$3 25 3 40
Steel bars, base, Toronto	3 25 3 40
Small shapes	3 40
Iron bars, base, Montreal	3 15 3 25
Steel bars, base, Montreal	3 15 3 2
Reinforcing bars, base	3 15 3 25
Steel hoops	4 25
Tire steel	3 40
Spring steel	7 00
Band steel, No. 10 gauge and 3-16 in. base	3 65 3 75
Chequered floor plate ¼" and heavier	6 00
Bessemer rails, heavy, at mill	2 35
Steel bars, Pittsburgh mill prices	1 80
Tank plates, Pittsburgh mill prices	1 80
Structural shapes, Pittsburgh mill prices	1 80
Steel hoops, Pittsburg	2 75
F. O. B. Chicago Warehouse	
Steel bars	2 70
Structural shapes	2 80
Plates	2 80
Small shapes under 3-in.	2 70

FREIGHT RATES

	Per 100 lbs. C.L.	L.C.L.
Pittsburgh to Following Points		
Montreal	52	65½
St. John, N. B.	76	96
Halifax	77½	97
Toronto	34	48½
Guelph	34	48½
London	34	48½
Windsor	31½	45½
Kingston	48½	61

Current surcharge 1 per cent.

METALS

	Montreal	Toronto
Lake Copper	$17 75	$17 25
Electrolytic Copper	17 50	17 25
Castings, Copper	17 25	17 00
Tin	35 00	36 50
Spelter	8 75	7 50
Lead	7 00	7 00
Antimony	6 50	7 40
Aluminum	22 00	22 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$3 75	$3 50
Plates, ¼ up	3 40	3 25

PIPE—WROUGHT

Standard Buttweld Pipe S/C

Per 100 feet

	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
⅛ inch	$ 6.00	$ 8.00	$	$ ....
¼ inch	3.84	5.94	7.20	9.30
⅜ inch	3.84	5.94	7.20	9.30
½ inch	4.85	6.46	7.31	8.93
¾ inch	5.87	7.71	8.86	10.70
1 inch	8.16	11.05	12.58	15.30
1¼ inch	11.04	14.95	17.02	20.70
1½ inch	13.20	17.88	20.35	24.75
2 inch	17.76	24.05	27.38	30.30
2½ inch	28.08	38.03	.....	.....
3 inch	36.72	49.73	.....	.....
3½ inch	47.84	63.48	.....	.....
4 inch	56.68	75.21	.....	.....

Standard Lapweld Pipe S/C

Per 100 feet.

Below Dividing Line—Price Per Foot.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
2 inch	$21.46	$27.38	$31.08	$37.00
2½ inch	31.50	40.95	46.80	56.16
3 inch	41.31	53.55	61.20	73.44
3½ inch	48.76	65.32	72.68	89.24
4 inch	57.77	77.39	86.11	105.73
4½ inch	66.04	86.36	1.04	1.24
5 inch	76.96	100.64	1.21	1.45
6 inch	1.00	1.31	1.57	1.88
7 inch	1.30	1.76	2.02	2.45
8L inch	1.40	1.85	2.13	2.58
8 inch	1.61	2.13	2.45	2.97
9 inch	1.97	2.59	2.97	3.59
10L inch	1.82	2.40	2.75	3.33
10 inch	2.35	3.09	3.54	4.28

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4-in. and under 60 per cent.
4½-in. and larger, 50 per cent.
4-in. and under, running thread, 40%.
Standard couplings, 4-in. and under 30%
Do., 4½-in. and larger, 10%.

OLD MATERIAL

Dealers' Average Buying Prices

	Montreal	Toronto
Copper, light	8 50	$ 8 50
Copper, crucible	11 00	11 00
Copper, heavy	11 00	11 00
Copper, wire	11 00	11 00
No. 1 machine composition	9 00	9 00
New brass cuttings	6 00	6 00
Red brass turnings	6 50	6 50
Yellow brass turnings	5 00	4 85
Light brass	4 00	3 50
Medium brass	5 50	4 50
Scrap zinc	3 50	4 00
Heavy lead	4 50	4 50
Tea lead	3 00	3 00
Aluminum	11 00	11 00

	Per Ton	Gross
Boiler plate	$ 9 00	$ 9 00
Heavy Melting Steel	10 00	11 00
Axles (wrought iron)	20 00	16 00
Rails (scrap)	11 00	11 00
Malleable scrap	10 00	11 00
No. 1 Machine cast iron	20 00	21 00
Pipe, wrought	7 00	6 00
Car wheel	17 00	16 00
Steel axles	10 50	15 00
Mach. shop turnings	4 00	6 00
Stove plate	16 00	14 00
Cast boring	4 00	6 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, 7-16 and up	30
Carriage bolts, ⅜ in. and smaller 6 in. and shorter	40
Coach and lag screws	45
Stove bolts	72½
Wrought Washers	60
Do., corru. head	60
Machine bolts, 7-16 and over	35
Machine bolts, ⅜-in. and less	35
Blank bolts	35
Bolt ends	35
Machine screws, fl. and rd. hd., steel cut thread	37½ & 10
Machine screws, o. and fil. hd., steel cut thread	30
Machine screws, o, and fil. hd., brass cut thread	15
Standard couplings, 4-in. and under, brass cut thread	30% 30
Nuts, square, blank off net list	$1.00
Nuts, square, tapped off net list	50c.
Nuts, hex., blank off net list	50c.
Nuts, hex., tapped net list	
Copper rivets and burrs, list less	32c.
Burrs only, list plus	10%
Iron rivets and burrs	47%
Boiler rivets, base ¾ in and larger	$5.75
Structural rivets, as above	5 65
Wood screws, O. & R., bright	80
Wood screws, flat, bright	82½
Wood screws, flat brass	77½
Wood screws, O. & R., brass	75
Wood screws, flat, bronze	72½
Wood screws, O. & R., bronze	70

MILLED PRODUCTS

(Prices on unbroken packages)

Set screws	65
Square and hexagon head cap screws	60
Round head cap screws	20
Fillister head cap screws	35
Flat head screws	25
Button head cap screws	20
Studs	45
Semi-finished nuts up to and including 9/16 in.	70
Semi-finished nuts ⅝ to 1¼ in.	65
Semi-finished nuts 1⅜ to 2 in	35
Coupling bolts	35
Taper pins, No. 2 to No 5	65
Taper pin No. 6 and over	10
Planer bolts without fillet	10
Planer bolts with fillet	Net
Patch bolts	Plus 10%
Hollow set screws	20
Thumb screws	50
Thumb nuts	70

BILLETS

F. O. B. Pittsburgh

	Per gross ton
Bessemer billets, 4 in. x 4 in. and larger	$35 00
Open hearth billets	35 00
O. H. sheet bars	35 00
Forging billets	45 00
Bessmer rods	43 00

NAILS AND SPIKES

Wire nails, base	$3 65
Cut nails, base	4 35
Miscellaneous wire nails	72½%

ROPE AND PACKING

Plumbers' oakum, per cwt.	6 30
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 23
British Manila rope	0 20
New Zealand hemp	0 20

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	Net..

Squares
Twisted Squares
Rounds
BARS for
REINFORCED CONCRETE
DOMINION IRON & STEEL COMPANY, LIMITED
NOVA SCOTIA STEEL & COAL COMPANY, LIMITED
Units of the
British Empire Steel Corporation, Limited
CANADA CEMENT BUILDING, MONTREAL
From ore to finished product-All within the Empire

Solder, strictly	$0 22½
Solder, guaranteed	0 24
Soldering coppers, lb.	0 62½
White lead, pure, cwt	13 20
Red dry lead, 100-lb. kegs, per cwt.	10 75
Wood alcohol, per gal.	1 75
Whiting, plain, per 100 lbs.	3 00

CARBON DRILLS AND REAMERS

	Discount.
S. S. drills, wire size	60
Can. carbon cutters	plus 10
Standard drills, all sizes	60
3-fluted drills, plus	10
Jobbers and letter sizes	60
Bit stock	50
Ratchet drills	25
S. S. drills for wood	10
Wood boring brace drills	50
Electricians' bits	30
Sockets	50
Sleeves	30
Taper pin reamers	25
Drills and countersinks	20
Bridge reamers, carbon	50
Centre reamers	Net
Taps, machine screw	50 to 60
Taps, hand, sizes up to 1"	30 to 60
Chucking reamers	20 off
Hand reamers	20
High speed drills, list	40
Can. high speed cutters	plus 10
American	plus 40

COLD ROLLED STEEL
(At Warehouse)

Rounds and squares	$4.50 base
Hexagon and flats	$5.50 base

MALLEABLE FITTING LIST

1 in. elbow	.32	.53
2 in. elbow	1.05	1.70
1 in. tee	.43	.70
2 in. tee	1.45	2.40
1 in. coupling	.33	.53
1 in. locknut	.15	.23

Discount to dealers 70/5 off list.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$5 40	$5 25
Sheets, blue ann., No. 10	4 05	4 25
Canada plates, dull, 52 sheets	5 50	5 25
Can. plates, all bright	7.00	6.00
Galvanized sheets, No. 28		6 35
Queen's Head, 28 B.W.G.	7 25	
Fleur de Lis, 28 B.W.G.	7 00	
Gorbal's best, No. 28		
Colbornes Crown, No. 28		
Premier	6 85	6 35
Premier 10¾ oz.	6 85	6 75
Zinc sheets	9 25	11 00

PROOF COIL CHAIN
B. B. B. CHAIN

⅜ in., $16.45; 7-16 in., $14.00; ½ in., $12.95; 5-8 in., $13.15; ¾ in., $12.75; ⅞ in., $12.25; 1 in., $11.85; 1⅛ and 1¼ in., $10.55. Fire weld chain same sizes respectively are $14.00; $11.50; $10.40; $10.55; $10.15; $9.75; $9.35; and $8.25.

ELECTRIC WELD COIL CHAIN B.B.B.

⅛ in. $20.00; 3-16 in. $16.50; ¼ in. $15.50; 5-16 in. $12.70.

FILES AND RASPS

Cl be	60/5
Vulcan	50
P. H. and Imperial	60/5
Nicholson	40
Black Diamond	40
J. Barton Smith, Eagle	55
McClelland, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	60
Great Western-American	50
Kearney & Foote, Arcade	60/5

BOILER TUBES

Size	Seamless	Lapweld
1 in.	19.00	
1¼ in.	20.00	
1½ in.	20.00	
1¾ in.	21.50	
2 in.	20.00	16.00
2¼ in.	22.00	20.00
2½ in.	23.00	20.00
3 in.	27.00	24.00
3½ in.	32.00	28.00
4 in.	41.00	35.00

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS

Castor Machine Oil, per lb.	34½
Royalite, per gal. bulk	20
Palacine	23
Machine oil, per gal.	39
Black oil, per gal. (Summer)	19
Cylinder oil, Capital	69½
Petroleum fuel oil bbls., net	10.80
Pure turp., single bbls., gal.	1.75
Linseed oil, raw, single bbls.	1.10
Premier galsoline	34

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	30%
Standard	30 and 10%
Cut leather lacing, No. 1	1.75
Leather in side, (Lacing)	1.50

TAPES

Chesterman Metallic, 50 ft.	$5 00
Lufkin Metallic, 603, 50 ft.	3 17
Admiral Steel Tape, 50 ft.	3 00
Admiral Steel Tape, 100 ft.	4 50
Major Jun. Steel Tape, 50 ft.	3 75
Rival Steel Tape, 50 ft.	4 00
Rival Steel Tape, 100 ft.	8 75
Reliable Jun. Steel Tape, 50 ft.	5 25

PLATING SUPPLIES

Polishing wheels, felt	$3 80
Polishing wheels, bull-neck	1 50
Emery in kegs, Turkish	08
Pumice, ground	05
Emery glue	05
Tripoli composition	08
Crocus composition	12
Emery composition	11
Rouge, silver	16
Rouge, powder, nickel	38

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	20
Brass sheets, 24 gauge and heavier base	23
Brass tubing, seamless	28

WASTE

XXX Extra	16	Atlas	18
Peerless	21	X Empire	13
XX Grand	15	Ideal	18
Superior	20	X Press	11½
X L C R	14		

Colored

Lion	12	Fancy	13½
Standard	10½	Popular	9
No. 1	13	Keen	7½

Wool Packing

Arrow	24	Anvil	16
Axle	20		

Washed Wipers

Select White ...18 Dark colored. 13
Mixed Colored ..14
This list subject to trade discount

RUBBER BELTING

Standard 36 ....28% Best grades 28%

ANODES

Nickel	.55 to .60
Copper	.38 to .40
Tin	.70 to .17
Zinc	.16 to .17

COPPER PRODUCTS

Prices per lb.

	Montreal	Toronto
Copper Bars, ½ to 2 in.	.29	.28
Brass Tube		.28
Plain sheets, 16 oz. in. 30 x 72	.30	.29
Copper sheet, tinned, 16 oz.	.37	.36
Copper sheet, planished, 16 oz. base	.42	.41
Braziers', in sheets, 6 x 4 base	.30	.29
Copper tubing, seamless		.32

LEAD SHEETS

Roll Lot Prices

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$ 8 75	$ 9 25
Sheets, 3 1-2 lbs. sq. ft.	8 75	9 25
Sheets, 4 to 6 lbs. sq. ft.	8 25	8 50

Cut sheets, ¾c. per lb. extra
Cut sheets to size, 1c. per lb. extra

PLATING CHEMICALS

Acid, boracic	.23
Acid, hydrochloric	.03¾
Acid, nitric	.10¼
Acid, sulphuric	.03¾
Ammonia, aqua	.20
Ammonium, Carbonate	.15
Ammonium, chloride	.18
Ammonium, hydrosulphuret	.75
Ammonium, sulphate	.10
Arsenic, white	.18
Copper, carbonate, anhy.	.32
Copper, sulphate	.08
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.14
Nickel carbonate	.32
Nickel sulphate	.14
Potassium sulphide (substitute)	.40
Silver chloride (per oz.)	.85
Silver nitrate (per oz.)	.65
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.35
Sodium hyposulphite per 100 lb.	6 50
Sodium phosphate	.15
Tin chloride	.30
Zinc chloride, C. P.	.30
Zinc sulphate	.06

Prices per lb. unless otherwise stated

Cashing In On A Service

Buyers of Machinery and supplies in Canada appreciate the "Williams Service." They know that it is behind every sale that is made—that it is part of the Williams Guarantee of Satisfaction. This "Williams Service" benefits not only the buyer—its reaction is evidenced also in the wonderful growth and high esteem of the House of Williams, now accepted as **"The Home of Dependable Machinery and supplies."**

Our regular Monthly Machinery List is full of Bargains.
Shall we put your Name on our Mailing List?

The A. R. Williams Machinery Co., Ltd.

64 Front St. W., Toronto

HALIFAX ST. JOHN MONTREAL WINNIPEG VANCOUVER

If its Machinery—Write "Williams"

News From the Industrial Field

Rienforced steel contract for the new car barns for Toronto Transportation Commission has been awarded to the Burlington Steel Co., Toronto.

The Dominion Bridge Co., Toronto, have secured the structural steel contract for the new addition to car barns for the Toronto Transportation Commission.

The National Steel Car Co., of Hamilton, recently secured a contract from the C. P. R. for 250 refrigerator cars and a number of large baggage cars.

The steel contract for the repairing of the Scholastical at Outremont, Que. goes to the Walsh Plate and Structural Works, Montreal.

The promising outlook in the glass business is the reason for a recent report that the Libby-Owens Sheet Glass Co., of Hamilton, would enlarge their plant to provide for double the present production. This concern produces for a widening export demand as well as a large domestic business.

The steel contract for the new $150,000 hotel to be erected at Campbellton, N. B., has been awarded to the Eastern Canada Steel and Iron Works, of Quebec.

The Joliette Steel Products, Ltd., of Joliette, Que., have acquired the plant and equipment of the Joliette Steel Co. The new organization will continue manufacturing the lines of the old concern in addition to their other products.

The Montreal Architectural Iron Works, 145 Prince St., Montreal, have obtained the contract for ornamental iron for the Presbytery and Sacristy on Visitation St. The value of the building is approximately $125,000.

Contracts will soon be awarded for the several new buildings to be erected for the Western University at London, Ont. These structures include a natural science building to cost $250,000. The arts building will require an outlay of $200,000, while the new central heating plant will cost about $25,000.

The Hayes Wheel Co. of Chatham, have recently acquired the plant and equipment of the Dominion Forgings and Stampings of Merritton, Ont.

The Trussed Concrete Steel Co. of Canada, have secured the steel contract for the $700,000 hospital to be erected for the Grey Nuns at St. Hyacinthe, Que.

One result of labor unrest in the States was shown last yeek when a train of fifty crippled locomotives from the Wabash system across the line were sent through to Montreal to be repaired. It is the first shipment of the kind since the U. S. strike commenced.

Jno. Watson and Son, 167 Wellington St., Montreal, have obtained contracts for the ornamental iron work on the new $141,500 school at Bordeaux, Que., to be constructed for the Catholic School Commission; also for a school to be built by the same commission in the vicinity of Montreal.

The coal strike in the States has resulted in greater production in other localities. Ninety-eight thousand tons of coal were shipped from Sydney piers last week, a new record, surpassing the boom days of the war. In addition, considerable bunker coal was loaded at Louisburg piers. It is expected that these figures will be surpassed by the present week.

CANADIAN BRANCH OF AMERICAN CONCERN TO BUILD AT BELLEVILLE

BY THE decision of the Bassick Manufacturing Company, of Bridgeport, Conn., Chicago, Ill., to establish their Canadian branch at Belleville, the latter city has secured its tenth new industrial location within the last fifteen months. Mr. E. W. Bassick, president of the company, and Mr. Fesler, general manager, were in Belleville last week and carried to successful conclusion negotiations for the purchase of the H. A. Wood factory and plant on Pinnacle St. Here they will introduce forthwith the manufacture of the well-known "Alemite" products now used as part of the standard equipment for motor cars and generally adopted by manufacturers throughout Canada and the United States. The company will also carry on in its new premises the manufacture of all the lines now controlled by the Bassick interests in the United States.

The principal lines produced by the Bassick Company are casters and furniture hardware. In these they are said to be the largest manufacturers, not only in the United States, but in the entire world. They have already established five important plants in the United States, the parent plant being at Bridgeport, Conn., the most important subsidiary at Chicago, Ill., and others at Meriden, Conn., Newark, N. J., and Cleveland, Ohio. The company also manufactures a considerable line of automobile parts and accessories, such as the Dole valves, locks, hood latches, and in particular vacuum tanks. They are also introducing a promising novelty in the form of a flexible metal shield for automobile springs. The necessary mechanical equipment for the new plant will be forwarded to Belleville at once and installed as soon as possible. It is the intention, not only to manufacture at Belleville all the Bassick lines, but to manufacture all the parts so that the Belleville factory will be far more than an assembling centre. It is expected that when fully established the company will employ several hundred hands and will probably carry on from this city its important European and Colonial export business, as the American Optical Co., which established at Belleville a few months ago, also intends to do. The Bassick Company will have an independent Canadian Corporation and the new company will be known as the Bassick Alemite Company of Canada.

BIG TWINE SHIPMENTS

Fort William.—To date, 1922 shipments of binder twine received at the local warehouses of the International Harvester Company and the Plymouth Cordage Company, exceed any other year's business in the history of the plants. Six steamship cargoes have been unloaded at the former house and five at the latter. The Plymouth people estimate the increase over last year as fifty per cent. The twine is being shipped to the Canadian West where it is being used upon the harvest fields of the prairies to garner the 1922 grain crop, as fast as it is received here.

The total shipments of twine here since the opening of navigation reach 44,000,000 pounds. At 550 feet to the pound, the twine if made into a single strand would measure 4,583,333 miles; long enough to circle the earth one hundred and eighty-three and a third times, or form twenty strands reaching from the earth to the moon.

F. C. Perry, for the past twenty-two years collector of customs at Fort William, has been superannuated. His successor has not yet been appointed but it is probable that a returned soldier will get the post.

Due to the consumption of coal stocks at Sault Ste. Marie, several cargoes of coal have been shipped there during the past week. The coal will be used for the purpose of coaling ships.

Fire which started from an undetermined cause, caused damage estimated at $20,000 last week to the Sellers and Jones garage here, not including the destruction of eight automobiles.

Arrangements are being completed for the establishment in Fort William of a bottling factory by the Orange Crush Company of Winnipeg. The proposed plant will have a capacity of 96,000 bottles a day.

Eighty-five acres of land in Neebing township several miles from the city, have been acquired from the Vickers estate by the Canadian National Railways. The price paid was $25,000. Fifty years ago the land was purchased by the late J. J. Vickers for $1 per acre.

Building permits issued here during the month of July totalled well over half a million dollars, the figures being $557,985. The permits include those issued for the new Paterson grain elevator, the paper mill now under construction for the Fort William Paper Company, and sixteen residences.

On Saturday, August 12, the new steel bulk freighter, Matthewson, built at the plant of the Port Arthur Shipbuilding Company, for the Matthews Steamship Company, Toronto, was launched. Mr. Matthews, president of the transportation company, his wife, and a party of Toronto citizens, attended the ceremony, arriving in a private car Saturday morning.

TO MAKE STEEL CASTINGS

Montreal.—Joliette Steel Products Limited, 211 McGill Street, Montreal, have taken over the property and plant formerly operated by Joliette Casting and Forgings Limited, plant of which is in Joliette, Quebec. The company will specialize in steel castings and alloy steel castings. W. A. McCallum will be in active charge of the company as vice-president and managing director and it is reported that he has large steel interests in Montreal behind him.

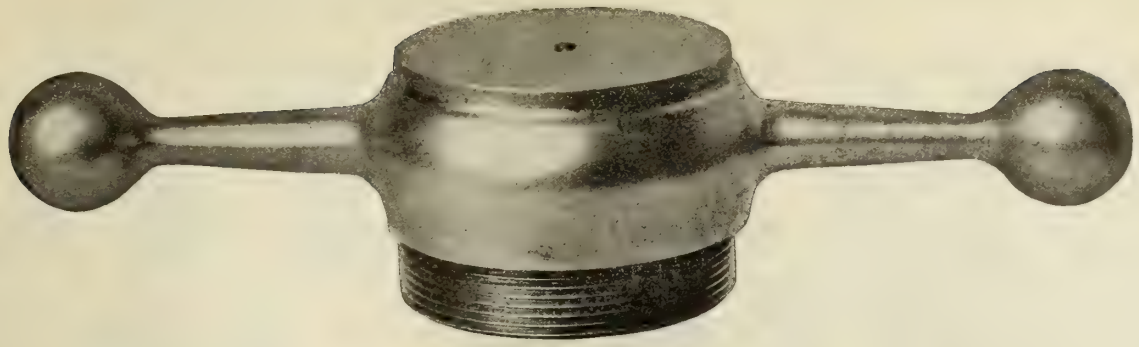
Mr. McCallum was born in Montreal, Que., April 21, 1891, and educated in public school and commercial technical school. His business career follows: Began as clerk, Consumers Cordage Co., Ltd., Montreal, 1906 to 1913; assistant to secretary, Geo. W. Reed & Co., Montreal, 1913 to 1916; assistant to vice-president, Canadian Tube and Iron Co., Ltd., Montreal, assistant to president, Canadian Rolling Mills Co., Ltd., and assistant to president, Colonial Wire Mfg. Co., Ltd., 1916 to 1919; (these three companies now constitute the Canadian Tube and Iron Co, Ltd.); appointed vice-president F. E. Smith Ltd., Montreal, Oct 1, 1919; appointed vice-president of the Independent Steel Specialties Corporation 1920; appointed vice-president Joliette Castings and Forgings, Ltd., July 2, 1920.

"BROOKLYN BRIDGE IS FALLING DOWN"

At last we learn that this historic structure may soon be definitely closed to traffic owing to the excessive stretching of the suspension cables, a condition that may cause the gradual disintegration of the entire bridge. No announcement has been made as to what action will be taken as a thorough study will be made before a decision is made. It is more than likely that immediate steps will be taken to construct a new modern bridge, even though temporary repairs are made to the present one to carry the light traffic, to which it is now restricted.

LARGE CHAIN CONTRACT GOES TO HANS RENOLD COMPANY

In connection with the handling and storing of the large grain crops in South Africa it is interesting to note that the contract for the chain drives for a large number of elevators has been awarded to the Hans Renold Co. of Manchester. This order, which includes 38 Renold silent chain drives for the Capetown terminal elevator, 50 similar drives for the Durban terminal elevator, and 184 extended pitch bush roller chain drives for the 24 country station elevators, is probably the largest single order for power transmission chain drives in grain elevators that has ever been placed.



15,000 THREADS

Cut with One Set of Geometric Thread Chasers on These Radiator Caps—a German Silver Casting—Not a Very Clean Casting, Either

Geometric Adjustable Thread Chasers are a small part of the Opening Die Heads and Collapsing Taps in which they are used, but they are an important part.

They stand up to the work—doing even more than is claimed for them, when rightly used.

"No sign of wear on the cutting face of a set of Geometric Chasers after cutting threads on fifty pieces of work, and from all appearances good for many hundred pieces without regrinding."

Such factory reports make Geometrics the Standard wherever they go.

Geometric Die Heads and Collapsing Taps Complete the Turret Equipment of the Screw Machine

GEO MET RIC

Right on the Lead

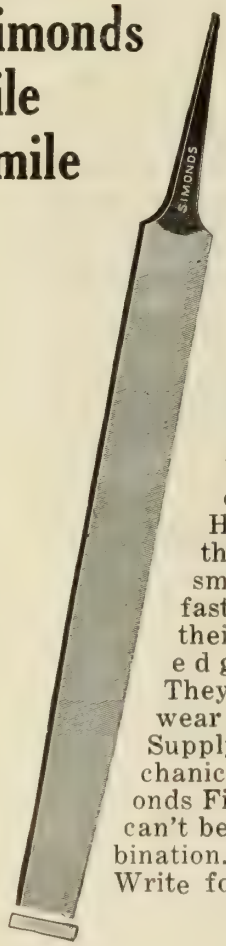
THE GEOMETRIC TOOL COMPANY

NEW HAVEN CONNECTICUT

Canadian Agents :

Williams & Wilson, Ltd., Montreal. The A. R. Williams Machinery Co., Toronto, St. John, N.B.; Halifax, N.S.; Vancouver, B.C.

The Simonds File Smile



A good mechanic is pleased when he has Simonds Files. He knows that they cut smooth and fast and hold their cutting edge longer. They will outwear other files. Supply your mechanics with Simonds Files and you can't beat the combination.
Write for prices.

Simonds Canada Saw Co.,
Limited
Montreal, Que.
St. John, N.B. Vancouver, B.C.

New Case-Hardening Process

A NEW steel and iron hardening process has been developed, based on research covering a period of several years. The results obtained through this process are interesting. The hardening agent used is a nitrogeneous powder, marketed under the trade name of "Nitrol." The use of this material results in a nitrogen hardening, of which the advantages are obvious, but which thus far had remained undiscovered, other substances having invariably induced oxidation.

The Government Testing Laboratory at Berlin-Lichterfelde, in its annual report for 1916, while characterizing the hardening substances generally employed as practically worthless, expresses the opinion that this powder induces a very marked surface hardening, at the same time leaving the inner body unaffected. The report further states that various degrees of hardening can be obtained through the use of the material, and that it is possible to intensify the hardening process to such a degree that the surface must be ground off to permit file or saw to grip. In spite of this intensified surface hardening, however, the inner structure of the material remains in its original state.

The hardening result is not affected by the state of the surface; thus, even rusty objects can be surface hardened equally as well as polished ones. The carrying through of the hardening process is very simple, and can be handled even by unskilled labor. Another remarkable effect is that the surface after hardening is practically rust-proof. Nitrol is furnished in two grades, namely: "A"—being used for surface hardening, and "E"—for case hardening down to a depth of 4 mm. (about 3/16 in.

Sprinkling Powder "A"

This powder turns into a liquid state at the usual hardening temperature. When sprinkled on the heated object to be hardened, it liquefies and forms a thin uniform coating over the surface. A perfectly even and flawless hardened surface is the result, no insoluble particles remaining to mar the coating. The object having gone through the hardening process, and after being quenched, presents an absolutely flawless exterior of glittering brightness, the core, however, remaining absolutely unaffected. Such is not the case with the hardening substances heretofore in general use, as there are always present in them certain insoluble elements which, by adhering to the surface of the object, prevent an even distribution of the hardening material. A non-uniform degree of hardness, and a spotty appearance, is the result.

Powder "E" For Case Hardening

Through careful and prolonged experiments, it has been established that the best results in case hardening by this process are obtained with the hardening agent in a gaseous state. An extraordinary degree of uniformity and depth of hardening is thus attained without any smudging, forming of deposits or lack of uniformity. The hardened object, when removed from the case, will be found to have no particles adhering to it. After quenching, the penetration of the hardening will be found to be absolutely uniform. Here also, the core or inner structure of the object remains in its original state.

Through properly adjusting time and temperature, the depth and degree of hardness can be regulated. In most cases, a few hours of hardening will be found to serve the purpose, but the proper time and temperature required in each case depends on the quality of the materials to be hardened and the purpose to which it will be put.

Directions For Use

For shallow surface hardening the object should be brought to light red heat in an open or closed fire, then sprinkled with the powder or dipped in the material, at the same time turning the object around so that the entire surface will be covered. When the object has cooled down to the proper temperature, it should be quenched in water or in a saline solution in the usual way and dried off. Should the object have cooled prematurely while being treated, it should be held over the fire once more and then quenched. The surface will be found to be bright and hard as glass.

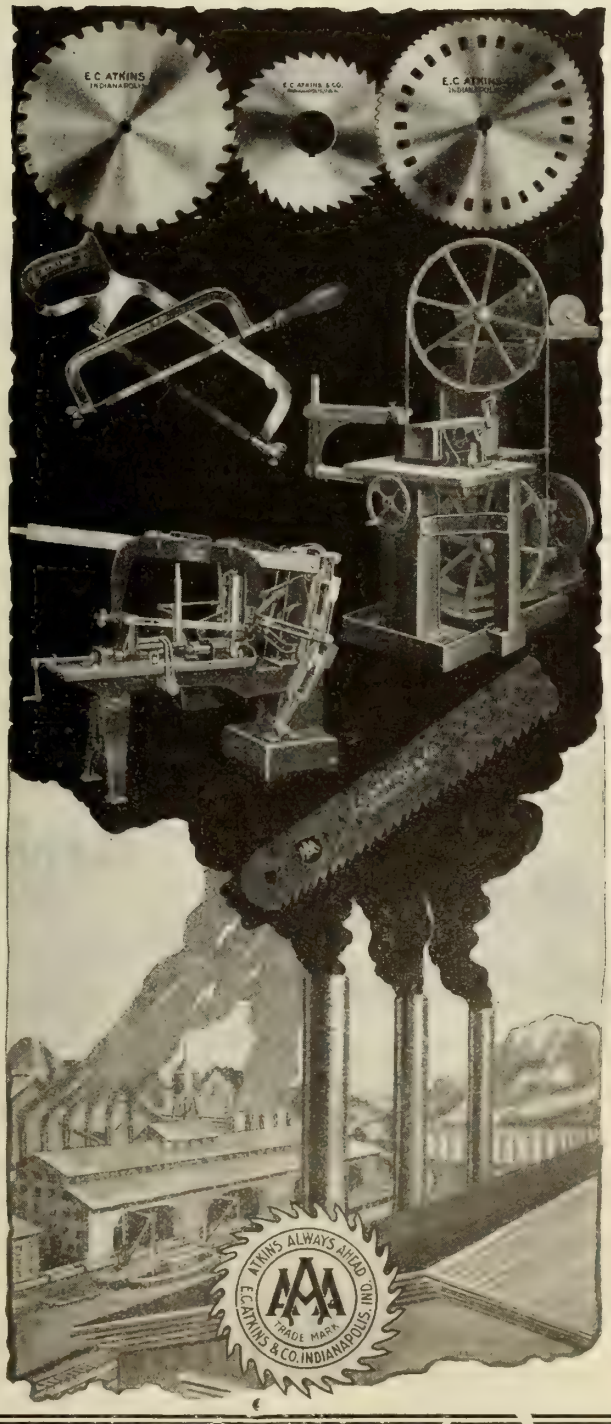
For case hardening the objects should be placed in cases packed with powder "E," and then heated in the usual manner up to 88 deg. C. for about two to four hours, depending on the depth of hardening required. The heated objects are then removed and quenched in the usual manner. The hardening powder can be re-used with addition of some fresh powder. The powder should be protected from any access of outside air while still hot, and it is advisable to pack it in air-tight boxes immediately after removing the objects to be hardened. Through the re-use of the material, a considerable economy is effected.

BRITISH FIRMS GETTING BUSY

Many British firms are now putting their men on full time, and it is stated that a very good spirit prevails amongst the men, who are working steadily and well under the conditions of settlement. The result has put new heart into the engineering industries, and considerably more optimism prevails than has existed for some time. The general depression shows signs of passing slowly away, but all estimates agree that it is bound to take a considerable time before trade can be regarded as normal. The brighter outlook is however welcomed by all persons engaged in trading in engineering products and it only needs a constantly increasing stream of orders especially from overseas to make it possible to reduce prices by manufacturing on a larger scale than is at present the case.

ATKINS SAWS

METAL CUTTING



Business Looking Up?

Building Contracts are increasing; metal stocks are being depleted; factories are resuming; metal saws and machines must be ordered.

ARE YOU READY?

Put your plant in shape for a long run of good business.

Write to the nearest point below for a catalog which will tell you why

Atkins Metal Cutting **Saws** and Machines are the BEST.

"A Better Saw for Every Use"

E. C. ATKINS & CO.

Est. 1857 "The Sterling Quality Saw People"

Home Office and Factory, Indianapolis, Indiana

Canadian Factory, HAMILTON, Ontario

Branch carrying complete stock, VANCOUVER, B.C.

Classified Opportunities

Two cents a word, including "Canadian Machinery" box numbers; minimum charge is $1.00 per insertion for 50 words or less, set in 6-pt. type. Each figure counts as a word. Display ads., or ads. set in border, are at the card rates.

PATENTS

THE OLD ESTABLISHED FIRM. PATENTS everywhere. Head Office, Royal Bank Bldg., Toronto. Ottawa Office, 5 Elgin St. Offices throughout Canada.—Booklet free.
FETHERSTONHAUGH & CO.

PATTERNS

TORONTO PATTERN WORKS, 65 JARVIS Street, Toronto. Patterns in wood and metal for all kinds of machinery. (ctfm)

BRANTFORD PATTERN WORKS ARE PREpared to make up patterns of any kind—including marine works—to sketches, blue prints or sample castings. Prompt, efficient service. Bell 'Phone 631; Machine 'Phone 733. Brantford Pattern Works, 49 George St., Brantford, Ont. (ctfm)

FOR SALE

"RICARDO" ENGINES, PETROL OR PARAFfin, excellent for marine, commercial or stationary use. Brand new. 100 h.p. 4-cylinder, 150 h.p. and 250 h.p. 6-cylinder, 300 h.p. 12-cylinder. Thirty shillings per horse-power sterling London. Sykes, Patching, Sussex, England.

FOR SALE—ONE HAM & NOTT COMbination Refrigerator No. 24, W.E. and Glass Doors. One McClary 4950 Double Oven Army Range with H. Shelf and straight water front. Above items suitable for restaurant or cafeteria use. Both in good condition. Communicate with **Oneida Community, Ltd.**, Purchasing Dept., Niagara Falls, Ontario. (C7m)

WELDING APPARATUS

We have just taken over the Smith Invention's complete line of Welding and Cutting apparatus with a full line of miscellaneous welding supplies.
Write us for full particulars.
THE ACME WELDING CO.,
118 McNab St. N., Hamilton, Canada.

A. R. SMITH BELTING
138 YORK ST. TORONTO

WANTED

SCRAP ENDS
STEEL PLATES 9, 10, 11 Gauge
Carloads or less. Suitable for making Iron Washers.

The Graham Nail Works
Toronto

OPPORTUNITIES

FOR SALE OR ROYALTY—CANADIAN PATent No. 214964 on resilient wheel for automobiles and trucks, absorbs the shock in the leaf spring spokes of the wheel, either hard rubber or pneumatic tires may be used; simple, practical and substantial in construction. Reasonable terms. Wm. H. Schlake, Yuma, Colo.

WANTED

CASH REGISTER WANTED—SINGLE DRAWer. Receipt printer. Must be in excellent condition. Box No. 807L, Canadian Machinery.

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WELDING
and
CUTTING APPARATUS

Oxygen, Acetylene, and a complete line of Welding and Cutting Supplies.

Carter Welding Co.
of Toronto, Limited
7-11 Sheppard St., Toronto, Ont.
Phones: Adelaide 2841 and 1524
(TF)

PAPER MILL MACHINERY
BERTRAMS LIMITED
SCIENNES EDINBURGH

"Maple Leaf"
BRAND
Stitched Cotton Duck Belting
Save Money

Use ONLY "Maple Leaf" Belting. Costs less than leather, rubber or balata. Has a very positive grip on any pulley, always runs true and saves expense in many other ways.

"Maple Leaf" belting is the best obtainable. It embodies "Economy, Strength and Durability."
We will willingly send you samples. Write us today.

Dominion Belting Co. Ltd.
Hamilton, Canada
Quebec Branch: 51 Duluth Bldg., Montreal

SITUATIONS WANTED

SITUATION WANTED AS SUPERINTENDENT or general foreman of machine shop, twenty years' experience. At present employed; best of references. Box 861T. Canadian Machinery. (c23m)

MECHANICAL DRAFTSMAN DESIRES A change; age 30; married. Experienced in tool, jig and machine design. If you are looking for a young man who by practical shop experience, knows his job from the drafting office to the shipping platform, arrange interview, at your convenience. Box 798, Canadian Machinery.

MECHANICAL DRAFTSMAN AND DESIGNER desires position, preferably firm where advancement and responsibility is given. Competent chief draftsman with machine shop experience, well educated. Box 810, Canadian Machinery, Toronto. (C.18M.)

SALESMAN, 6 YEARS' MACHINE TOOL EXperience 10 years' general engineering with A1 practical and theoretical knowledge of mechanics, open to represent manufacturer in Toronto and district. Box 805L, Canadian Machinery.

Grey Iron Castings

Light and Medium-Bench and Floor Repetition Castings; Capacity 15 tons per day.
Expert Metal and Wood Pattern Work. Our advice and estimates will save you money.
Semi-finishing operations on Lathe or Grill on Castings supplied if required.
ASK US.
THE KATIE FOUNDRY, GALT, ONT.

STEEL
Air Pressure Tanks, Air Receivers, Steel Plate Tanks, Pneumatic Tanks, Tote Boxes, Shop Barrels, Steel Factory Equipment, Smoke Stacks, Gasoline Tanks.
Write For New Catalogue
THE STEEL TROUGH & MACHINE CO. LTD.
TWEED - ONT.

BLACK DIAMOND OVENS

"OVENS"

Japanning and Varnishing Ovens heated by Gas, Electricity, Steam or Coal, Kernchen and Apex Siphonage Ventilators, Bakers' Ovens, trucks, casters, etc. Write for Booklet.
BRANTFORD OVEN & RACK CO.
Brantford, Canada

CLOSING TIME

Advertisements for this section must be in our composing room Tuesday morning prior to day of issue.

In order that the announcements of your wants, machinery for sale, etc., etc., shall not be delayed, please try to have them in our office with the Tuesday morning mail.

Canadian Machinery

Where To Buy Your CASTINGS

The Brown-Boggs Co., Limited
HAMILTON, ONT.
Grey Iron.

Fisher Motor Co., Limited.
ORILLIA, ONT.
Die Castings.

Sully Brass Foundry, Limited
618 Brock Ave., TORONTO, ONT.
Brass, Bronze, Copper and Aluminum.

Canadian Rumley Co., Limited
Queen West and Abell Streets,
TORONTO, ONT.
Grey Iron.

Galt Malleable Iron Co., Ltd.
GALT, ONT.
Malleable.

S. Vessot & Company
JOLIETTE, QUE.,
Grey Iron, Brass and Aluminum.

Miller Bros. & Sons, Limited,
120 Dalhousie St., MONTREAL.
Grey Iron, Semi-Steel Castings up to 10 tons.

Can. Mead-Morrison Co., Ltd.,
MONTREAL, P.Q. WELLAND, ONT.
Grey Iron Machinery Castings.

Hugh Park Foundry Co., Ltd.,
OSHAWA, ONT.
Grey Iron, Patterns, Etc.

Hull Iron & Steel Foundries Ltd.
HULL, CANADA.
Steel, Manganese, Chrome.

Aurora Foundries, Limited,
AURORA, ONT.
Grey Iron.

Aluminum Last & Metal Co.,
KITCHENER, ONT.
Aluminum, Brass, Bronze and Special Alloys.

Can. Hanson & VanWinkle Co.
LIMITED
TORONTO, ONT.
Monel, Aluminum, Brass, Bronze, Grey Iron.

Tallman Brass & Metal, Ltd.
HAMILTON, CANADA
Brass, Bronze, Manganese Bronze, Aluminum.

Dom. Foundries & Steel, Ltd.
HAMILTON, CANADA.
Steel Castings all sizes.

Manitoba Steel Foundries, Ltd.
Office Winnipeg. Works Selkirk, Man.
Steel Castings up to 5,000 lbs.

Brantford Brass Foundry Co.
BRANTFORD, ONT.
Aluminum, Brass, Bronze, Specialty.

The Katie Foundry
GALT, ONT.
Grey Iron, Semi-Steel, Brass, Aluminum.

William Kennedy & Sons, Ltd.
OWEN SOUND, ONT.
Steel, Malleable and Heavy Grey Iron.
See Advertisement Page 8

Machinery & Foundries, Ltd.
BROCKVILLE, ONT.
Light and Medium Grey Iron.

A. F. McCulloch
OSHAWA, ONT.
Brass, Alum. Castings—Wood, Metal Patterns.

Corbet Foundry & Machine Co. Ltd.
OWEN SOUND, ONT.
Grey Iron, Brass.

Fittings Limited,
OSHAWA, ONT.
Malleable, Grey Iron, Brass, Aluminum.

John T. Hepburn, Limited
TORONTO, ONT.
Grey Iron.

W. W. Wells
370 Victoria Street, TORONTO, ONT.
Nickel and Monel Metal.

The Robert Mitchell Co., Ltd.
64 Belair Ave., MONTREAL.
Light Grey Iron.

Canadian Steel Foundries, Ltd.
MONTREAL, QUE.
Steel and Ferro-Alloy.

Langley & Austin,
GALT, ONT.
Copper, Bronze, Brass and Aluminum.

Maxwells, Limited
ST. MARYS, ONT.
Light Grey Iron, Tinning same a specialty.

The Eureka Planter Co., Ltd.,
WOODSTOCK, ONT.
Specialty Light Grey Iron.

Lindsay Foundry and Pattern Works, Limited
Victoria Avenue, LINDSAY, ONT.
Grey Iron.

Dominion Engineering Works, Limited
MONTREAL, QUE.
Grey Iron.

Smith's Falls Malleable Castings, Limited
SMITH'S FALLS, ONT.
Malleable.

Joliette Steel Co.
JOLIETTE, QUE.
Electric Steel and Ferro-Alloy.

International Malleable Iron Company, Limited
GUELPH, ONT.
Malleable.

Getting The Business
You Can Do Likewise
A Few Panels For Sale

APPLY

Canadian Machinery & Mfg. News
143 University Avenue,
TORONTO, CAN.

BRANTFORD BRASS FOUNDRY COMPANY
BRANTFORD, ONTARIO
FOUNDRY AND OFFICE 22 LEONARD ST

June 27th., 1922

The MacLean Publishing Co., Limited.
Toronto, Ont.

Gentlemen;-

We wish to inform you that we have had quite satisfactory results from our advertisement in Canadian Machinery and Manufacturing News, which runs under the classified heading " Where to Buy your Castings ".

Yours Truly,
Brantford Brass Foundry Company.
per David McIntosh

Canadian Machinery BUYERS DIRECTORY

If what you want is not here, write us, and we will tell you where to get it. Let us suggest that you consult also the advertisers' index— last page of book, after having secured advertisers' names from this directory. The information you desire may be found in the advertising pages. This department is maintained for the benefit and convenience of our readers. The insertion of our advertisers' names undr proper headings is gladly undertaken, but does not become part of an advertising contract.

ABRASIVE DISCS
J. R. Baxter & Co., Ltd., Montreal, Que.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John, London, S.E., Eng.

ABRASIVE MATERIALS
J. R. Baxter & Co., Ltd., Montreal, Que.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John, London, S.E., Eng.

ACETYLENE, DISSOLVED
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Toronto.
Liquide Air Company, Toronto.

ANCHOR BELTS
Steel Co. of Can. Ltd., Hamilton, Ont

ANGLE BARS
Steel Co. of Can. Ltd., Hamilton, Ont.

ANVILS
Atkins & Co., Inc., E.C., Indianapolis, I.
Petrie, Ltd., H. W., Toronto, Ont.

ANCHOR BOLTS
Steel Co. of Can., Ltd., Hamilton, Ont.

ANGULAR HOLE DRILLING TOOL
Globe Engineering Co., Ltd., Hamilton, Ont.

ARBORS
Atkins & Co., Inc., E. C., Indianapolis,
Brown & Sharrpe Mfg.Co., Providence,R.I
Jacobs Mfg. Co., Hartford, Con.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.

BELLS, BRASS, BRONZE and STEEL
Canada Foundries & Forgings Co., Welland, Ont.
Canadian SKF Co., Toronto, Ont.

BARRELS, TUMBLING
McDougall Co., Ltd., R., Galt, Ont.

BARS, BORING
Armstrong Bros. Tool Co., Chicago, Ill.
Bertram & Son Co., td., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

BARS, BORING, PORTABLE
Underwood Corp., H. B., Philadelphia.

BARS, STEEL
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
British Empire Steel Corporation, Montreal, Que.

BEARINGS, BALL
Canadian SKF Co., Toronto, Ont.

BEARINGS, ROLLER
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

BELT CEMENT
D K McLaren Co., Ltd., Montreal, Que.
McLaren Belting Co., J. C., Montreal, Que.

BELT DRESSINGS AND FILLERS
Dom. Belting Co., Ltd., Hamilton, Ont.
D K. McLaren Co., Ltd., Montreal, Que

BELT FASTENERS
Bristol Company, Waterbury, Conn.
D K McLaren Co., Ltd., Montreal, Que
McLaren Belting Co., J.C., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

BELT HOOKS
Bristol Co., Waterbury, Conn.
D K. McLaren Co., Ltd., Montreal, Que.

BELT LACING
Bristol Company, Waterbury, Conn.
D. K. McLaren Co., Ltd., Montreal, Que
McLaren Belting Co., J. C., Montreal,

BELT LACING, STEEL
Bristol Company, Waterbury, Conn.

BELT LACING MACHINES
D. K. McLaren Co., Ltd., Montreal, Que.
McLaren Belting Co., J. C., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

BELTING, CHAIN
Can. Link-Belt Co., Toronto, Ont.
Fittings, Limited, Oshawa, Ont.
Jones & Glassco, Montreal, Que.
Renold (Hans) of Canada, Ltd., Montreal, Que.

BELTING, FABRIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Dom. Belting Co., Ltd., Hamilton, Ont
D K. McLaren Co., Ltd., Montreal, Que
McLaren Belting Co., J. C., Montreal, Que.

BELTING, LEATHER
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Can. Fairbanks-Morse Ltd., Montreal, Q.
D. K. McLaren Co., Ltd., Montreal, Que.
McLaren Belting Co., J. C., Montreal, Que.
Smith Belting Co., Toronto, Ont.

BOLTS AND NUTS
British Empire Steel Corporation, Montreal, Que.
Fittings, Limited, Oshawa, Ont.
National Acme Co., Montreal, Que
Petrie, Ltd., H. W., Toronto, Ont

BOLT THREADING DIE HEADS
Landis Machine Co., Inc., Waynesboro Pa.

BOLTS, TRACK
Steel Co. of Canada, Ltd., Hamilton, Ont.

BORING and TURNING MILLS, Vertical
Bertram & Sons Co., Ltd., The John Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

BORING, DRILLING and MILLING MACHINES, Horizontal.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
Landis Tool Co., Waynesboro, Pa.
Vertical
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
McDougall Co., Ltd., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont
Rockford Drilling Machine Co., Rockford,

BORING TOOLS
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.

For list of Dealers see the last page of This Buyers Directory

BELTS, ABRASIVE
Oakey & Sons, Ltd., John, London, S.E., Eng.

BENDING MACHINES, POWER
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bertrams Ltd., Edinburgh, Scotland.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

BILLETS, BLOOMS and SLABS
Steel Co., of Can. Ltd., Hamilton, Ont.

BLOCKS
Wright Mfg. Co., Lisbon, Ohio.

BLOCKS, CHAIN (See Hoists, Hand)
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

BLOCKS, DIE
Canada Foundries & Forgings Co., Welland, Ont.

BLOCKS, PILLOW
Can. Link-Belt Co., Toronto, Ont.

BLOWERS
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

BOILERS, LOCOMOTIVE
Goldie & McCulloch Co., Ltd., Galt,

BOLT AND NUT MACHINERY
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Montreal, Que.

BOLT AND NUT MACHINERY, Automatic
National Acme Co., Cleveland, Ohio.

BUCKET CARRIERS, Pivoted
Can. Link-Belt Co., Toronto, Ont.

BUFFERS
Pryibil Machine Co., New York, N.Y.

BUFFING OR POLISHING MACHINES (See Polishing and Buffing Machines)
Blount Co., J. G., Everett, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Pryibil Machine Co., New York, N.Y.
U. S. Electrical Tool Co., Cincinnati, O.

BUILDING MATERIALS
Bertram & Son Co., Ltd., The John Dundas, Ont.

BURNERS, OIL AND GAS
Rockwell Co., W.S., New York City.

BURRS
Steel Co. of Can. Ltd., Hamilton, Ont.

CABINETS, OIL
S. F. Bowser & Co., Ltd., Toronto, Ont

CALIPERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Starrett Co., L. S., Athol, Mass.

CAMS
Canada Foundries & Forgings Co., Welland, Ont.

CAN-MAKING MACHINERY (See Sheet Metal Working Machinery)
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Smooth Mfg. Co., Jersey City, N. J.

CARBONIZING
Chapman Double Ball Bearing Co., Toronto.

CEMENTS, IRON
CENTERING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.

CHAINS (See Sprockets and Chains)
Reynold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

CHUCKS, DRILL
Jacobs Mfg. Co., Hartford, Conn.

CARD CLOTHING
D K McLaren Co., Ltd., Montreal, Que

CASTINGS, ALUMINUM, BRASS, BRONZE, COPPER, DIE-MOLDED, FERRO-ALLOY, IRON, SEMI-STEEL, STEEL.
See "Where to buy your castings" Section. Page number may be found by turning to Advertisers' Index.

CHAINS, DRIVING
Can. Link-Belt Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont
Jones & Glassco, Montreal, Que.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

CHASERS
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, a.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CHUCKING MACHINES
Acme Machine Tool Co., Cincinnati, O.
Brown & Sharpe Mfg. Co., Providence, R. I
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

CHUCKS, DRILL AND TAP
Can Fairbanks-Morse Co., Ltd., Montreal.
Canadian SKF Co., Toronto, Ont.
Cushman Chuck Co., Hartford, Conn
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg., New Britain, Conn.

CHUCKS, LATHE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Cushman Chuck Co., Hartford, Conn.
Geometric Tool Co., New Haven, Conn.
Gisholt Machine Co., Madison, Wis.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pryibil Machine Co., New York, N.Y.
Skinner Chuck Co., New Britain, Conn
Union Mfg. Co., New Britain, Conn.

CHUCKS, MAGNETIC
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CHUCKS, PLANER
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cushman Chuck Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn
Union Mfg. Co., New Britain, Conn.

CHUCKS, TAPPING
William L. Procunier, Chicago, Ill.

CHUCKS, VERTICAL BORING MILL
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Skinner Chuck Co., New Britain, Conn
Union Mfg. Co., New Britain, Conn.

CLAMPS, MACHINISTS'
Brown & Sharpe Mfg Co., Providence,
Starrett Co., L. S., Athol, Mass.

CLEANERS, METAL, WASTE, GENERAL
Oakley Chemical Co., New York, N. Y.

CLOCKS
Chicago Watchman's Clock Co., Chicago
Hardinge Bros., Limited, Toronto, Ont.

CLOCKS, TIME
Gisholt Machine Co., Madison, Wis.

CLOCKS, WATCHMEN'S
Chicago Watchman's Clock Co., Chicago Ill.
Hardinge Bros., Limited, Toronto, Ont.

BUYERS' DIRECTORY

CLUTCHES, FRICTION
Can.-Link-Belt Co., Toronto, Ont
Johnson Machine Co., Carlyle, Manchester, Conn.

COAL AND ASH HANDLING MACHINERY
Can.-Link Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

COAL-STORAGE SYSTEMS
Can. Link-Belt Co., Toronto, Ont.

COLLARS, SHAFT OR SET
Canada Foundries & Forgings Co., Welland, Ont.
Can. Link-Belt Co., Toronto, Ont.

COLLETS
Butterfield & Co., Inc., Rock Island, Que.
Hardinge Bros., Inc., Chicago, Ill.
Hendley Machine Co., Torrington Conn.
Kearney & Trecker Co., Milwaukee, Wis
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

COMPOUNDS, CLEANING
Oakley Chemical Co., New York, N.Y

COMPOUNDS—CUTTING, DRILLING, GRINDING, SCREW CUTTING
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Oakley Chemical Co., New York, N.Y.

COMPRESSORS, AIR AND GAS
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.

CONES, FRICTION
Norton Co., of Can. Ltd., Hamilton, Ont.

CONNECTING RODS AND STRAPS
Canada Foundries & Forgings Co., Welland, Ont.

CONTRACT WORK
Victoria Foundry Co., Ltd., Ottawa, Ont

CONVEYORS AND ELEVATORS (SEE ELEVATORS)
Jones & Glassco, Montreal, Que.

COTTERS
Steel Co. of Canada, Ltd., Hamilton, Ont.

COUNTERBORES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

COUNTERS, REVOLUTION
Starrett Co., L. S., Athol, Mass.

COUNTERSHAFTS
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Johnson Machine Co., Carlyle, Man-
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

COUNTERSINKS
Butterfield & Co., Inc., Rock Island, Que.
Pratt &Whitney Co., of Canada, Ltd., Dundas, Ont.

COUPLERS, CAR AND LOCOMOTIVE
Can. Steel Foundries, Montreal, Que.

COUPLINGS
Steel Co. of Canada, Ltd., Hamilton, Ont.

COUPLINGS, PIPE
Fittings, Limited, Oshawa, Ont.

COUPLINGS, SHAFT
Can. Link-Belt Co., Toronto, Ont.

CRANES, ELECTRIC
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can.-Link-Belt Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

CRANES, LOCOMOTIVE
Can. Link-Belt Co., Toronto, Ont.

Bertram & Son Co., td., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

CRANK PIN TURNING MACHINE
Underwood Corp., H.B., Philadelphia, Pa.

CUTTERS, GEAR
Brown & Sharpe Mfg. Co., Providence R. I.
Butterfield & Co., Inc., Rock Island, Q. Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CUTTERS, HIGH SPEED
Atkins & Co., Inc., E. C., Indianapolis.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
[illegible] & Trecker Co., Milwaukee, Wis
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CUTTERS, MILLING
Brown & Sharpe Mfg. Co., Providence, R. I
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.

CUTTERS, STAY BOLT
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.

CUTTING-OFF MACHINE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

CUTTING OFF MACHINES, PIPE (SEE PIPE-CUTTING AND THREADING MACHINES)
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.

CUTTING-OFF TOOLS
Armstrong Bros. Tool Co., Chicago, Ill.

CUTTING OIL FILTERS (SEE OIL FILTERING SYSTEMS
Bowser, S. F. & Co., Ltd., Toronto.

CUTTING, OXY-HYDROGEN
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Ltd., Toronto, Ont.

DEALERS, MACHINERY (SEE SEARCHLIGHT SECTION)
Petrie, Ltd., H. W., Toronto, Ont.

DETACHABLE CHAIN
International Malleable Iron Co., Guelph, Ont.

DIAMONDS, BLACK AND ROUGH
Can Desmond-Stephan Mfg Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

DIAMOND TOOLS
Can. Desmond-Stephan Co., Hamilton,
Wheel Trueing Tool Co., Windsor, Ont.

DIAMOND CROSSINGS
Can. Steel Foundries, Montreal, Que.

DIAMONDS, IMPORTERS
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Co., Windsor, Ont.

DIES, SCREW AND THREAD CUTTING
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.

DIES, SHEET-METAL AND SUB-PRESS (See Tool Work)
Brown, Boggs & Co., Ltd., Hamilton, Ont.

DIES, FORGING
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

DIES, SELF-OPENING, ADJUSTABLE
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Landis Machine Co., Inc., Waynesboro.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DIES, THREADING-OPENING
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DIVIDING HEADS
Burke Machine Tool Co., Conneaut, Ohio.
Hendey Machine Co., Torrington, Conn.
Kearney & Treacker Co., Milwaukee, Wis.
Petrie, Ltd., H. W. Toronto, Ont.

DOGS, LATHE AND MILLING MACHINE
Armstrong Bros. Tool Co., Chicago, Ill.

DRAFTING MATERIALS
American Lead Pencil Co., New York City, N.Y.

DRESSERS, GRINDING WHEEL
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ont.
Norton Co., of Can., Ltd., Hamilton.
Wheel Trueing Co., Windsor, Ont.

DRESSING TOOLS
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Co., Windsor, Ont.

DRILL HOLDERS
Armstrong Bros. Tool Co., Chicago, Ill.

DRILLING MACHINES, BENCH
Burke Machine Tool Co., Conneaut,, Ohio.
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Hardinge Bros., Inc., Chicago, Ill.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
U. S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, ELECTRIC AND HAND
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, GANG
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

DRILLING MACHINES, HEAVY DUTY
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
Rockford Drilling Machine Co., Rockford, Ill.

BORING, DRILLING AND MILLING MACHINES, (HORIZONTAL.)
Gisholt Machine Co., Madison, Wis.

DRILLING MACHINES, Multiple Spindle
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
National Acme Co., Cleveland, Ohio.

DRILLING MACHINES, Pneumatic
Cleveland Pneumatic Tool Co., Toronto. Ont.

DRILLING MACHINES, PORTABLE
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, RADIAL
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Wiliams Machinery Co., A. R., Toronto,

DRILLING MACHINES, SENSITIVE
Burke Machine Tool Co., Conneaut, O.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Williams Machinery Co., A. R., Toronto.
Wisconsin Electric Co., Racine, Wis

DRILLING MACHINES, TURRET
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wisconsin
Williams Machinery Co., A. R., Toronto.

DRILLING MACHINES, VERTICAL
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

DRILLS, CENTRE
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DRILLS, HIGH SPEED TWIST
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Cleveland Twist Drill Co., Cleveland, O.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DRILLS, RATCHET
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

DRILLS, TWIST AND FLAT
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont

DROP FORGINGS
Steel Co of Canada, Ltd., Hamilton.

DUST HANDLING EQUIPMENT
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

ELECTRICAL INSTRUMENTS
Bristol Co., Waterbury, Conn.

ELECTRICAL SUPPLIES
Atkins & Co., Inc., E. C., Indianapolis
Diamond State Fibre Co., Toronto, Ont.
U.S. Electrical Tool Co., Cincinnati, O

ELEVATING TRUCKS (See Trucks)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

ELEVATORS AND CONVEYORS
Can. Link-Belt C., Toronto, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q

EQUIPMENT, ELEVATOR SAFETY
Jones & Glassco, Montreal, Que.

EMERY WHEELS (See Grinding Wheels)
J. R. Baxter & Co., Ltd., Montreal, Que.
Atkins & Co., E. C., Indianapolis, I
Norton Co., of Canada., Ltd., Hamilton.

ENGINES, CAPSTAN
Kennedy & Sons, Wm., Owen Sound, Ont.

ENGINE LATHE MANUFACTURERS
Oliver Machinery Co., Grand Rapids, Michigan.

ENGINEERS, MECHANICAL
Dominion Engineering Works, Limited, Montreal, Que.
Gisholt Machine Co., Madison, Wis.
Hamilton Gear & Machine Co., Toronto,

EXPANDERS, TUBE
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

FANS, ELECTRIC
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

FANS, EXHAUST
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Petrie Ltd., H. W., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass.

FANS, VENTILATING
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

FIBRE
Diamond State Fibre Co., of Can. Ltd., Toronto, Ont.

FILES AND RASPS
Nicholson File Co., Port Hope, Ont.
Simmons Canada Saw Co., Montreal, Que.

FILLER, IRON (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J.

FIRE ESCAPES
Roelofson Elevator Co., Galt, Ont.

FITTINGS, PIPE
International Malleable Iron Co., Guelph.
Fittings, Limited, Oshawa, Ont.

FLEXIBLE SHAFTS
Strand & Co., N. A., Chicago, Ill

FLUXES, WELDING
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd, Toronto
Liquide Air Company, Toronto, Ont.

FORGING MACHINERY
Acme Machinery Co., Cleveland, Ohio
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown Boggs & Co., Ltd., Montreal.
National Machinery Co., Tiffin, Ohio.
Steel Co. of Canada, Ltd., Hamilton

BUYERS' DIRECTORY

FORGINGS, DROP
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Ltd., Toronto, Ont.

FORGINGS, HAMMER
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Hepburn Ltd., John T., Toronto, Ont.

FOUNDRY EQUIPMENT
McDougall Co., Ltd., R. Galt, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

FOUNDRY SUPPLIES
Rice Lewis & Son, Ltd., Toronto, Ont.

FROGS, SPRING OR RIGID
Can. Steel Foundries, Montreal, Que.

FURNACES, ELECTRIC
Rockwell Co., W. S. New York City.
Hiram Walker & Sons Metal Products. Ltd., Walkerville, Ont.

FURNACES, HEAT TREATING COAL
Rockwell Co., W. S., New York City.

FURNACES, HEAT TREATING OIL AND GAS
Bellevue Industrial Furnace Co., Detroit, Michigan.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Rockwell Co., W. R., New York City.

FURNACES TEMPERING AND ANNEALING
Bellevue Industrial Furnace Co., Detriot, Mich.
Brown & Sharpe Mfg., Co., Providence R. I.
Rockwell Co., W. S., New York City.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

FURNACES AND OVENS, ELECTRIC
Petrie, Ltd., H. W., Toronto, Ont.
Rockwell & Co., W. S., New York city.
Starrett Co., L. S., Athol, Mass.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

GAGES, MEASURING (See Tool Work)
Brown & Sharpe Mfg. Co., Providence, R. I.
Greenfield Tap & Die Corp., Galt, Ont
Lufkin Rule Co., Windsor, Ont.
Starrett Co., L. S., Athol, Mass.

GAGES, RECORDING
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont
Brown & Sharpe Mfg. Co, Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GAGES, SPECIAL MEASURING (See Tool Work)
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GAGES, THREAD
Brown & Sharpe Mfg. Co., Providence R. I.
Starrett Co., L. S., Athol, Mass.

GALVANIZING
Fittings, Limited, Oshawa, Ont.

GAS, COAL COMPRESSED
L'Air Liquid Society, Toronto, Ont.

GAS, COMPRESSED
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

GASKETS
Diamond State Fibre Co. of Ca., Ltd., Toronto, Ont.
Smooth Mfg. Co., Jersey City, N. J.

GAUGES VACUUM AND PRESSURE
Taylor Instrument Co. Toronto, Ont.

GEAR BLANKS
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.
Dominion Engineering Works, Limited, Montreal, Que.

GEAR COUNTERS
Hart Mfg. Co., R. A., Battle Creek, Michigan.

GEAR-CUTTING MACHINES
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Fellows Gear Shaper Co., Springfield, Vt.
Petrie, Ltd., H. W., Toronto, Ont.
Whiton Machine Co., D. E., New London, Conn.

GEAR TESTING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.

GEARS, CAST
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Hull Iron & Steel Foundries, Hull, Que.
Dominion Engineering Works, Limited, Montreal, Que.

GEARS, CUT
Brown & Sharpe Mfg. Co., Providence, R. I.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Gardner & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto, Ont.
Hepburn Ltd., John T. Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

GEARS, DRESSED
Kennedy & Sons, Wm., Owen Sound, Ontario.

GEARS, FORGED
Canada Foundries & Forgings Co., Welland, Ont.

GEARS, HERRINGBONE
Hamilton Gear & Machine Co., Toronto, Ont.

GEARS, RAWHIDE (See Gears, Cut)
Hamilton Gear & Machine Co., Toronto.

GEAR, SILENT CHAIN
Gardner & Son, Robt., Montreal, Que.
Can. Link-Belt Co., Ltd., Toronto, Can.
Hans Renold of Canada, Ltd., Montreal, Quebec.

GEARS, WORM
Hamilton Gear & Machine Co., Toronto.

GENERATORS, ACETYLENE
L'Air Liquide Society, Toronto, Ont.

GLOVES, PROTECTIVE
Industrial Glove Co., Toronto, Ont.

GOGGLES, SAFETY
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto
Liquide Air Company, Toronto.

CRAB BUCKETS
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Cleveland Twist Drill Co., Cleveland, O.

GREASE CUPS, PRESSED STEEL AND BRASS
Can. Winkley Co., Ltd., Windsor, Ont.

GREASES, LUBRICATING
Canadian SKF Co., Toronto, Ont.

GRINDING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Norton Co., of Canada, Ltd., Hamilton.

GRINDING MACHINES, ABRASIVE BELT
Norton Co. of Can. Ltd., Hamilton, Ont.

GRINDING MACHINES, AUTOMATIC
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, BENCH
Blount Co., J. G., Everett, Mass.
Geometric Tool Co., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
McDougall Co., Ltd., R., Galt, Ont.
Norton Co. of Canada, Ltd. Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, CENTER
U. S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES, CUTTER AND REAMER
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Petrie Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, CYLINDRICAL
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.
Norton Co., of Canada, Ltd., Hamilton.

GRINDING MACHINES, DIE
National Acme Co., Cleveland, O.
National Machinery Co., Tiffin, Ohio.

GRINDING MACHINES, DRILL
Bellevue Industrial Furnace Co., Detroit, Mich.
Bertram & Son Co., Ltd., The John, Dundas, Ont.

GRINDING MACHINES, ELECTRIC
Strand & Co., N. A., Chicago, Ill.

GRINDING MACHINES, FLOOR AND TOOL
Blount Co., J. G., Everett, Mass.
National Acme Co., Cleveland, Ohio.
Norton Co. of Canada, Ltd., Hamilton, Ontario.
Petrie, Ltd., H. W., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.

GRINDING MACHINES, INTERNAL
Garlock Machinery Ltd., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES PORTABLE
Strand & Co., N. A., Chicago, Ill.

GRINDING MACHINES, SNAGGING
Blount Co., J. G., Everett, Mass.
Norton Co., of Can. Ltd., Hamilton, Ont.

GRINDING MACHINES, SURFACE
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, THREAD
Pratt & Whitney Co., of Canada, Ltd.,

GRINDING MACHINERY, TOOL POST
Gisholt Machine Co., Madison, Wis.
Grenfield Tap & Die Corp., Galt, Ont.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES, UNIVERSAL
Brown & Sharpe Mfg Co., Providence, Rhode Island.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co., of Canada, Ltd., Hamilton Ontario.
Petrie, Ltd., H. W., Toronto, Ont

GRINDING WHEELS
J. R. Baxter & Co., Ltd., Montreal, Que.
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Norton Co. of Can., Ltd., Hamilton, Ont.

GUN-BARREL MACHINERY
Steinle Turret Machine Co., Madison, Wisconsin.

HACK SAWS, POWER
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Petrie, Ltd., H. W., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que
Starrett Co., L. S., Athol, Mass.

HAMMERS, CHIPPING
Cleveland Pneumatic Tool Co., Toronto, Ont.
High Speed Hammer Co., Rochester.

HAMMERS, DROP
Bertram & Son Co., Ltd., The John Dundas, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

HAMMERS, ELECTRIC
Brown, Boggs & Co., Ltd., Hamilton, Ont.

HAMMERS, PNEUMATIC
Can. Steel Foundries, Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto Ont.

HANGERS, SHAFTING
Canadian SKF Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Hamilton Gear & Machine Co., Toronto.

HOBBING MACHINES
Shore Instrument Co., Jamaica, N.Y.

HARDENING, CASE-HARDENING AND TEMPERING
Barnes Company, Wallace, Hamilton.
Chapman Double Ball Bearing Co., Toronto.
Petrie, Ltd., H. W., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Cleveland Pneumatic Tool Co., Toronto Ont.

HAMMERS, POWER
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

HOBS
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

HOISTS, ELECTRIC
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

HOISTS, ELECTRIC
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

HOISTS, HAND
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

HOISTS, PNEUMATIC
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont

HOLDERS-ON, PNEUMATIC
Cleveland Pneumatic Tool Co., Toronto Ont.

HYDRAULIC MACHINERY
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Dominion Engineering Works, Limited Montreal, Que.

IGNITERS, GAS ENGINE
Canada Foundries & Forgings Co. Welland, Ont.
Burke Machine Tool Co., Conneaut, O

INDICATORS, SPEED AND TEST
Brown & Sharpe Mfg. Co. Providence, R.I.

INSULATION
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.

IRON BARS
Steel Co. of Canada, Ltd. Hamilton Ont.

JACKS, HYDRAULIC
Norton, A. O., Boston, Mass.

JACKS, PLANER
Armstrong Bros Tool Co., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

JAPANNING AND VARNISHING OVENS
Brantford Oven & Rack Co., Brantford, Ont.

JIGS AND FIXTURES (SEE TOOL WORK)
Fisher Motor Co., Ltd., Orillia, Ont
Gisholt Machine Co., Madison, Wis.
Preston & Schwartz, Galt, Ont

KEYSEATING MACHINES
Morton Mfg Co., Muskegon, Mich

Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

KEYS, MACHINE
Can. Dranw Steel Co., Hamilton, Ont
Morton Mfg. Co., Muskegon, Mich.

KNIVES, MACHINE
Atkins & Co., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

KNURL HOLDERS
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

LATHE ATTACHMENTS
Hendey Machine Co., Torrington, Conn.
Petrie, Ltd., H. W., Toronto, Ont.

LATHE TOOLS
Armstrong Bros. Tool Co. ,Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

LATHES, AUTOMATIC AND SEMI-AUTOMATIC
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, BENCH
Hardinge Bros., Inc., Chicago, Ill.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

LATHES, BORING
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, CHUCKING (SEE LATHES, HORIZONTAL TURRET, AND LATHES, VERTICAL TURRET)
Acme Machine Tool Co., Cincinnati, O.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, ENGINE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd. H. W., Toronto, Ont
Rockford Lathe & Drill Co., Rockford, Illinois.

LATHES, EXTENSION AND GAP
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, O.
Petrie, Ltd., H. W., Toronto, Ont.
Steinle Turret Machine Co., Madison, Wis.

LATHES, PRECISION
Hardinge Bros., Chicago.

LATHES, RELIEVING
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.

LATHE, UNIVERSAL HAND
Brown & Sharpe Mfg. Co., Providence, Rhode Island.

LATHE, SPEED AND HAND
Blount Co., J. G., Everett, Mass.

LATHES, SPINNING
Pryibil Machine Co., Torrington, Conn.

LATHES, VERTICAL TURRET
Bertram & Son, Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

LATHES, WOOD TURNING
Blount, Co., J. G., Everett, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.

LEAD PIPE
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

LEATHER FILLET
D. K. McLaren Co., Ltd., Montreal, Que.

LIGHTING AND GENERATING SETS
Beardmore & Co., Ltd., Wm., Montreal, Que.

LINOLEUM MILL MACHINERY
Bertrams, Ltd., Edinburgh, Scotland.

LIQUID AIR PLANTS
L'Air Liquide Society, Toronto, Ont.

LOCKERS, CLOTHES
Dennis Wire and Iron Works, London, Ont.

BUYERS' DIRECTORY

LUBRICANTS
Oakley Chemical Co., New York, N.Y.

LUBRICATING SYSTEMS
Bowser, S. F., & Co., Ltd., Toronto, Canada.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Ltd., Welland, Ont.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R. Toronto Ont.

MANGANESE STEEL
Can. Steel Foundries, Montreal, Que.

MANDRELS, EXPANDING
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MANDRELS, SOLID
Greenfield Tap & Die Corp., Galt, Ont.
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Pratt & Whitney Co., of Canada. Ltd., Dundas, Ont.

MEASURING MACHINES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MECHANICS' FINE TOOLS
Lufkin Rule Co., Windsor, Ont.

METALS, ALLOY
Canada Metal Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.

METAL WORKERS
Parker Co., Charles, Meriden, Conn.

MICROMETER CALIPERS
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Rice Lewis & Son, Ltd., Toronto, Ont.

MILLING ATTACHMENTS
Burke Machine Tool Co., Conneaut, O.
Hendey Machine Co., Torrington, Conn.
Hinckley Machine Works, Hinckley, Ill.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

MILLING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Burke Machine Tool Co., Conneaut, O

MILLING MACHINES, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence, R. I.
Hardinge Bros., Inc., Chicago, Ill.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

MILLING MACHINES, BENCH
Burke Machine Tool Co., Conneaut. O.
Hardinge Bros., Inc., Chicago, Ill.

MILLING MACHINES, HAND
Brown & Sharpe Mfg. Co., Providence
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MILLING MACHINES, HORIZONTAL PLANER TYPE.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Kearney & Trecker Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto.

MILLING MACHINES, PLAIN
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, O.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

MILLING MACHINES, THREAD
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MILLING MACHINES, UNIVERSAL
Brown & Sharpe Mfg. Co., Providence,
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

MILLING MACHINES, VERTICAL
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, O.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto.

MOTORS, ELECTRIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Roelofson Elevator Co., Galt, Ont.
Williams Machinery Co., A. R., Toronto,
Wisconsin Electric Co., Racine Wis.

NAILS AND STAPLES
Canada Metal Co., Ltd., Toronto, Ont.

NIPPLES
Canada Metal Co., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton.

NITROGEN
Carter Welding Co. Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

NUT TAPPERS
(See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
National Acme Co., Cleveland, Ohio.

NUTS, FINISHED and SEMI-FINISHED
Galt Macine Screw Co., Galt, Ont.
National Acme Co., Montreal, ue.

NUTS (Up to 4-in.)
Steel Co. of Canada, Ltd., Hamilton.

NUTS, S.A.E., PLAIN AND CASTELLATED
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

OIL FILTERING AND STORAGE SYSTEMS
Bowser, S. F., & Co., Ltd., Toronto,

OIL STORAGE ENGINEERS
Bowser, S. F., & Co., Ltd., Toronto,

OIL HOLE COVERS
Can. Whitney Co., Ltd., Windsor, Ont.

OILS, SOLUABLE
Brantford Oven & Rack Co., Brantford, Ontario.

OXYGEN
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

OXY-ACETYLENE APPARATUS
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Atlas Press Co., Kalamazoo, Mich.

PAPER MILL CONVEYORS
Bertram Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd., Montreal, Que.

PATTERNS, WOOD AND METAL
Fittings, Limited, Oshawa, Ont.
Victoria Foundry Co., Ltd., Ottawa.

PHOSPHOR TIN
Canada Metal Co., Ltd., Toronto, Ont.

PHOTOGRAPHIC DUPLICATING MACHINES
Photostat Corp., Providence, R. I.

PIPE BENDING MACHINES
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Underwood Corp., H. R., Philadelphia, Pa.
Williams Machinery Co., A. R., Toronto.

PIPE CUTTING AND THREADING MACHINES
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

PIPE
Canada Metal Co., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.

PIPE FITTINGS
Canada Metal Co., Toronto, Ont.
Fittings, Limited, Oshawa, Ont.
International Malleable Iron Co., Guelph Ont.

PIPE AND NIPPLE THREADING MACHINES
Landis Machine Co., Inc., Waynesboro, Pa.

PIPE FITTERS' TOOLS
Rice Lewis & Son, Ltd., Toronto, Ont.

PIPE THREADING DIE HEADS
Landis Machine Co., Inc., Waynesboro, Pa.

PISTON-RING MACHINES
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

PLANING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Williams Machinery Co., A. R., Toronto.

PLANING MACHINES, ROTARY
Bertram & Son Co., Ltd., The John, Dundas, Ont.

PLATE ROLLS
Bertram & Son Co., Ltd., The John, Dundas, Ont.

PNEUMATIC TOOLS
Cleveland Pneumatic Tool Co., Toronto.

POLISHING AND BUFFING MACHINES
J. R Baxter & Co., Ltd., Montreal, Q.
Blount Co., J. G. Everett, Mass.
Brown & Sharpe Mfg. Co., Providence.
Pryibil Machine Co., New York, N.Y.

PRESSED STEEL PARTS
American Pulley Co., Philadelphia, Pa.
Fisher Motor Co., Ltd., Orillia, Ont.

PRESSES, ARBOR
Atlas Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

PRESSES, DROP AND FORGING
Brown, Boggs & Co., Ltd., Hamilton.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

PRESSES, FOOT AND HAND
Brown, Boggs & Co., Ltd., Hamilton.

PRESSES, HYDRAULIC
Bertram & Son Co., Ltd., The John, Dunldas, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Perrin Ltd., W. R., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

PRESSES, POWER
Bliss Co., E. W., Prooklyn, N. Y.
Brown, Boggs, & Co., Ltd., Hamilton.
Hepburn Ltd., John T., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Stoll Co., Inc., D. H., Buffalo, N.Y.

PRESSES, SCREW
Brown, Boggs & Co., Ltd., Hamilton.
Petrie, Ltd., H. W., Toronto, Ont.

PROFILING MACHINES
Prtt & Whitney Co., of Canada, Ltd., Dundas, Ont.

PROTRACTORS
Brown & Sharpe Mfg. Co., Providence
Lufkin Rule Co., Windsor, Ont.

PROPELLERS
Kennedy & Sons, Wm., Owen Sound Ontario.

PULLEYS, CORK INSERT
American Pulley Co., Philadelphia, Pa.

PULLEYS, METAL AND FIBRE
American Pulley Co., Philadelphia, Pa.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.
D. K. McLaren Co., Ltd., Montreal, Que.

PULP AND PAPER MILL EQUIPMENT
Dominion Engineering Works, Ltd., Montreal, Que.

PUMPS, HYDRAULIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Dominion Engineering Works, Ltd. Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.

BUYERS' DIRECTORY

PUMPS, LUBRICANT AND OIL
Bowser, S. F., & Co., Ltd., Toronto.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Hepburn Ltd., John T., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.

PUMPS, POWER
Bowser, S. F., & Co., Ltd., Toronto.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hepburn Ltd., John T., Toronto, Ont.

PUNCHES, CENTER
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

PUNCHES, HAND
Brown Boggs & Co., Ltd., Hamilton.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Jardine & Co., A. B., Hespeler, Ont.

PUNCHES, POWER
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

PUNCHING MACHINES, HORIZONTAL
Bertrams Ltd., Edinburgh, Scotland.

PYROMETERS, ELECTRIC
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Hiram Walker & Sons Metal Products Co., Walkerville, Ont.

RACKS, CUT
Hamilton Gear & Machine Co., Toronto.

RACKS, STORAGE
(See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ontario.

REAMER HOLDERS
Simonds Canada Saw Co., Montreal, Q.

REAMERS, EXPANDING
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

REAMERS, SOLID
Butterfield & Co., Inc., Rock Island, Q.
Morse Twist Drill & Machine Co., New Bedford, Mass.

REAMERS, TAPER
Brown & Sharpe Mfg. Co., Providence, R. I.
Butterfield & Co., Inc., Rock Island, Q.
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canad, Ltd., Dundas, Ont.

RECORDERS, TEMPERATURE
Taylor Instrument Co., Rochester, N. Y.

RECORDERS, TIME
Gisholt Machine Co., Rochester, N. Y.
Taylor Instrument Co., Toronto, Ont.

REGULATORS, TEMPERATURE
Taylor Instrument Co., Toronto, Ont.

RIVETS AND BURRS
Parmenter & Bulloch Co., Gananoque, Ont.
Steel Co., of Canada, Ltd., Hamilton,

RIVETS, CHAIN
Fittings, Limited, Oshawa, Ont.

RIVET-MAKING MACHINERY
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

RIVETING MACHINES
Can. Fairbanks-Morse Ltd., Montreal Q.
High Speed Hammer Co., Rochester, N.Y.
Parmenter & Bulloch Co., Gananoque Ont.
Petrie, Ltd., H. W., Toronto, Ont.

RUDDER FRAMES, STEEL
Can. Steel Foundries, Montreal, Que.

RUBBER MILL MACHINERY
Bertram Ltd., Edinburgh, Scotland.

RULES, STEEL AND WOOD
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Windsor, Ont.

RUST PREVENTATIVES
Oakley Chemical Co., New York, N. Y.

SAND EQUIPMENT
Can. Link-Belt Co., Toronto, Ont.

SAND RAMMERS, PNEUMATIC
Cleveland Pneumatic Tool Co., Toronto.

SAW FRAMES AND BLADES, HACK
Atkins & Co., Inc., E. C., Indianapolis.
Diamond Saw & Stamping Works, Buffalo, N. Y.
Rice Lewis & Sons, Ltd, Tornto, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWING MACHINES, POWER HACK
Atkins & Co., Inc., E. C., Indianapolis.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

SAW SHARPENING MACHINES
Atkins & Co., Inc., E. C., Indianapolis.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

SAW SHARPENING MACHINES
Atkins & Co., Inc., E. C., Indianapolis.

SAW TABLES, UNIVERSAL
Petrie, Ltd., H. W., Toronto, Ont.

SAWS, CIRCULAR METAL
Atkins & Co., Inc., E. C., Indianapolis.
Pryibil Machine Co., New York, N. Y.
Gisholt Machine Co., Madison, Wis.

SAWS, HAND
Atkins & Co., Inc., E. C., Indianapolis
Simonds Canada Saw Co., Montreal, Q.

SAWS, HOT AND COLD
Atkins & Co., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Q.

SAWS, HIGH SPEED STEEL
Atkins & Co., Inc., E.C., Indianapolis, I.
Butterfield & Co. Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWS, METAL BAND
Atkins & Co., E. C., Indianapolis, I.

SAWS, METAL CUTTING
Brown & Sharpe Mfg. Co., Providence.
Butterfield & Co., Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.
Starrett Co., L. S., Athol, Mass.

SAWS, SCREW SLOTTING
Atkins & Co., Inc., E., C., Indianapolis.
Butterfield & Co., Inc., Rock Island, Q.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canda, Ltd., Dundas, Ont.

SAWS, SCREW SLOTTING
Atkins & Co., Inc., E. C., Indianapolis.
Butterfield & Co., Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q

SAWS, WOOD
E. C. Atkins & Co., Indianapolis, Ind

SCALES
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Lufkin Rule Co., Windsor, Ont.

SCREENS
Dominion Engineering Works, Ltd., Montreal, Que.

SCREW DRIVERS, OPTICAL, JEWELRY AND NOVELTY
Strand & Co., N. A., Chicago, Ill

SCREW MACHINE WORK
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Montreal, Que.

SCREW MACHINERY, WOOD AND LAG
Cook Co., Asa S., Hartford, Conn.

SCREW MACHINES
Brown & Sharpe Mfg. Co., Providence, Rhode Island.

SCREW MACHINES, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.

SCREW MACHINE PRODUCTS
National Acme Co., Montreal, Que.

SCREW PLATES
Butterfield & Co., Inc., Rock Island. Que.
Jardine & Co., A. B., Hespeler, Ont.

SCREWS, CAP AND SET
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

SCREWS, SAFETY, SET
Galt Machine Screw Co., Galt, Ont.

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See last page of directory.
Petrie, Ltd., H. W., Toronto, Ont.

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Bowser, S. F., & Co., Ltd., Toronto, Canada.

SEPARATORS, OIL AND WASTE
Bowser, S. F., & Co., Ltd., Toronto.

SHAFTS, FLEXIBLE
Strand & Co., N. A., Chicago, Ill.

SHAFTING
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
Williams Machinery Co., A. R., Toronto.

SHAPES, COLD-DRAWN SPECIAL STEEL
Union Drawn Steel Co., Hamilton, Ont.

SHAPING MACHINES
Hendey Machine Co., Torrington, Conn.
Morton Mfg. Co., Muskegon, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Williams Machinery Co., A. R. Toronto.

SHEARS HAND
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

SHEARS, POWER
Bliss Co., E. W., Brooklyn, N. Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Stoll Co., Inc., D. H., Buffalo, N. Y.
Williams Machinery Co., A. R., Toronto, Ont.

SHEARING MACHINES, ANGLE, IRON BAR AND GATE
Bertrams Ltd., Edinburgh, Scotland.

SHEET LEAD
Canada Metal Co., Ltd., Toronto, Ont.

SHEET METAL WORKING MACHINERY
Bliss Co., E. W., Brooklyn, N. Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Stoll Co., Inc., D. H, Buffalo, N.Y.

SHEETS, NICKEL, MONEL AND FIBRE
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.

SHEETS, O.P.C.R. & B. A. AND BLUE ANNEALED
Steel Co., of Canada, Ltd., Hamilton, Ont.

SIDE FRAMES, LOCOMOTIVE
Can. Steel Foundries, Montreal, Que.

SLOTTING ATTACHMENTS
Brown & Sharpe Mfg. Co., Providence, R.I.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

SLOTTING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.

SOLDERS
Canada Metal Co., Ltd., Toronto, Ont.

SPECIAL MACHINERY AND TOOLS
Brown Engineering Corp., Ltd., Toronto.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Cleveland, O.

SPIKES, RAILWAY AND PRESSED
Steel Co of Canada, Ltd., Hamilton, Ont.

SPINNING LATHES
Prybil Machine Co., P., New York City

SPRING, MILLED
Barnes & Co., Wallace, Hamilton, Ont.

SPRINGS, SMALL SPIRAL HELICAL, COMPRESSION, EXTENSION, TORSION AND SPECIAL
Barnes Company, Wallace, Hamilton.

SPRINGS
Barnes Company, Wallace, Hamilton.
Cleveland Wire Spring Co., Clevleand, O.
Steele Ltd., James, Guelph, Ont.

SPRINGS, FLAT STEEL, BRUSH HOLDER, CLOCK, SMALL FLAT SPRINGS
Barnes Company, Wallace, Hamilton.

SPROCKETS AND CHAINS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Renold Hanson of Canada, Ltd., Montreal, Que.

SQUARES
Brown & Sharpe Mfg. Co., Providence, R.I.
Lufkin Rule Co., Windsor, Ont.
Steel Co. of Canada, Ltd., Hamilton. Ont.

STAMPING, METAL
American Pulley Co., Philadelphia, Pa.
Barnes Company, Wallace, Hamilton.
Diamond Saw & Stamping Works, Buffalo, N. Y.
Parmenter & Bulloch Co., Gananoque, Ont.

STAMPS, STEEL
Diamond Saw & Stamping Works, Buffalo, N. Y.

STEEL CONCRETE REINFORCEMENT
Steel Co. of Canada, Ltd., Hamilton.

STEEL PLATE
British Empire Steel Co., Montreal, Que.

STEEL AND IRON BARS
Steel Co. of Canada, Ltd., Hamilton.

STEELS TOOL
British Empire Steel Co. Montreal Q.

STEEL, COLD-ROLLED STRIP
British Empire Steel Co., Montreal, Q.
Barnes Company, Wallace, Hamilton.

STEEL, CRUCIBLE, SPRING
Barnes, Company, Wallace, Hamilton.
British Empire Steel Co., Montreal, Q.

SHEETS, OPEN HEARTH STEEL
Steel Co., of Canada, Ltd., Hamilton.

STEEL, SHAFTING AND FREE CUTTING SCREW
Union Drawn Steel Co., Hamilton, Ont.

STEEL, SHEET
British Empire Steel Co., Montreal, Q.
Rice Lewis & Son, Ltd., Toronto, Ont.

STEEL, STAINLESS
Steel Co., of Can. Ltd., Hamilton, Ont.

STEELS, ALLOY AND CARBON
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Can. Steel Foundries, Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton. Ont.

STEELS, HIGH-SPEED
Armstrong Bros. Tool Co., Chicago, Ill
Atkins & Co., Ltd., Wm., Sheffield, England.
British Empire Steel Co., Montreal, Q.
Rice Lewis & Son, Ltd., Toronto, Ont
Steel Co., of Canada, Ltd., Hamilton

STEEL TUBING, CLOSE JOINT AND WELDED
Standard Tube & Fence Co., Ltd., Woodstock, Ont.

STERN FRAMES, CAST STEEL
Can. Steel Foundries, Montreal, Que

STRAIGHTENING MACHINERY
Bertram Ltd., Edinburgh, Scotland
Williams & Co., J. H., Brooklyn, N.Y.

STUDS
Galt Machine Screw Co., Galt, Ont.

Geometric Tool Co., New Haven, Conn.

SWAGING MACHINES
Atkins & Co., Inc., E. C., Indianapolis, Indiana.

SWITCHES, RAILWAY
Can. Steel Foundries, Montreal, Que.

TACHOMETERS
Bristol Co., Waterbury, Conn.

TANKS AND PUMPS, OIL
Bowser, S. F., & Co., Ltd., Toronto.

TAP HOLDERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
William L. Procunier, Chicago, Ill.

TAPER PINS
Galt Machine Screw Co., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

TAPES, MEASURING
Starrett Co., L. S., Athol, Mass.
Lufkin, Rule Co., Windsor, Ont.

TAPPING MACHINES AND ATTACHMENTS
Burke Machine Tool Co., Conneaut, O.
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Wm. L. Procunier, Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

TAPS AND DIES
Butterfield & Co., Inc., Rock Island, Q.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

TAPS, COLLAPSING
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.

TEETH, DREDGE BUCKET
Kennedy & Sons, W., Owen Sound, Ont.

THERMOMETERS
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Greenfield Tap and Die Corp., Galt, Ontario.

THREAD-CUTTING TOOLS
Butterfield & Co., Inc., Rock Island, Q.
Greenfield Tap and Die Corp., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

THREAD CUTTING MACHINES
Landis Machine Co., Inc., Waynesboro, Pa.

THREADING MACHINES
Acme Machinery Co., Cleveland, Ohio.
Geometric Tool Co., New Haven, Conn.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Williams Tool Corp., of Can. Ltd., Brantford, Ont.

THREAD LEAD TESTING MACHINES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

THREAD-ROLLING MACHINES
Bliss Co., E. W., Brooklyn, N. Y.

BUYERS' DIRECTORY

TIE PLATES
Steel Co. of Canada, Ltd., Hamilton

TIME RECORDERS
International Business Machine Co., Ltd., Toronto, Ont.

TONGS
Hepburn Ltd., John T., Toronto, Ont.

TOOL CASES
Rice Lewis & Son, Ltd., Toronto, Ont.

TOOL HOLDERS
Armstrong Bros., Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis
Bertrams Ltd., Edinburgh, Scotland.

TOOL POSTS, LATHE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Williams & Co., J. H., Brooklyn, N. Y.

TOOLS, SMALL
(See Machinists' Small Tools)
Armstrong Bros. Tool Co., Chicago, Ill.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Lufkin Rule Co., Windsor, Ont.
National Machine Tool Co., Racine, Wis.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S. Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A.R., Toronto,

TOOL WORK
Brown Engineering Corp., Ltd., Toronto, Ontario.

TORCHES, BLOW
Rice Lewis & Son, Ltd., Toronto, Ont.

TRACKWORK, RAILWAY
Can. Steel Foundries, Montreal, Que.

TRACKWORK, MANGANESE STEEL
Can. Steel Foundries, Montreal, Que.

TRANSMISSION MACHINERY
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound.
Petrie, Ltd., H. W., Toronto, Ont.
Renold, (Hans) of Canada, Ltd., Montreal, Que.

TROLLEYS AND TRAMWAYS
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Wright Mfg. Co., Lisbon, Ohio.

TROLLEY WHEELS
Langley & Austin, Galt, Ont.

TROWELS, PLASTERING
E. C. Atkins & Co., Indianapolis, Ind.

WRENCHES, MACHINISTS'
Armstrong Bros. Tool Co., Chicago, Ill.

TRUCKS
Can. Fairbanks-Morse Ltd., Montreal, Q.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

TUBING, SEAMLESS STEEL, BRASS AND COPPER AND FIBRE
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Goldstein Mfg. Co., Ltd., Toronto, Ont.

TURRET HEADS
Bertram & Son Co., Ltd., The John Dundas, Ont.

TURRET MACHINES
(See Lathes, Horizontal Turret)
Acme Machine Tool Co., Cincinnati, O.
Cook Co., Asa S., Hartford, Conn.
Gisholt Machine Co. Madison Wis.
National Acme Co. Cleveland O.
Pratt & Whitney Co. of Canada Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin

TURRETS, TOOL POST
Gisholt Machine Co. Madison, Wis.

UNIONS, PIPE
Fittings, Limited, Oshawa, Ont.

VALVES
Canada Metal Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Mon-
Dominion Engineering Works, Limited. Montreal, Que.

VISES, DRILLING MACHINE
Burke Machine Tool Co., Conneaut, Ohio.
Charles Parker Co., Meriden, Conn.
Cleveland Pneumatic Tool Co., Toronto, Ontario.
Kempsmith Mfg Co., Milwaukee, Wis.

VISES, PIPE
Charles Parker Co., Meriden, Conn.

VISES, PLANER AND SHAPER
Bertram & Son Co., Ltd., The John Dundas, Ont.
Philip Gies Foundry, Kitchener, Ont.
Hendley Machine Co., Torrington, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

VISES, WOOD WORKERS'
Charles Parker Co., Meriden, Conn.
Parmenter & Bulloch Co., Gananoque, Ontario.

VOLTMETERS
Bristol Co., Waterbury, Conn.

WAGON LEADERS
Can. Link-Belt Co., Toronto, Ont.

WASHERS, LOCK, SPLIT AND SPRING
Barnes Company, Wallace, Hamilton.

WELDING APPARATUS, OXY-ACETYLENE
L'Air Liquide Society, Toronto, Ont.
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto, Ont.

WELDING APPARATUS
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.

WELDING, ELECTRIC, ARC, SPOT AND BUTT
International Malleable Iron Co., Guelph, Ont.

WELDING MACHINES, OXY-ACETYLENE
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.

WELDING, ELECTRIC
McLaren Belting Co., J. C., Montreal Que.
Steel Co. of Canada, Ltd., Hamilton.

WELDING ROD, TOBIN, MANGANESE BRONZE AND ALUMINUM
Dominion Oxygen Co., Ltd., Toronto
Liquide Air Company, Toronto, Ont.

WELDING SUPPLIES
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.

WHEELS, INDUSTRIAL
American Pulley Co., Philadelphia, Pa.
Hull Iron & Steel Foundries, Hull, Que.
Kennedy & Sons, Wm., Owen Sound, Ontario.

WINCHES, HEADGATE
Kennedy & Sons, Wm. Owen Sound, Ontario.

WINCHES, STOPLOG
Kennedy & Sons, Wm., Owen Sound Ontario.

WIRE
Barnes Company, Wallace, Hamilton.
Canada Metal Co., Ltd., Toronto, Ont
Dennis Wire & Iron Works, London, Ontario.
Greening Wire Co., B., Hamilton, Ont.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

WIRE, BLACK TEMPERED, MUSIC PHOSPHOR BRONZE AND PREMIER
Barnes Company, Wallace, Hamilton

WIRE, COPPER AND BRASS, FINE AND HEAVY
Steel Co., of Canada, Ltd., Hamilton, Ontario.

WIRE STRAIGHTENING AND CUTTING MACHINERY
Brown, Boggs & Co., Ltd., Hamilton, Ontario.

WIRE, WELDING
L'Air Liquide Society, Toronto, Ont.
Carter Welding Co., Ltd., Toronto, Ont
Dominion Oxygen Co., Ltd., Toronto

WIRES, SPECIAL
Dennis Wire & Iron Works, London Ontario.
Greening Wire Co., B., Hamilton, Ont

WOODWORKING MACHINERY
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Williams Machinery Co., A. R., Toronto, Ontario.

WRENCHES, DROP FORGED
Armstrong Bros. Tool Co., Chicago, Ill.
Canada Foundries & Forgings Co., Welland, Ont.

List of Directory of Dealers will be Found above Advertising Index

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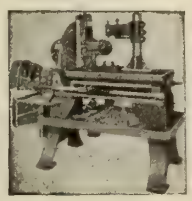

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DIRECTORY OF DEALERS

THE Buyers' Directory of CANADIAN MACHINERY was originally intended to contain information regarding lines actually manufactured by our advertisers. We now carry the advertising of leading machinery dealers, some of whom represent scores of manufacturers in addition to being manufacturers themselves in some cases. We recommend, therefore, if our subscribers cannot find what they want in our Directory that they communicate with the dealers whose names appear herewith.

MACHINE TOOLS, ETC.

Bertram & Sons, Ltd., John, Dundas, Ont.

The Canadian Fairbanks-Morse Co., Montreal, Que.

Garlock Machinery Ltd., Toronto.

H. W. Petrie, Ltd., Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

Yeates Machinery Co., London, Ont.

SHOP and FACTORY SUPPLIES

The Canadian Fairbanks-Morse Co., Montreal, Que.

Garlock Machinery Ltd., Toronto.

H. W. Petrie Ltd., Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

Yeates Machinery Co, London, Ont.

POWER EQUIPMENT, ETC.

The Canadian Fairbanks-Morse Co., Montreal, Que.

H. W. Petrie, Ltd., Toronto, Ont.

WOODWORKING MACHINERY

The Canadian Fairbanks-Morse Co., Montreal, Que.

Garlock Machinery Ltd., Toronto.

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of interest to every buyer of machinery and supplies in Canada. The 130,000 feet of floor space in our Toronto warehouse is filled to capacity with machine tools and supplies of every description required in machine shops. Our lines include the best makes on the market. From our immense stock we are always able to meet requirements and our splendid shipping facilities enable us to fill all orders promptly.

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Issued in 1917 and Maturing 1st December, 1922.

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THE MINISTER OF FINANCE offers to holders of these bonds who desire to continue their investment in Dominion of Canada securities the privilege of exchanging the maturing bonds for new bonds bearing 5½ per cent interest, payable half yearly, of either of the following classes:—

(a) Five year bonds, dated 1st November, 1922, to mature 1st November, 1927.

(b) Ten year bonds, dated 1st November, 1922, to mature 1st November, 1932.

While the maturing bonds will carry interest to 1st December, 1922, the new bonds will commence to earn interest from 1st November, 1922, GIVING A BONUS OF A FULL MONTH'S INTEREST TO THOSE AVAILING THEMSELVES OF THE CONVERSION PRIVILEGE.

This offer is made to holders of the maturing bonds and is not open to other investors. The bonds to be issued under this proposal will be substantially of the same character as those which are maturing, except that the exemption from taxation does not apply to the new issue.

Holders of the maturing bonds who wish to avail themselves of this conversion privilege should take their bonds AS EARLY AS POSSIBLE, BUT NOT LATER THAN SEPTEMBER 30th, to a Branch of any Chartered Bank in Canada and receive in exchange an official receipt for the bonds surrendered, containing an undertaking to deliver the corresponding bonds of the new issue.

Holders of maturing fully registered bonds, interest payable by cheque from Ottawa, will receive their December 1 interest cheque as usual. Holders of coupon bonds will detach and retain the last unmatured coupon before surrendering the bond itself for conversion purposes.

The surrendered bonds will be forwarded by banks to the Minister of Finance at Ottawa, where they will be exchanged for bonds of the new issue, in fully registered, or coupon registered or coupon bearer form carrying interest payable 1st May and 1st November of each year of the duration of the loan, the first interest payment accruing and payable 1st May, 1923. Bonds of the new issue will be sent to the banks for delivery immediately after the receipt of the surrendered bonds.

The bonds of the maturing issue which are not converted under this proposal will be paid off in cash on the 1st December, 1922.

W. S. FIELDING,
Minister of Finance.

Dated at Ottawa, 8th August, 1922.

CANADIAN MACHINERY
AND MANUFACTURING NEWS

Vol. XXVIII. No. 8 Published Weekly by the MacLean Publishing Company, Limited, Toronto, Ont. August 24, 1922 $4.00 a Year Subscription Price

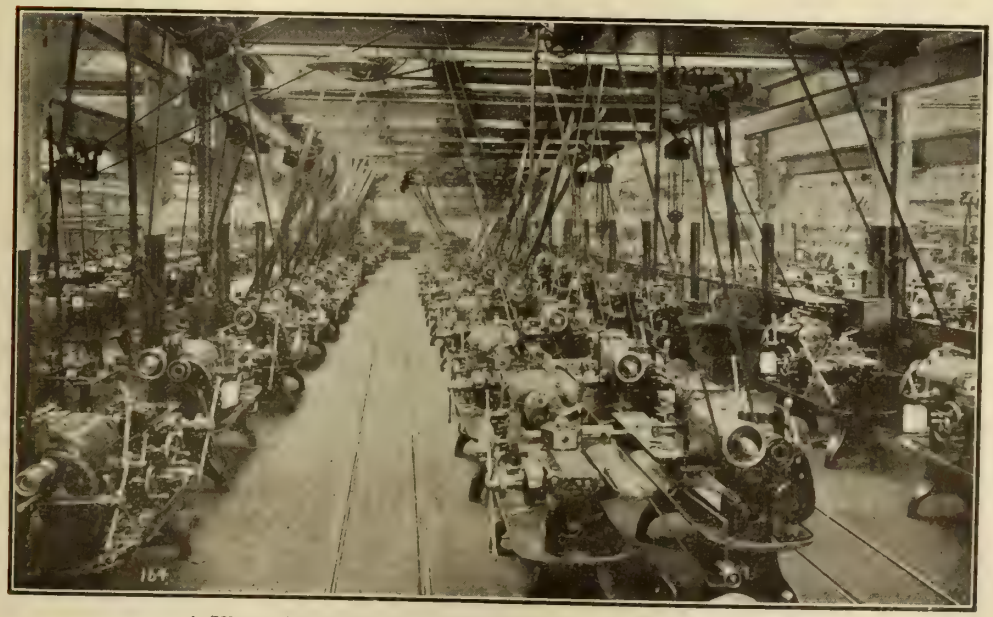
READ AND PASS TO	Check	See Page	READ AND PASS TO	Check	See Page

The Business of

ALFRED HERBERT LTD

consists of two main divisions; viz., the "Manufacturing" and the "Factored." The first consists of two well-equipped, self-contained shops comprising Laboratories, Foundries, Machine and Erecting Shops, employing upward of 3,000 men in the production of Automatic and Turret Lathes, Milling and Drilling Machines. The second or "Factored" Division acts as sole selling agents in various countries for leading British and American makers of machine tools.

The combined result is an organization able to quote on the most suitable machines for any given work and to deliver them tooled up with all the necessary tools and fixtures. Complete Plants can also be quoted on for the production of complete units when desired.



A View of our Head Works Test Bay at Coventry, England

OUR TORONTO OFFICE

carry a large stock of machine tools and equipment at all times. Write for information or call and inspect our stock at

1-3 Jarvis Street, TORONTO

SOMETHING NEW

IN

WELDING

You are cordially invited to visit our booth at the forthcoming Canadian National Exhibition, Toronto, (commencing August 26, 1922) which is situated in Machinery Hall opposite the main entrance.

In addition to our display of Oxy-Acetylene Welding Apparatus and Supplies we are showing Electric Welding Rods, both flux coated and plain, suitable for all classes of Electric Welding.

Features of special interest will be the welding of steel by Alternating Current using Special flux coated rods. Also welding Cast Iron Electrically with a patented flux Coated Cast Iron Rod giving a weld equal to that obtainable by Oxy-Acetylene Welding. Demonstrations of the use of these rods will be given continuously during the exhibition. We shall also demonstrate the use of all kinds of welding rods for general purposes, both Electric and Oxy-Acetylene, special equipment being installed for these purposes so as to make the exhibit as interesting to you as possible.

It will be our pleasure to give you all information possible on any point relating to autogenous welding, both Electric and Oxy-Acetylene. Expert operators will be in constant attendance and you can rely upon receiving a hearty welcome and courteous attention which will make your visit, we sincerely trust, both pleasant and profitable.

L'AIR LIQUIDE SOCIETY

Sales Offices :

Halifax Montreal Toronto Winnipeg Calgary Vancouver

LONGEST SERVICE

We make these three right.

1. Exacting analysis of the physical and chemical properties of our steel insures a uniform product.
2. Intelligent workmanship constantly striving to produce the better tool yields the Pratt & Whitney quality.
3. Rigid inspection of the work in process and of the finished product guarantees tools for longest service.

The finished product must be right.

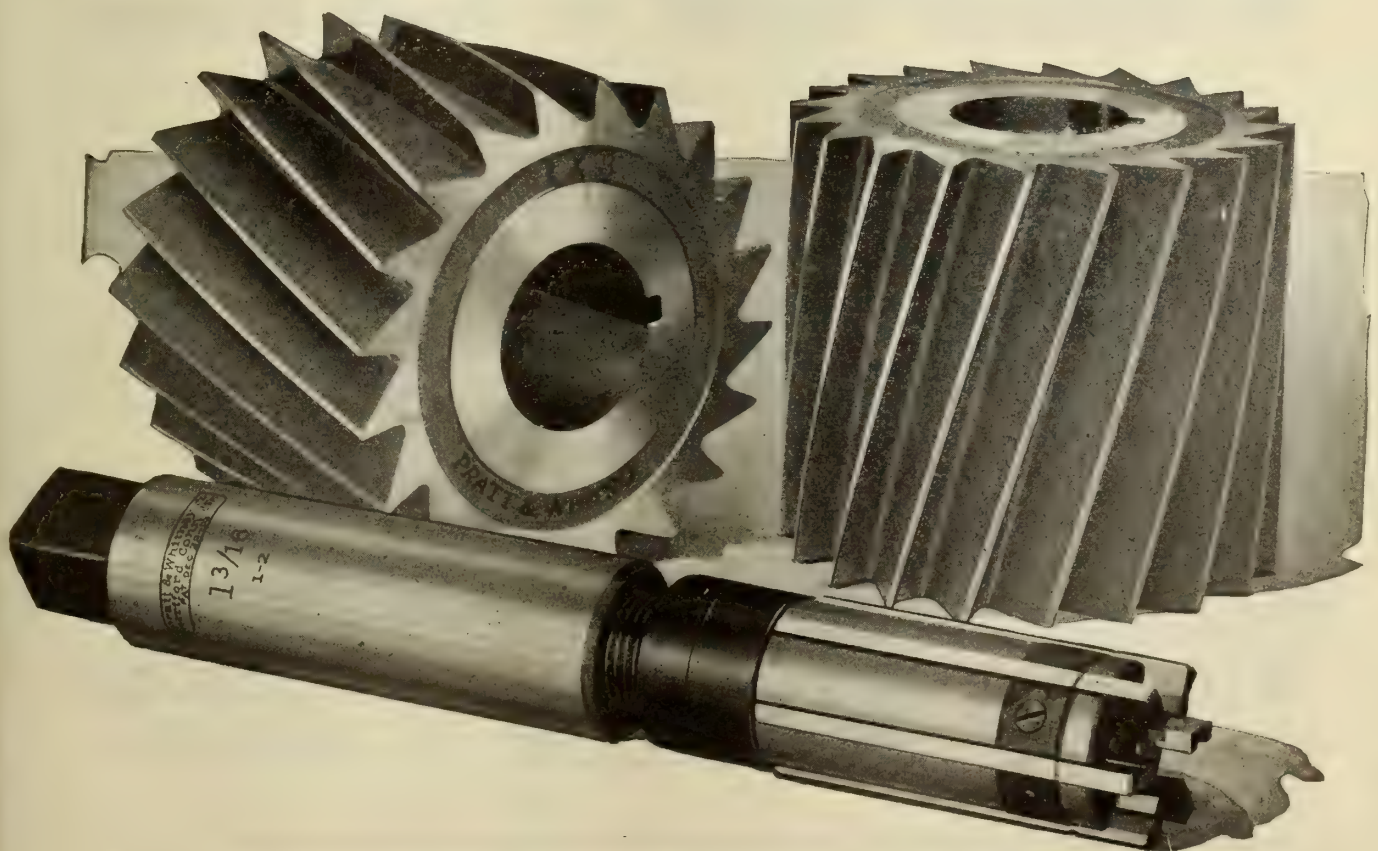
PRATT & WHITNEY

SMALL TOOLS

PRATT & WHITNEY COMPANY OF CANADA, LIMITED

Works: Dundas, Ontario

MONTREAL 723 Drummond Bdg.	TORONTO 32 Front St. West	WALKERVILLE 103½ Sandwich St.
HALIFAX Roy Building	VANCOUVER B. C. Equipment Co.	WINNIPEG 1205 McArthur Bldg.



If what you need is not advertised, consult our Buyers' Directory and write advertisers, listed under proper heading.

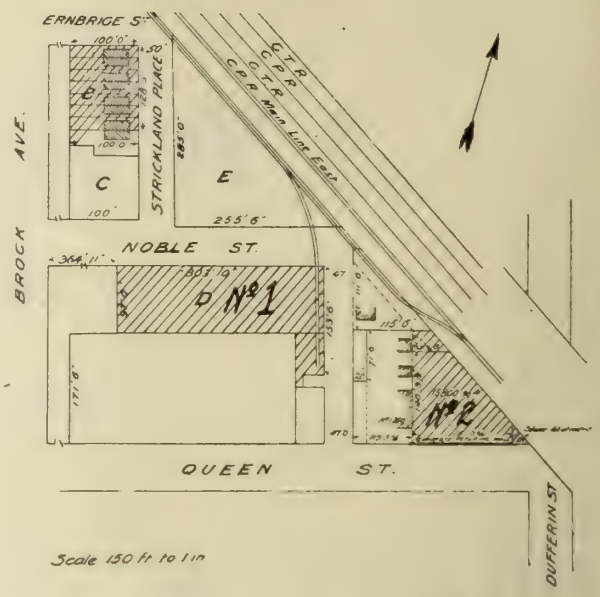
IDEAL FACTORY SITES

A RARE OPPORTUNITY—Seldom have we been able to offer manufacturers a location equal to the two factory sites shown in diagram. Both sites are very central, low in price and possess splendid transportation facilities.

No. 1—303 ft. 10 in. frontage; total area 31,500 sq. ft. The railroads have promised us that immediately land is purchased they will place a siding to suit purchaser's requirements. It will also be noted from sketch that this siding may be brought from the east on to the south side of this land, thus holding control over land fronting on Queen Street, and making the property we offer more valuable and profitable.

No. 2—A splendid location for small factory. Total area, 15,800 sq ft. Provided with rear entrance on which is a railroad siding that may be extended to suit purchaser. Both sites are steadily increasing in value. Purchase now. Reasonable offers given due consideration.

On your way to Toronto Exhibition stop off at corner of Dufferin and Queen Streets and view both sites—they are in close proximity. In the meantime write for particulars and prices.



ARNOLDI, GRIERSON & PARRY 103 Bay Street TORONTO

Solicitors and Agents for the Proprietors

Manufacturers' Supplies for Ready Shipment

Machine Shop - Foundry - Factory and Construction Supplies

Seventy-five years of successful service to the Canadian trade lends emphasis to our guarantee of complete satisfaction. We handle only nationally-known lines—products we can confidently guarantee personally. We offer, in addition, a service that ensures the prompt and intelligent handling of all orders, large and small.

Our Line Includes:

HACK SAW BLADES,
MACHINE SCREWS,
STARRETT, BROWN & SHARPE AND OTHER MACHINISTS' TOOLS.
SET SCREWS,
CAP SCREWS,
DRILLS, CARBON AND HIGH SPEED,
FILES (Extra Large Stock).

We also carry a heavy stock of Bar Iron, Sheet Iron (black and galvanized), Machine Steel, Cast Steel, High Speed Steel, Cold Rolled Steel, etc.

Be sure and visit us while at Toronto Exhibition

Rice Lewis & Son, Limited

Established 1847 TORONTO, ONT. 19 Victoria Street

If interested tear out this page and place with letters to be answered.

How DIAMOND FIBRE and Condensite Celoron

CAN and is being applied to MECHANICAL-ELECTRIC and TRANSPORTATION FIELDS

"How can we apply Diamond Fibre and Condensite Celoron to our business?"

"Will the use of Diamond Fibre and Condensite Celoron reduce our cost?"

These two important questions are often put before us by manufacturers who frankly admit they do not fully understand the wide scope and uses of Diamond Fibre and Condensite Celoron. They are anxious to improve their product if either of our materials are suitable, and naturally they are desirous of reducing costs if at all possible.

In practically every case we are able to prove that Diamond Fibre or Condensite Celoron **WILL** suit their purpose and **WILL** reduce costs. If we do not think our product is suitable we SAY SO FRANKLY. We give only EXPERT ADVICE for we are SPECIALISTS in the business and our reputation has long since been established.

The uses of Diamond Fibre and Condensite Celoron are so varied that it is impossible to mention them all in this space, so we will, for the benefit of manufacturers, present a different use in every advertisement of this series telling of its successful application to the industry or plant as the case may be. We know you will be interested in this series for they will be Educative. Interesting, and be the means of showing the way to Greater Production. The first will appear in the October 5th issue.

Be sure and visit our exhibit at the Toronto Exhibition, August 26th to September 9th. We will show you the various uses of our products and courteous attendants will answer all questions.

For prices and full data on both these products, write to the

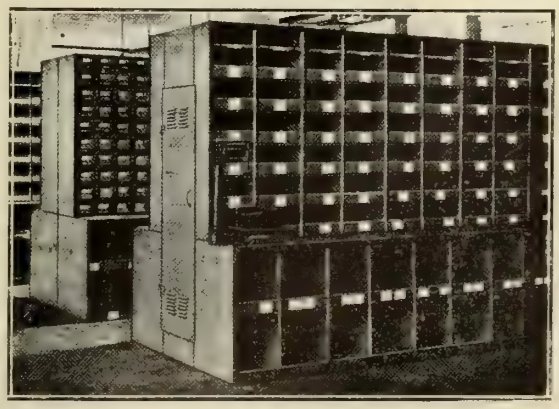
Diamond State Fibre Company

of Canada, Limited, Toronto, Ont.

If It's Made of Wire, We Make It!

WHEN in need of high-grade wire rope of any kind for any purpose, get in touch with us because we have facilities for making wire rope that are second to none. We combine the highest quality of material with the greatest degree of skill in manufacture. Good wire rope, such as we make, is far superior to hemp rope because it gives you greater strength under all weather conditions and is lower in cost in the long run. We make all kinds for all purposes.

In addition to our wire rope and wire cloth, we manufacture a complete line of clothes lockers, tool room enclosures, storage bins, etc., and one type, known as design "C," is shown in the illustration. Note the compact and rugged design, also the protection against fire.



This is only one style and we have many others to meet all shop and storage room conditions. The best thing to do is write for our catalogue and bulletins which give full particulars about our many lines.

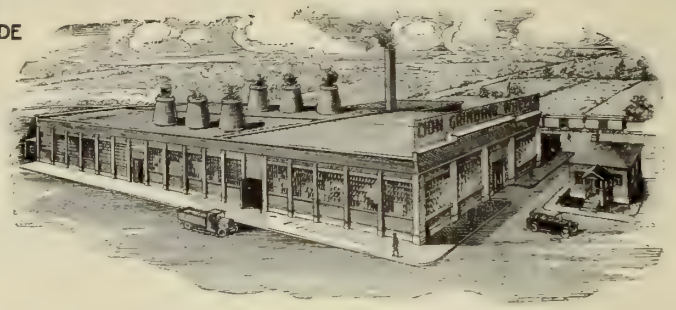
When at Toronto Exhibition, come to our Hamilton plant and we will make you welcome and show you why we are proud of the goods we manufacture. We solicit your enquiries.

Canada Wire and Iron Goods Co.

Hamilton, -:- Ontario

"LION" GRINDING WHEELS

MANUFACTURERS OF HIGH GRADE GRINDING WHEELS



ALU-LION

For Grinding High Tensile Material

CARBO-LION

For Grinding Low Tensile Material

The Wheels You Will Eventually Buy. Why Not Now?

LION GRINDING WHEELS Ltd.

BROCKVILLE, ONT.

Agents for Prov. Quebec
J. R. Baxter & Co., Ltd.
Montreal

Photograph by courtesy of our customer

Efficiency

BLISS

To BE PROFITABLE the manufacture of small stampings made in large quantities must be extremely rapid with practically no loss due to rejections.

In the picture we show a BLISS No. 19½ Inclinable Power Press the production of which is 45,000 blanks a day. The operator and the character of the work are each factors in the production rate as well as the efficiency of the press. With BLISS Presses you are assured of the latter. Over one hundred BLISS Presses are operating in the plant where this photograph was taken.

BLISS on your machinery is more than a name, it's a guarantee.

Bliss for Machinery

E. W. BLISS CO. MAIN OFFICE AND WORKS **BROOKLYN, N. Y., U. S. A.**

SALES OFFICES DETROIT Dime Bank Bldg. · CLEVELAND Cleveland Discount Bldg. · CHICAGO Peoples Gas Bldg. · PITTSBURGH Oliver Bldg. · ST. LOUIS Boatmen's Bank Bldg. · BUFFALO Marine Bank Bldg. · CINCINNATI Union Trust Bldg. · NEW HAVEN Second Nat'l Bank Bldg.

American Factories: BROOKLYN, N.Y. HASTINGS, MICH. CLEVELAND, OHIO. SALEM, OHIO.

FOREIGN SALES OFFICES AND FACTORIES:

ENGLAND, Pocock St., Blackfriars Rd., S. E., London · ITALY, 345 Via Nizza, Turin · FRANCE, 54 Blvd. Victor-Hugo, St. Ouen, Paris

No. 313

If interested tear out this page and place with letters to be answered.

Bond

Engineering Works, Limited, wish to announce that

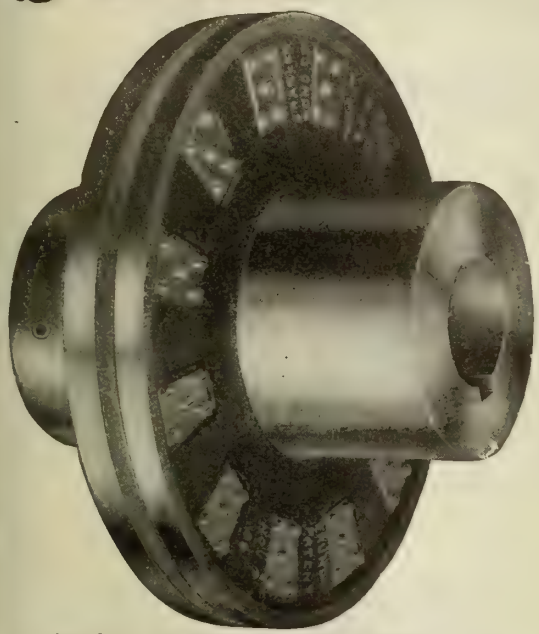
BOND POWER TRANSMITTING APPLIANCES

Will be on Display at

The Canadian National Exhibition, Machinery Hall

We cordially invite you to visit our booth and see Bond Specialties in actual operation.

Bond Transmission Products have exclusive points you should know about, therefore be sure to call and see us.

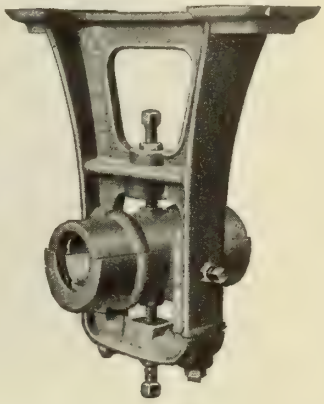


Grundy Patent Flexible Insulated Coupling.

Our line comprises **Hangers, Collars, Couplings, Pillow Blocks, Bearings, Pulleys, Friction Clutches, Ball Bearing Loose Pulleys, etc., also Bond Stationary and Ball Bearing Swivel Truck Casters.**

"GOOD AS A BOND" — that's always been the acme of quality because there is nothing better.

Remember the name "Bond" Place-- Machinery Hall



BOND ENGINEERING WORKS, LIMITED

POWER TRANSMITTING SPECIALISTS VILLIERS & MUNITION STS., TORONTO, ONT.

REGO "Little Six"—$75.00

Complete, Portable, Standard Welding Equipment

THE REGO "Little Six" is the answer to the demand for a small but complete **high quality welding outfit** for garage and repair shop trade. It is called the REGO "Little Six" because the man who owns one can perform the six most important types of repair work. They are as follows: Welding, Cutting, Brazing, Lead Burning, Radiator Repairing and Decarboning. When used for welding the standard REGO M T welding torch equipped with three copper one-piece tips is used. This torch is suitable for all ordinary repair work, and

WILL NOT FLASH BACK

By changing tips, all the other operations already mentioned can be performed.

Standard REGO quality exists in every element of the Rego "Little Six" Outfit. Oxygen and acetylene regulators, hose, wrenches, spectacles, spark lighter and an instruction book that tells you how, all packed in an attractive carrying case, make Rego "Little Six" the most complete, high grade, small outfit ever offered to the repair trade. Price $75.00.

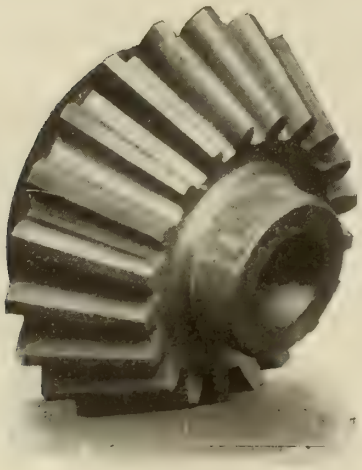
"FUSEON"

A new and better Metallic Flux for repairing water jackets and scored cylinders. You can secure the complete outfit with tools at the moderate price of $25.00.

See this equipment at the Toronto Exhibition in the Machinery Hall

Carter Welding Co., 165 Adelaide St., W. TORONTO, ONT.

Bevel Gears



Teeth Planed Theoretically Correct

Gear Data for Your Notebook

Cut this out---More coming later.

Bevel Gears—Rules and Definitions from
HAMILTON GEAR and MACHINE CO., TORONTO.

Relations of Pitch Diameter, Pitch of Teeth and Number of Teeth same as for Spur Gears.

Outside Diameter is Pitch Diameter added to Diametral Increment. This latter may be got from table (to follow) or worked out thus:

Diametral Increment equals double the cosine of pitch angle provided by the diametral pitch. Figure separately for gear and for pinion.

Pitch Angle is found from a table of Tangents. The number of teeth in a gear (or pinion) divided by the number of teeth in its mate gives the Tangent of the Pitch Angle. Face Angle is sum of Pitch Angle and Addendum Angle. Addendum Angle is found from table of Tangents. Twice the sine of pitch angle divided by the number of teeth gives the Tangent of Addendum Angle.

Write us for Quotations

Hamilton Gear & Machine Co.

76 Van Horne St., Toronto

Spending Coppers to Save Dollars

To use a file after it has begun to get dull is to waste effort.

Don't do it! A few cents spent on a new file means dollars saved in labor-time.

Maximum service from every file is assured when you buy one of these standard brands.

Kearney & Foot
Great Western
American
Arcade
Globe

Nicholson File Company

Port Hope - Ontario

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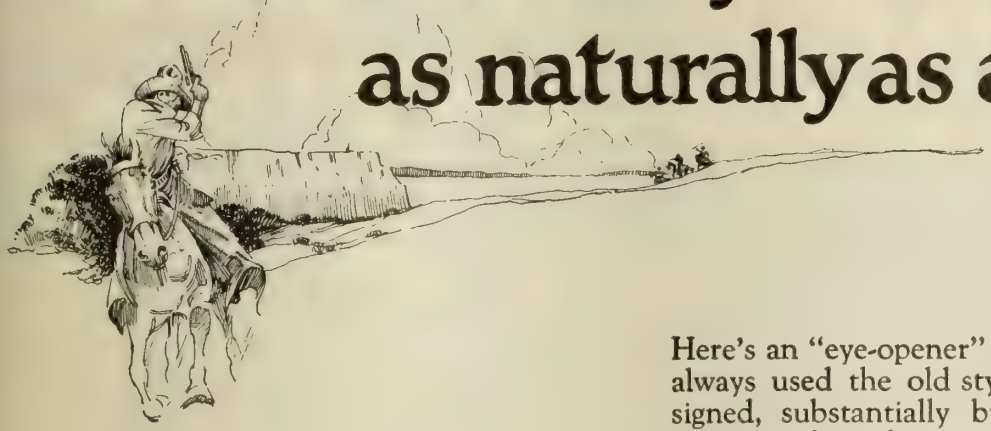
Balances in your hand as naturally as a Colt .45



Here's an "eye-opener" for the man who has always used the old style frame. A well designed, substantially built hack saw frame has a perfect "hang"—takes any length of blade from 8 to 12 inches and can be set to cut in four directions without removing the wing nut. A constant tension on the bolts holding the blade and a positive adjustment on the tubular back saves cuss words and much valuable time when changing blades. Hard rubber checked handle and stream line design. A Hack Saw Frame you will always swear *by*—never *at*.

Ask for *Starrett Pistol Grip Adjustable Hack Saw Frame No. 169.* You can get it at almost any hardware store.

Write for Catalog No. 22-3 and the Supplement describing the new Starrett Tools.

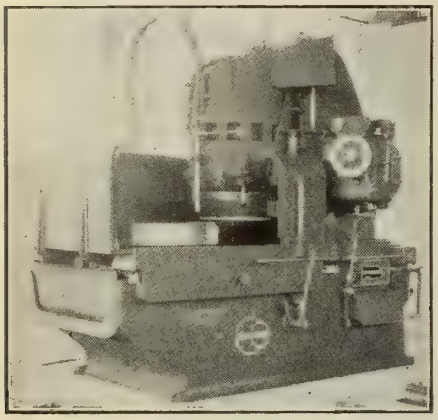
THE L. S. STARRETT CO.
The World's Greatest Toolmakers
Manufacturers of Hacksaws Unexcelled
ATHOL, MASS.

The Starrett Hack Saw Chart and "Hack Saws and Their Use" (a standard reference book on the subject) will be sent free on request

42-201

Starrett Hack Saws

THE JOHNSON FRICTION CLUTCH
AS USED ON THE
NEW No. 27-R, BLANCHARD VERTICAL SURFACE GRINDER



Courtesy The Blanchard Machine Co., Cambridge, Mass.

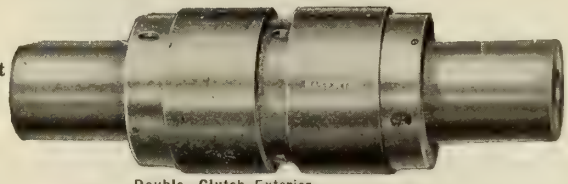
Another advance of progress in abrasive engineering is the use of Johnson friction clutches on this **NEW** machine.

Two No. 6 double clutches provide for rapid raising or lowering of the wheel.

One No. 10 single clutch is located in the gear box for rotating table.

The **AUTOMOTIVE INDUSTRY** demands reliable friction control—the Johnson Friction Clutch is the answer.

Write for Stock List and Yellow Catalog



Double Clutch-Exterior.

THE CARLYLE JOHNSON MACHINE CO. MANCHESTER, CONN

STEEL CASTINGS

QUICK DELIVERIES

High Carbon Steel
Manganese Steel
Chrome Steel
Mild Steel

QUALITY GUARANTEED

Sizes—½lb. to 5,000 lbs.

THE WILLIAM KENNEDY & SONS
LIMITED
OWEN SOUND, ONTARIO
ESTABLISHED 1860

CANADA
FOUNDRIES & FORGINGS
LIMITED

HEAVY FORGINGS
Ship Forgings Car Axles
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FORGED SHAFTINGS
Up to
30,000 Pounds
Smooth Forged Rough Turned
Machine Finished

Send Blue Prints for Prices
Prompt Delivery

Canada Foundries & Forgings Ltd.
Welland, Ont.

GISHOLT
LABOR SAVING EQUIPMENT

TURRET LATHES
Hand Operated
For Chucking and Bar Work
AUTOMATIC TURRET LATHES
For Chucking Work
VERTICAL BORING and TURNING MILLS
UNIVERSAL TOOL GRINDERS
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CYLINDER GRINDERS
TOOL-POST TOOL HOLDERS
REAMERS, "SOLID ADJUSTABLE"
Shell and Chucking
BORING BARS
With Adjustable Cutters
PERIODOGRAPH
For Time Recording in Factories
Separate Catalogs on each Product
Send for the ones you want

GISHOLT MACHINE CO.
1207 E. Washington Avenue
Madison, Wisconsin, U. S. A.

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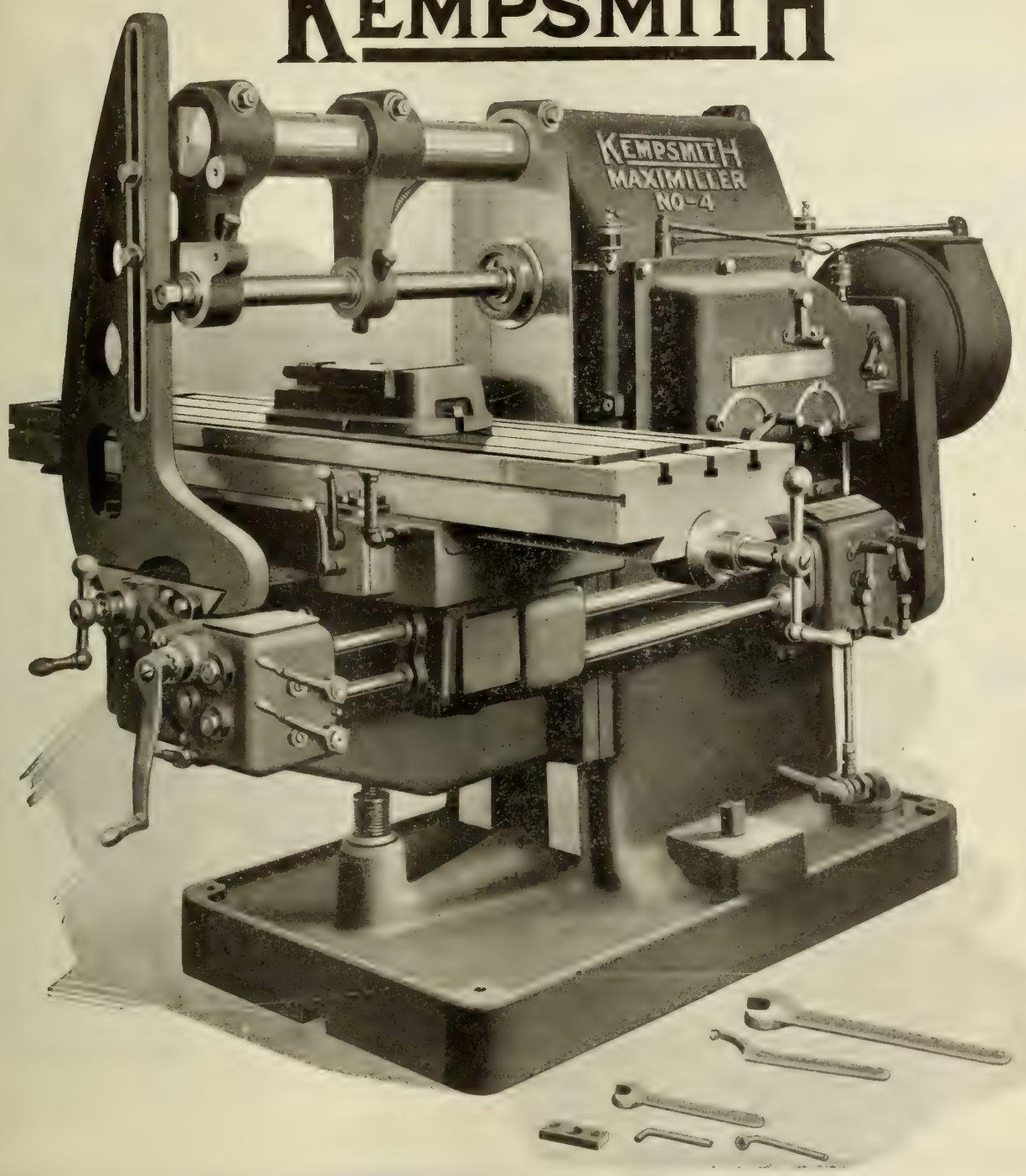
KEMPSMITH



KEMPSMITH No. 4 Plain Maximiller

A veritable maximum in milling machines embracing all Kempsmith patented features, permitting a maximum in production and efficiency. Write for particulars as to this machine.

THE KEMPSMITH MANUFACTURING CO.

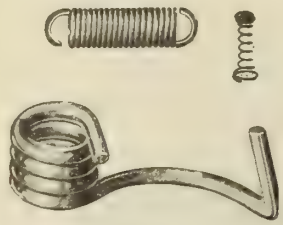
MILWAUKEE, WIS., U.S.A.

FOREIGN DEALERS:—American Trading Co., 25 Broad Street, New York, N. Y. (Japan); **Barandiaran & Co.** 3-Alameda, San Sebastian, Spain; **Bovan & Edwards Pty., Ltd.,** 117 King Street, Melbourne, Australia; **Blair, Reed & Company,** Nathan's Bldg., Wellington, N.Z.; **Bloxham, Edgar,** 12 Rue Du Delta, Paris, France; 245 W. 12th St., New York City; **L. S. Devos,** Grand Central Palace, New York City; **Herbert Alfred,** 54 Dey Street, New York City; **Neilsen & Winther,** Blegdamsvej 60, Copenhagen, Denmark; 24 Stone Sreet, New York City, **Park and Lacy Co.,** 60 Clarence Street, Sidney, N.S.W. Aust.; **Selson Engr. Company,** 85 Queen Victoria St., London, E. C., England; **Corso Vitiorio Emmanuele,** 11, No. 9, Turin; 5 Piazzo Castella, **Milan, Italy;** 24 Stone Street, New York City; **Pascual Teja,** La Capuchinas, No. 65, Mexico, D. F.; **Spliethoff, Beeuwkes & Co.,** Leuvehaven, W.Z. 159, Rotterdam, Holland; **Turner, Hoare & Co., Ltd.,** Lansdowne Road, Post Box No. 195, Bombay, India; **Charter & Gardiner,** 35 Calle Echaqu Santa Cruz, P. O. Box 1201, Manila, Philippine Is.; **Cociete Anonyme Belge Alfred Herbert,** Rue De Laeken, 35a. & 35b. Brussels, Belgium.

CANADIAN DEALERS:—The Geo. F. Foss Machinery & Supply Co., Limited, 305 St. James St., Montreal, Canada; **General Supply Co.,** 38 Toronto St., Toronto, Canada.

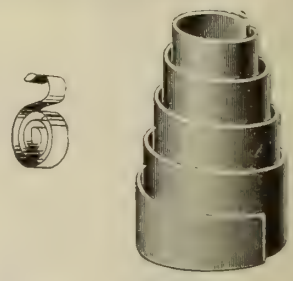
PRECISION SPRINGS

SPECIAL TORSION AND SMALL WIRE SPRINGS



THE WALLACE BARNES CO. LIMITED
WIRE
BARNES CANADIAN SPRINGS
STEEL
HAMILTON, ONTARIO CANADA

FLAT AND FLAT COIL SPRINGS OF ALL DESCRIPTIONS



Cleveland Sand Rammers

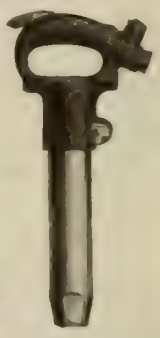
FOR FLOOR, BENCH, PEIN AND FLASK RAMMING

Cleveland Sand Rammers are made in several sizes and weights, and are adapted for all kinds of Foundry Ramming.

The Piston Rods are packed with a resilient packing which prevents any dirt from entering piston chamber and working parts—They are fitted with either Round or Flat Rod as required. Cleveland Rammers are light in weight, have high speed and practically no vibration, making them ideal foundry tools.

CLEVELAND CHIPPING HAMMERS

For Foundry Work. Are furnished in any required size or weight for grey iron or steel castings; they have high speed, and are adapted for fast chipping now required by piece-workers.



CLECO PRESSURE-SEATED AIR VALVES AND BOWES AIR HOSE COUPLINGS

Are Standard Equipment Everywhere

Both Valves and Couplings are pressure tight.

Bowes Couplings are instantly connected or disconnected.

Bowes Couplings are absolutely air tight under all pressures.

Above cut shows the Never-Slip Clamp attached to Bowes Coupling.

IN STOCK:—RIVETING HAMMERS, DRILLS, REAMING, TAPPING AND FLUE-ROLLING MACHINES, CORNER DRILLS, PORTABLE AND BENCH GRINDERS, PRESSURE-SEATED AIR VALVES, ETC.

Write for Bulletins Nos. 50 and 51

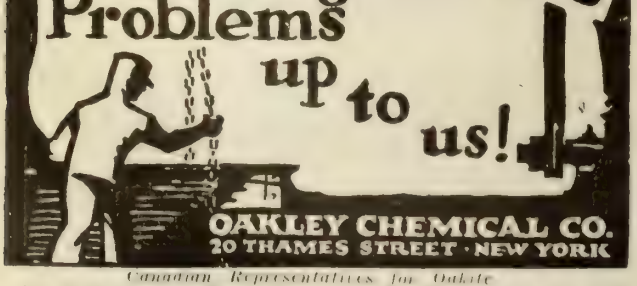
ADDRESS ALL INQUIRIES TO:

CLEVELAND PNEUMATIC TOOL CO. OF CANADA, LIMITED

84 CHESTNUT STREET, TORONTO, ONT. 337 CRAIG ST. W., MONTREAL, QUE.

OAKITE CLEANS

Put your Cleaning Problems up to us!



OAKLEY CHEMICAL CO.
20 THAMES STREET · NEW YORK

Canadian Representatives for Oakite

Mr. C. P. Murphy, Toronto. Mr. C. Burgin, Montreal.

J.C.McLAREN BELTING

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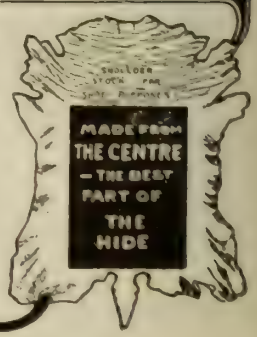

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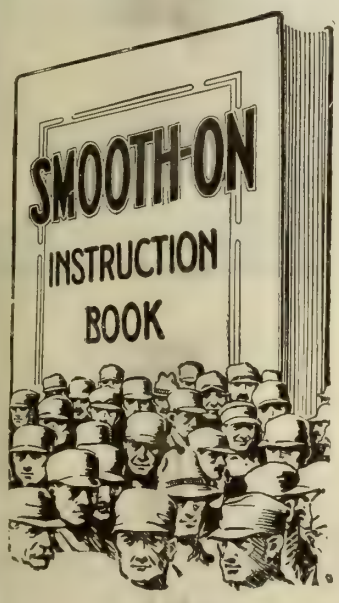

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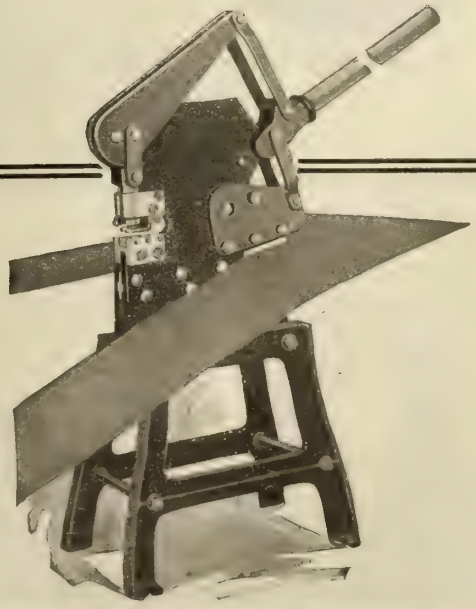

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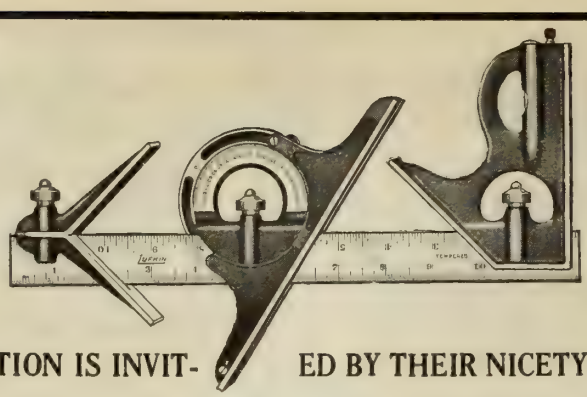

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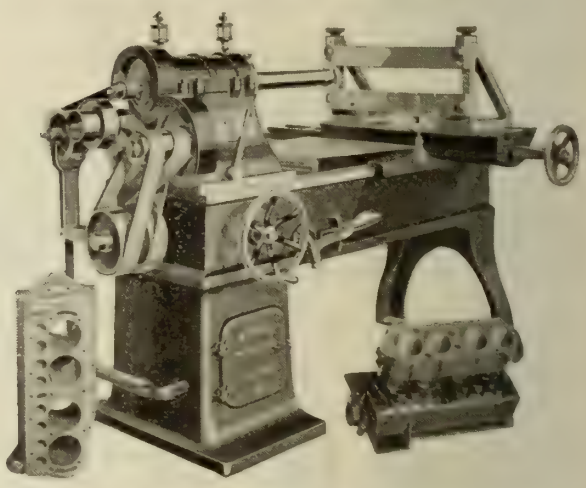

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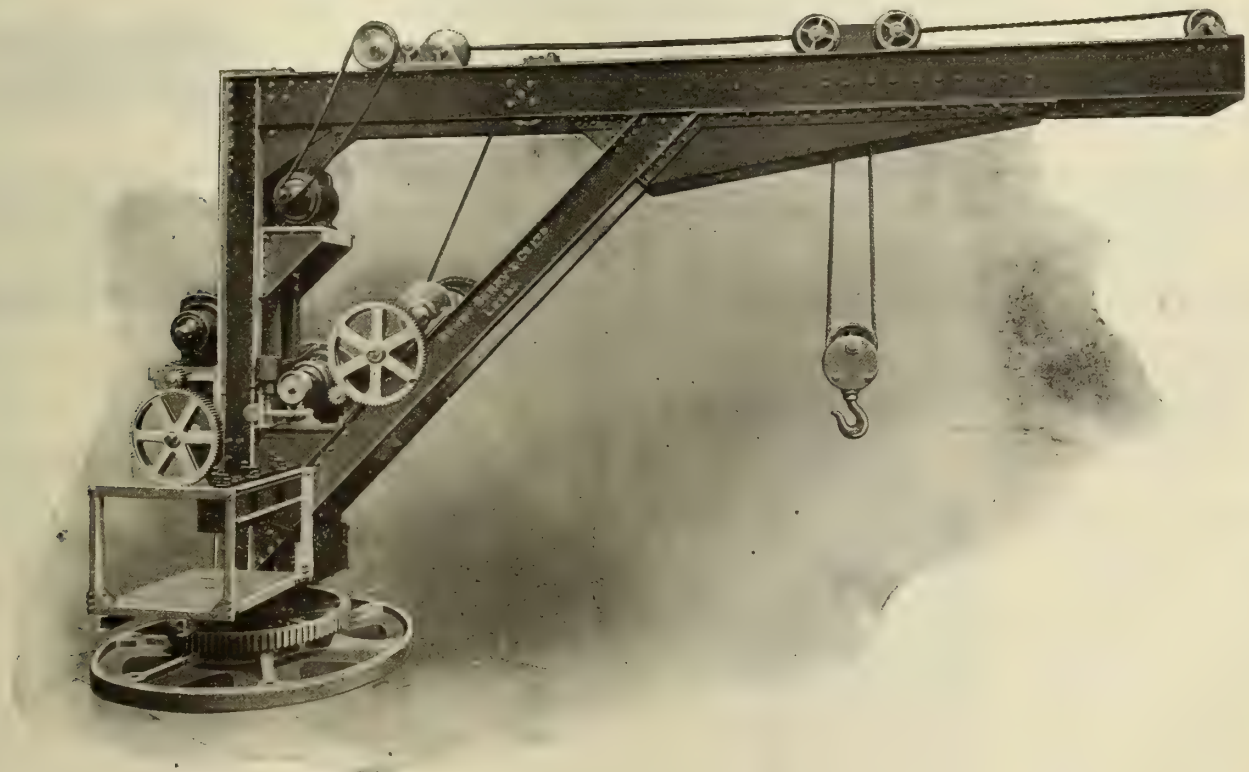

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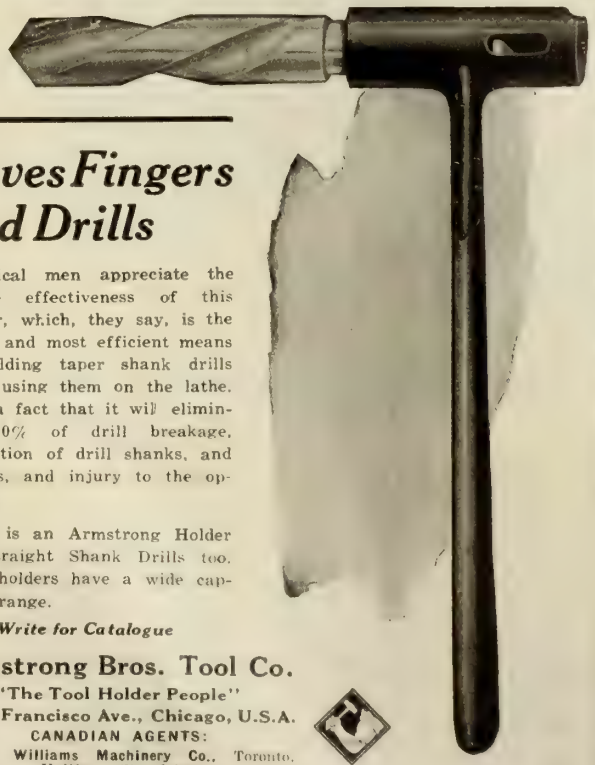

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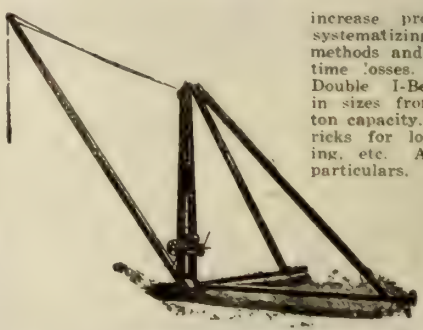

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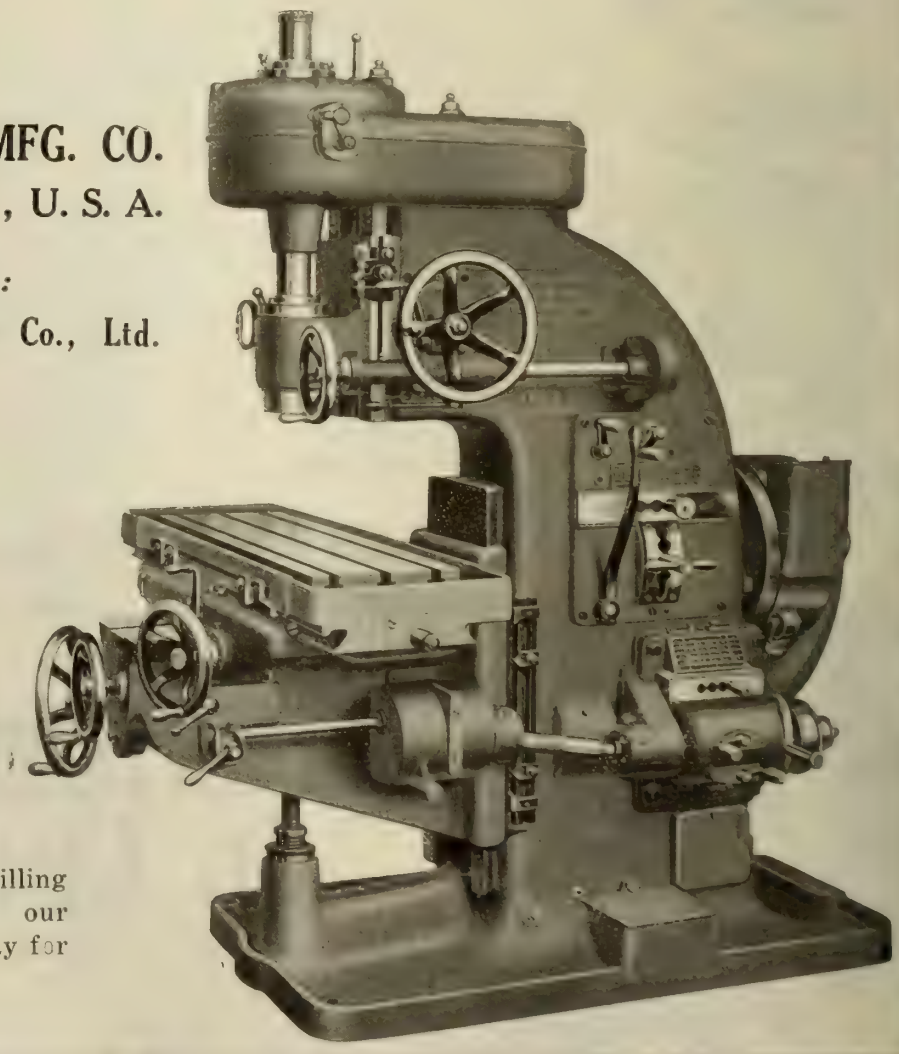

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CANADIAN MACHINERY
AND
MANUFACTURING NEWS

VOL. XXXVII, No. 8 AUGUST 24, 1922

Some Interesting Examples of Production Drilling

Keeping Down the Labor Cost—Smoothness of Operations Essential—Special Work Holding Fixtures—Maintaining Alignment of Holes—Multiple Sprindle Drilling

IN THE machining of parts for mechanical equipment the drilling of holes assumes a prominent place in the scheme of production. It is the practice today to utilize a tool to its full capacity in order to keep the labor cost down to a minimum. Under the old system, where each individual hole in a piece of work had to be laid off and drilled separately, the labor cost was a very large item and the same methods would be almost prohibitive at the present time. The development of high speed steels and the improvements in machines to meet the new requirements has resulted in stepping up production to a point not even dreamed of a generation ago. In the early days of the drilling machines the general use of the tool for any other purpose than drilling holes was seldom thought of and less frequently practised. To-day, the drill press has become almost a universal machine tool that can handle a wide range of drilling, reaming, tapping and boring operations.

To get the best results out of any drilling machine it is necessary that smoothness of operations be the dominating features. The movements of the spindle and the feeds should remain uniform when cutting. When the feed is intermittent and irregular, owing to unnecessary friction and vibration, undue shocks are transmitted to the drill point and very often breakage results. Back lash in the driving gears and spindle should be kept as low as possible. Special attention should be given to the cutting points of drills to minimize the thrust that comes on the spindle bearing. This is particularly true in the case of multiple drilling, as it is desirable to maintain a uniform pressure on all spindles.

Use of Special Fixtures

When parts are manufactured in sufficient quantities to call for the undivided attention of one machine or set of tools for a comparatively long period, it is almost imperative that suitable jigs and fixtures be designed for holding the work while the machining operations are being performed. The use of high speed steel for cutting, and the rigid construction of tool equipment, has reduced the time required for the actual cutting operations to such an extent that quantity production at the present time is more a question of rapid handling and setting of the work than cutting down the time of tooling. On account of the irregular shapes of many component parts of mechanical appliances it would be very difficult, if not economically impossible to perform the necessary machining details without the use of supporting fixtures.

The imperative need of standardization and interchangeablity in present-day manufacturing, aside from the demand for increased output, is another reason why adequate shop facilities are necessary for assuring uniform and accurate product. These are essential requirements in all modern production schemes.

Handling Work Speedily

As the handling of the work is a very vital factor in the problem of quantity and quality production, the feature of speed in the manipulation of a work holding fixture is extremely important. Next to the accuracy of a jig the convenience of its operation should receive careful consideration, as the speed at which the work can be located and removed from position is the key of successful production. Whenever possible it is advisable to construct a fixture so that as many as possible of the drilling operations can be performed at the one setting of the work. This insures great-

Illustrations through the courtesy of the Tool-Burt Co., and the Bausch Machine Tool Co.

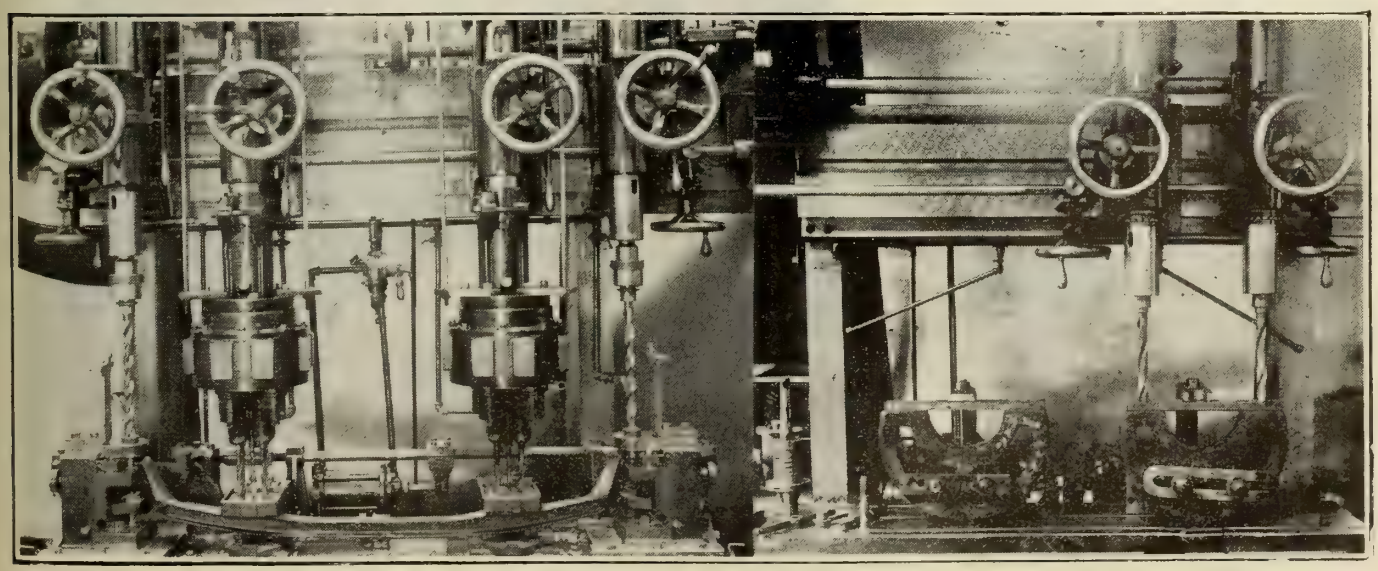


Fig. 1.—Left: Four-spindle machine drilling automobile front axles. Fig. 2.—Right: Drilling eccentric sheaves on two spindle machine.

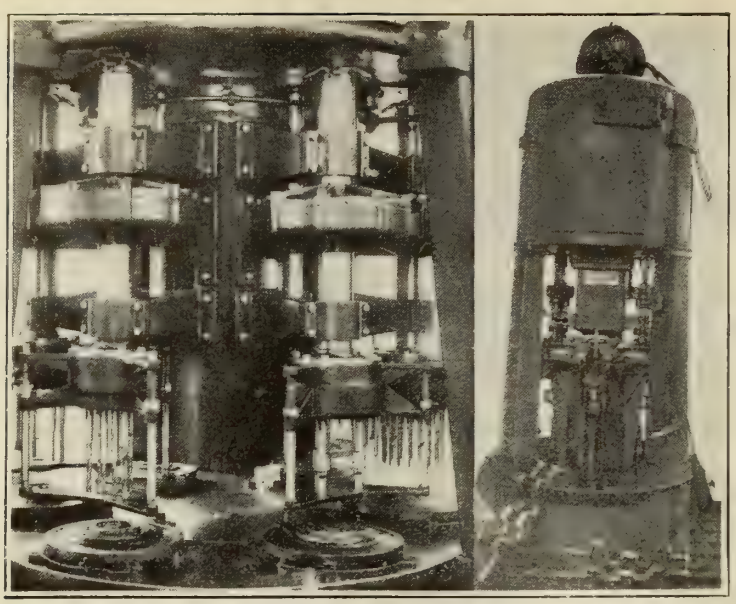


Fig. 3.—Six-station semi-automatic machine drilling automotive fly wheels.
Fig. 4.—Drilling and reaming holes in crank shaft flange.

er output and accurate alignment of the different holes. When it is necessary to change from one fixture to another to perform successive operations the same locating surfaces should be utilized in each fixture.

Multiple Drilling

When a number of holes are to be drilled in a piece of work and the quantity makes it permissible it is good practice to drill several or all of the holes simultaneously by means of multiple spindle machines. An operation of this kind is shown in Fig. 3. This illustrates a six-station semi-automatic machine designed for drilling, reaming, counterboring and end milling all holes in an automobile fly wheel. The production figures on this work are one complete wheel in 58 seconds with one operator. Fig. 4 illustrates a similar machine adapted for drilling and reaming six holes in the flange of a crank shaft. The production time with one operator on this machine is approximately 70 shafts per hour.

When it is desired to drill two or more holes at fixed centres in the one piece of work, or where two similar parts may be drilled simultaneously, the multiple spindle machine proves ideal in performing the necessary functions. An operation of this character is shown in Fig. 1. This shows a four-spindle independent feed drilling machine working on automobile front axles.

The centre heads are regular No. 4 independent heads fitted with five spindle adjustable auxiliary drill heads for spring pad holes. The end heads are regular No. 17 heads with the exception that they are fitted with hand facing attachment through bevel gears, this device being operated by a handwheel shown in a vertical position on the outside of each head; these head spindles are also fitted with ring operated quick change collets making it possible to change from drills to reamers without stopping spindle.

In loading this fixture the two end clamping slides are brought in place and as they are equalized the axle is centered accurately endwise and the V jaws provided in these slides also bring the axle up central sidewise; this will mean that irrespective of the amount of shrinkage variations in the axle forgings the king bolt holes will in all cases be drilled central with the king bosses; these clamping slides are operated by means of an air cylinder and the axle is clamped securely and quickly by this method. The small lugs at the top of the angle plates on each slide are used for spotting the end spindles so as to bring each spindle into alignment with the centre of the drill guide bushing. A production of 12 front axles per hour completely drilled and reamed is obtained.

Eccentric Sheaves

The advantages of this machine on front axle drilling work, connecting rod drilling and other automotive production operations, is apparent. This class of machine is also widely used for railroad shop work. Fig. 2 illustrates the drilling and tapping of two eccentric sheaves. In this instance it will be noted that the two sheaf sections are clamped to a common angle plate the vertical face of which is in the same plane as the cross slide of the drilling machine. The two drill spindles move in unison from one position to the other so that the same centre distance is maintained for all pairs of holes. While drilling is being performed on one piece the other is dismounted and a new one placed in position.

The Bausch Machine Tool Co. make a four-head horizontal drilling machine especially adapted for drilling all the holes simultaneously in automobile transmission cases. All spindles in the heads are driven from one motor shaft, the motor being located at one end of the machine. Special facilities are provided for drilling angular holes.

Drilling Harvester Parts

An interesting drilling operation is shown in Fig. 5. This illustrates the drilling of twelve holes in long pieces of pipe used in connection with harvesting machinery. The drill press is equipped with individual heads so that the spacing of holes can be varied at will. The work holding fixture is semi-automatic; in operation a movement of the lever A ejects the finished work at the same time moving the waiting pipe B into drilling position beneath the drill jig bushings, the spindles running continuously.

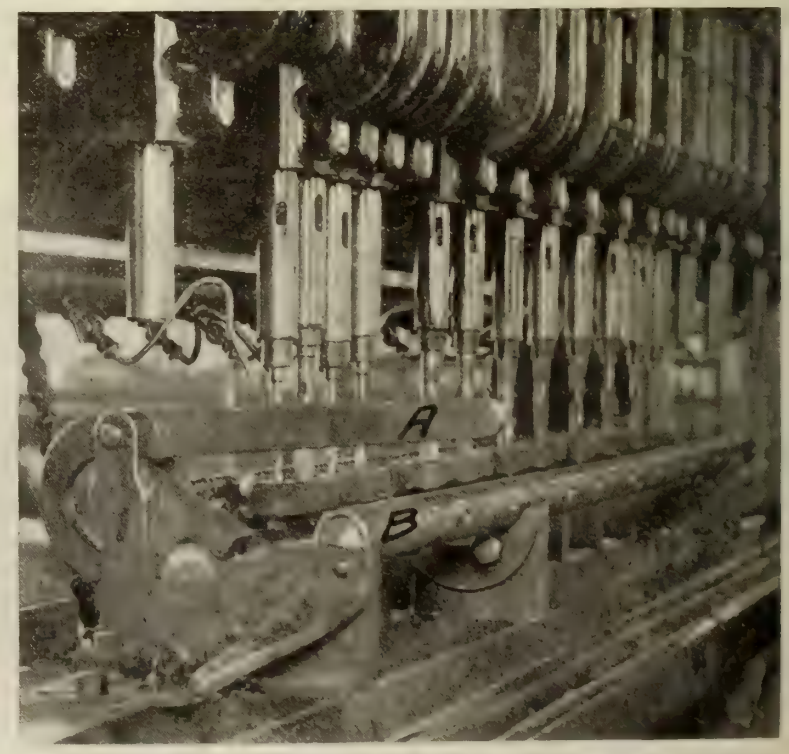


Fig. 5.—Drilling holes in pipes for harvesting machines.

Predicts Upswing in Machine Tool Markets

Dealers Optimistic as to Fall Business—Better Movement Reported in Some Quarters—DeBrul's Conviction That February and March Will See Return of Activity—Bases Observation on Pig Iron Production—Seven Year Period Between Depressions

F. F. BARBER, of F. F. Barber Machinery C., Toronto:—"Demand for machinery continues to be more or less spasmodic, but occasionally there are bright spots which encourage the conviction that things are getting better. We look for marked improvement next season."

J. C. Blair of Alfred Herbert, Limited, Toronto:—"It is encouraging that the Canadian machinery market, passing through a somewhat difficult period, is showing signs of betterment. Some machinery is being bought and as is generally the case in such movements, much of the business is coming from smaller manufacturers who are in a position to adapt their plants more easily to the demands of the occasion. I think we may now confidently expect a steady trend to more favorable conditions."

John Ferguson, Toronto office, John Bertram & Sons Co., Dundas, Ont.:—"For heavy equipment, such as we manufacture, there appears to be a better feeling in the market. Some machinery is moving, but you must consider that the month of August is generally dull in all departments. It is my opinion that the coming fall will see marked improvement."

F. W. Evans, Canadian Fairbanks-Morse Co., Toronto:—"Having concluded a survey of some of the more important cities and towns in Ontario, I will say there is every reason for optimism. The general tone is better, and while the demand for machinery is, of course, not what it should be, there is encouragement for aggressive work. Business in supplies maintains a gratifying level."

Wm. Garlock, Garlock Machinery, Limited, Toronto:—"The best that can be said is that the sun is shining in spots. It is a difficult time of year to pass decision upon conditions as a whole. We are all looking forward to much better business this fall. If it doesn't come then, why we will look forward to January, February and March. Hope springs eternal and I will agree that this is the time for optimism. The future looks bright and in the meantime we are all getting business, especially in the wood-working department."

T. A. Hollinrake, A. R. Williams Machinery Co., Toronto:—"Apart altogether from any sign or indication upon which to dope out the actual return of prosperity, my practical experience is that it is on the way. Machinery orders being received indicate that the country, industrially, is feeling better. When the movement may reach the peak, I cannot venture an opinion. Business is moving in the right direction."

T. H. Watson, president Canada Machinery Corporation, Galt.—"In my opinion, Mr. DuBrul's prediction that February and March next should see a return of activity in the machine tool business, sizes up the situation correctly. Everybody is ready to go. Crop prospects are favorable and that means much. As soon as present industrial troubles are washed out, industry and business generally should go ahead. I have just returned from the Maritime Provinces and there is great optimism there. All signs are encouraging."

H. W. Petrie, of H. W. Petrie, Limited, Toronto:—"Such conditions as these through which we are passing are, in my experience of 51 years in the machinery business, but resting points to prepare industry and business generally for problems of the future. I think I may say that every seven years, on the average, there have been recurrences of good and poor business conditions, and I have observed that almost every recovery is marked, first, by activity in the building industry. A machinery builder would, of course, be more inclined to regard movements in pig or steel. But the great point about it is that it always comes back, and I think we may safely say that it is now on the way."

There is remarkable unanimity in the foregoing statements with reference to the future of the machine tool market. They indicate that the optimistic period in the cycle has arrived. Anticipation is taking the place of apprehension, and with a future that looks well, and promises much, the long awaited upswing will gradually work its way into consideration. There is some fine philosophy in the observation of H. W. Petrie to the effect that "prosperity has always returned," and that these slumps, "heart breaking" as they may be to some and disastrous as they are to others, seem but stages when industry may pause temporarily to fit itself for better work, and broader perspective, if not for more thorough consideration of and adaptation to new or changing conditions. Even Babson, economist and statistician, states in a recent letter, that "for the first time in over two years he felt justified in talking optimism. From now on we shall be on the home stretch. We have reached the turning point in the business outlook."

Upswing Early in 1923

That the turn has been made and that an exhilarating change for the better is approaching, is the keynote of the August letter of E. F. DuBrul, Cincinnati, general manager of the National Machine Tool Builders' Association. As a close student of cycles and their attendant influences and results, Mr. DuBrul's opinions carry much weight in the industry which he represents. He considers the situation as affected by seven factors, namely, demand, capital, labor, material, fuel, transportation and equipment. In his summary it will be noticed that he adopts, as a reliable guide, the movement in pig iron and shows that machine tool demand develops its best stride some twenty months after low point of production is passed. On this basis, activity may be expected by February or March next. The summary, which, it must be remembered, comes from the heart of the American machine tool industry, follows:

Demand.—Now is the time to watch the signs. In previous cycles pig iron production generally reached the peak of the preceding cycle about twenty months after the low point, and not much before that time did the demand for machine tools become brisk. According to this past history, demand for machine tools may be expected to be active by February or March of 1923.

Capital.—Funds should be ample for the next year or two. The facilities for inflation are greater to-day than they were in 1919. The present cycle may easily develop into a relatively short period of sharp activity, with high prices and low production.

Labor.—Labor shortage is now apparent. Short labor supply creates demand for machinery of all kinds, and increases the activity of management in devising cost cutting plans, including labor-saving machines. The machine builder faces high costs, due to high wages and the necessity of training new crews.

Material.—The coal and railroad strikes are causing restriction in the supply of material. Prices of iron and steel continue to increase. All signs point to a continued upward movement in the demand.

Fuel.—Continuance of the coal strike coupled with the railroad strike make very short supply of fuel. In spite of efforts at stabilization, prices have gone up and will surely be high in the fall

Transportation.—The shopmen's strike is curtailing production in many lines. There will undoubtedly be a car shortage this fall, with delayed shipments and a repetition of the transportation demoralization that we had early in 1920. This will make for high prices generally.

Equipment.—The equipment factor is not limiting production at this time. However, with the growing shortage of

labor, the equipment factor will begin to become stronger each month, and should be reflected in machine tool orders.

Dealing with phases of demand, Mr. DuBrul continues: The whole world has been very sick, economically speaking. The convalescence takes time and cannot be hurried. General business is still very far below normal, but the period of optimism is under way.

Students of the cycle well know the optimistic and pessimistic stages, and they well know that when in the progress of the business cycle prices are going up, sellers and buyers are found co-operating to put them up further, so also when they are going down there is a similar co-operation.

All indexes of demand, price and production, indicate that the present cycle is definitely on the upswing and we have entered the period of optimism. Certain effects of the labor, fuel and transportation factors now combine to make higher prices, and as usual buying will be stimulated because it is merely human to buy on a rising market instead of on a dead market.

Demand for Machine Tools

Machine tool demand responds to the upswing considerably later than other demand, so that the concerns that have been able to survive the "heart-breaking" slump ought soon be in a position to begin the exhilarating rise on the upward swing.

In anticipation of the rise it is well for members of the association to review their experiences in some previous depression, notably 1904, 1908, and 1911.

1904.—The low point in pig iron production was reached in December, 1903. Machine tool demand did not become brisk until July, 1905—about twenty months after, when pig iron production got well past its previous peak.

1908.—The low point of pig iron production was reached in January, 1908. It did not reach its previous peak until September, 1909, or about twenty months after the low point was passed. The machine tool builders did not reach full activity until about October, 1909.

1911.—The low point of pig iron production was January, 1911. It did not reach the previous peak until October, 1912, or twenty-one months after the low point. Machine tool demand did not fully occupy the plants until about that time.

1914.—A low point was reached in pig iron production in January, 1914, but when the war in Europe broke out this cycle was complicated, and a still lower point was reached in December of 1914. Curiously enough, however, the previous peak was passed in October, 1915, again about twenty months after the January, 1914, low point.

If the present cycle runs true to form, then the low point having been reached in July, 1921, the previous peaks attained during the war would be reached somewhere near February or March of 1923, and we could expect the machine tool business to be very active by that time.

War Accentuated Cycle

It is interesting to note that the war merely accentuated the cycles, and that the seven year interval between depressions came on in 1921, almost according to schedule. The machine tool builder can get plenty of warning of activity, and can make his preparations accordingly if he will watch the signs. The indexes of capital accumulation have always checked in closely enough for all practical purposes in making forecasts in the machine tool business. Although the world's situation as to capital, and the labor situation in the United States, coupled with political movements, make one more cautious, it looks as though humanity is going to run true to form; perhaps a little slow, but finally getting around in about the same way as usual.

Close attention to the signs of the times for the next few months ought to be very well rewarded. The chances are that we may have a relatively short, sharp activity, somewhat inflationary in its nature, and for that reason one that must be watched closely if this industry is not to again get stuck with a lot of inventory, accumulated at high costs just as the demand is sliding out from under it. Conditions being created by the fuel, labor and transportation factors seem to be very likely to bring this sort of cycle about.

Labor and Material

Mr. DuBrul adds:—"The labor situation has a double interest for the machine tool builder. On one hand, demand for his product must soon become evident, and as shown by our barometer figures this demand is now on the way. On the other hand, the scarcity of labor and the high cost that the machine tool builder is bound to face, due to high wages and the necessity of training a whole new crew, makes the labor factor a very important one for the machine tool builder to take count of, in making his price.

"The railroad and coal strikes, by decreasing production, are sure to increase prices just as in 1919. A period of rising prices could develop into a period of inflation based on high profits and fairly low production, rather than a period of prosperity based on heavy production and low profits.

"All indications are that when the strikes are over there will be a continued upward movement in the demand for iron and steel, and perhaps also in the price. It does not pay to become panicky and to throw all the orders into the market at one time, but a forehanded man will make reasonable provisions with responsible suppliers who will meet their contracts. There will no doubt be a pressure of demand as a result of the supply being shortened by the strike, and the longer these strikes last the greater will be that pressure.

"The shortage of industrial equipment is not yet a marked limitation on production in any line of business at this time. However, with the growing shortage of labor relative to general demand, the demand for high production equipment will come on stronger each month and will be reflected in machine tool orders."

MACHINISTS IN ANNUAL PICNIC

There was a record attendance of about one thousand at the annual picnic of the International Association of Machinists, district No. 46, in High Park, Toronto, Aug. 12. Five lodges were represented namely, Leaside, No. 1252; Junction, No. 371; Toronto, (contract men), No. 235; Brassworkers, No. 1,301; and automobile lodge, No. 772. The program of sports comprised events for the children as well as grown-ups, and there was a baby show in which the entries formed a particularly fine representation of oncoming Canadians. Joe Bannon, C. P. R. roundhouse machinist, Lambton Mills, carried off a special cash prize as the member having the largest family on the grounds. When the Bannons mustered ten on this auspicious occasion they stifled all competition. No mean task was assigned Mrs. J. P. Crompton and Mrs. Wm. Williamson when they took charge of the refreshments. Fifteen hundred ice cream cones, 15 gallons of ice cream, 24 gallons of tea and 18 gallons of milk were accounted for, besides much else, and after that the picnickers were photographed, forming a happy, prosperous looking group. During the afternoon, the labor situation was discussed by Harry Harper, Toronto, and H. Kerwin, Montreal grand lodge representatives; R. J. Tallon, president of division No. 4 railway employees, Montreal, and Mrs Singer, national vice-president, Ladies' Auxiliary, Toronto

DANGER IN PULVERISED COAL

Careless handling of pulverised coal has caused a number of fires and explosions, and it is desirable that where pulverising is adopted the unit system should have preference. Pulverised coal in bulk is not particularly dangerous, but hazard occurs when the dust is raised in the form of a cloud. In the unit system the fuel is pulverised at or near the point of use and delivered from the pulveriser in a stream of air directly into the furnace by means of a fan which is a part of the pulveriser. This system eliminates the dangers incidental to a central system, involving storage, piping, etc. A great source of trouble to users of pulverised coal has been due to fires in storage bins. There can be but little doubt that spontaneous combustion plays a large part in the origin of these fires. All storage bins and furnace bins containing pulverised coal should be as far as consistent with operating requirements from furnaces and away from open lights and flames. Motors of the non-sparking type, preferably squirrel cage motors, are the nearest explosion-proof motors now available. All machinery should be thoroughly grounded to prevent sparks due to static electricity.

Efficiency of Various Types of Belts and Lacings

Constructional Features of Different Materials—Choice of Belts for Power Transmission—Conditions Often the Governing Factor—Advantages of Steel Belt Lacing With Alligator Hide Pin

THE purpose of a belt drive is to carry a certain amount of power from one pulley to another. Therefore the problem that confronts the belt user is that of determining the kind of belt to purchase in order to secure the desired results. The amount of power transmitted will depend on the velocity at which the belt travels, the tension under which it is placed on the pulleys, the arc of the smaller pulley with which the belt is in contact and conditions under which the belt is used. There are several different types of belts, all of which have considerable merit. Some are more adaptable to certain conditions than others and considerable care should be exercised in making a choice. Regardless of the kind of belting to be purchased it is essential that certain facts be known before an intelligent decision on any belting problem can be reached.

It is always advisable to supply the manufacturers from whom belting is purchased with complete details and allow them to advise you from the viewpoint of greater and more practical experience. No thoroughly accurate decision bearing on the purchase and use of belting can be arrived at without the following information:

(1) Horse power to be transmitted: (a) average; (b) least; (c) most. (2) Diameter of driving pulley. (3) Diameter of driven pulley. (4) Number of revolutions per minute made by one of them. State which one. (5) Distance between pulley centers. (6) Whether drive is vertical or horizontal. (7) Whether the tight side runs on top or underneath. (8) Operating conditions such as dampness, fumes, flying dirt, changes from light to heavy load; high speed over small pulleys; running at quarter twist; use of idlers, mule pulleys and stepped or flanged pulleys.

Compiled from material supplied through courtesy of the Flexible Steel Lacing Co., Chicago, Ill.

However, certain types and sizes of belts have been proven thoroughly satisfactory and are known to be standard for many uses. Belting salesmen and many dealers can tell you accurately what these standards are, based on your requirements of horse power, use, size of pulleys and working conditions. Many belting salesmen will be found to have an excellent knowledge of belting installations, even on the most technical and unusual points and they will gladly work out knotty problems with you in connection with your purchases of the beltings they recommend. It is confusing at times to learn from salesmen of different kinds of belts that each type seems to fit your requirements perfectly. But in many cases the interchange of types is possible. Your guide as to the class of belt will have to be founded upon a knowledge of good usage, of cost per year and of working conditions. It is as a guide to a good choice that the following information has been prepared.

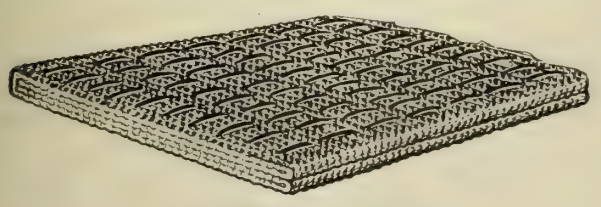
Fabric Belts

Fabric belts can be divided into three general classes. (a) Solid woven cotton, camel's hair, or other fibrous material (usually impregnated with a waterproofing compound). (b) Stitched canvas. (c) Rubber or balata which are composed of several plies of cotton duck cemented or vulcanized together with the tropical gums, giving them their name. There are numerous plies, weights and forms of weaving and stitching. Several varieties of American and imported cotton fibres are also used in the fabric base.

Cotton is the material of general use in making woven and stitched belts. There are two general methods used in making. The more common is the combining of several layers or plies of cotton duck. These plies are sewed or stitched in various patterns to increase the tensile strength and prevent excessive stretching of the material. Various weights of duck are used and in purchasing it is advisable to know exactly the weight of the material, the kind of cotton used and the methods of weaving. Even then the specifications may be so confusing that the best method is to place dependance on the recommendations of a manufacturer whose name and product are well known and of proper worth. The solid woven belt is produced from a special yarn of cotton or other fibre woven into solid belt in somewhat the same manner as a lamp wick. The different makes of this type vary considerably in the weave and method of manufacture, but all possess a homogeneous body produced in widths and weights proportioned to the service required. In both methods of manufacture the material is specially treated to withstand friction. dirt, atmospheric conditions, etc.

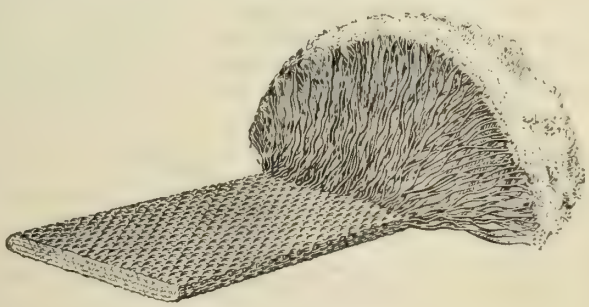
Rubber Belts

The construction of rubber belting consists of a backbone of cotton duck which is specially treated with rubber compound. Crude rubber is obtained from the Hevea tree, which grows in nearly all tropical countries. It yields a milk-like fluid that thickens and becomes dark upon contact with the air. The rubber gatherer prepares the fluid for market by pouring it over a stick and turning it around in the thick yellow smoke of burning palm nuts. This smoking process imparts a tough, tenacious quality to the rubber. As each layer hardens more fluid is added until the ball is about twelve inches in diameter. The balls are then split for shipment. Methods of preparing the rubber compound and applying it to the duck

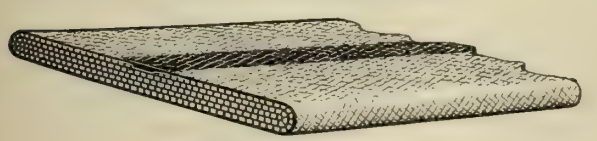


STITCHED CANVAS

Section of stitched canvas belt.

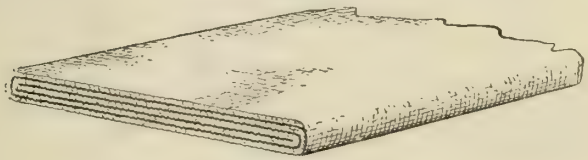


Showing the structure.



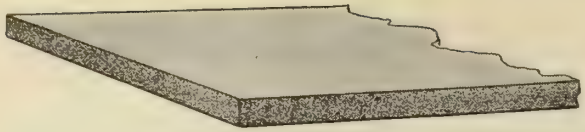
RUBBER BELT

Section of rubber belt.

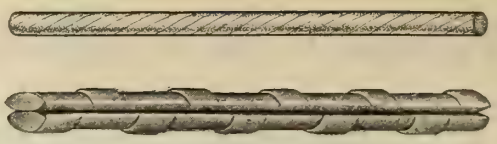


BALATA BELT

Section of balata belt.



Section of leather belt.



Rocker hinge pins.

base differ in method but the principle is generally the same.

The duck is inspected and tested for imperfections. All moisture is removed. The compound is applied and forced into the plies by pressure. The whole is then vulcanized under terrific pressure which removes all superfluous stretch and unites the rubber and duck into one inseparable body. Rubber belting is made in both red and gray colors.

Balata Belts

Balata belting has a canvas base or backbone similar to rubber belting. Balata is a vegetable gum that comes from the milk of a tree which grows in the Guianas.

The process of manufacture differs somewhat from rubber belting. The fabric is thoroughly impregnated with Balata gum. The outer surface is finished off with a thin coating to give it a finished appearance. The whole is welded into solidity under pressure, although it is not vulcanized in the manner of rubber belting. This type of belting is satisfactory for general transmission service, other than where extreme heat prevails.

Rope Belts

Rope belts are more extensively used in Europe than in this country. The English system employs a single grooved drive pulley from which several parallel rope belts distribute power to several places. The English multiple rope method employs several parallel ropes over grooved pulleys for main driving power. In contrast to the English multiple system is the American single rope belt. The rope is carried around the grooved pulleys as many times as necessary to gain the desired power. From the last groove in the driven pulley the rope is carried by an idler back to the starting groove in the driving pulley. In this way a continuous single rope drive is secured. Among the advantages offered by rope belts is their economical installation and their ability to transmit power to considerable distance.

Metal Belts

Plain steel band belts are used to some extent in Europe but are not employed as yet in this country, except possibly in very few isolated cases. Their principal advantages are in their light weight, their being impervious to dampness, and the consequent high speed at which they can run without any noticeable effect from centrifugal action. Belts of this type commonly run from 0.008 to 0.036 inch in thickness and in width from ⅞ in. to 8 in., and are operated at speeds up to 10,000 feet per minute.

Metal chain drives are made of flat steel links joined by pins. They are adaptable for high speed work and heavy loads and can be used to good advantage where pulleys are close together.

Leather Belting

This type of belting is efficient, and in standard grades gives long service. The wearing qualities and slight attention required have made its use general under the conditions to which it is suited. The best leather belts are from selected hides of mature steers killed in the fall. The hides of old animals have lost some degree of their flexibility, and the immature have not gained their greatest strength. For the best wide belts only a center back strip, 30 inches wide and 50 inches long, is used. As the distance from the spine increases, the stretching quality of the belting varies. For narrow belts strips cut equally distant from the spine or either side and spliced together are used, this making a belt that stretches evenly and runs straight over the pulleys. Oak tanned leather is the type most used in general work. It is light in color and firm in texture.

The best oak tanned leather is "currried" after tanning, the processing involving the working in of oil and tallow. This gives it greater flexibility and a soft finish. Ordinary oak tanned belting is not at its best when exposed to certain conditions, such as the action of water, steam, oil, heat, chemical fumes, etc., for work under these conditions leather belts should be specially finished. Chrome leather belting is one of the best for special purposes. Chrome tanning imparts qualities to the leather which enable it to be used under the most severe conditions such as excessive heat, steam, etc. Single leather belting consists of one thickness. Double belting is composed of two thicknesses of leather; the strips being cemented together. Heavier belts are sometimes made for special purposes but can only be used to advantage over extra large pulleys.

Direction to Run Belts

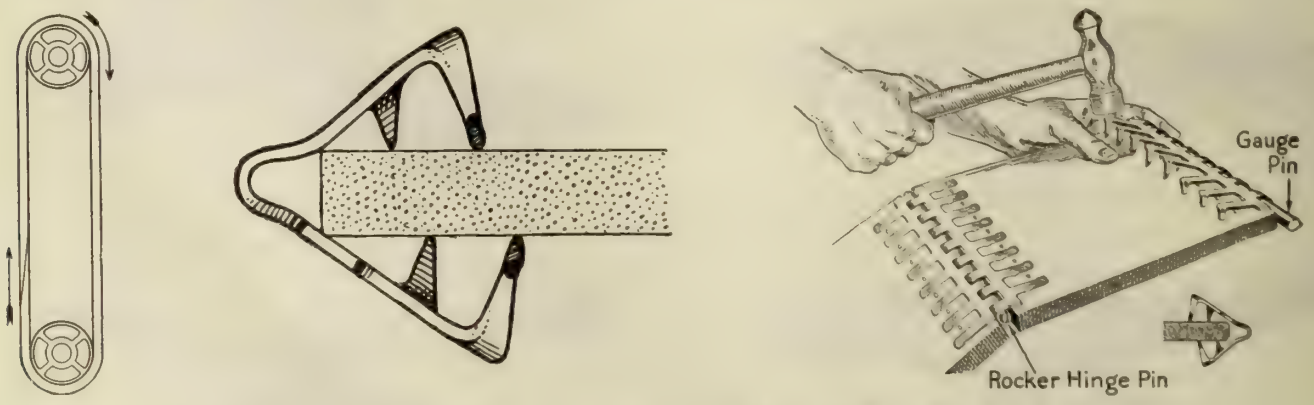
In cases where belts are spliced the belts should be run in such a direction that the thin edge of the splice on the inside of the belt should be the first part of the splice to run over the pulley.

There is considerable difference of opinion among authorities on this point and we have given the rule in most favored use. Several well known authorities assert that the reverse is preferable. The disagreement is founded on the action of the air or of the pulley surface in turning back the lap and thus causing the splice to break down.

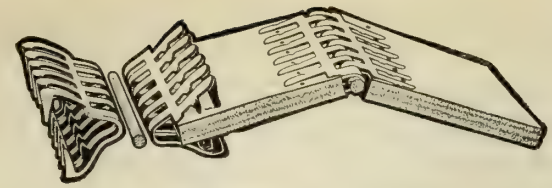
In splicing double leather belts arrange laps like the above illustration. The thin edge of the laps on both outside and inside of belt should point away from the direction of running.

Side to Run Next to Pulley

The general practice in this country and the one recommended by the foremost makers of leather belting, is to run the hair side next to the pulley since this gives the greatest length of service. On the other hand the general European practice is to run the belt with the flesh side to the pulleys, because this side grips and has better cohesion than the hair side. But belting run in this manner has a tendency to crack and



Left.—Direction to run belt. Centre.—Enlarged view of steel hinge. Right—Method of driving prongs.



The metal hinge open and closed.

split as the greatest strain comes on the close grained hair side.

Belts and Their Uses

Leather belts will render excellent service for practically every power transmission purpose except when exposed to the action of water, steam, oil, heat and chemical fumes — but action of these elements can be largely overcome by special processes of preparation if the manufacturer is supplied with information regarding these conditions.

Woven, stitched canvas and other fabric belting gives satisfactory results where exposed to moisture, or the action of weather, or where there is considerable grit and dirt. It is used extensively in elevating and conveying operations. The initial cost is comparatively low. Although this type of belt has a greater tendency to stretch than leather, constant improvements in construction are resulting in good general purpose belting that has many friends.

Rubber belting is becoming steadily more popular. Its extreme flexibility, excellent pulley grip and ability to withstand moisture and climatic conditions are its most desirable features. It is used for elevating and conveying purposes; in paper mills, brick yards and other industries where unusual conditions are encountered, as well as for general power transmission.

Balata belting has advantages similar to rubber belting and can be used under the same general transmission conditions excepting where exposed to extreme heat.

Care of Belts

Belting is one of the greatest single expense items in a belt-driven plant. To reduce this item to the lowest possible level, belts should have systematic inspection and intelligent care. **Keep belts clean.** Where exposed to dirt or dust, rub them occasionally with waste or some coarse fabric. Never let mineral oil come in contact with any kind of a belt. If oil or grease does reach a belt it should be removed at once with gasoline after which a dressing adapted to the belt should be applied to give the necessary elasticity. Where belts have become dry and hard or have stretched so as to allow excessive slippage an application of good belt dressing will help considerably.

Belt Dressing

It is always best to use a belt dressing recommended by the manufacturer of the belt on which it is to be used. We give below several short cuts to dressings which will be found satisfactory.

To clean and loosen leather belts use this dressing which is similar to that put on new belts by manufacturers.

Edible beef tallow .....2 pounds
Cod liver oil .....1 pound

Melt the tallow and allow it to cool slightly. Then add cod liver oil, stirring the mixture in one direction until cold. Apply in such quantities as the belt will absorb, using a light camel's hair brush. Neatsfoot oil improves the performance and durability of leather belting, but is injurious to rubber belting.

A few drops of castor oil judiciously used, will prove a good dressing on rubber belts.

Canvas belting can be kept in good working condition by the light application of castor or raw linseed oil at intervals. The cost of the amount of belt dressing used is small compared to the benefits to the belt. It is suggested that a dressing made or approved by your belt maker be kept on hand for regular use.

Factory Belt Room

Every establishment using considerable belting should maintain a separate room for belting repairs. It is a good policy to keep extra belting on hand for emergencies should a belt give out entirely.

Sooner or later every belt is bound to break. Usually the break occurs when it will cause the greatest loss of time, labor, material, production and expense. Various methods of making repairs have been evolved. Alligator steel belt lacing is adapted to all kinds of belting—leather, woven, cotton duck, camel's hair, rubber, balata—of every combination of thickness, width and length. It renders perfect service on all kinds of drives, whether open or serpentine—over any pulley or idler. In fact this lacing makes a perfect flat flexible joint that will go anywhere the rest of the belt goes. The joint is flat on both sides and sets flush with the surface of the belt. The double toothed jaw of the Alligator lacing grips the belt from both sides and clinches in such a manner as to secure a strong hold without weakening the belt. It is so constructed that the pull comes against the edge of the teeth—not the flat.

Only a Hammer Required

In a working time of only three minutes the average belt can be laced with this steel belt lacing. No tool but a hammer is required. No special skill or training is needed. Any one can repair a break in short order.

The double staggered teeth give extra strength to the joint. Notice how the long end teeth pierce the belt and are clinched tightly with the hammer. In damp or heavy work where other lacings pull out this steel belt lacing holds securely.

The short flexible joint insures smoothness of operation. One very important feature is the special steel rods with lugs spaced to correspond to sections in the lacing. Lugs hold them in place and oval faces form a frictionless "rocker" for the flexible joint.

The tensile strength of belting joints made with any size or kind of fastener or lacing will vary according to the kind of belt, higher results being developed with the same size of fastener or lacing on belts of firm structure as compared with those of poor quality.

TAKING THE PUNCH OUT OF SHELLS

A contract with the British Ministry of Munitions to break down all surplus ammunition in Great Britain has been undertaken by George Cohen Sons and Co. The amount to be thus disposed of is approximately 500,000 tons, and consists of all classes of material, including high-explosive shells from 15in., weighing three-quarters of a ton, down to the small pom-poms, weighing 1 lb., aerial bombs weighing 1600 lb., millions of hand grenades, and gas shells. All this ammunition has to be rendered innoxious; chemicals have to be recovered in some cases, and the steel shells have to be made absolutely free from chemicals and explosives, so as to make them suitable for the steel furnaces. Factories had to be built and equipped at Farlington, near Portsmouth; Gainsborough, Pembrey, Banbury and Creden Hill. At present, upwards of 3,000 men are employed on the work, and to date over 135,000 tons of ammunition has been completely broken down, and the material consumed by the steel works and brass foundries in the country. The Disposal and Liquidation Commission has now entrusted the firm with a further contract, and an arrangement has been made whereby it is to undertake the clearance of the whole of the empty shells and shrapnel which has been thrown up for disposal, also all the arisings from the Government depots during the next six months.

NEW RAILROAD CAR

The Great Eastern Railway of Great Britain announce that they are trying out on a branch line, a railway car so easily moved that its brakes must be kept in order to keep the wind from moving it along the tracks. The journals are fitted with a new type of ball bearing. Railroad engineers admit that it will be a great saver to power, but are not sure that it will be able to stand up against the hard usage to which it will be subjected in actual service. The bearing parts are constructed of steel hardened by a process discovered during the war.

Fine Demonstration and Display at Exhibition

Wide Range of Machine Tools, Equipment and Accessories Representing Great Variety of Industries—Rubber Goods Production Well Represented—Good Prospect for New Engineering Building—Project Well Received

EACH succeeding year, Canadian National Exhibition, which opens Saturday, August 26, attempts greater achievements not only in attendance, but in features that will still more intimately portray the agricultural, industrial and commercial growth of Canada. Each year brings closer a realization of the dream that engineering enterprises particularly in machinery and equipment of different kinds will have adequate housing accommodation and proper facilities for display. The plan of the exhibition board is to segregate industries to distinctive buildings, and many fine structures have been added within recent years. Thus the automotive industry occupies the Transportation building, and the display here will undoubtedly form one of the outstanding features of the big fair this year.

Plans have already been drawn up for an engineering building that will make old Machinery hall look like the York pioneers' cabin alongside a modern dwelling. Canadian Machinery gave a detailed description of this structure recently, and the illustration herewith is of the front elevation. The idea is to make each of these new buildings pay for itself by rental of space and a committee of manufacturers of which T. A. Hollinrake of the A. R. Williams Co., is chairman, has this department of the undertaking in hand. Already, quite a large amount of space has been contracted for. The new building will not be far from the eastern entrance to the Exhibition grounds, and is so planned as to give the best space, lighting and shipping facilities. The project is receiving enthusiastic support. All things being favorable the structure may be ready for 1923, but, in any event, not later than 1924.

This year's exhibits in Machinery hall and Industrial building of machinery and associated activities, constitute quite a representative display and there are many interesting demonstrations. Following are brief descriptions:

Anglo-Canadian Leather Co., 666 King St., W., Toronto, location Manufacturers building, represented by S. L. Lawther. Display of different grades of oak and hemlock sole leather and tap soles for shoe repair trade.

John Bertram and Sons Co., Ltd., and Pratt and Whitney Co. Ltd., Dundas, Ont., Toronto offices, 32 Front St., W. Represented by John Ferguson, T. Woods and A. Mover. Display in Machinery hall of machine tools and small tools such as reamers, cutters, taps and dies, comprising an extensive range.

Black Donald Graphite Co., Calabogie, Ont., location Machinery hall. Display of extensive range of graphite products for industrial purposes.

The Brown Boggs Co., Hamilton, location, Machinery Hall; display of tinsmiths' and sheet metal workers' tools and machinery presses, shears, etc. Represented by W. J. Graham, W. E. Blandford, A. B. Walker and F. L. Lavery.

Bond Engineering Works, foot of Cherry St., Toronto, represented by P. E. Thring; location, Machinery hall. This is an extensive display of Bond transmission equipment, featuring specially the Grundy flexible insulated coupling, together with truck castors of ball-bearing-swivel and other types. This exhibit emphasizes the various features of bond products that adapt them to a wide range of industrial purposes and includes various types of shaft hangers and bearings, pillow blocks, clamp boxes, floor stands, wall brackets, base plates and the Bond "spiro" compression coupling which is so constructed as to exert an enormous gripping power on the shaft plates and clamp couplings are also shown as well as a range of safety collars.

A prominent feature is the Grundy patent flexible coupling. The merit claimed for this equipment is based on the absence of rubber parts that disentegrate and there are no springs or screws to come loose. Of three parts entering its construction, two are metal flanges, and hence indestructible; the third part is a leather disc cemented and riveted, which, it is claimed, under normal conditions will last for years. This coupling is used wherever flexi-

Proposed engineering building to take place of old machinery hall at Toronto National Exhibition.

bility is required, while the leather disc serves as an effective non-conductor of electricity. This in many cases is very desirable. The coupling is necessarily of such accurate construction that each driving point of the flange bears uniformly on each lug. That is, each lug takes its proportion of the load instantly, so that it is thoroughly distributed and the bearing surface of the flange being so wide, there is no chance for the lugs to shear off or wear.

The Booth-Coulter Copper and Brass Co., 115 Sumach St., Toronto, location Industrial building, represented by A O. Wilson and F. P. Miller. Display of fire guns for automobiles and motor boats, brass and copper goods, brass castings, fire extinguishers and a new line of art brass goods.

The Canadian Hanson and Van Winkle Co., Morrow Ave., Toronto, location, booths 6 and 6A Industrial building. Represented by J. Elder, J. Acheson, Wm. Salmon and Wm. Whalen. Display of plating and polishing equipment including polishing wheels, buffs, buffing material, scratch brushes, Royal and Capital pickle salts cyanide, carbonate of copper and zinc, cyanide of sodium, anodes of nickel, copper, brass, bronze and zinc, also a full line of lackers and brushes and brooms for domestic use.

Clipper Belt Laces Co., Grand Rapids, Mich., location Machinery hall. Display of their various types and sizes of their belt-lacing equipment, also specimens of their work.

Cowan & Co., Galt, location Machinery Hall, represented by S. F. Barrows. Display of woodworking machinery as follows:

Power feed rip saw, 280, with variable feed; automatic knife grinder, 277, for grinding planer knives with water attachments; chain saw mortiser; belt sanding machine with rolling table, 319; vertical hollow chisel mortiser with power feed.

Crane Limited, 88 Terauley St., Toronto, location Process building, represented by E. J. Laidlaw, H. W. Ballis, J. H. Ryding and H. Tabbiner. Display of steam goods for power plants—valves, fittings, pipe bends, special flanges and other steam specialties.

Dominion Belting Company, Hamilton, location, Machinery Hall, represented by Mr. Kinrade. Display of Maple Leaf brand stitched cotton belting and belt dressing.

Dominion Rubber System, 1 Front St., E., Toronto, location Industrial & Transportation buildings. Display and demonstration in charge of J. H. Robertson and representative staff of thirty-five salesmen. Large exhibit in industrial section, demonstrating manufacture of commercial felt, rubber footwear and athletic goods, with several tableaux, having decorative background, illustrating rubber footwear styles. Exhibit also includes revolving pyramid displaying belting, hose and light mechanical goods and features, further a model shoe store. Motor car tire display in Transportation building.

Gutta Percha & Rubber, Limited, 47 Yonge St., Toronto. Locations, Industrial and Transportation buildings. Represented by traveling sales staff. Display in Industrial building of mechanical rubber goods—belting, hose, packing, mats and matting and folded rubber goods. There is also a display of rubber footwear, rubbers, athletic outing goods and heavy wear such as boots, etc., and Maltese Cross rubber heels. Transportation building has display of auto tires, tubes and accessories.

Dunlop Tire and Rubber Goods Co., Queen and Booth Aves., Toronto: location, Transportation and Industrial buildings, the former in charge of H. C. Austin, district manager; and the latter in charge of Leo Levy, assistant mechanical sales manager. Transportation display consists of tires, cord and fabric, giant pneumatics and solids for trucks, tubes and accessories. The exhibit features a mileage guessing contest, in which the central operation consists of two car wheels propelled by motor and with speedometer attachment. The wheels revolve on a surface and run for 12 hours daily. Prizes will be awarded for the 25 nearest correct guesses as to mileage covered by these wheels in the two weeks of the exhibition. The display in the Industrial building will consist of mechanical goods such as belting, hose, and the new flooring, rubberoleum, together with moulded goods, such as golf balls, etc.

The Elliott Machine Co., Belleville, location Machinery hall. Display of different types of portable woodworking machinery—planers, band saws, floor and drum sanders, scroll saws, etc.

Fisher Motor Co., Orillia, Industrial building, display of die castings, also accessories, and attachments for soda fountains and ice cream service.

Gurney Scale Co., Hamilton, location Industrial building. Display of range of heavy industrial scales for various purposes.

Ingersoll Machine & Tool Co., Ingersoll, Ont., location, Electrical building. Display of electric iron boards and equipment and also exhibit of small tools such as reamers, milling cutters, and specials.

International Nickel Co., of Canada, Limited, Harbor Commission Building, Toronto, location Industrial building, representative C. A. Richardson, sales engineer. Display of non-corrodible and rust-resisting qualities of Monel metal, as illustrated in meat slicers, water coolers, refrigerator parts, meter diaphragms, tea kettles, name plates, etc., also Monel metal castings as produced by St. Catharines Brass Works. Exhibit further includes nickel specimens in ingot and other forms.

International Business Machines Co., 300 Campbell Ave., Toronto; two exhibits located in Industrial building; represented by Allen Buddo. One exhibit consists of computing scales, bacon scales and meat slicers, cheese cutters, electric meat choppers, coffee mills and coffee roasters. The time recording machines department will be represented in an exclusive display by electric time systems, time recorders, job time recorders, elapsed time recorders, self-winding master clocks and secondary clocks.

Jones and Moon Electric Co., 296 Adelaide St., W., Toronto, location Machinery hall, represented by W. Dalton, displaying Century electric motors ranging in size from one-sixth to 60 horse power.

Lancashire Dynamo and Motor Co., 45 Niagara St., Toronto, location Machinery hall, represented by Albert Lloyd, display of standard electric motors and other electrical equipment.

L'Air Liquide Society, 16 Boler St., W., Toronto, location Machinery hall, represented by Andrew McDougall, R. Godfrey and L. Sykes. Exhibit and demonstration electric and oxy-acetylene welding and cutting apparatus. Demonstration of the use of special rods for electric welding.

D. K. McLaren, Limited, 194 King St., W., Toronto, location, Machinery hall, represented by W. S. Hamilton. Display of belting, extra C. leather and woven cotton; belt dressing, split pulleys, and a line of supplies for cotton and woollen mills, rope banding, spindle banding, picker leather, sticks, etc.

James Morrison Brass Co., Limited, 93 Adelaide St., W., Toronto, location Industrial building, represented by Arthur Betton, W. Dobbin, and J. Noble. Display of varied line of steam specialties, and standard brass goods, including boiler and engine mountings for stationary, marine and locomotive types; injectors, pressure recording gauges, engine clocks and counters and J. M. C. pressure reducing valves. The exhibit also features automatic cellar drainer and gas water heaters.

Moore Bros., 61 Nelson St., Toronto, location, Machinery hall, represented by W. F. Moore, showing two ball-bearing grain grinders such as used in shopping flour, feed and grist mills.

Northern Electric Co., Ltd., 131 Simcoe, St., Toronto, location, Industrial building, represented by B. L. Baulch, W. M. Woodward, W. Hollowell, and E. C. Coome. Display featuring telephone equipment for private automatic exchanges for industries and institutions such as hospitals. There will also be shown telephone apparatus for rural operating companies, magneto telephone equipment and fire alarm apparatus. Radio display at Prince George Hotel during exhibition.

Macauley Pope, 186 Bay St., Toronto, location, Machinery hall, represented by Macauley Pope, in a display of wire and

wire rope made by Wilkins Wire and Wire Ropes, Limited, England. Mr. Macauley states that this is the first time a British product of this kind has been shown at the exhibition. An interesting feature is a display of wire rope used on the royal yacht "Victoria and Albert," at the time Queen Victoria crossed over to Denmark for the Prince Consort.

W. R. Sexton Boiler Setting Co., 127 D'Arcy St., Toronto, location, Machinery hall, represented by W. R. Sexton in a display of "Nonpareil" shaking and dumping grates, and accessories.

Peckover's, Limited, foot of Cherry St., Toronto, location, Machinery hall; represented by C. R. Peckover, J. G. Near, G. Jolly, M. C. Rice, and J. Gefferson. Display of Monel metal castings and products, also a line of slip-roof treads and an extensive range of steel and steel products.

E. Pullan Wipers and Waste Paper Co., 6 Maud St., Toronto, location in Machinery hall, represented by W. F. Cribbs, display of cotton waste, washed and sterilized "Kleanser Kloths," wiping rags, wash cheese cloth squares and mop cloths.

Prest-O-Lite Co., of Canada, Limited, Hillcrest Park, Toronto, location, Machinery hall. Display and demonstration of welding torches and general welding apparatus, rods and other materials. Represented by Messrs. Judson, Gimble, Pollock, Northwood and Murray Leich.

A. R. Williams Machinery Co., 64 Front St., W., Toronto, location, Machinery hall, represented by Enoch Cronk, who has been with this company for 25 years and has continuously figured in their exhibition activities; A. K. Hasen, Arthur Haynes, and Clifford Toderingham. Demonstration of universal woodworking machine, and of special hardwood floor scraper and polisher. Display of machine tools and shop specialties.

Westco Pumps, Limited, Queen and Abell Sts., Toronto, location, Machinery hall, represented by J. F. S. Madden, D. B. McWilliams, C. Templeman, J. L. Johnson, Claude B. Owen, and G. L. Gardner, in a display of standard tankless water systems, equipped with dual automatic valves for hard and soft water; a one-horse power greenhouse pump; ten-horse power boiler-feed pump, oil burner pumps adapted to a wide range of pumping requirements.

Wayne Forge Machine Co., 191 Adelaide St., W., Toronto, location, Machinery hall, represented by Mr. Watson, Wilfred Bolton, and Geo. Morley. Display of industrial furnaces and appliances—heat-treating furnaces, candy furnace, , bench forge, soft metal furnace, gas soldering irons, blowpipes, Bunsen burners, gas-fired tailor irons.

Webber Machine Co., 848 Dupont St., Toronto, represented by R. H. Webber, and Roland Smith; location, Machinery hall. This display is a demonstration of the Webber cylinder grinding machine and of the Webber products for the motor car and garage trade—piston rings, gears, flywheel ring gears, axles and drive shafts and wrist pins. It is claimed for the Webber cylinder grinder that it is the only one of its kind built in Canada, and that it has had a satisfactory record in the three years it has been on the market. The machine weighs 2,500 lbs., is of sturdy construction and is meeting a demand from a growing garage and machine shop field, equipped to give efficient motor repair service.

Wyatts Products, 225 Richmond St., W., Toronto, location, Machinery hall, displaying a line of blow-off valves and other steam specialties.

Wallace Barnes Co., Hamilton, location, Industrial building. Display of springs for great variety of purposes—phonograph, motor, clock, flat steel springs of all kinds, valve and other compression type, extension and torsion springs, brush holder and special flat coil springs, in tempered steel, brass and phosphor bronze, also spring washers.

P. B. Yates Machine Co., Hamilton, location, Machinery hall, represented by Mr. Avery. Display of machinery as follows: Double end box nailing machine, nailing a box together in three strokes, planer and matcher and a G2 edging and ripping saw.

* * * *

Canadian Ice Machine Co., Ltd., Villiers St., Toronto, location, Machinery hall, represented by C. H. Bower, displaying a one ton refrigerating unit complete on one base, including three horse-power motor. This machine is suitable for butcher shops and grocery stores. The exhibit includes fittings and different apparatus in connection with refrigeration.

Canadian Link-Belt Co., 265 Wellington St., W., location, Machinery hall, represented by E. C. Burton, R. C. Turner, and F. M. Corrant. Display of various sizes of malleable chain, malleable buckets, sprocket wheels and a moving exhibit of a silent chain paradox which demonstrates the action of the joint construction in link-belt silent chain. There are also large photos of Link-Belts installations of conveyors, coal and ash handling equipment and photo of locomotive cranes.

Carter Welding Co., 165 Adelaide St. W., Toronto, represented by H. W. Carter, F. Archer and P. Sorley, location, Machinery hall. Display and demonstration of Rego welding and cutting apaparatus, welding supplies, acetylene generators and fuseon metallic flux for repairing scored cylinders of any kind, including auto cylinders and water jackets. The display also includes the "Little 6" a new low-price welding and cutting outfit for use in garages and machine shops and applicable to a great range of uses particularly in carbon moving, lead burning and radiator repair, or work of that kind in connection with a car, truck or tractor. Though the generator is of medium pressure the efficiency of the outfit is shown by the fact that either high or low pressure torch may be used. The entire display is an example of the development that has taken place in this kind of equipment and in the increasing adaptability of price to meet every circumstance. Cutting and welding demonstrations in this exhibit employ steel, cast iron, aluminum, brass and other metals. Methods employed in using fuseon metallic flux in the treatment of auto cylinders and water jackets is also shown and form an interesting section of a creditable exhibit.

Cleveland Pneumatic Tool Co., 84 Chestnut St., Toronto, location, Machinery hall and Arena annex of Automobile building. Represented by C. D. Garner, A. W. Hughes, Toronto, and R. E. Johnston, Montreal, for Machinery hall display of pneumatic tools and appliances. Featured here will be a new ball bearing emery grinder with ball bearing wrist connections on the crank shaft. There will also be a display of valves, couplings and other accessories. Of interest to the motor trade will be an exhibit of air springs for motor cars. This location is in the arena annex and representatives in charge are F. H. Burr and Mr. Wallace from Cleveland headquarters.

Delaval Co., Peterborough, location, Machinery hall. Display of centrifugal pumping equipment for steam and electric drive.

Diamond State Fibre Company, of Canada, Limited, 235 Carlaw Ave., Toronto, represented by T. E. Webster, T. J. McFadden, R. Ray and H. E. Ballard, location, booth 80A. Industrial building. This is a display of fibre in sheets, rods, tubes and special shapes and is a demonstration as to the extent to which this material is now being employed for industrial purposes, especially in the electrical, mechanical and transportation fields. The material, a high grade of vulcanized fibre, is claimed to be tougher than horn, almost as hard as iron and yet lighter than aluminum. Besides being impervious to oil or grease, it does not crack, split or break with ordinary use. It has a tensile strength of from 12,000 to 15,000 lb. per square inch, has high insulating qualities, is non-corrosive, may be secured in various colors and is employed in the automotive industry for battery box linings, brake bands, bushings, conduits for wiring, gaskets, insulators, speedometer gears, switch handles, washers, and in connection with starting, lighting and ignition systems. It has a wide application in the electrical field for bushings, cleats, commutator rings, lightning arrestors, parts for dynamos, and motors, handles, etc. In the mechanical field is is employed for brake shoes, friction straps, pinions, pulleys, pump valves, built up gears and many other purposes. In the

(Continued on page 28)

Enters Second Half Century in Machinery Business

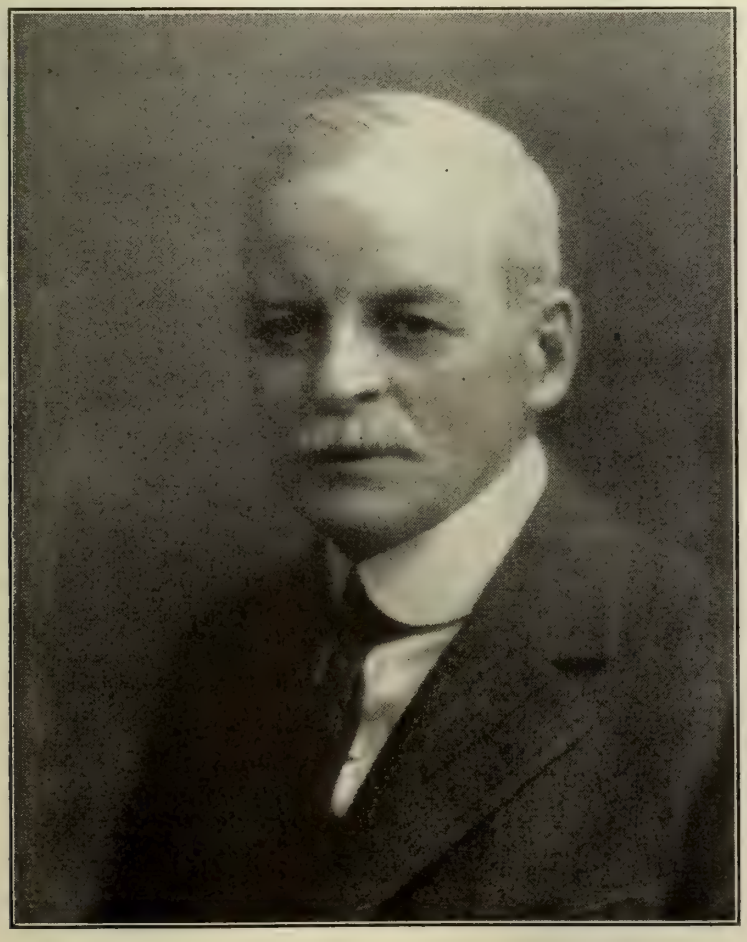
H. W. Petrie Has Carried on Since 1871—Moved from Brantford to Toronto 1890—Since 1876 Warehouse Sales Account for 37,000 Machines—Early Advertising Lists Reveal Interesting Prices—Fifty-Year Record Shows Seven-Year Cycles—Country Always Comes Back

WITH the present year, H. W. Petrie, of H. W. Petrie, Limited, Toronto, enters upon his second half century in the machine tool business. Continuously, since 1871, he has carried on. To-day the name may be said to be synonymous with machinery, and the place of business, near the Union Station, in the old Cyclorama building, may be almost regarded as one of those landmarks that gives distinctive identity to a locality. Mr. Petrie's business did not have its origin in Toronto, but in Brantford. Even at that time, Brantford was a thriving town, and prominent in its industrial roster were such names as Waterous, Cockshutt, Massey and Paterson. It was in 1890 that Mr. Petrie, seeing greater opportunity in Toronto, moved thither and leased from the city that piece of property extending west from his present building to Simcoe Street, on the south side of Front Street, and this took in the site on which the present Union Station is built. It gave him a central display station for his array of boilers and other equipment, and some of the property is used for that purpose to-day.

That New Station

It may be regarded as a notable fact, that Mr. Petrie has passed through the remarkable experience of seeing a new Union Station projected, completed and actually in use in Toronto, for the present building occupies a part of the property which he originally leased from the city. He has a photo of the foundation of the old structure, and he declares that it is his hope to live to see the day when the new building, further east, will be in actual operation. At the present rate of going he may with a great many others, think there is room for reasonable doubt.

Since 1876, there have passed through the Petrie warehouse, as actual sales, 37,000 machines of all kinds. This of course does not take in the number, which if anything would be larger, that has been delivered direct by manufacturers whom the firm represents and which would include the brisk demand of the war period. Since 1876 there have been many changes, and great developments in machinery construction in the matter of gearing, in the range of adaptability, in high speed production and in specialization, but that does not detract from the fact that the old timers were just as wonderful and just as efficient for the purposes of industry in those days as are the modern tools for present day requirements.



H. W. PETRIE
Head of H. W. Petrie, Ltd., Toronto, who this year enters upon his second half century in the machinery business.

Interesting Price Lists

In the matter of machine tool advertising, Mr. Petrie has preserved some interesting records, chief among which is a file of all lists issued between 1876 and 1899. The first of these consists of twenty-six items of used machinery, the first of which is descriptive of a soda water apparatus with marble fountain and attachments complete, offered for $240, the original cost having been $550. There is an upright drilling machine, hand or power, at $28, while an iron planer of Baldwin make, 40x7x7½, was offered for $125. This would hardly buy the metal in such a machine to-day and one of that size would bring down at least $1,000. Then there was listed "one large grocer's coffee mill" at $18, a heavy iron tackle and pair of wrought iron cranks, suitable for windlass, used but little, for $7, while a lot of sewing machine parts, needle bars, feeds, gears, crankshafts, were offered in whole or in part for what they would bring. On the removal of the firm to Toronto, the lists took the form of a catalog, running over 100 pages, each item described in small type detail, and Mr. Petrie declares that the bulk of this work was done by himself at home after hours. A few items will serve to indicate the trend of prices in those days. A new screw cutting engine lathe, 18′ x 12″ x 16″, John Bertram & Sons, was priced at $310; engine lathe, E. E. Abbott, Gananoque, priced at $300; engine lathe, all iron and steel, 7 ft. bed and 17 in. swing, American build, $130; engine lathe, London Machine Tool Co., 6 ft. bed, 14 in. swing, $135. What is now the Canada Machinery Corporation was in Mr. Petrie's earlier days, Cant, Gourley & Co., and later the McGregor, Gourley Co. The succeeding lists of new and used machinery were indicative of business

(Continued on page 36)

Montreal Firm Builds Largest Hydraulic Valve in the World

THE rapid strides made in the last ten years in the sizes of water turbine units have naturally called for similar developments in the line of accessory equipment. During the present summer there was installed at Shawinigan Falls, P.Q., a 41,500 h.p. unit, which turbine operates under a head of 145 feet, making 138.5 r.p.m. The last link in the equipment which feeds the water to this turbine is a steel penstock 20 feet in diameter. At the end of this penstock nearest the turbine, is located a Larner-Johnson valve, which is used to shut the water off the turbine, and this valve is the largest of its kind in the world. The valve was designed by the Larner-Johnson Valve and Engineering Co. of Philadelphia, and was built by the Dominion Engineering Works Ltd., of Lachine, P. Q.

Fig. 1 shows the valve assembled in the shop previous to same being shipped. The tapered part of the valve casing, shown to the left in Fig. 1, is made of cast steel, and is composed of four pieces. This section contains the removable seat on which the plunger closes, when it is wished to turn off the water. The first machine operations on this section of the valve casing are to face, drill, spot, and ream the flanges which permit the four pieces to be bolted together to form a circular piece. Fig. 2 shows this work in progress. A large duplex horizontal facing, drilling and boring machine is used. No templates were made for this work. Two of the four pieces were marked off and drilled. Then the four parts were assembled, so that a drilled section was between each section not drilled. Then the locations of the holes in the undrilled sections were obtained by marking same with a scratch awl, using the drilled sections as templates.

As soon as the sections were bolted together work was continued on a large boring mill. The end flanges were faced and the casting bored for the plunger, brass bush, and seat. Some of the principal general dimensions of the valve are: outside diameter of the casing, 23 feet; extreme length, 27 feet; inside diameter of the casing 22½ feet tapering to 13 feet at the outlet. This latter dimension is approximately that of the intake diameter of the turbine scroll casing. The diameter of the cylindrical plunger inside the shell is 16 feet. This plunger has conical ends and can be seen protruding from the casing in Fig. 1. The total weight of the valve is 150 tons and the plunger or moving part weighs 25 tons.

This valve is the largest in the world and is operated by varying the pressure in an annular space, which is located between the casing and the plunger.

That cylindrical section of the valve shown to the right in Fig. 1 is made from heavy steel plate, and rivetted to the cast steel section of the casing. This plate section is rivetted to the 20 foot diameter steel flume. Large brass sleeves line the annular chamber and guide the integral steel rings, (one on the casing, one on the plunger), that seal the ends of the annular space. Thus when the plunger moves, a contact of brass and steel is made.

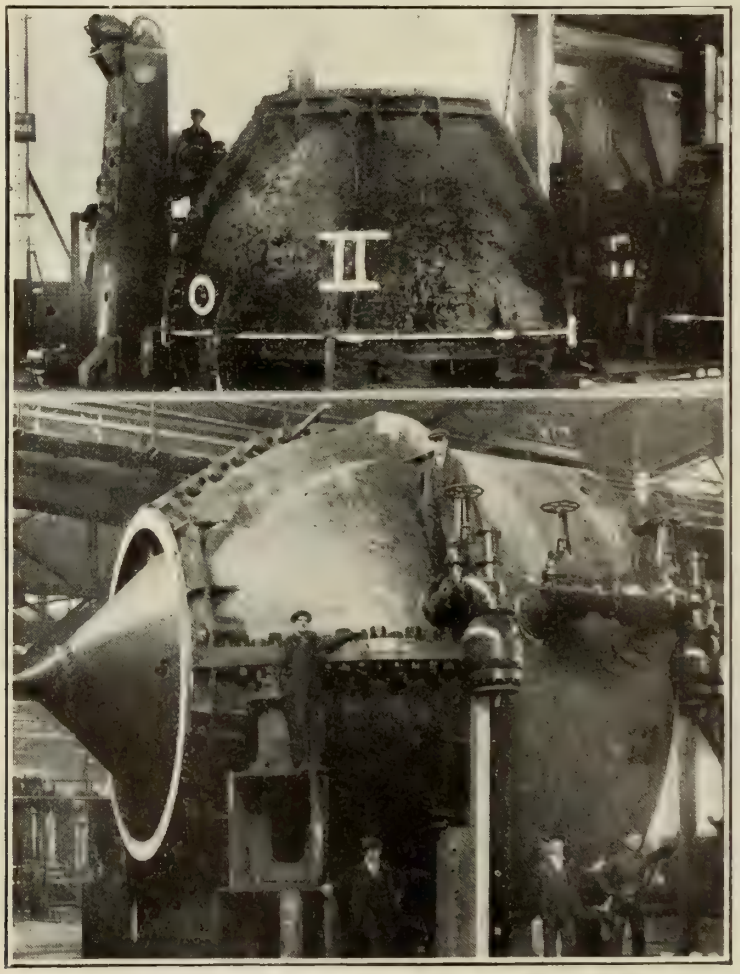


Fig. 1.—Lower: Largest hydraulic valve in the world.
Fig. 2.—Top: Machining the valve castings.

EXHIBITION DISPLAY

(Continued from page 26)

transportation field fibre appears in engine box liners, fishplates, braddock plates, head pieces, switch shims, etc., while bobbin heads, lacing combs, shuttles, spool heads, gears and thrust washers indicate some of its uses in textile machinery production.

A feature of this display is that devoted to radio parts in which another material "Condensite Celeron," a fibre which has the added quality of being waterproof, is used. This product is vulcanized fibre impregnated with condensite and hardened by heating, producing high dielectric and mechanical strength. It is used extensively in the electrical field and is particularly adaptable to radio work. Parts made from it may be punched, shaved, sheared, turned, sawed, drilled, milled, threaded or engraved and in the uncured state may be formed in special shapes. Gears made from the material will stand high speed and, it is further claimed, eliminate noise and vibration. It will take a high polish and is being employed in an increasing variety of uses.

Dodge Mfg. Co., Pelham St., Toronto, location, Machinery hall, represented by W. B. Burrows. Display of Standard Dodge transmission products as well as a complete line of samples of standard products for the transmission of power as well as conveying and elevating.

Dominion Engineering Agency, Limited, 24 Adelaide St., E., Toronto, location, Machinery hall, represented by D. M. Fraser. Exhibit of I. T. E. circuit breakers. Sunah automatic electrical control, high tension equipment, lightning arresters, etc., and other electrical apparatus.

Forged brass pump valve seats are meeting with great favor because of their density and consequently longer life. They can be made lighter and stronger and have a larger waterway, eliminating friction, thereby making a pump using forged brass valve seats more efficient.

Practical Ideas From Practical Men

BELT DRIVE ECONOMIES

By N. G. Near

Very often, when installing a new driving pulley on a lineshaft in the machine shop the problem of proportioning the driving elements, not only for first cost of installation, but for economical upkeep arises. Generally the diameter of the pulley is assumed and the width of the belt is determined by a formulae or rule of thumb. This often results in a heavy, wide, expensive belt. Since the revolutions per minute of the shaft are generally fixed, they cannot be char without altering practically the entire arrangement in the machine shop. By increasing the diameter of the pulleys, a greater lineal speed of the belt is attained. This also increases its driving power per inch of width and so will allow a narrower, less costly belt.

The writer knows a company that wanted to transmit 20 horsepower from a shaft running at two hundred revolutions per minute to another shaft thirty feet away which was to be run at the same speed. The man who had had considerable experience with belts, and who should have known better, used his "judgment," which told him that two-foot pulleys would be sufficient for the job, and on those pulleys he would use a ten-inch double ply leather belt. He struck the belt width fairly close because a good rule to follow for selecting double-ply leather belts is to allow each inch in width, running at 500 ft. per minute, to transmit one horsepower.

The peripheral speed of a two-foot pulley running at 200 revolutions per minute is 1,255 feet per minute. Each inch in width will, therefore, transmit 2.5 horsepower and a ten-inch belt would easily transmit five horsepower. This man's judgment was, in this case, on the side of safety, but his judgment was not on the side of dollars and cents of economy. "How much will it cost?" he was asked by his superior. "Two hundred and forty-five dollars," was his answer. A little figuring on the part of the man higher up who happened to be better versed in belt matters showed that by using a fifty-two-inch pulley, and a seven-inch belt, the cost would be only one hundred and sixty dollars. The eighty-five dollar difference decided the question in favor of the larger pulleys, to be sure. Of course, there is not always room for as large pulleys as extreme economical considerations would dictate but often larger pulleys may be used to advantage.

MAKING COMPOSITION ROLLER MOULDS

By Geo. Barrett

The accompanying sketch and text describes the tooling used in making steel moulds for casting composition rolls used on printing machinery. These moulds are of different sizes but the one here shown is 6 ft. x 3½ in.; bore and outside must be within .004 in. in dia., and a fine smooth finished surface. The general layout is shown at Fig. 1. The work is performed on a 24 in. by 18 ft. LeBlond lathe, fitted with a special steady rest A and boring bar holder B. The rest A is of the hinge type, having an adjustable bearing B, Fig. 2, which is raised or lowered by the sliding block attached to the screw C. The rest is clamped to lathe bed and bored in place so as to maintain proper alignment.

The bar holder B, Fig. 1, is attached to the carriage after removing cross slide. This fixture is also bored while in position, and it is split on one side for clamping the bar. The boring bar A, Fig. 3, is of considerable length and must be supported at the extreme end by a hardened steel bush inserted in the hollow spindle of the lathe head. The cutters are made on a special jig and are split in the centre, after being drilled and countersunk, for the purpose of adjusting by means of the screw A. After cutters are inserted in their proper location in the boring bar, they are held rigidly in position by the wedge B. The lubricant is hard oil and is applied to the cutters through a pipe inserted in the bar, the oil being supplied by a rotary pump attached to the lathe. The bar is also cut away at the cutting edges to provide for chip clearance; a necessary detail in getting good results on work of this character.

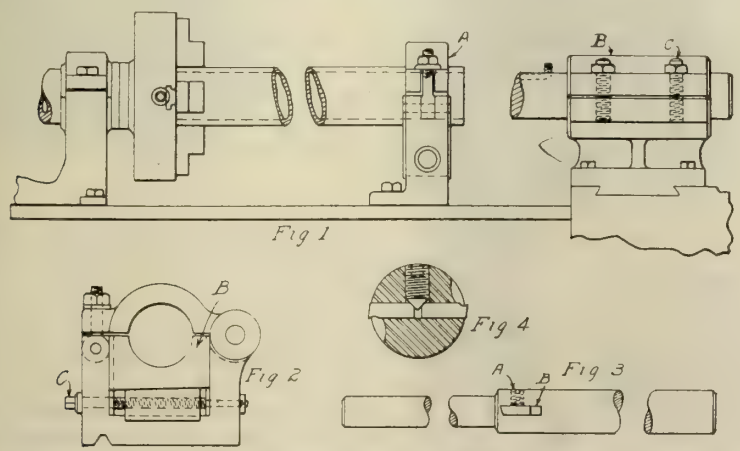
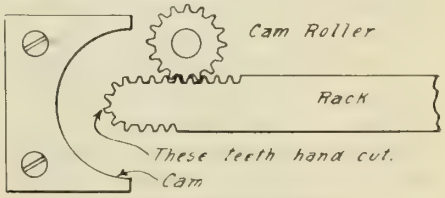


Fig. 1.—General arrangement for boring. Fig. 2.—Adjustable steady rest. Fig. 3.—Boring bar. Fig. 4.—Adjustment of cutters.

HOW DO THEY GET AWAY WITH IT?

By D. A. Hampson

One of the joys of being a machinist is the joy of service. It used to be that regularly every spring the old maid upstairs would ask you to put up the screen door for her or Mr. Murphy would come over to get you to look at his meat grinder or the people in the next block would want your opinion on



Why the teeth were broken.

how to repair the lawn mower—always thanking you very kindly. But with the coming of automobiles the field has widened immeasurably and we now get requests for every kind of service from judging second-hand flivvers to repairing carburetors—we even get invitations to go riding, couched so beautifully as to disguise the real reason which was to adjust the roadability of some unit of the car.

But not all requests are for auto service, even in these days, as may be noted from one I am going to describe which was complied with for sweet charity's sake. This time it was for service on the washing machine in the Old Folks' Home. "I thought you would like to see this machine," I was told. And before I got through I was very glad that I had had the opportunity—it was a marvelous piece of machinery, and put out by a well-rated American concern too.

Though the Home had had the machine nearly a year, they had been able to turn out only four washes, for every time they started it up a gear broke. The drive was the familiar mangle motion and "the gear" was the bevel pin-

ion that drove the rack back and forth. The matron handed me the new gear—the third replacement—and she also dug out the directions that accompanied them. These follow:

"You are to file the camm on reverse gear yourself as we are unable to do that without frame as they all veary. In filling camm be careful that you do not brake teet in gear, you may have to file gear a littel to fit camm. Cut off pin to suite roller and rivet roller must turn freeley."

Far be it from me to laugh at one's lack of education, but this was a joke indeed, coming from such a concern. Now the startling part of the whole business is not the ignorance of the poor workman who wrote on the tag intending to help the installer but the lack of engineering skill displayed in botching an otherwise good machine. All the discarded pieces had been broken in the same way—reference to the drawing will show why and how.

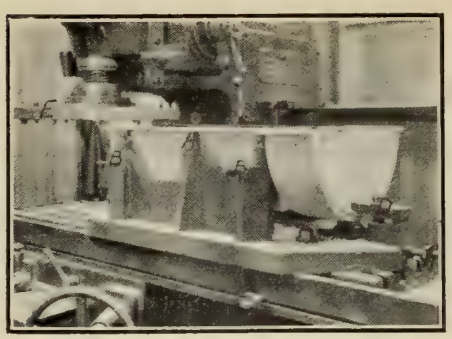
At the end of the stroke a cam encounters the roller on the pinion shaft, causing the latter to work itself around the rack and move the latter in the opposite direction—this is usual on mangles and printing presses which use this movement. However, on this washing machine, the teeth on the ends of the rack were genuine hand cut. That is why the pinions broke and that is why the bench hand in the factory laid so much stress on the shape of the cam. The pinions were cut by the planing process and the rack was nicely milled except on the ends where the workman apparently sawed and filed by eye, sometimes coming out even but more often having to decide for himself that momentous question, "shall I put one tooth or two in the space that is left?"

In this case, it was possible to file down the teeth on the rack ends, selecting the proper side, and by having slack between them and the pinion to produce a job that worked fairly well. The cam was left alone, circular, as it should have been.

MILLING THE JOINT SURFACE ON AN AUTOMOBILE OIL PAN

By Robert Mawson

The Weidely Motors Co., Indianapolis, Ind., manufacture a variety of motors used in some of the high grade automobiles built in the country. The illustration shows the tools and method used when machining the joint surface on one type of automobile oil pan. The aluminum casting is placed on three fixed pins one at A and two one the rear face which are near the outer edge of the piece. Five plunger pins as B, two on the front side as shown, one on the rear and one on each end are then brought against the casting. Those on the sides are operated with the pin headed screw, which may be seen from the illustration. The end plungers are controlled with knob screws, the screw is first slackened, a spring then forces the plunger against the casting and the screw being tightened owing to a wedge surface on the side of the plunger it cannot be pushed back with the casting and thus assists in holding it firmly against the machining stresses. A clamp at each end as D is then fastened onto the piece which holds it securely during the milling work. The fixture is located on the machine table with tongues and held down by means of bolts in the usual manner.



Milling automobile oil pan.

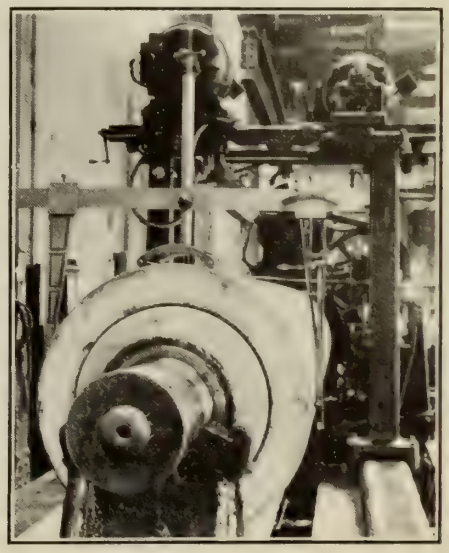
The milling operation is performed with the cutter E. This tool is fitted with cutters made of round tool steel placed into reamed holes and prevented from moving with set screws. These can easily be loosened and the cutters taken out for grinding or when it is necessary to replace them with new ones. The milling cutter is sufficiently large in diameter so that one passing across will machine the entire surface of the oil pan. It will also be noticed that the cutters are placed at a generous distance apart so that the chips will fall away from the face being machined as the surface speed is rather high which has been proved to give the best results when milling or drilling aluminums.

ACCURATE MEASUREMENT OF PAPER MACHINE ROLLS

By H. A. W.

Extreme accuracy in the manufacture of comparatively small machine shop products is very common to-day. The micrometer, the vernier, the indicator, and many other precision measuring instruments are more or less familiar sights to most machinists. All these instruments are, however, designed to be used on small parts with diameters up to six, eight or possibly ten inches.

Now modern paper machine rolls vary in diameter from 12 inches to 48 inches and in most cases diameters have to be exact to a ten thousandth part of an inch. It is also very important in the manufacture of the high grades of paper to have the rolls parallel, that is to say they must be exactly the same diameter throughout their entire length. In the accompanying illustration a granite roll in the shop of the Dominion Engineering Works, Ltd., is shown in the grinding machine with a specially constructed measuring apparatus in position to check the diameter. The bar is set at the proper height so that the contact points on the arms are at the exact height of the centre line of the roll. The arm at the left is moved in till its contact point is touching the roll. The arm at the right is then moved in, till it is also in contact with the roll. It will be noted that an indicator is provided on the right arm. The right arm is always set with the indicator pointer in a vertical position. Then the diameter of the roll is obtained. By moving the device slowly down the roll longitudinally it can easily be seen by watching the indicator if the diameter varies, and if so, in what direction and to what extent. The graduations are such that the pointer will indicate in ten thousandths of an inch.



Measuring paper rolls

In the case of the measurement of calender rolls the crown that is required on the bottom roll can be checked.

BOOK REVIEW

The Radio Experimenter's Hand Book, by M. B. Sleeper, has been prepared for the better instruction of those interested in the development of radio apparatus for experimental purposes. The chief object of this book is to enlighten the novice and advanced student on practical matters pertaining to the construction and operation of radio appliances. One chapter is devoted to the questions on antennae, both for transmitting and receiving; many helpful suggestions are found throughout the entire 16 chapters. A chapter is devoted to radio rules and regulations and includes the latest information on how your antennae should be protected from lightning and meet the requirements of the National Board of Fire Underwriters. This book is published by the Norman W. Henley Publishing Co. Price $1.00.

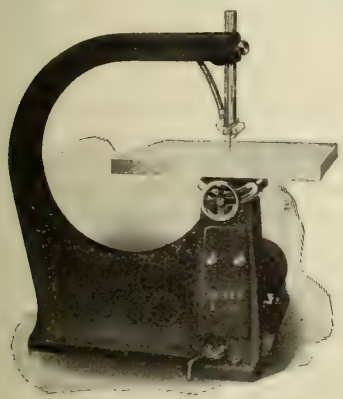
Due to the greatly improved physical qualities and uniformity of form of brass forgings it is often possible to lighten parts appreciably and still retain a higher factor of safety. This feature alone is of great importance in the construction of all apparatus where it is desired to have great uniform strength with minimum weight, such as automotive vehicles, aircraft, etc., and can be compared with the use of special alloy steels for the same reason.

New Things in Shop Equipment

SELF-CONTAINED JIG SAW

A radical departure in the design of jig saw has recently made its appearance on the market. This machine has no overhead belts, no moving parts unguarded and no tension in the saw blade. It is designed for all kinds of interior and exterior scroll work primarily on wood but other substances of course may be sawn on same. It is designed for use in pattern shops and wood-working plants of all kinds. It has a capacity operating from the front of the machine up to 36½in. between the saw and the column but the saw may be operated from the side, that is, the saw turned at 90 deg. so that work of almost any length or practical width may be sawn. The highest work that can be taken under the guide is 10in. The stroke of the saw blade itself is 3in. and saws up to 18in. may be used. All moving parts are very carefully guarded and unlike all other jig saws this saw is operated without tension in the blade so that a broken blade would not be likely to cause an accident. This is the only jig saw, as far as the writer knows, on the market, for which this can be claimed.

The clamping device below the table is automatic and the sliding block in the upper guide way provides a very rapid and convenient method for inserting the saw. There is no over balance load. This feature is unique and insures a steady, quiet running, vibrationless machine resulting in finer and better work. Saws may be turned ¼ way around operating standing against side of machine



Self-contained jig saw.

or at the front of the machine thus increasing, very materially, the length and width of stock that may be worked on this machine.

The jig saw is self contained when belt driven as well as when motor driven. All parts are made interchangeable and all bearings and movable parts are made to compensate for wear. The pitman and the cross heads are made of aluminum light in weight yet very rigid. Complete and easy control of the machine is obtained by means of foot lever located conveniently for operator. The slide dumping device in the table in front of and around the saw, with a knob on the under side, may be drawn back to permit small cuttings to drop through the table and out of the way when doing intricate interior scroll work. A continuous air blast is so arranged that a continuous flow of air is directed to the front of the saw.

The table is of cast iron strongly ri[b]bed, size 39 x 34, mounted on rockers so as to tilt 30 deg. to the right and to the left and it may be locked in any position by means of clamp screw and hand wheel. When direct motor driven, a flexible coupling is mounted on the shaft for direct connection to the motor. The speed of the shaft is 1,200 r. p. m. There are two saw guides, one above and one below the table which may be turned to permit the sawing from either front or side. One dozen assorted blades and necessary wrenches are furnished with the machine. These machines are manufactured by the Oliver Machinery Co., Grand Rapids, Mich.

GEAR DRIVE CRANK SHAPER

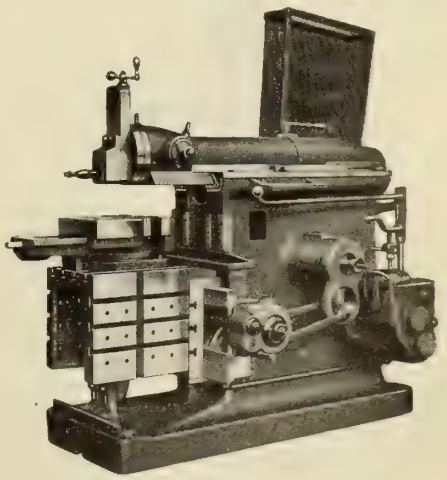
The following is a description of a gear-drive 24 in. crank shaper that has recently been placed on the market:

Advantages which the speed change gear mechanism possesses over the cone pulley drive are its application of greater and more constant power in that the drive pulley runs at constant speed with the speed changes all made through gearing, and the readiness with which this design lends itself to the application of motor drive. No countershaft is required, as the machine can be driven from the main line. The speed change gearing is carried in an oil tight box on the right side of the frame of machine, and it is important to note that the outer projections of this box are well within the dimensions of the floor space required for this machine.

There are but eight gears in the assembly, all alloy steel, properly hardened and heat treated after the manner of motor transmission gears, and are practically noiseless in operation. The gear and main drive shafts are mounted in ball bearings and the gear mechanism runs in an oil bath. Through this gear assembly four speed changes are secured, which with the regular back gears of the machine give eight speeds in geometrical progression. The gear shifts are very easily made with ball handle lever guided by slots in an H plate, and their manipulation is further simplified by the patented quick stop and start clutch controlled by long horizontal lever passing to the front of the machine, which the operator naturally handles with his left hand while making the gear shifts with his right.

The double angle cone driving clutch engages with driving pulley for power and also acts as quick brake when shifted in the opposite direction. This clutch drive is controlled by long horizontal lever at side of frame of machine. It has a very short motion and provides a quick stop and start feature to the ram which is a very important time saver in all classes of work, being of great value in setting of tools, taking measurements, etc. It also simplifies the throwing in of the back gears. Two index plates are fitted to machine, one gives the strokes per minute obtained through the speed change gearing and back gears which run 6-9-14-21-30-46-69-102; whereas the other plate gives the approximate cutting speeds in feet per minute figured for the eight different strokes per minute in combination with the various lengths of stroke of ram from 2 in. to 24 in.

The ram has a bearing of 12¼ in. by 41¼ in., and can be set in any position while machine is running, the length of stroke being shown on index. The crank pin is hardened and ground on all wearing surfaces, likewise the crank pin block. The cross feed mechanism is operated entirely at end of cross rail in all its adjustments. Feed is controlled



24-in. gear-drive crank shaper.

by a dial the graduations on which show the amount of feed. The movement of the table takes place on return stroke of ram. The power down feed operates at all speeds and a graduated dial provides for a range of feeds from .005 in. to .060 in. in steps of .005 in. The machine requires a floor space of 52 in. by 107 in. and has a net weight of 5,680 lbs. It is manufactured by the Hendey Machine Co., Torrington, Conn.

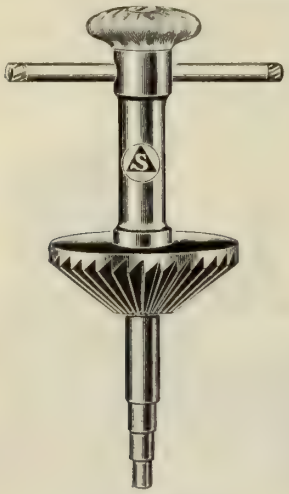
SMALL AIR COMPRESSOR

A single-stage air compressor designed especially for the small shop with light requirements for compressed air, has recently been placed on the market. This is particularly suitable for the operation of small capacity hoists, drills, hammers and similar tools. The machine is of the centre-crank, double-acting type, equipped with belt pulley and fly-wheel on opposite ends of the crank shaft.

All valves are readily accessible due to the overhang of the cylinder, which is fitted with an ample water jacket. High speed, multiple port plate valves are used. Moving parts are entirely enclosed and lubricated by the splash system. The oil is prevented from entering the compression cylinder. The gland stuffing is outside the frame and can easily be reached through the ports. The machine is built in ten sizes, the 6 x 6in. cylinder type having a capacity of 57.6 cu. ft. of free air per min., while the 18 x 12in. machine has a capacity of 748 cu. ft. per min. The compressors may be driven either by overhead belt or by motor on the same level. These compressors are manufactured by the Norwalk Iron Works, South Norwalk, Conn.

VALVE RESEATER AND GEAR PULLER

The two cuts here shown are illustrations of automobile and gas engine repair equipment that have recently been placed on the market. Fig. 1 shows the universal reseater for repairing valve



Valve reseater.

seats on practically all 45 deg. removable head motors. This pilot is one-piece and stepped off for the four popular sizes of valve stems, 3/16, ⅜, 7/16, and ½ inch. Each step is slightly tapered to insure a snug fit in the valve guide. The pilot telescopes into the handle and instantly adjusts itself to any valve seat. The large cutter can fit any job, for it tapers from ⅛ to 3 inches. It is made with extraordinary care from a high-grade tool steel. The design of this tool insures smooth, efficient service.

The cut Fig. 2 shows a duplex gear puller. The body of the tool is a malleable casting, flexible, and strong enough to withstand the severest strain to which a tool of this kind will be subjected. All bearing surfaces are smoothly machined for an **accurate fit** so that they will fully protect the gears being removed. These two tools are made by Stevens and Co., New York.

FORMING TOOL HOLDER

A specially constructed tool holder for use in lathes, shapers, planers and screw machines, has recently been placed on the market. It is claimed that it does the work of forming without chatter, will protect the cutter from breaking and prevents tearing of the work. Two holes are drilled in the cutter, one for the clamping bolt and the other to fit over a dowel for rigidity and assured alignment after grinding. Cutters of any desired forms may be kept on stock and placed in proper position in the holder at any time; no other adjustment is required. The holder is made of tough steel, the bearing surface for the cutter is parallel with the lower side of the shank. Two sizes of holders are made, one to take cutters ¼ x 1 x 1½in., the other for size ⅜ x 1¼ x 2in. These are made by the Willard Tool Co., of Stratford, Conn.

DOUBLE-HEAD LATHE

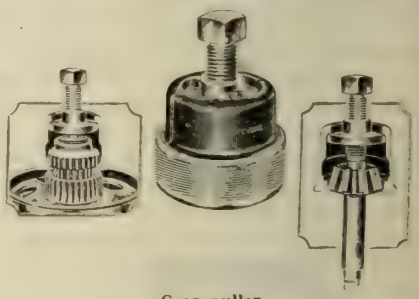
A large double-head lathe, especially designed for the turning of heavy crank shafts and long propeller shafts, has recently been developed. The bed has a total length of 76 feet, but in order to provide a capacity for shorter work, two independent head stocks are provided, one at either end; also two tail stocks and steady rests, this making two lathes in one. A head screw is fittted on either side of the bed, and on long work two sets of cutting tools may be operated simultaneously. The machine has a swing of 72 in. and two shafts 27 ft. in length can be worked on at the same time. Twelve spindle speeds are provided, all being controlled by levers at the operating side of head stock. Hardened steel gears are used on all shifting gears. A friction clutch and brake operated from the carriage or from the headstock is in the drive of each head. Carriage travel is reversed by high speed gearing. Saddle aprons are of double-wall unit construction, all gears being of steel and running in oil. Two 50 h.p. motors are used, both being fitted with automatic starters. These lathes are made by the Betts Machine Co., Rochester, N. Y.

ENGINE-DRIVEN WELDING EQUIPMENT

For the special purpose of generating electricity for welding operations where local power is not available, a self-contained power unit operated by a gasoline engine has recently been developed and placed on the market. The unit consists of a single-operator welding generator geared to a Doman four-cycle, two cylinder, low speed, marine type, gasoline engine. The generator is rated at 175 amp. with a maximum capacity of 225 amp. at 1,750 r.p.m. The unit is especially designed for welding operations so that it is easy for the operator to strike and maintain the arc and likewise to obtain the deep penetration and thorough fusion required for welding. The generator shaft is connected to the exciter by means of a flexible coupling. The cylinder block and removable head is made of semi-steel. The control panel is mounted directly over the generator on an angle iron frame. The outfit is made in both stationary and portable models. They are built by the Westinghouse Electric and Manufacturing Co. of Pittsburgh, Pa.

MULTIPLE-SPINDLE DRILLING MACHINE

Several improvements have been made to the multiple-spindle drilling machine recently developed by the Fox Machine Co. of Jackson, Mich. These changes include the installation of a "Little David" air motor for elevating the drilling head, an interlocking device that prevents engagements of feed gears while air motor is operating. A rotary table has also been fitted to the machine, and the base has been extended to allow for the placing of a motor for individual drive. The drilling head diameter has also been increased from 20 to 25 in. It is possible to index the table for station drilling. The table is elevated by means of a foot treadle while moving to next position



Gear puller.

and is automatically released and lowered to position when proper point is reached. Table revolves on ball-thrust bearings when in a raised position.

BOOK REVIEW

Construction of Radiophone and Telegraph Receivers for Beginners, by M. B. Sleeper, is the title of a new book recently issued by the Norman W. Henley Publishing Co. Those interested in this science can follow the data in this volume in full confidence because each unit of apparatus described has been thoroughly tested and found efficient before the final design was accepted. Regenerative circuits as well as audio and radio frequency amplifiers are described and illustrated by clear photos, diagrams, and working drawings prepared especially for the novice and the man who wants to receive what is being sent out from broadcasting stations. The treatise is prepared in 18 chapters. Price 75 cents.

CANADIAN MACHINERY
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Consumers and Coal Problems

RECURRING coal problems generally reveal the fact that a surprisingly large number of industries neglect to cover their requirements against emergency, even to a reasonable extent. Expectation that better prices may be available is one of the main reasons for this short sightedness, while on the other hand, not a few plants have inadequate storage facilities. Nevertheless, all this contributes to undesirable conditions at the mines and in the handling and transportation of coal. Trouble in the coal fields is very often the result of an accumulation of problems, many of which work back to the consumer.

Discussing these matters, an authority declares that "coal miners are lying around the mines all summer waiting for jobs. It isn't the fault of the miner but the fault of the consumer who does not order coal until the snow flies. The railroads have their tracks full of empty coal cars all summer, and if they were to have enough coal cars to handle the demand when the heavy consumption is on, they would have to have a lot more cars lying around and a lot more side tracks to hold them. Very few industries have enough room for coal storage. They make contracts for a continuous supply, and that is a mistake. The industries of the country ought to supply more coal storage somehow either on their own grounds where they have ample space, or make it an object for coal dealers to have good size storage yards which could be loaded up beginning with February, by which time the demand is off."

The same authority discussing some of the causes contributing to high prices, points out that the so-called "snow-bird" mines complicate the situation for the regular operators, because under transportation laws they are entitled to get cars according to their shipping ability. These mines only operate when the spot market is very high. They have no contracts, but when panicky buyers go into the market and bid high prices, the "snow-bird" fellow goes to the other mines and takes the labor away from them at bonus rates, until he has all the men he can use. Then, the contract operator, finding his production cut down, bids his men back again at a still higher rate to be able to fill his contracts. There is no reason to think that this same thing will not happen again this winter with all the conditions framing to bring it about.

Thus does so-called human weakness create conditions, but the consumer does not always realize the extent to which he is an important factor in the situation. Canadian buyers, naturally, feel this responsibility, situated as they are at considerable distances from the source of supply, but emergency calls in a market that has "hair-trigger" tendencies certainly do not make for stable conditions.

Wage Rate Differences

SOME SPECULATION was caused among railway shopmen recently when pay cheques failed to arrive on the regular date. It appears that cheques had been made out at the reduced rate of 70 cents an hour, but in the opinion of the Department of Justice such reduction was contrary to law pending reference to a Board of Conciliation. The railways held a contrary view and Premier King urged that the opinion of the Department of Justice should stand in the meantime. The railways have, therefore, rescinded the wage reduction and reverted to rates of pay effective prior to July 16. It is reported, however, that men who for various reasons, have ceased to be employed by the railways since July 16, have been paid off on the 70 cent basis. This is a matter which may also have readjustment.

Enquiry at machinists' headquarters in Toronto shows that skilled craftsmen are fairly well employed with very few idle. Quite a number refuse to consider employment on former jobs under present conditions, claiming they can do better at other employment. There appears to be great variety in wage rates recognized and paid on various contracts and by institutions in Toronto at the present time. One motor car plant interviewed, stated that their rate ranged from 60 to 65 cents an hour; another intimated that they were paying 75 cents for the best men; the Toronto Transportation Commission is paying as high as 81 cents, while at the University of Toronto, on certain experimental work requiring high class men, as high as 87½ cents is the rate. Reports from outside places indicate wages for machinists as low as 45 cents an hour. While employers are of opinion that in larger centers there may have to be further reductions in wages, it is claimed on the other hand that the supply of skilled men is gradually falling below the demand. The assertion is made in well informed quarters that few, if any, competent all-round machinists have been made since 1916, that the great majority of those developed on munitions were specialty men accustomed largely to repetition work, and that industry is approaching the period when it will have to consider the training of new all-round forces. There is no doubt that technical training schools will figure to a certain extent in the solution of this problem, but not before shops will have to take a hand themselves in the development of new crews.

* * * *

So-called authority claims that widows are, as a rule, glad to regain the state of single blessedness. On the other hand, and also to the contrary nothwithstanding, Compensation Board statistics show the average period of widowhood to be about three years. Leave it to the widow.

Demand Active But Supply Has Limitations

Good Market for Structural Steel and Bars—Black and Galvanized Pipe Advances—Premiums Increasing Where Prompt Deliveries Are Required—Continued Strength in Galvanized Sheets—Situation in Montreal

PIG SCARCITY MAY BOOST SCRAP METAL

WITH Canadian producers of pig iron practically out of the market, except so far as their contracts are concerned and with transportation facilities from other sources of supply becoming increasingly difficult, a situation is developing that handicaps the increasing strength of the Canadian markets. Prices in most departments are inclined to advance, and the supply is approaching dangerous levels. Large importers of structural steel and bars to Canadian order, declare that the demand is exceptionally active, not for advance covering, but as a matter of immediate necessity, and that the shipping service is fast approaching the impossible. Even in pipe, both butt and lapweld, which has extensive use in building operations and on which prices have remained at stable figures for some weeks, there is a prospect of an immediate advance. In the American market the price is up two points on black and three points on galvanized, and this means that similar advances will have immediate application here. It does not mean much to the small buyer, but it serves to illustrate the fact that conditions are fast having effect on the entire market. In the pipe market, one point means about $1.90 per net ton.

Reports from Pittsburgh and other stock centres indicate continued decrease in pig iron and steel production. Coal receipts are not adequate to keep up reserve supplies. Meanwhile the strike has not been settled, but some operators are signing up. There is no stampede in this direction, however, and the total capacity that has come into line is far under 50 per cent. of the capacity that was formerly union. Coal storage appears to have affected steel production more than consumption. There is some pressure upon mills for deliveries and when prompt deliveries are required, premiums have increased. So well sold up are they that mills will not have to sell much steel for the remainder of the year.

As a result basis prices have had some sharp advances in bars, shapes, plates and sheets. Quotations, it is evident, have little stability, but the market does not appear to be losing its head and no charges of profiteering have, as yet, made their appearance. It seems to be a case where supply and demand are appreciative of each other's difficulties.

Montreal advices are that it would be difficult to place an order for pig iron with dealers there, unless for Scotch iron. Foundries, however, appear to be pretty well covered, but it would not be surprising to see one or two large shops in the market at an early date. Imported pig is quoted, at dock, $32.50; warehouse, $37.50.

Business on the whole continues to show improvement in Montreal. Sheets continue to be the most active feature of the market. British mills are doing some business there in galvanized sheets. Prices in all departments continue firm.

Toronto

August 23

TORONTO iron and steel markets are active, though reflecting in firm and advancing prices, the increasing difficulty of service. Few extreme cases of shortage in pig iron have developed, however, and if the worst happened it is not unlikely that Montreal sources of supply of Scotch pig iron might be tapped. Prices, however, would necessarily be on a high level basis. Summerlee pig at dock, is quoted at $32.50, and the rate from Montreal to Toronto would be in the neighborhood of $6 the ton. Conditions in the bar and sheet department show increasing problems of supply and prices are unstable and inclined upward.

Scrap metal markets as yet show little activity but continuation of the strike would certainly have the effect of boosting the price of cast iron. This at the present time is exceedingly scarce. Very little buying is being done in any department at the present time, however, and the following prices show practically no change:

Copper, light	per 100 lbs.	8 50
Copper, crucible		11 00
Copper, heavy		11 00
Copper Wire		11 00
No. 1 compositon		9 00
New brass cuttings		6 00
Red brass turnings		6 50
Yellow brass turnings		4 85
Light brass		4 00
Medium brass		5 50
Scrap zinc		3 50
Heavy lead		4 50
Tea lead		3 00
Aluminum		11 00
Boiler plate, per gross ton		9 00
Heavy melting steel		10 00
Axles (wrought iron)		20 00
Rails (scrap)		11 00
Malleable		10 00
No. 1 machine cast iron		20 00
Pipe, wrought		7 00

Prices of iron and steel bars for the present reflect some stability with the demand strong and supply not so easily available, naturally, as dealers would like. Service, however, has been fairly well maintained. The price range is $3.25 to $3.40. Sheets continue in strong demand and the prediction is made in this connection that "galvanized may go anywhere." Current prices:

Iron bars	3 25	3 40
Steel bars	3 25	3 40
Reinforcing bars	3 25	3 40
Steel hoops		4 25
Tire Steel		3 40
Spring steel		7 00
Band steel, No. 10 gauge and 3-16 in base	3 65	3 75
Small shapes		3 40
Sheets, black, No. 28		5 40
Sheets, blue ann., No. 10		4 25
Canada plates, dull, 52 sheets		5 75
Canada plates, all bright		6 00
Galvanized Sheets, No. 28		6 35

Copper and brass products are reported increasingly hard to get and this fact contributes to exceptional firmness. In the non-ferrous metals little activity is reported. Copper prices continue firm, tin has seem some remarkable fluctuations owing to temporary interruption of cable service, but New York reports a return of stability; lead is firm, and in zinc an easing of prices has been reported. There has been a decrease in consumption owing to the strike and to the increased number of retorts in operation. Current prices:

Lake copper	17 25
Electrolytic copper	17 25
Castings, copper	17 00
Tin	36 50
Spelter	7 50
Lead	7 00
Antimony	7 40
Aluminum	22 00

Montreal

August 23

ALTHOUGH the coal strike in the American mining districts has been in progress since April 1st, it is only in the last few weeks that it has had a direct influence on the local iron and steel markets. Business has been improving slowly but steadily for several months. The major portion of the material handled was for legitimate consumption, although in many instances the uncertainty of the situation brought consumers into the market to the extent of covering themselves for some months in advance. Recently when quotations advanced and the mills commenced to exercise caution in accepting new business, buyers interpreted the situation differently. Some have attempted to cover themselves, others feeling that coal and coke would not be obtainable refrained from purchasing. The result is that the local situation is rather complicated. The gross sales have dropped during the month of August to a point slightly below those of July. In past years this has been the usual action of the market, therefore there is nothing unusual in this movement. The United States usually send a considerable tonnage of iron and steel into the local jobbers. Recently this supply has been largely cut off. A few firms who had orders placed in advance are still receiving a few odd shipments. The tonnage, however, is only nominal.

The Canadian mills at the Sault and at Ontario points have ceased to aggressively go after business on the local market as it is felt that their coal supply is not much more than sufficient to care for the present bookings. The local mills are enjoying a very good business with the local jobbers. Orders given the mills by the jobbers have not been large individually, but have been sufficient to keep them busy. The local mills have had no trouble in purchasing billets, and there was a fair tonnage of Nova Scotia coal in this city at the begininng of the summer. Thus, it is felt, that for some time at least, the local mills can take care of local requirements, which have not been excessive for over a year. The mills in the maritime provinces have been able to obtain coal all year, and have been able to handle the more or less limited tonnage that they had booked. Now that the strike has spread to Eastern Canada miners, the situation will, no doubt, become acute, if matters are not settled shortly.

Merchant bars are moving fairly well, and there is a scattered demand for structural steel. Reinforcing bars, steel hoops, band steel, and small shapes still continue to be in demand in small lots.

Sheets continue to be the most active of steel products. Galvanized sheets in varying quantities are arriving constantly from British mills. The demand for this material is such that no stocks are being accumulated. This statement is particularly true of standard sizes and gauges. Black and blue annealed sheets are also moving well.

Small steel products such as nuts, bolts, spikes, nails, wire, etc., are in good demand. Jobbers all are of the opinion that in spite of the uncertainties that surround the market, business is very satisfactory. Matters have arrived at such a point, that if the rail and coal strikes were settled at once, it would be some time before anything like normal conditions would be restored. On the local market the following prices are representative, but at the same time there is considerable firmness:

Iron bars, base	3 15 to 3 25
Steel bars, base	3 15 to 3 25
Reinforcing bars, base	3 15 to 3 25
Steel hoops	4 25
Tire steel	3 25 to 3 40
Spring steel	7 00
Band steel, No. 10 gauge and 3-16" base	3 65 to 3 75
Small shapes, base	3 40
Sheets black, No. 28	4 40
Shets blue ann., No. 10	4 05
Canada Plates dull, 52 sheets	5 50
Canada plates, all bright	7 00
Galvanized sheets, No. 28	7 25

Pig iron. Many of the conditions described above, will apply to the pig iron situation. Prices have undergone a considerable advance in the last few weeks. As far as Canadian iron is concerned, the Algoma Steel Corp., the Steel Co. of Canada, and others, have temporarily withdrawn from the market owing largely to the coal shortage. Nominal quotations on pig run at $36.80 for No. 1. Considerable Scotch iron has been imported, and small lots of Summerlee iron continue to arrive. Summerlee is quoted at $37.50 ex storehouse in lots of five tons and upwards. In lots of thirty tons and upwards a figure of $32.50 on dock is named. One jobber is importing a trial lot of Carron Scotch iron, which it is believed will be quoted at about the same figure as Summerlee iron. For some weeks past a Belgian representative of Belgian, French and German furnaces has been in the city. No large sales have been made in this connection.

Except in the case of Scotch iron, it would be found very difficult to-day to place an order with the local dealers for pig. Most of the foundries in this locality have covered their nominal requirements for some months ahead, and it is not expected that anything in the shape of large tonnages will be booked by local sales offices. There are one or two exceptions to this statement, as at present there are one or two large shops that will be forced to come into the market for iron in the next few weeks. In the list that follows all Canadian iron quotations are nominal, while those on Scotch iron are for actual acceptance.

	5 tons upwards ex Warehouse	Carlots
Algoma, No. 1	$.....	$36 80
Summerlee	37 50	*32 50
Carron	37 50	*32 50

*On Docks Montreal.

Machine tools and shop supplies. Machine tools are decidedly quiet at the present time. Sales have been unusually light for the past year, and at present they have fallen off to practically nothing. Woodworking tools have been moving somewhat better than iron working tools, however. The supply end of the business has fallen off slightly but still is very satisfactory.

Non-ferrous metals. There has been but little activity in the non-ferrous metal market. Tin has stiffened slightly in price during the week. No other price changes have been made. The local demand has remained about the same for several weeks pas . The following are local quotations:

Lake Copper	17 75
Electrolytic Copper	17 50
Castings, Copper	17 25
Tin	35 50
Lead	7 00
Spelter	8 75
Antimony	6 50
Aluminum	22 00

Scrap metals. Very little activity is shown in the scrap metal market. Owing to pig iron being more or less off the market, it appears that interest in scrap has been small and from widely varying quarters The ruling prices locally are as follows:

Copper, light per 100 lbs.	8 50
Copper, crucible	11 00
Copper, heavy	11 00
Copper Wire	11 00
No. 1 composition	9 00
New brass cuttings	6 00
Red brass turnings	6 50
Yellow brass turnings	5 00
Light brass	4 00
Medium brass	5 50
Scrap zinc	3 50
Heavy lead	4 50
Tea lead	3 00
Aluminum	11 00
Boiler plate, per gross ton	9 00
Heavy melting steel	10 00
Axles (wrought iron)	20 00
Rails (scrap)	11 00
Malleable	10 00
No. 1 machine cast iron	20 00
Pipe, wrought	7 00

Pittsburg

August 23.

PRODUCTION of pig iron and steel continues to decrease. Receipts of coal by the iron and steel industry are not increasing, while one stock pile after another plays out. Here and there some good-sized stocks remain.

The so-called "settlement" of the coal strike at a conference in Cleveland, called by President Lewis of the United Mine Workers and attended by many operators of Ohio but few other operators, does not settle the strike. The operators who signed at the Cleveland conference were said to represent 60,000,000 tons annual production out of 400,000,000 tons previously union. This, however, was not 15 per cent. of the total strike, as there are strikes in non-union mines, particularly in the Connellsville region. Possibly the union expected a stampede of operators to sign the scale after the Cleveland meeting, but thus far there has been no stampede. A number of additional operators have signed but as a rule they are small operators, and the total capacity signed up is certainly far under 50 per cent. of the capacity formerly union, while the non-union strikes are continuing.

Guessing at Strike Results

There are various guesses as to what will occur in future. On two points there is a strong preponderating opinion: (1) That the non-union strikes in the Connellsville region will crumble by about September 1, probably with a moderate advance in wages over the scale paid last March, but positively with no semblance of recognition of any union; (2) That the leading operators of the Pittsburgh district, under the leadership of the Pittsburgh Coal Company, will absolutely refuse to sign the national union scale and will hold out as long as necessary for a district settlement with reduced wages and with elmination of the check-off, with an alternative of the district becoming simply open shop or non-union.

Coal production will increase in a moderate way from week to week, but the coal available must be distributed to the more important consumers, and steel consumers will get no preference or priority. Hence there is no definite promise of an early increase in the iron and steel industry's coal supplies and there is merely hope that there will be increased supplies of coal and coke from the Connellsville region. The question then would be whether such increase would offset the further decrease in supplies that is promised by stock piles running out one after another.

It is altogether too soon to predict when the production of pig iron and steel will increase, or even to predict

when the decrease in production will cease.

The best guess seems to be that at the present time steel ingot production is at a rate about half way between 25,000,000 and 30,000,000 tons a year. This would be about 75 per cent. of the recent maximum rate, attained late in June, and about 50 per cent. of the existing capacity.

Consumption Keeps Up

While the production of steel can be estimated with reasonable closeness, the consumption of steel cannot be estimated at all. Shortage of coal affects consumption of steel, of course, but there is no means of guessing how great the influence has been or will be in future. It has been positively reported as long as a fortnight ago that some consumers had instructed steel mills to discontinue shipments because coal supplies had run out, but these cases may not be involving much tonnage.

The appearance in the steel market is that the shortage of coal has affected the production of steel more than its consumption. There is more pressure upon the mills for deliveries than there was a couple of months ago. In the prompt market, in which consumers seek to buy early deliveries, at premium prices, the premiums have been increasing. It would require little tonnage demand, however, to produce premiums, because nearly all mills are already well sold up or oversold. The testimony of the steel market is plain, that steel is scarce, but such testimony has not always proved trustworthy. At the end of a period of heavy demand buyers are always found to have larger stocks than was estimated. This was true even as to 1920, when premiums were enormous, but when the slump developed some large stocks had to be liquidated, one of the causes of the light steel demand being the liquidation of stocks. Everyone was agreed that the consumption of steel in 1921 was considerably greater than the production.

With restricted production and with moderately heavy sales in the past few weeks the mills find themselves much more heavily sold up, in point of time, than was assumed in June. At that time there was a policy among many producers of holding prices down, so as to leave an attractive basis for buyers to take hold for deliveries late in the year. Now it develops that the mills will not need to sell much steel for the remainder of the year. Perhaps it is on this account that basis prices, for delivery as far ahead as mills care to sell, have been advancing rather sharply. Our reports have already recorded advances in bars, shapes and plates to a minimum of 1.80c, for delivery at mill convenience.

All Prices Advancing

The American Sheet and Tin Plate Company (Steel Corporation) has advanced its sheet prices $2 a ton on blue annealed to 2.50c and $4 a ton on black and galvanized to 3.35c and 4.35c respectively. Previously, the company was oversold to October 1 and was not booking any sheet business. Now it does not have its books open to the trade at large but is accepting orders from regular customers, at these new prices. Ostensibly the bookings are for fourth quarter delivery but practically it is likely that much of the tonnage will last over January 1.

All the independent pipe mills, with one or two possible exceptions, have reduced discounts on merchant steel pipe by three points in black and two points in galvanized, a point being about $1.90 a net ton. The independent basing discount is now 68 per cent., while the Steel Corporation continues its old prices, with 71 per cent. basing discount. The Reading Iron Company has issued a new discount card on wrought iron pipe, with a basing discount of 39½ per cent., on 1 to 1½-inch black.

The Pittsburgh Steel Company and some other independent interests have advanced prices to 2.35c for plain wire and $2.60 for nails. Nominally this is an advance of $2 a ton but practically it is $2 a ton on plain wire and $4 a ton on nails, for the advance in nails from $2.40 to $2.50 made by independents early in April held only for a couple of months.

Pig iron is very dull in point of tonnage. Consumers have no thought of buying for late delivery and there is simply a little demand for small lots for spot or prompt shipment. Such demand must be met out of stocks, which are small, there being hardly any current production. Foundry iron is up $2 a ton to $30, valley, and basic is said to be quotable at $26, valley following recent sales at $25.50. Bessemer remains quotable at $27, valley, but it is not certain that it could be bought at this figure.

Connellsville foundry coke is $15 to $16 depending on brand, etc. Both demand and offerings are extremely limited. Prices have shown little change for 30 days.

ENTERS SECOND HALF CENTURY

(Continued from page 27)

expansion and of gradual specialization along certain lines.

Slumps and Comebacks

Discussing slumps, booms, cycles and comebacks, Mr. Petrie states that in 1890 when he came to Toronto, conditions were somewhat discouraging. Vacant houses were numerous and landlords were letting large dwellings free to people who would agree to occupy and keep them in good condition. Banks as usual were advising extreme caution. "In the course of fifty years, one becomes more or less accustomed to recurrences of depression," said Mr. Petrie, "and out of it all comes the confidence that better conditions will always return. That is how I regard the present situation. Our records will show that changes develop about every seven years, and that on the whole, they work out along very much similar lines. First, comes activity in building and then other things follow, always remembering that good crops seem absolutely essential. Business, it seems to me, is much like the human frame. Whether we like it or not, a rest seems necessary to fit it for future progress. I have great confidence in Canada that whatever comes or goes, the underlying assurance is that youth will not be denied and it must go forward."

Mr. Petrie's son, H. W. Petrie, jr., has been closely identified with the business for more than twenty years. Having received early practical training in the machine shop, he subsequently devoted his activities to the sales department. He is secretary and treasurer of H. W. Petrie, Limited.

FIRST CANADIAN GENERAL MANAGER

On Thursday, Aug. 17th, at a meeting of the board of directors of the Grand Trunk Railway System at Montreal, W. D. Robb was appointed ranking vice-president and General Manager. Mr. Robb will thus succeed to the duties of ex-president, Howard G. Kelley.

The board of the Grand Trunk is at present composed of Sir Joseph Flavelle; E. L. Newcombe, K. C., Deputy Minister of the Department of Justice; Graham A. Bell, Deputy Minister of the Department of Railways and Canals; J. N. Dupuis, Montreal, and A. J. Mitchell, vice-president of the Canadian National Railways, Toronto.

W. D. Robb is the first native born Canadian to be called upon to occupy the chief executive office of the Grand Trunk Railway System. He is also the first chief executive of the Grand Trunk to have risen step by step, with unbroken service, from an apprentice with the company. He was born at Longueuil, P. Q., in 1857, his father having come to Canada from Scotland to join the Grand Trunk when it was in its stages of construction. He began his career with the Grand Trunk in 1871 as an apprentice machinist. He was appointed night foreman of the Montreal shops in 1883. In the same year he was promoted to the position of foreman at Belleville in charge of motive power and car departments. In 1897 he was appointed master-mechanic of the mid-division with headquarters at London. In 1901 he was made acting-superintendent of motive power at Montreal. In 1902 he became superintendent of motive power, which position he occupied until in 1917 he was made vice-president of the roa in charge of motive power, car departments, and machinery. In 1918 his jurisdiction was extended to take in th operating, maintenance and construction departments of the system. This position he held until he was created the chief executive.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Toronto price:—

Silicon, 2.25% to 2.75%	35 65
Summerlee, Scotch, Montreal dock,	32.50
Summerlee, Warehouse, 5-ton,	37.50
Carron, Montreal docks	32.50
Grey forge, Pittsburgh	30 00
Lake Superior, charcoal, Chicago	33 15
Standard low phos., Philadelphia	35 00
Bessemer, Pittsburgh	27 00
Basic, Valley furnace	26 00

METALS

	Montreal	Toronto
Lake Copper	$17 75	$17 25
Electrolytic Copper	17 50	17 25
Castings, Copper	17 25	17 00
Tin	35 50	30 50
Spelter	8 75	7 50
Lead	7 00	7 00
Antimony	6 50	7 40
Aluminum	22 00	22 00

Prices per 100 lbs.

BILLETS

F. O. B. Pittsburgh

	Per gross ton
Bessemer billets, 4 in. x 4 in. and larger	$35 00
Open hearth billets	35 00
O. H. sheet bars	35 00
Forging billets	45 00
Bessemer rods	45 00

IRON AND STEEL

Per 100 lbs. to Large Buyers	Cents
Iron bars, base, Toronto	$3 25 — 3 40
Steel bars, base, Toronto	3 25 — 3 40
Small shapes, base	3 40
Iron bars, base, Montreal	3 15 — 3 25
Steel bars, base, Montreal	3 15 — 3 25
Reinforcing bars, base	3 15 — 3 25
Steel hoops	4 25
Tire steel	3 40
Spring steel	7 00
Band steel, No. 10 gauge and 3-16 in. base	3 65 — 3 75
Chequered floor plate ¼" and heavier	7 00
Bessemer rails, heavy, at mill	2 35
Steel bars, Pittsburgh mill prices	1 90
Tank plates, Pittsburgh will prices	1 90
Structural shapes, Pittsburgh mill prices	1 80
Steel hoops, Pittsburg	2 75

F. O. B. Chicago Warehouse

Steel bars	2 70
Structural shapes	2 80
Plates	2 80
Small shapes under 3-in.	2 80

PLATES

Plates, 3-16 in.	$3 75	$3 50
Plates, ¼ up	3 40	3 25

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$4 50	$5 40
Sheets, blue ann., No. 10	4 05	4 25
Canada plates, dull, 52 sheets	5 50	5 75
Can. plates, all bright	7.00	6.00
Galvanized sheets, No. 28		6 35
Queen's Head, 28 B.W.G.	7 25	
Fleur de Lis, 28 B.W.G.	7 00	
Gorbal's best, No. 28		
Colbornes Crown, No. 28		
Premier	6 85	6 35
Premier 10¾ oz.	6 85	6 75
Zinc sheets	9 25	11 00

FREIGHT RATES

	Per 100 lbs. C.L.	L.C.L.
Pittsburgh to Following Points		
Montreal	52	65½
St. John, N. B.	76	96
Halifax	77½	97
Toronto	34	48½
Guelph	34	48½
London	34	48½
Windsor	31½	45½
Kingston	48½	61

Current surcharge 1 per cent.

OLD MATERIAL

Dealers' Average Buying Prices

	Montreal Per Ton	Toronto Gross
Boiler plate	$ 9 00	$ 9 00
Heavy Melting Steel	10 00	11 00
Axles (wrought iron)	20 00	16 00
Rails (scrap)	11 00	11 00
Malleable scrap	10 00	11 00
No. 1 Machine cast iron	20 00	21 00
Pipe, wrought	7 00	6 00
Car wheel	17 00	16 00
Steel axles	10 50	15 00
Mach. shop turnings	4 00	6 00
Stove plate	16 00	14 00
Cast boring	4 00	6 00
Copper, light	8 50	$ 8 50
Copper, crucible	11 00	11 00
Copper, heavy	11 00	11 00
Copper, wire	11 00	11 00
No. 1 machine composition	9 00	9 00
New brass cuttings	6 00	6 00
Red brass turnings	6 50	6 50
Yellow brass turnings	5 00	4 85
Light brass	4 00	3 50
Medium brass	5 50	4 50
Scrap zinc	3 50	4 00
Heavy lead	4 50	4 50
Tea lead	3 00	3 00
Aluminum	11 00	11 00

COLD ROLLED STEEL

(At Warehouse)

Rounds and squares	$4.50 base
Hexagon and flats	$5.50 base

COPPER PRODUCTS

Prices per lb.

	Montreal	Toronto
Copper Bars, ½ to 2 in.	.29	.28
Brass Tube		.28
Plain sheets, 16 oz. in. 30 x 72	.30	.29
Copper sheet, tinned, 16 oz.	.37	.36
Copper sheet, planished, 16 oz. base	.42	.41
Braziers', in sheets, 6 x 4 base	.30	.29
Copper tubing, seamless		.32

LEAD SHEETS

Roll Lot Prices

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$ 8 75	$ 9 25
Sheets, 3 1-2 lbs. sq. ft.	8 75	9 25
Sheets, 4 to 6 lbs. sq. ft.	8 25	8 50

Cut sheets, ¾c. per lb. extra

Cut sheets to size, 1c. per lb. extra

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	20
Brass sheets, 24 gauge and heavier base	23
Brass tubing, seamless	28

PIPE—WROUGHT

Standard Buttweld Pipe S/C

Per 100 feet

	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
⅛ inch	$ 6.00	$ 8.00	$	$ ....
¼ inch	3.84	5.94	7.20	9.30
⅜ inch	3.84	5.94	7.20	9.30
½ inch	4.85	6.46	7.31	8.93
¾ inch	5.87	7.71	8.86	10.70
1 inch	8.16	11.05	12.58	15.30
1¼ inch	11.04	14.95	17.02	20.70
1½ inch	13.20	17.88	20.35	24.75
2 inch	17.76	24.05	27.38	30.30
2½ inch	28.08	38.03	.....	.....
3 inch	36.72	49.73	.....	.....
3½ inch	47.84	63.48	.....	.....
4 inch	56.68	75.21	.....	.....

Standard Lapweld Pipe S/C

Per 100 feet.

Below Dividing Line—Price Per Foot.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
2 inch	$21.46	$27.38	$31.08	$37.00
2½ inch	31.50	40.95	46.80	56.16
3 inch	41.31	53.55	61.20	73.44
3½ inch	48.76	65.32	72.68	89.24
4 inch	57.77	77.39	86.11	105.73
4½ inch	66.04	86.36	1.04	1.24
5 inch	76.96	100.64	1.21	1.45
6 inch	1.00	1.31	1.57	1.88
7 inch	1.30	1.76	2.02	2.45
8L inch	1.40	1.85	2.13	2.58
8 inch	1.61	2.13	2.45	2.97
9 inch	1.97	2.59	2.97	3.59
10L inch	1.82	2.40	2.75	3.33
10 inch	2.35	3.09	3.54	4.28

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4-in. and under 60 per cent.

4½-in. and larger, 50 per cent.

4-in. and under, running thread, 40%.

Standard couplings, 4-in. and under 30%

Do., 4½-in. and larger, 10%.

MALLEABLE FITTING LIST

1 in. elbow	.32	.53
2 in. elbow	1.05	1.70
1 in. tee	.43	.70
2 in. tee	1.45	2.40
1 in. coupling	.33	.53
1 in. locknut	.15	.23

Discount to dealers 70/5 off list.

BOILER TUBES

Size	Seamless	Lapweld
1 in.	19.00	
1¼ in.	20.00	
1½ in.	20.00	
1¾ in.	21.50	
2 in.	20.00	16.00
2¼ in.	22.00	20.00
2½ in.	23.00	20.00
3 in.	27.00	24.00
3½ in.	32.00	28.00
4 in.	41.00	25.00

Prices per 100 ft., Montreal and Toronto

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, 7-16 and up	30
Carriage bolts, ⅜ in. and smaller 6 in. and shorter	40
Coach and lag screws	45
Stove bolts	72½
Wrought Washers	60
Do., corru. head	60
Machine bolts, 7-16 and over	35
Machine bolts, ⅜-in. and less	35
Blank bolts	35
Bolt ends	35
Machine screws, fl. and rd. hd., steel cut thread	37½ & 10
Machine screws, o. and fil. hd., steel cut thread	30
Machine screws, o, and fil. hd., brass cut thread	15
Standard couplings, 4-in. and under, brass cut thread	30% 30
Nuts, square, blank off net list	$1.00
Nuts, square, tapped off net list	50c.
Nuts, hex., blank off net list	50c.
Nuts, hex., tapped net list	
Copper rivets and burrs, list less	32c.
Burrs only, list plus	10%
Iron rivets and burrs	47%
Boiler rivets, base ¾ in and larger	$5.75
Structural rivets, as above	5 65
Wood screws, O. & R., bright	80
Wood screws, flat, bright	82½
Wood screws, flat brass	77½
Wood screws, O. & R., brass	75
Wood screws, flat, bronze	72½
Wood screws, O. & R., bronze	70

NAILS AND SPIKES

Wire nails, base	$3 65
Cut nails, base	4 35
Miscellaneous wire nails	72½%

MILLED PRODUCTS

(Prices on unbroken packages)

Set screws	65
Square and hexagon head cap screws	60
Round head cap screws	20
Fillister head cap screws	35
Flat head screws	25
Button head cap screws	20
Studs	45
Semi-finished nuts up to and including 9/16 in.	70
Semi-finished nuts ⅝ to 1¼ in.	65
Semi-finished nuts 1⅜ to 2 in	35
Coupling bolts	35
Taper pins, No. 2 to No 5	65
Taper pin No. 6 and over	10
Planer bolts without fillet	10
Planer bolts with fillet	Net
Patch bolts	Plus 10%
Hollow set screws	20
Thumb screws	50
Thumb nuts	70

CARBON DRILLS AND REAMERS

	Discount.
S. S. drills, wire size	60
Can. carbon cutters	plus 10
Standard drills, all sizes	60
3-fluted drills, plus	10
Jobbers and letter sizes	60
Bit stock	50
Ratchet drills	25
S. S. drills for wood	10
Wood boring brace drills	50
Electricians' bits	30
Sockets	50
Sleeves	30
Taper pin reamers	25
Drills and countersinks	20
Bridge reamers, carbon	50
Centre reamers	Net
Taps, machine screw	50 to 60
Taps, hand, sizes up to 1"	30 to 60
Chucking reamers	20 off
Hand reamers	20
High speed drills, list	40
Can. high speed cutters	plus 10
American	plus 40

FILES AND RASPS

Globe	60/5
Vulcan	50
P. H. and Imperial	60/5
Nicholson	40
Black Diamond	40
J. Barton Smith, Eagle	55
McClelland, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	60
Great Western-American	50
Kearney & Foote, Arcade	60/5

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

PROOF COIL CHAIN
B. B. B. CHAIN

⅜ in., $16.45; 7-16 in., $14.00; ½ in., $12.95; 5-8 in., $13.15; ¾ in., $12.75; ⅞ in., $12.25; 1 in., $11.85; 1⅛ and 1¼ in., $10.55. Fire weld chain same sizes respectively are $14.00; $11.50; $10.40; $10.55; $10.15; $9.75; $9.35; and $8.25.

ELECTRIC WELD COIL CHAIN B.B.B.

⅛ in. $20.00; 3-16 in. $16.50; ¼ in. $15.50; 5-16 in. $12.70.

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	30%
Standard	30 and 10%
Cut leather lacing, No. 1	1.75
Leather in side, (Lacing)	1.50

RUBBER BELTING

Standard 36 ....28% Best grades 28%

TAPES

Chesterman Metallic, 50 ft.	$5 00
Lufkin Metallic, 603, 50 ft.	3 17
Admiral Steel Tape, 50 ft.	3 00
Admiral Steel Tape, 100 ft.	4 50
Major Jun. Steel Tape, 50 ft.	3 75
Rival Steel Tape, 50 ft.	4 00
Rival Steel Tape, 100 ft.	8 75
Reliable Jun. Steel Tape, 50 ft.	5 25

PLUMBING SUPPLIES

Plumbers' oakum, per cwt.	6 30
Solder, strictly	$0 22½
Solder, guaranteed	0 24
Soldering coppers, lb.	0 62½
White lead, pure, cwt	13 20
Red dry lead, 100-lb. kegs, per cwt.	10 75
Wood alcohol, per gal.	1 75
Whiting, plain, per 100 lbs.	3 00

ROPE AND PACKING

Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope ¾ and larger, base	0 21
British Maila rope	0 17
New Zealand hemp	0 19
Jute packing, fine	15c
Jute packing, coarse	11c

OILS AND COMPOUNDS

Castor Machine Oil, per lb.	34½
Royalite, per gal. bulk	20
Palacine	23
Machine oil, per gal.	39
Black oil, per gal. (Summer)	19
Cylinder oil, Capital	69½
Petroleum fuel oil bbls., net	10.80
Pure turp., single bbls., gal.	1.75
Linseed oil, raw, single bbls.	1.10
Premier galsoline	34

WASTE

XXX Extra	16	Atlas	18
Peerless	21	X Empire	13
XX Grand	15	Ideal	18
Superior	20	X Press	11½
X L C R	14		

Colored

Lion	12	Fancy	13½
Standard	10½	Popular	9
No. 1	13	Keen	7½

Wool Packing

Arrow	24	Anvil	16
Axle	20		

Washed Wipers

Select White	18	Dark colored.	13
Mixed Colored	14		

This list subject to trade discount

PLATING SUPPLIES

Polishing wheels, felt	$3 80
Polishing wheels, bull-neck	1 50
Emery in kegs, Turkish	08
Pumice, ground	05
Emery glue	05
Tripoli composition	08
Crocus composition	12
Emery composition	11
Rouge, silver	16
Rouge, powder, nickel	38

Prices per lb.

ANODES

Nickel	.55 to .60
Copper	.38 to .40
Tin	.70 to .17
Zinc	.16 to .17

PLATING CHEMICALS

Acid, boracic	.23
Acid, hydrochloric	.03¾
Acid, nitric	.10¼
Acid, sulphuric	.03¾
Ammonia, aqua	.20
Ammonium, Carbonate	.15
Ammonium, chloride	.18
Ammonium, hydrosulphuret	.75
Ammonium, sulphate	.10
Arsenic, white	.18
Copper, carbonate, anhy.	.32
Copper, sulphate	.08
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.14
Nickel carbonate	.32
Nickel sulphate	.14
Potassium sulphide (substitute)	.40
Silver chloride (per oz.)	.85
Silver nitrate (per oz.)	.65
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.35
Sodium hyposulphite per 100 lb.	6 50
Sodium phosphate	.15
Tin chloride	.30
Zinc chloride, C. P.	.30
Zinc sulphate	.06

Prices per lb. unless otherwise stated

News From the Industrial Field

Reports from the leather trade indicate an improvement in shoe business with prices quite firm.

Fire damage, estimated at $100,000, was done to the plant of the Graves-Bigwood Lumber Co., at Byng Inlet.

Assured by local dealers that there would be sufficient supplies of soft coal to tide over the situation, Guelph City council has decided not to go into the coal business by purchase of Welsh coal.

Galt union moulders are asking recognition of the 48-hour week. This means a difference of twenty minutes daily in their favor. Employers are not inclined to grant the demand.

St. John, N. B.—The city council recently rejected the Bodell proposal for the sale to the city of the control of the New Brunswick Power Co., with its street railway, power, light, and gas plants.

Montreal.—W. C. Chisholm, general solicitor of the Grand Trunk Railway System, has assumed the duties as head of the legal department, which position was rendered vacant by the death of W. H. Biggar, K. C.

There is some likelihood of the International Nickel Co. making certain changes whereby all of their nickel refining will be done at Port Colburne, Ont. This is now done at Bayonne, N. J.

The Dominion Glass Co. of Montreal has declared a dividend recently and it is stated that plans are being made for the erection of a new plant that will cost approximately one million dollars.

T. H. Watson, president of the Canada Machinery Corporation, Galt, has returned from a trip to the Maritime provinces. He states that there is an outstanding optimism in the East and that industrial prospects are very encouraging.

An all-year freight and limited passenger service between St. John's and the West Indies will be inaugurated in October by the Newfoundland Government, provided steamers can be secured at a reasonable rate. The service will commence with six weeks sailings and if conditions warrant, this will be increased to a sailing every three weeks.

Canadian branches of American concerns continue to be established in various sections of the country. New industries to locate during the past several months are a copper plant in Toronto, cutlery manufacturers at Hamilton and Welland, electric bulbs at Oshawa, automobile plants at Sarnia and Windsor, auto tire plant at Hamilton, and many others.

G. E. Farrel, formerly with Geo. W. Cole, Toronto, has been appointed director of sales for the Canadian Morehead Mfg. Co., Toronto.

Iroquois Falls.—The first of the rolling stock for the Abitibi Railway and Navigation Co. arrived at Iroquois Falls on August 11. The equipment was 12 flat cars for hauling logs. These are the regulation cars 41 feet long fitted with all safety devices.

Brockville.—At a meeting of the Directors of the Canada Foundries and Forgings Ltd., held during the last week, there was presented a report for the first half of the year ending June 30th which showed that the figures for the present year were a marked improvement over those for the same period last year.

Northern Engineering Works' Detroit and Walkerville, have issued a four-page illustrated circular descriptive of their different types of jib cranes. These are adapted for use in shops, foundries and warehouses where traveling cranes cannot very well be employed. There are power and hand operated types and the line comprises the derrick, stiff leg, under-braced, triple braced, top braced and pillar designs. One page is devoted to truck and stacking cranes, both hand and electric.

Ottawa.—The old St. Maurice forges near Three Rivers, Que., are to be preserved as a memorial of the beginning of the Canadian iron industry, and a monument will be erected there by the Canadian National Parks Branch of the Department of the Interior. Founded in 1730, these forges lasted through the French and during the English regime until 1885. There the first Canadian stoves were manufactured, and for four or five generations these forges turned out porridge pots, axes, nails, bars, hammers, spades and shovels. There in 1776, at the time of the American invasion, guns were made for the defence of Canada.

Montreal.—The Dominion Engineering Works have about completed the manufacture of a special machine designed to bore dryer cylinders for paper machines. These cylinders on the larger machines are four feet in diameter and have been built as long as " inches. In order to have them balanced, and to provide uniform distribution of heat, these cast iron cylinders are bored out throughout their length. In the new machine, the cylinder revolves on rollers, while the boring tool has only one motion, namely that of its feed. the cylinders are turned previous to boring, this method of setting up not only saves time, but ensures concentricity.

Montreal.—It is reported locally that the Canadian National Railways have called for tenders on a lot of 1,500,000 ties. These ties are to be manufactured from timber cut between October 1922 and May 1923.

Montreal.—Two of the four floating grain elevators owned by the Harbour Commissioners of this city were placed in commission August 14th in order to accelerate the movement of grain through the port. Grain is being transferred direct from lake vessels to the ocean steamers without the necessity of being handled by the regular port elevators. The floating elevators have each a capacity of 7,000 bushels an hour.

Timmins, Ont.—According to a recent report from Mr. Alexander Gray, the Hollinger mines will take priority over the mine that has hitherto been credited as being the largest gold producer in the world. This mine is the New Modderfontein in South Africa. For the seventh four-weekly period ending mid-July Hollinger reported a profit of $517,895, which is at the rate of $6,732,645 per annum, which figure is more than any other gold mine has ever done.

Ottawa.—On August 15th operations on a small scale were commenced at the plant of the British-American Nickel Corporation at Deschenes, Que. For some time past work has been suspended and it is only lately that conditions have warranted the resumption of activities. Only a small portion of the plant has been put in operation, but S. M. Brown, secretary-treasurer of the company, stated he felt that it would not be long before operations on a larger scale were inaugurated.

Bellville, Ont.—W. S. Springer, of the Springer Lock Mfg. Co., Ltd., stated to a representative of Canadian Machinery that his firm is extremely busy at present. A new wing was added to the factory early in the year, and already, even with this added capacity, rush orders now on the books, have made it necessary to commence working overtime, and it will be three months before the congestion is cleaned up. Other orders, already contracted for, will keep the factory busy until well on into the New Year. All through the depression this factory has enjoyed good business and the firm is optimistic about the future.

Montreal.—The Canadian Car and Foundry Co. have recently started work on 150 street cars for the Toronto Transportation Co. The new cars will be on the Peter Witt type, having front entrance, one man motors, with centre exit, similar in type to those now being

operated on the Yonge Street line in Toronto. Of the order of 150 cars 100 are trailers and the other fifty will be fitted with motors. This work will be taken care of at the Turcott Works. It is also stated that this firm is repairing 500 box cars for the Grand Trunk Railway; a further order for the repair of 500 coal cars is also understood to have been received by the firm. For some time past the plants of the Canadian Car and Foundry Co. have been very quiet and these orders are very reassuring. The officials of the Company state that they have more business in prospect and it is assumed that in the course of a short time further work will be announced.

The steel work for the $20,000 store for the St. Lambert Hardware Co. has been given to the Phoenix Bridge and Iron Works of Montreal.

The steel work in connection with the addition to the high level sub-station of the Toronto Hydro Electric Commission, costing $300,000, has been awarded to the Dominion Bridge Co.

Price Bros. Co. of Kenogami, Que., will construct two pulp mills and 20 residences. They also contemplate the erection of a railway between Kenogami and Saguenayville, Que.

W. E. Dillon & Co. of Toronto have secured the contract for roofing, sheet metal, waterproofing, fire doors and mechanical ventilating system to be erected by dition to the sub-station to be erected by the Toronto Hydro Electric Commission.

The Dominion Bridge Co. has recently closed contracts for steel work in connection with a $25,000 school in Montreal, and the $30,000 field building for McGill University. This firm has also secured the steel and millwork contracts for the extension to Calvin Westminster church at Westmount, Que.; the cost of the improvements will be $18,000. Another contract obtained is that for the steel and cut stone work for the $75,000 restaurant building for the Walton Lunch of Montreal.

Montreal.—It was officially announced from Ottawa on August 16th that the resignation of Howard G. Kelley from the Board of Directors of The Grand Trunk Railway had been accepted. Ceasing to be a director, he automatically ceases to be president of the road. It is understood that the acceptance of Mr. Kelley's resignation at this time arises out of the fact that his contract with the Grand Trunk expires the end of the month. It is expected that h will leave shortly on a long deferred vacation. Pending the reorganization of the Canadian National Board, the Go ernment has appointed Major Graham Bell, C. M. G., deputy Minister of Railways, to fill the vacancy on the Board created by Mr. Kelley's resignation. The question as to the selection of an e cutive head will be dealt with at a meeting of the Board to be held shortly in Montreal.

The Hamilton Bridge Works has obtained the contract for supplying the steel work in connection with the construction of a $100,000 school building at Mount Hamilton, Ont.

The reinforced steel contract for the $190,000 school and residence to be erected by the Montreal Catholic School Commission has been given to the Trussed Concrete Steel Co. of Montreal.

The contract for the steel work and reinforced concrete for a $200,000 church in Montmagny has been awarded to the National Agricultural Machinery Co. of Montmagny, Que., and the Trussed Concrete Steel Co. of Montreal.

Announcement is made of the incorporation of Joyce Bros. at a capitalization of $45,000. The company will carry on a business of structural, civil and mechanical engineers, builders, etc. Offices will be located at Bronte, One.

Montreal.—Business is improving each month with the Dominion Engineering Works Ltd., at Lachine. Among the larger work now going through the shops are two 28,000 h.p. turbines for the Winnipeg development and three of the largest type of paper machines yet built. These latter machines will be installed in one of the local mills on the St. Maurice river. The paper is produced at the rate of one thousand feet a minute in widths of 166 inches. In the month of June the foundry produced 800 tons of castings, while in July over 1,000 tons were poured. In addition to the above work there are many smaller orders.

Montreal.—August 14th more than one hundred members of the Boards of Trade of Cornwall and Alexandria inspected the Port of Montreal as guests of Dr. W. L. McDougald, president of the Harbour commissioners. The party arrived in the city at noon and took lunch at the Windsor hotel before making the trip round the port on the harbour commissioners' steamer Sir Hugh Allan. The same day a large party of members of the American Ceramic Society visited the harbour and made a trip of inspection on the steamer Sir Hugh Allan just previous to the trip taken by the Cornwall and Alexandria representatives.

Montreal.—For some months past the City Council has been considering the assessment valuation of the C. P. R. Angus Shops. On one or two occasions it has been announced through the Press that the matter had been settled. However, it was under discussion on August 14 and the figure of $1,000,000 was finally decided upon as the amount of the assessment of these shops and the figure is to remain stationary for five years. The discussion on the above occasion took the form of a debate as to whether it would be better for the city to have an assessment of $1,500,000 for ten years or to take the $1,000,000 assessment and hold it for five years. The latter, as above stated, was finally decided upon.

Montreal.—The Hon. Ernest Lapointe, Minister of Marine and Fisheries, inspected the Port of Montreal for the first time in his official capacity on Aug. 18. After the inspection he proceeded to Quebec, where he will sail on Aug 22 with the Hon. W. S. Fielding, Minister of Finance, on the Empress of Scotland. The ministers will attend the meetings of the Assembly of the League of Nations, and in addition both ministers will take up departmental matters while they are in England and France. The results of their efforts are expected to bring about better trade relations.

Montreal.—The Honorable Ernest Lapointe sent a telegram on Aug. 16th to Joseph Archambault, M. P. for Chambly-Vercheres, advising him that at a meeting of the cabinet an order-in-council had been passed authorizing the Harbor Commission of Montreal to spend the sum of $50,000 for the work preliminary to the construction of the Montreal-Longueuil bridge. This sum is to be deducted from the $5,000,000 voted at the last session of parliament for the improvement of the harbor. Recently the Harbor Commission asked for authority to expend this amount. The preliminary work of the engineers, such as soundings, borings, plans, estimates of cost, etc., will proceed at once, and a report will be ready for the opening of the next session of parliament.

Kingston. — Canadian Locomotive Works, Kingston, are not to be sold to the Baldwin Locomotive Company, or any other company, but will remain under present control and management, according to a report published here. It is stated that an explanatory letter to this effect is being forwarded to all the shareholders who had given options on their stock in the expectation that a sale of the control of the company might be effected. This letter is very brief, and on behalf of F. G. Wallace, president of the company, in whose name the option had been obtained, merely states that it has been found impossible to put the sale through. As to when the works will open up, that is problematical, but it is believed that there is reasonable expectation and hope that they will be opened this Fall, although on this point local officials have nothing to say.

According to railway reports, 25,000 men have gone west to engage in the harvesting of the wheat crops. The return of these men to eastern Canada begins about Nov. 20 and continues until Christmas. Eighty per cent. will have returned before mid-winter.

It is now possible to weld cast iron to steel by electric resistance welding. The majority of failures of resistance are due to the fact that people not thoroughly familiar with the subject attempt to make them without using the necessary precautions as regards cleanliness and freedom from rust and scale on the parts to be welded.

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A rivet a second, sizes up to 3/16".
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And on special order we build machines to handle rivets up to 1½" with proportionate rapidity.
Built in eight sizes.
Besides riveting, the High Speed Riveting Hammer does all kinds of peining, swaging, upsetting, etc.
Send us sample assembly parts with rivets or sketch of your work,

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Let us shoulder your riveting problems.
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ROCHESTER, N.Y.

BUSY INDUSTRIAL BUILDING

Construction or adaptation of a building in which to house youthful industries is a matter which, from time to time, has had consideration by boards of trade, industrial commissioners and committees in thriving municipalities. Belleville has such a building which has enabled the city to co-operate with concerns wishing temporary accommodation. One of the best examples is that of the Walker Power Building, Walkerville. In 1912, the site on which this building stands was so much unoccupied land. To-day it is the scene of thriving industry, occupying the four floors of the modern structure. All power is supplied by the Walker Power plant, independent of the Hydro or any other source. The building represents a cost of $100,000.

On the first floor is situated the Interchangeable Counterbore and Tool Company; Sand Level Company; Peter Smith Heater Company and the Square D Company.

The second floor houses the Pensar Chemical Company and other sections of the Square D Company.

The Timken Roller Bearing Company, the Barkol Manufacturing Company and the perforated Hone Company are occupants of the third floor.

On the fourth floor are situated the Jewett Radio Company, the Canadian Coil Company and the E. W. Jefferies Company, Ltd.

The four large floors of the Walker Power Building each cover 14,548 square feet of floor space, making a total of 58,172 square feet. Demand for manufacturing space has been such since the first of the year that approximately only 2,000 feet are still available.

ST. CATHARINES GOING 100%

M. M. Maxwell, manager St Catharines Chamber of Commerce, comments as follows upon industrial conditions in that locality:—

"St. Catharines and district is at present time operating at practically 100% production, based on 1912 and '13 production. Some plants are slightly low while others again are running full, so that the average is good.

"During the past few months there has been a steady improvement and managers are very optimistic as to the outlook. Several are buying stocks ahead in anticipation of an increase in production and preparing for a comparatively steady run. In the majority of instances at the present time there appears to be a feeling that the winter months will not see more than the ordinary reduction of activity. At the present time there is practically no more than normal unemployment and compared with one year ago the situation is very much improved so that the coming winter is not viewed with as much concern as was the case a few months ago.

"It would be difficult to specify any particular line of trade which shows definite increase in production or improvement in condition as practically all lines appear to be affected about the same.

"Agricultural conditions in the section are very good and retail business as a result is anticipating a good fall and winter business with the combined activities of agricultural and manufacturing lines showing improvement.

"The outlook for new industries is fair. One new industry has been located within the past few weeks and negotiations are under way with several. There are a good many so called industries looking for locations but the majority of these are in need of financial assistance, which is not looked upon favorably by the people of this district. The city is ready to render such assistance as may be possible to good substantial industries, but many of the projects proposed during recent months have not been of this kind, but appeared to be more the hope of some individual with an idea that someone else will furnish the cash to test out the idea. We believe that Ontario municipalities would be wise to investigate very thoroughly projects before giving them any special encouragement."

PROSPERITY IN VICTORIA, B. C.

Through George I. Warren, industrial commissioner, Canadian Machinery has received the following with reference to industrial conditions in Victoria, B. C.:—

After many years arduous work by those interested, it has been decided to start a rolling mill and smelter in the vicinity of Victoria for the manufacture of iron and steel. This undertaking will have both federal and provincial assistance and the British firm of Vickers, Ltd., is also engaging in the enterprise. Every effort will be made to have the plant on the Island. There are excellent iron prospects here, and the iron mines at Jordan River on the West Coast close to Victoria are very rich.

A movement is afoot at present to amalgamate the adjoining municipalities with the city of Victoria and thus create a Greater Victoria. This idea has much to recommend it, and is being considered by a civic and municipal officials. If it is carried through, Victoria will embrace the Oak Bay District, the Saanich Peninsula, Esquimalt, and Sooke; and will cover an acreage of approximately 200 square miles. A central water board for the districts has already been established. Such an important and far-reaching movement must come about slowly, but when once established it would mean a wonderful future for this city and the south end of the Island.

There has not been so much evidence of prosperity in Victoria since several years before the war. Building statistics are the best proof of the growth of any community, and the number of permits issued this year far exceeds that of many years past. Among the buildings in course of construction are two banks, the Bank of Nova Scotia and the Bank of Toronto. The opening of the Hudson's Bay stores on the upper part of Douglas Street has meant the enlargement of the business district, and the erection of many new offices. One of the largest new stores is that of Woolworth Co. on the corner of Douglas and View streets.

A very hopeful indication of the growth of overseas trade is in the utilization by the Canadian National Railways of the new Outer Docks at Ogden Point, where steamers call now for shipments of cement, roofing, whale oil, etc. The tonnage at this port has been exceptionally heavy this year; several new steamship lines are in operation and there is a large increase in shipping from Oriental ports and via the Panama Canal.

Industries in the city include lumber, shingles, boxes, paper, soap, paint, varnishes, oatmeal, oil refining, ship-building, iron works, ship repair plant foundries, sand and gravel, boiler making, stove making, breweries, mineral waters, cement, explosives, machinists, bricks, marble, sheet metal, dye works, laundries, phonographs, creameries, cooperage, roofing material, carriage work, upholstery, tents and awnings, mattresses, furniture, toys, fish canneries, fruit canneries, flour, rice, coffee and spices, manufacturing confectionery, jam, pickles, boat-building, lime kiln, biscuit, seed-growing, nurseries.

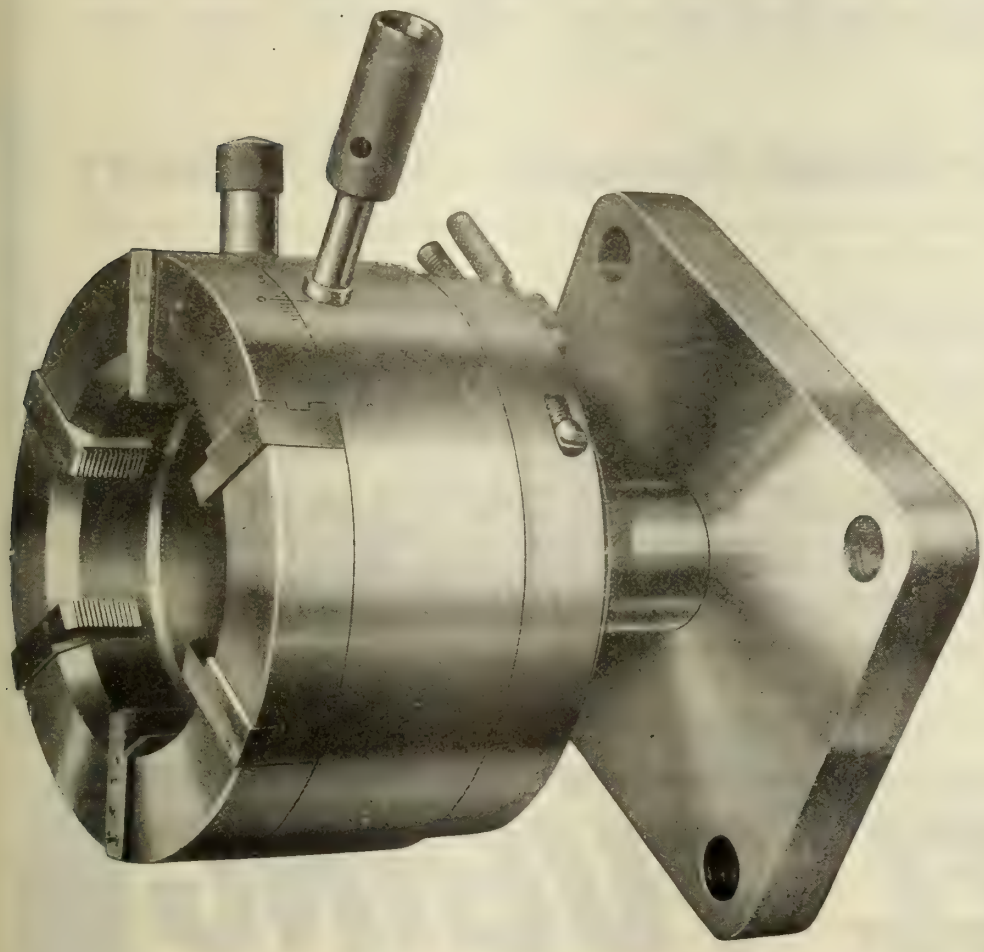
Development within the last two years has secured successful results with home weaving, to the extent that many articles are now being made from Island wool, and rabbit fur, the whole work, to the finished tweed and woollen goods being made on the Island. This is an industry which could be greatly enlarged and would very much interest the tourist trade. Vancouver Island is admirably adapted for sheep-raising and Victoria is the logical centre for a big textile mill. Half a million was invested by the Government on the Island under the instrumentality of the Provincial Industries Act, during the past year. Among the industries assisted were fish, by-products, sawmills, plant for manufacturing electro-plate fixtures, furniture, model-making, fish curing, yacht and boat building, antique furniture.

Although the unemployment problem was very acute all over the continent, and Victoria experienced the difficulties attendant upon abnormal conditions in common with other cities, indications so far, go to prove that times are returning to normal, and that the coming winter will not be a hard one in the above respect.

Vancouver, B. C.—J. G. Kerry, hydro electric engineer of Toronto, has been chosen by a special committee of the City Council for the position of consulting engineer in connection with Vancouver's proposed hydro-electric development. If Mr. Kerry's appointment is confirmed he will be asked to investigate and report on sites that might be available for hydro-electric purposes adjacent to the city.

—IT'S A STAR—

This Was the Reply of a Production Manager When Asked How He Liked THE GEOMETRIC DIE HEAD



The Geometric Die Head illustrated is flanged for bolting to the Turret Face.

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TRADE P.M.S MARK
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Light and Medium-Bench and Floor Repetition Castings; Capacity 15 tons per day.
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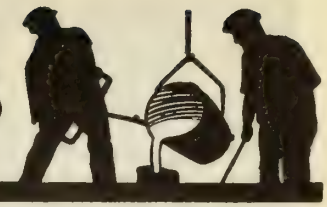

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Can. Mead-Morrison Co., Ltd.,
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Hugh Park Foundry Co., Ltd.,
OSHAWA, ONT.
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Hull Iron & Steel Foundries Ltd.
HULL, CANADA.
Steel, Manganese, Chrome.

Aurora Foundries, Limited,
AURORA, ONT.
Grey Iron.

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Can. Hanson & VanWinkle Co.
LIMITED
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Brass, Bronze, Manganese Bronze, Aluminum.

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HAMILTON, CANADA.
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The Katie Foundry
GALT, ONT.
Grey Iron, Semi-Steel, Brass, Aluminum.

William Kennedy & Sons, Ltd.
OWEN SOUND, ONT.
Steel, Malleable and Heavy Grey Iron.
See Advertisement Page 8

Machinery & Foundries, Ltd.
BROCKVILLE, ONT.
Light and Medium Grey Iron.

A. F. McCulloch
OSHAWA, ONT.
Brass, Alum. Castings—Wood, Metal Patterns.

Corbet Foundry & Machine Co. Ltd.
OWEN SOUND, ONT.
Grey Iron, Brass.

Fittings Limited,
OSHAWA, ONT.
Malleable, Grey Iron, Brass, Aluminum.

John T. Hepburn, Limited
TORONTO, ONT.
Grey Iron.

W. W. Wells
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Nickel and Monel Metal.

The Robert Mitchell Co., Ltd.
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Light Grey Iron.

Canadian Steel Foundries, Ltd.
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Steel and Ferro-Alloy.

Langley & Austin,
GALT, ONT.
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Maxwells, Limited
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The Eureka Planter Co., Ltd.,
WOODSTOCK, ONT.
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Grey Iron.

Dominion Engineering Works, Limited
MONTREAL, QUE.
Grey Iron.

Smith's Falls Malleable Castings, Limited
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Malleable.

Joliette Steel Co.
JOLIETTE, QUE.
Electric Steel and Ferro-Alloy.

International Malleable Iron Company, Limited
GUELPH, ONT.
Malleable.

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You Can Do Likewise
A Few Panels For Sale

APPLY

Canadian Machinery & Mfg. News
143 University Avenue,
TORONTO, CAN.

BRANTFORD BRASS FOUNDRY COMPANY
BRANTFORD, ONTARIO
FOUNDRY AND OFFICE 25 LEONARD ST

June 27th., 1922

The MacLean Publishing Co., Limited.
Toronto, Ont.

Gentlemen;-

We wish to inform you that we have had quite satisfactory results from our advertisement in Canadian Machinery and Manufacturing News, which runs under the classified heading " Where to Buy your Castings ".

Yours Truly,
Brantford Brass Foundry Company.
per David McMaster

If what you need is not advertised, consult our Buyers' Directory and write advertisers, listed under proper heading.

HINTS TO BUYERS

ATKINS Sterling Quality SAWS

When in need of Circular Metal Cutting Saws, Hack Saw Blades, Hack Saw Frames, Kwik-Kut Power and Metal Cutting Band Saw Machines we will be pleased to have your specifications.

"A BETTER SAW FOR EVERY USE"

Address the nearest point below

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BLOUNT Grinders are built to stand up under the hard service which is the usual lot of a grinder. They are just as good in every detail as we can make them. They are fast, accurate, strong and rigid—dependable in every sense. Let us send you full particulars.

"We will accept Canadian funds at par."

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Everett, Mass. U. S. A.

-A Small Heavy Duty Lathe
-With 32 Thread Changes

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ROCKFORD "ECONOMY"

This double back geared, quick change engine lathe brings many advantages to the tool room. High grade, accurate, small in size but extremely powerful.

All gears are cut steel and covered to safe-guard the operator. A lead screw is used only for chasing. Sizes 12", 14", 18" and 22" swing. Write for circular.

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These valve troubles are inexpensively and easily overcome by using our New Air-Tight Blast Gate.

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Light, Strong, Compact, Inexpensive, Quick-Acting
Threaded or Flanged Connections.

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BRITISH REPRESENTATIVE: Gibbons Bros., Ltd., Dudley, Worcester, England.

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Manufactured and Sold by

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COSTS LESS AND GOES FARTHER

For Hardness Testing

in shop and laboratory use the

Standard Scleroscope

Universally adopted; direct reading; inexpensive, and the only instrument that agrees with others of its kind in all parts of the world, thus solving problems of ordering materials to specification.

BOOKLET FREE.

Heat Indication

by optical means is fast becoming the correct thing. The PYROSCOPE has solved the problem

THE PYROSCOPE

THE SCLEROSCOPE (Set)

Perfect constancy, inexpensive, no electricity used. Built to stand rough usage, and upon common-sense lines. Used by the Government and best firms

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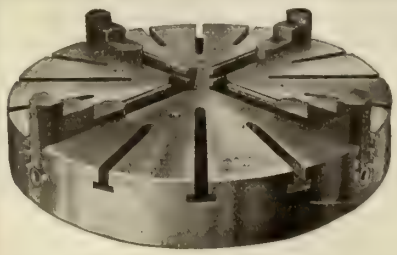
A. R. Williams Machinery Co., Ltd., Toronto, Canada



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Our All-Steel Independent Chucks have established records for accurate, long-wearing qualities. We also make Geared Scroll Chucks and the Geared Scroll Combination. Ask for particulars.

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ACCURATE RIGID DEPENDABLE
Manufactured in various types and sizes
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Send Us Blueprints of Your Work
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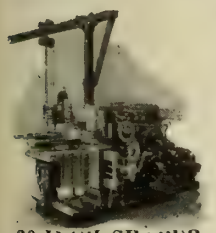
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Investigate this machine to-day. The most powerful shaper. Wide range of work. Ask for bulletin 3A.
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Flexible shaft equipments for grinding, polishing, drilling, reaming, scraping, scratch brushing, power screw driving and nut setting.
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VICTORIA Special Machinery
DESIGNS PATTERNS
CASTINGS FORGINGS
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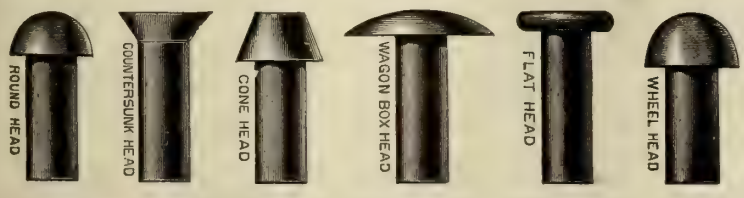
Victoria Foundry Co., Limited, Ottawa, Canada



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Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John, London, S.E., Eng.

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Dominion Oxygen Co., Toronto.
Liquide Air Company, Toronto.

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Steel Co. of Can. Ltd., Hamilton, Ont

ANGLE BARS
Steel Co. of Can. Ltd., Hamilton, Ont.

ANVILS
Atkins & Co., Inc., E.C., Indianapolis, I.
Petrie, Ltd., H. W., Toronto, Ont.

ANCHOR BOLTS
Steel Co. of Can., Ltd., Hamilton, Ont.

ANGULAR HOLE DRILLING TOOL
Globe Engineering Co., Ltd., Hamilton, Ont.

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Atkins & Co., Inc., E. C., Indianapolis,
Brown & Sharrpe Mfg.Co., Providence,R.I
Jacobs Mfg. Co., Hartford, Con.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.

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Canada Foundries & Forgings Co., Welland, Ont.
Canadian SKF Co., Toronto, Ont.

BARRELS, TUMBLING
McDougall Co., Ltd., R., Galt, Ont.

BARS, BORING
Armstrong Bros. Tool Co., Chicago, Ill.
Bertram & Son Co., td., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

BARS, BORING, PORTABLE
Underwood Corp., H. B., Philadelphia.

BARS, STEEL
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
British Empire Steel Corporation, Montreal, Que.

BEARINGS, BALL
Canadian SKF Co., Toronto, Ont.

BEARINGS, ROLLER
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

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D. K. McLaren, Limited, Montreal.
McLaren Belting Co., J. C., Montreal, Que.

BELT DRESSINGS AND FILLERS
Dom. Belting Co., Ltd., Hamilton, Ont.
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D. K. McLaren, Limited, Montreal.
McLaren Belting Co., J.C., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

BELT HOOKS
Bristol Co., Waterbury, Conn.
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BELT LACING
Bristol Company, Waterbury, Conn.
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BELT LACING, STEEL
Bristol Company, Waterbury, Conn.

BELT LACING MACHINES
D. K. McLaren, Limited, Montreal.
McLaren Belting Co., J. C., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

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Fittings, Limited, Oshawa, Ont.
Jones & Glassco, Montreal, Que.
Renold (Hans) of Canada, Ltd., Montreal, Que.

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Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Dom. Belting Co., Ltd., Hamilton, Ont
D. K. McLaren, Limited, Montreal.
McLaren Belting Co., J. C., Montreal, Que.

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Can. Fairbanks-Morse Ltd., Montreal, Q.
D. K. McLaren, Limited, Montreal.
McLaren Belting Co., J. C., Montreal, Que.
Smith Belting Co., Toronto, Ont.

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British Empire Steel Corporation, Montreal, Que.
Fittings, Limited, Oshawa, Ont.
National Acme Co., Montreal, Que
Petrie, Ltd., H. W., Toronto, Ont

BOLT THREADING DIE HEADS
Landis Machine Co., Inc., Waynesboro Pa.

BOLTS, TRACK
Steel Co. of Canada, Ltd., Hamilton, Ont.

BORING and TURNING MILLS, Vertical
Bertram & Sons Co., Ltd., The John Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

BORING, DRILLING and MILLING MACHINES, Horizontal.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
Herbert, Limited, Alfred, Toronto, Ont
Landis Tool Co., Waynesboro, Pa.
Vertical
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
McDougall Co., Ltd., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont
Rockford Drilling Machine Co., Rockford,

BORING TOOLS
Armstrong Bros Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.

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See "Where to buy your castings" Section. Page number may be found by turning to Advertisers' Index.

CHAINS, DRIVING
Can. Link-Belt Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont
Jones & Glassco, Montreal, Que.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

CHASERS
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, a.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CHUCKING MACHINES
Acme Machine Tool Co., Cincinnati, O.
Brown & Sharpe Mfg Co., Providence, R. I.
Gisholt Machine Co., Madison, Wis
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

CHUCKS, DRILL AND TAP
Can Fairbanks-Morse Co., Ltd., Montreal
Canadian SKF Co., Toronto, Ont.
Cushman Chuck Co., Hartford, Conn
Geometric Tool Co., New Haven, Conn
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Skinner Chuck Co., New Britain, Conn
Union Mfg., New Britain, Conn.

CHUCKS, LATHE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Cushman Chuck Co., Hartford, Conn.
Herbert, Limited, Alfred, Toronto, Ont
Geometric Tool Co., New Haven, Conn
Gisholt Machine Co., Madison, Wis.
Ker & Goodwin Machine Co., Brantford Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pryibil Machine Co., New York, N Y
Skinner Chuck Co., New Britain, Conn
Union Mfg. Co., New Britain, Conn

CHUCKS, MAGNETIC
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont.

CHUCKS, PLANER
Bertram & Son Co., Ltd., The John Dundas, Ont.
Cushman Chuck Co., Hartford, Conn
Skinner Chuck Co., New Britain, Conn
Union Mfg. Co., New Britain, Conn.

CHUCKS, TAPPING
William L. Procunier, Chicago, Ill

CHUCKS, VERTICAL BORING MILL
Bertram & Son Co., Ltd., The John, Dundas, Ont
Gisholt Machine Co., Madison, Wis
Skinner Chuck Co., New Britain, Conn
Union Mfg Co., New Britain, Conn

CLAMPS, MACHINISTS'
Brown & Sharpe Mfg Co., Providence
Starrett Co., L. S., Athol, Mass.

CLEANERS, METAL, WASTE, GENERAL
Oakley Chemical Co., New York, N Y

CLOCKS
Chicago Watchman's Clock Co., Chicago
Hardinge Bros., Limited, Toronto, Ont

CLOCKS, TIME
Gisholt Machine Co., Madison, Wis

CLOCKS, WATCHMEN'S
Chicago Watchman's Clock Co., Chicago Ill.
Hardinge Bros., Limited, Toronto, Ont

For list of Dealers see the last page of This Buyers Directory

BELTS, ABRASIVE
Oakey & Sons, Ltd., John, London, S.E., Eng.

BENDING MACHINES, POWER
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bertrams Ltd., Edinburgh, Scotland.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

BILLETS, BLOOMS and SLABS
Steel Co., of Can. Ltd., Hamilton, Ont.

BLOCKS
Wright Mfg. Co., Lisbon, Ohio.

BLOCKS, CHAIN (See Hoists, Hand)
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

BLOCKS, DIE
Canada Foundries & Forgings Co., Welland, Ont.

BLOCKS, PILLOW
Can. Link-Belt Co., Toronto, Ont.

BLOWERS
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

BOILERS, LOCOMOTIVE
Goldie & McCulloch Co., Ltd., Galt,

BOLT AND NUT MACHINERY
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Montreal, Que.

BOLT AND NUT MACHINERY, Automatic
National Acme Co., Cleveland, Ohio.

BUCKET CARRIERS, Pivoted
Can. Link-Belt Co., Toronto, Ont.

BUFFERS
Pryibil Machine Co., New York, N Y

BUFFING OR POLISHING MACHINES (See Polishing and Buffing Machines)
Blount Co., J. G., Everett, Mass.
Herbert, Limited, Alfred, Toronto, Ont
Petrie, Ltd., H. W., Toronto, Ont.
Pryibil Machine Co., New York, N Y
U. S. Electrical Tool Co., Cincinnati, O

BUILDING MATERIALS
Bertram & Son Co., Ltd., The John Dundas, Ont.

BURNERS, OIL AND GAS
Rockwell Co., W S., New York City

BURRS
Steel Co of Can. Ltd., Hamilton, Ont

CABINETS, OIL
S. F. Bowser & Co., Ltd., Toronto, Ont

CALIPERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Starrett Co., L. S., Athol, Mass.

CAMS
Canada Foundries & Forgings Co., Welland, Ont.

CAN-MAKING MACHINERY (See Sheet Metal Working Machinery)
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Bliss Co., E. W., Brooklyn, N Y
Smooth Mfg. Co., Jersey City, N. J.

CARBONIZING
Chapman Double Ball Bearing Co., Toronto.

CEMENTS, IRON
CENTERING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.

CHAINS (See Sprockets and Chains)
Reynold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio

CHUCKS, DRILL
Herbert, Limited, Alfred, Toronto, Ont
Jacobs Mfg. Co., Hartford, Conn.

CARD CLOTHING
D. K. McLaren, Limited, Montreal

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CLUTCHES, FRICTION
Can.-Link-Belt Co., Toronto, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.

COAL AND ASH HANDLING MACHINERY
Can.-Link Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

COAL-STORAGE SYSTEMS
Can. Link-Belt Co., Toronto, Ont.

COLLARS, SHAFT OR SET
Canada Foundries & Forgings Co., Welland, Ont.
Can. Link-Belt Co., Toronto, Ont.

COLLETS
Butterfield & Co., Inc., Rock Island, Que.
Geometric Tool Co., New Haven, Conn.
Hardinge Bros., Inc., Chicago, Ill.
Hendley Machine Co., Torrington Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

COMPOUNDS, CLEANING
Oakley Chemical Co., New York, N.Y.

COMPOUNDS—CUTTING, DRILLING, GRINDING, SCREW CUTTING
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Oakley Chemical Co., New York, N.Y.

COMPRESSORS, AIR AND GAS
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.

CONES, FRICTION
Norton Co., of Can. Ltd., Hamilton, Ont.

CONNECTING RODS AND STRAPS
Canada Foundries & Forgings Co., Welland, Ont.

CONTRACT WORK
Victoria Foundry Co., Ltd., Ottawa, Ont.

CONVEYORS AND ELEVATORS (SEE ELEVATORS)
Jones & Glassco, Montreal, Que.

COTTERS
Steel Co. of Canada, Ltd., Hamilton, Ont.

COUNTERBORES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

COUNTERS, REVOLUTION
Starrett Co., L. S., Athol, Mass.

COUNTERSHAFTS
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Johnson Machine Co., Carlyle, Man-
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

COUNTERSINKS
Butterfield & Co., Inc., Rock Island. Que.
Pratt &Whitney Co., of Canada, Ltd., Dundas, Ont.

COUPLERS, CAR AND LOCOMOTIVE
Can. Steel Foundries, Montreal, Que.

COUPLINGS
Steel Co. of Canada, Ltd., Hamilton, Ont.

COUPLINGS, PIPE
Fittings, Limited, Oshawa, Ont.

COUPLINGS, SHAFT
Can. Link-Belt Co., Toronto, Ont.

CRANES, ELECTRIC
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can.-Link-Belt Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

CRANES, LOCOMOTIVE
Can. Link-Belt Co., Toronto, Ont.

Bertram & Son Co., td., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

CRANK PIN TURNING MACHINE
Underwood Corp., H.B., Philadelphia, Pa.

CUTTERS, GEAR
Brown & Sharpe Mfg. Co., Providence, R. I.
Butterfield & Co., Inc., Rock Island, Q. Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CUTTERS, HIGH SPEED
Atkins & Co., Inc., E. C., Indianapolis.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney & Trecker Co., Milwaukee, Wis
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CUTTERS, MILLING
Brown & Sharpe Mfg. Co., Providence, R. I
Butterfield & Co., Inc., Rock Island. Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.

CUTTERS, STAY BOLT
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.

CUTTING-OFF MACHINE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

CUTTING OFF MACHINES, PIPE (SEE PIPE-CUTTING AND THREADING MACHINES)
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.

CUTTING-OFF TOOLS
Armstrong Bros. Tool Co., Chicago, Ill.

CUTTING OIL FILTERS (SEE OIL FILTERING SYSTEMS
Bowser, S. F. & Co., Ltd., Toronto.

CUTTING, OXY-HYDROGEN
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Ltd., Toronto, Ont.

DETACHABLE CHAIN
International Malleable Iron Co., Guelph, Ont.

DIAMONDS, BLACK AND ROUGH
Can. Desmond-Stephan Mfg Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

DIAMOND TOOLS
Can. Desmond-Stephan Co., Hamilton,
Wheel Trueing Tool Co., Windsor, Ont.

DIAMOND CROSSINGS
Can. Steel Foundries, Montreal, Que.

DIAMONDS, IMPORTERS
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Co., Windsor, Ont.

DIES, SCREW AND THREAD CUTTING
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.

DIES, SHEET-METAL AND SUB-PRESS (See Tool Work)
Brown, Boggs & Co., Ltd., Hamilton, Ont.

DIES, FORGING
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

DIES, SELF-OPENING, ADJUSTABLE
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Landis Machine Co., Inc., Waynesboro,
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DIES, THREADING-OPENING
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DIVIDING HEADS
Burke Machine Tool Co., Conneaut, Ohio.
Hendey Machine Co., Torrington, Conn.
Kearney & Treacker Co., Milwaukee, Wis.
Petrie, Ltd., H. W. Toronto, Ont.

DOGS, LATHE AND MILLING MACHINE
Armstrong Bros. Tool Co., Chicago, Ill.

DRAFTING MATERIALS
American Lead Pencil Co., New York City, N.Y.

DRESSERS, GRINDING WHEEL
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ont.
Norton Co., of Can., Ltd., Hamilton.
Wheel Trueing Co., Windsor, Ont.

DRESSING TOOLS
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Co., Windsor, Ont.

DRILL HOLDERS
Armstrong Bros. Tool Co., Chicago, Ill.

DRILLING MACHINES, BENCH
Burke Machine Tool Co., Conneaut, Ohio.
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Hardinge Bros., Inc., Chicago, Ill.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
U. S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, ELECTRIC AND HAND
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, GANG
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

DRILLING MACHINES, HEAVY DUTY
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
Herbert, Limited, Alfred, Toronto, Ont.
Rockford Drilling Machine Co., Rockford, Ill.

BORING, DRILLING AND MILLING MACHINES, (HORIZONTAL.)
Herbert, Limited, Alfred, Toronto, Ont.
Gisholt Machine Co., Madison, Wis.

DRILLING MACHINES, Multiple Spindle
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
National Acme Co., Cleveland, Ohio.

DRILLING MACHINES, Pneumatic
Cleveland Pneumatic Tool Co., Toronto. Ont.

DRILLING MACHINES, PORTABLE
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, RADIAL
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Herbert, Limited, Alfred, Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Wiliams Machinery Co., A. R., Toronto,

DRILLING MACHINES, SENSITIVE
Burke Machine Tool Co., Conneaut, O.
Herbert, Limited, Alfred, Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Williams Machinery Co., A. R., Toronto.
Wisconsin Electric Co., Racine. Wis

DRILLING MACHINES, TURRET
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wisconsin.
Williams Machinery Co., A. R., Toronto.

DRILLING MACHINES, VERTICAL
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Herbert, Limited, Alfred, Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

DRILLS, CENTRE
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DRILLS, HIGH SPEED TWIST
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Cleveland Twist Drill Co., Cleveland, O.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DRILLS, RATCHET
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

DRILLS, TWIST AND FLAT
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.

DROP FORGINGS
Steel Co. of Canada, Ltd., Hamilton.

DUST HANDLING EQUIPMENT
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

ELECTRICAL INSTRUMENTS
Bristol Co., Waterbury, Conn.

ELECTRICAL SUPPLIES
Atkins & Co., Inc., E. C., Indianapolis.
Diamond State Fibre Co., Toronto, Ont.
U.S. Electrical Tool Co., Cincinnati, O.

ELEVATING TRUCKS (See Trucks)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

ELEVATORS AND CONVEYORS
Can. Link-Belt C., Toronto, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.

EQUIPMENT, ELEVATOR SAFETY
Jones & Glassco, Montreal, Que.

EMERY WHEELS (See Grinding Wheels)
Lion Grinding Wheels, Limited, Montreal, Que.
Atkins & Co., E. C., Indianapolis, I.
Norton Co., of Canada., Ltd., Hamilton.

ENGINES, CAPSTAN
Kennedy & Sons, Wm., Owen Sound, Ont.

ENGINE LATHE MANUFACTURERS
Oliver Machinery Co., Grand Rapids, Michigan.

ENGINEERS, MECHANICAL
Dominion Engineering Works, Limited, Montreal, Que.
Gisholt Machine Co., Madison, Wis.
Hamilton Gear & Machine Co., Toronto.

EXPANDERS, TUBE
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

FANS, ELECTRIC
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

FANS, EXHAUST
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Petrie Ltd., H. W., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass.

FANS, VENTILATING
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

FIBRE
Diamond State Fibre Co., of Can. Ltd., Toronto, Ont.

FILES AND RASPS
Nicholson File Co., Port Hope, Ont.
Simmons Canada Saw Co., Montreal, Que.

FILLER, IRON (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J.

FIRE ESCAPES
Roelofson Elevator Co., Galt, Ont.

FITTINGS, PIPE
International Malleable Iron Co., Guelph.
Fittings, Limited, Oshawa, Ont.

FLEXIBLE SHAFTS
Strand & Co., N. A., Chicago, Ill

FLUXES, WELDING
Carter Welding Co., Ltd, Toronto, Ont.
Dominion Oxygen Co., Ltd, Toronto
Liquide Air Company, Toronto, Ont.

FORGING MACHINERY
Acme Machinery Co., Cleveland, Ohio
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown Boggs & Co., Ltd., Montreal.
National Machinery Co., Tiffin, Ohio.
Steel Co. of Canada, Ltd, Hamilton,

BUYERS' DIRECTORY

FORGINGS, DROP
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Ltd., Toronto, Ont.

FORGINGS, HAMMER
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Hepburn Ltd., John T., Toronto, Ont.

FOUNDRY EQUIPMENT
McDougall Co., Ltd., R., Galt, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

FOUNDRY SUPPLIES
Rice Lewis & Son, Ltd., Toronto, Ont.

FROGS, SPRING OR RIGID
Can. Steel Foundries, Montreal, Que.

FURNACES, ELECTRIC
Rockwell Co., W. S. New York City.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

FURNACES, HEAT TREATING COAL
Rockwell Co., W. S., New York City.

FURNACES, HEAT TREATING OIL AND GAS
Bellevue Industrial Furnace Co., Detroit, Michigan.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Rockwell Co., W. R., New York City.

FURNACES TEMPERING AND ANNEALING
Bellevue Industrial Furnace Co., Detriot, Mich.
Brown & Sharpe Mfg., Co., Providence R. I.
Rockwell Co., W. S., New York City.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

FURNACES AND OVENS, ELECTRIC
Petrie, Ltd., H. W., Toronto, Ont.
Rockwell & Co., W. S., New York city.
Starrett Co., L. S., Athol, Mass.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

GAGES, MEASURING (See Tool Work)
Brown & Sharpe Mfg. Co., Providence, R. I.
Greenfield Tap & Die Corp., Galt, Ont.
Lufkin Rule Co., Windsor, Ont.
Starrett Co., L. S., Athol, Mass.

GAGES, RECORDING
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GAGES, SPECIAL MEASURING (See Tool Work)
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GAGES, THREAD
Brown & Sharpe Mfg. Co., Providence R. I.
Herbert, Limited, Alfred, Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

GALVANIZING
Fittings, Limited, Oshawa, Ont.

GAS, COAL COMPRESSED
L'Air Liquid Society, Toronto, Ont.

GAS, COMPRESSED
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

GASKETS
Diamond State Fibre Co. of Ca., Ltd., Toronto, Ont.
Smooth Mfg. Co., Jersey City, N. J.

GAUGES VACUUM AND PRESSURE
Taylor Instrument Co. Toronto, Ont.

GEAR BLANKS
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.
Dominion Engineering Works, Limited, Montreal, Que.

GEAR COUNTERS
Hart Mfg. Co., R. A., Battle Creek, Michigan.

GEAR-CUTTING MACHINES
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Fellows Gear Shaper Co., Springfield, Vt.
Petrie, Ltd., H. W., Toronto, Ont.
Whiton Machine Co., D. E., New London, Conn.

GEAR TESTING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.

GEARS, CAST
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Hull Iron & Steel Foundries, Hull, Que.
Dominion Engineering Works, Limited, Montreal, Que.

GEARS, CUT
Brown & Sharpe Mfg. Co., Providence, R. I.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Gardner & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto, Ont.
Hepburn Ltd., John T. Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

GEARS, DRESSED
Kennedy & Sons, Wm., Owen Sound, Ontario.

GEARS, FORGED
Canada Foundries & Forgings Co., Welland, Ont.

GEARS, HERRINGBONE
Hamilton Gear & Machine Co., Toronto, Ont.

GEARS, RAWHIDE (See Gears, Cut)
Hamilton Gear & Machine Co., Toronto.

GEAR, SILENT CHAIN
Gardner & Son, Robt., Montreal, Que.
Can. Link-Belt Co., Ltd., Toronto, Can.
Hans Renold of Canada, Ltd., Montreal, Quebec.

GEARS, WORM
Hamilton Gear & Machine Co., Toronto.

GENERATORS, ACETYLENE
L'Air Liquide Society, Toronto, Ont.

GLOVES, PROTECTIVE
Industrial Glove Co., Toronto, Ont.

GOGGLES, SAFETY
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

GRAB BUCKETS
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Cleveland Twist Drill Co., Cleveland, O.

GREASE CUPS, PRESSED STEEL AND BRASS
Can. Winkley Co., Ltd., Windsor, Ont.

GREASES, LUBRICATING
Canadian SKF Co., Toronto, Ont.

GRINDING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Norton Co., of Canada, Ltd., Hamilton.

GRINDING MACHINES, ABRASIVE BELT
Norton Co. of Can. Ltd., Hamilton, Ont.

GRINDING MACHINES, AUTOMATIC
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, BENCH
Blount Co., J. G., Everett, Mass.
Geometric Tool Co., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
McDougall Co., Ltd., R., Galt, Ont.
Norton Co. of Canada, Ltd., Hamilton, Ont.
Petrie, Ltd., H. W. Toronto, Ont.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, CENTER
U. S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES, CUTTER AND REAMER
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Petrie Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, CYLINDRICAL
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.
Norton Co., of Canada, Ltd., Hamilton.

GRINDING MACHINES, DIE
Geometric Tool Co., New Haven, Conn.
National Acme Co., Cleveland, O.
National Machinery Co., Tiffin, Ohio.

GRINDING MACHINES, DRILL
Bellevue Industrial Furnace Co., Detroit, Mich.
Bertram & Son Co., Ltd., The John, Dundas, Ont.

GRINDING MACHINES, ELECTRIC
Strand & Co., N. A., Chicago, Ill.

GRINDING MACHINES, FLOOR AND TOOL
Blount Co., J. G., Everett, Mass.
Herbert, Limited, Alfred, Toronto, Ont.
National Acme Co., Cleveland, Ohio.
Norton Co. of Canada, Ltd., Hamilton, Ontario.
Petrie, Ltd., H. W., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.

GRINDING MACHINES, INTERNAL
Garlock Machinery Ltd., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES PORTABLE
Strand & Co., N. A., Chicago, Ill.

GRINDING MACHINES, SNAGGING
Blount Co., J. G., Everett, Mass.
Norton Co., of Can. Ltd., Hamilton, Ont.

GRINDING MACHINES, SURFACE
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, THREAD
Pratt & Whitney Co., of Canada, Ltd.,

GRINDING MACHINERY, TOOL POST
Gisholt Machine Co., Madison, Wis.
Grenfield Tap & Die Corp., Galt, Ont.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES, UNIVERSAL
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Herbert, Limited, Alfred, Toronto, Ont
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co., of Canada, Ltd., Hamilton Ontario.
Petrie, Ltd., H. W., Toronto, Ont.

GRINDING WHEELS
Lion Grinding Wheels, Limited, Montreal, Que.
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Norton Co. of Can., Ltd., Hamilton, Ont.

GUN-BARREL MACHINERY
Steinle Turret Machine Co., Madison, Wisconsin.

HACK SAWS, POWER
Atkins & Co., Inc., E.C., Indianapolis, Indiana.
Petrie, Ltd., H. W., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.

HAMMERS, CHIPPING
Cleveland Pneumatic Tool Co., Toronto, Ont.
High Speed Hammer Co., Rochester.

HAMMERS, DROP
Bertram & Son Co., Ltd., The John Dundas, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

HAMMERS, ELECTRIC
Brown, Boggs & Co., Ltd., Hamilton, Ont.

HAMMERS, PNEUMATIC
Can. Steel Foundries, Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto Ont.

HANGERS, SHAFTING
Canadian SKF Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Hamilton Gear & Machine Co., Toronto.

HOBBING MACHINES
Shore Instrument Co., Jamaica, N.Y.

HARDENING, CASE-HARDENING AND TEMPERING
Barnes Company, Wallace, Hamilton.
Chapman Double Ball Bearing Co., Toronto.
Petrie, Ltd., H. W., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Cleveland Pneumatic Tool Co., Toronto Ont.

HAMMERS, POWER
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

HOBS
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

HOISTS, ELECTRIC
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

HOISTS, ELECTRIC
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

HOISTS, HAND
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

HOISTS, PNEUMATIC
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

HOLDERS-ON, PNEUMATIC
Cleveland Pneumatic Tool Co., Toronto Ont.

HYDRAULIC MACHINERY
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

IGNITERS, GAS ENGINE
Canada Foundries & Forgings Co., Welland, Ont.
Burke Machine Tool Co., Conneaut, O.

INDICATORS, SPEED AND TEST
Brown & Sharpe Mfg. Co., Providence, R.I.

INSULATION
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.

IRON BARS
Steel Co. of Canada, Ltd., Hamilton, Ont.

JACKS, HYDRAULIC
Norton, A. O., Boston, Mass.

JACKS, PLANER
Armstrong Bros. Tool Co., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

JAPANNING AND VARNISHING OVENS
Brantford Oven & Rack Co., Brantford, Ont.

JIGS AND FIXTURES (SEE TOOL WORK)
Fisher Motor Co., Ltd., Orillia, Ont.
Gisholt Machine Co., Madison, Wis.
Preston & Schwartz, Galt, Ont.

KEYSEATING MACHINES
Morton Mfg. Co., Muskegon, Mich

BUYERS' DIRECTORY

Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

KEYS, MACHINE
Can. Dranw Steel Co., Hamilton, Ont.
Morton Mfg. Co., Muskegon, Mich.

KNIVES, MACHINE
Atkins & Co., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

KNURL HOLDERS
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

LATHE ATTACHMENTS
Hendey Machine Co., Torrington, Conn.
Petrie, Ltd., H. W., Toronto, Ont.

LATHE TOOLS
Armstrong Bros. Tool Co. ,Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

LATHES, AUTOMATIC AND SEMI-AUTOMATIC
Gisholt Machine Co., Madison, Wis.
Herbert, Limited, Alfred, Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, BENCH
Hardinge Bros., Inc., Chicago, Ill.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

LATHES, BORING
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, CHUCKING (SEE LATHES, HORIZONTAL TURRET, AND LATHES, VERTICAL TURRET)
Acme Machine Tool Co., Cincinnati, O.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
Herbert, Limited, Alfred, Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, ENGINE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hendey Machine Co., Torrington, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd, H. W., Toronto, Ont
Rockford Lathe & Drill Co., Rockford, Illinois.

LATHES, EXTENSION AND GAP
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison Wis.
Herbert, Limited, Alfred, Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, O.
Petrie, Ltd., H. W., Toronto, Ont.
Steinle Turret Machine Co., Madison, Wis.

LATHES, PRECISION
Hardinge Bros., Chicago.

LATHES, RELIEVING
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.

LATHE, UNIVERSAL HAND
Brown & Sharpe Mfg. Co., Providence, Rhode Island.

LATHE, SPEED AND HAND
Blount Co., J. G., Everett, Mass.

LATHES, SPINNING
Pryibil Machine Co., Torrington, Conn.

LATHES, VERTICAL TURRET
Bertram & Son, Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

LATHES, WOOD TURNING
Blount, Co., J. G., Everett, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.

LEAD PIPE
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

LEATHER FILLET
D. K. McLaren, Limited, Montreal.

LIGHTING AND GENERATING SETS
Beardmore & Co., Ltd., Wm., Montreal, Que.

LINOLEUM MILL MACHINERY
Bertrams, Ltd., Edinburgh, Scotland.

LIQUID AIR PLANTS
L'Air Liquide Society, Toronto, Ont.

LOCKERS, CLOTHES
Dennis Wire and Iron Works, London Ont.

LUBRICANTS
Oakley Chemical Co., New York, N.Y.

LUBRICATING SYSTEMS
Bowser, S. F., & Co., Ltd., Toronto, Canada.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Ltd., Welland, Ont.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R. Toronto Ont.

MANGANESE STEEL
Can. Steel Foundries, Montreal, Que.

MANDRELS, EXPANDING
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MANDRELS, SOLID
Greenfield Tap & Die Corp., Galt, Ont.
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Pratt & Whitney Co., of Canada. Ltd., Dundas, Ont.

MEASURING MACHINES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MECHANICS' FINE TOOLS
Lufkin Rule Co., Windsor, Ont.

METALS, ALLOY
Canada Metal Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.

METAL WORKERS
Parker Co., Charles, Meriden, Conn.

MICROMETER CALIPERS
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Rice Lewis & Son, Ltd., Toronto, Ont.

MILLING ATTACHMENTS
Burke Machine Tool Co., Conneaut, O.
Hendey Machine Co., Torrington, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Hinckley Machine Works, Hinckley, Ill.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

MILLING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Burke Machine Tool Co., Conneaut, O

MILLING MACHINES, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence, R. I.
Hardinge Bros., Inc., Chicago, Ill.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

MILLING MACHINES, BENCH
Burke Machine Tool Co., Conneaut, O.
Hardinge Bros., Inc., Chicago, Ill.

MILLING MACHINES, HAND
Brown & Sharpe Mfg. Co., Providence
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MILLING MACHINES, HORIZONTAL PLANER TYPE.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Kearney & Trecker Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto.

MILLING MACHINES, PLAIN
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, O.
Hendey Machine Co., Torrington, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

MILLING MACHINES, THREAD
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MILLING MACHINES, UNIVERSAL
Brown & Sharpe Mfg. Co., Providence,
Hendey Machine Co., Torrington, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

MILLING MACHINES, VERTICAL
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, O.
Herbert, Limited, Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto.

MILLING TOOLS, ADJUSTABLE HOLLOW
Geometric Tool Co., New Haven, Conn.

MOTORS, ELECTRIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Roelofson Elevator Co., Galt, Ont.
Williams Machinery Co., A. R., Toronto,
Wisconsin Electric Co., Racine Wis.

NAILS AND STAPLES
Canada Metal Co., Ltd., Toronto, Ont.

NIPPLES
Canada Metal Co., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton,

NITROGEN
Carter Welding Co. Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

NUT TAPPERS
(See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
National Acme Co., Cleveland, Ohio.

NUTS, FINISHED and SEMI-FINISHED
Galt Macine Screw Co., Galt, Ont.
National Acme Co., Montreal, ue.

NUTS (Up to 4-in.)
Steel Co. of Canada, Ltd., Hamilton.

NUTS, S.A.E., PLAIN AND CASTELLATED
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

OIL FILTERING AND STORAGE SYSTEMS
Bowser, S. F., & Co., Ltd., Toronto,

OIL STORAGE ENGINEERS
Bowser, S. F., & Co., Ltd., Toronto,

OIL HOLE COVERS
Can. Whitney Co., Ltd., Windsor, Ont.

OILS, SOLUABLE
Brantford Oven & Rack Co., Brantford, Ontario.

OXYGEN
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

OXY-ACETYLENE APPARATUS
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Atlas Press Co., Kalamazoo, Mich.

PAPER MILL CONVEYORS
Bertram Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd., Montreal, Que.

PATTERNS, WOOD AND METAL
Fittings, Limited, Oshawa, Ont.
Victoria Foundry Co., Ltd., Ottawa.

PHOSPHOR TIN
Canada Metal Co., Ltd., Toronto, Ont.

PHOTOGRAPHIC DUPLICATING MACHINES
Photostat Corp., Providence, R. I.

PIPE BENDING MACHINES
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Underwood Corp., H. R., Philadelphia, Pa.
Williams Machinery Co., A. R., Toronto.

PIPE CUTTING AND THREADING MACHINES
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

PIPE
Canada Metal Co., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.

PIPE FITTINGS
Canada Metal Co., Toronto, Ont.
Fittings, Limited, Oshawa, Ont.
International Malleable Iron Co., Guelph Ont.

PIPE AND NIPPLE THREADING MACHINES
Landis Machine Co., Inc., Waynesboro, Pa.

PIPE FITTERS' TOOLS
Rice Lewis & Son, Ltd., Toronto, Ont.

PIPE THREADING DIE HEADS
Landis Machine Co., Inc., Waynesboro Pa.

PISTON-RING MACHINES
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

PLANING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.
Herbert, Limited, Alfred, Toronto, Ont
Morton Mfg. Co., Muskegon, Mich.
Williams Machinery Co., A. R., Toronto

PLANING MACHINES, ROTARY
Bertram & Son Co., Ltd., The John, Dundas, Ont.

PLATE ROLLS
Bertram & Son Co., Ltd., The John, Dundas, Ont.

PNEUMATIC TOOLS
Cleveland Pneumatic Tool Co., Toronto.

POLISHING AND BUFFING MACHINES
Lion Grinding Wheels, Limited, Montreal, Que.
Blount Co., J. G. Everett, Mass.
Brown & Sharpe Mfg. Co., Providence.
Pryibil Machine Co., New York, N.Y.

PRESSED STEEL PARTS
American Pulley Co., Philadelphia, Pa.
Fisher Motor Co., Ltd., Orillia, Ont.

PRESSES, ARBOR
Atlas Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

PRESSES, DROP AND FORGING
Brown, Boggs & Co., Ltd., Hamilton.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

PRESSES, FOOT AND HAND
Brown, Boggs & Co., Ltd., Hamilton.

PRESSES, HYDRAULIC
Bertram & Son Co., Ltd., The John, Dunidas, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Perrin Ltd., W. R., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

PRESSES, POWER
Bliss Co., E. W., Prooklyn, N. Y.
Brown, Boggs, & Co., Ltd., Hamilton.
Hepburn Ltd., John T., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Stoll Co., Inc., D. H., Buffalo, N.Y

PRESSES, SCREW
Brown, Boggs & Co., Ltd., Hamilton
Petrie, Ltd., H. W., Toronto, Ont.

PROFILING MACHINES
Prtt & Whitney Co., of Canada, Ltd. Dundas, Ont.

PROTRACTORS
Brown & Sharpe Mfg. Co., Providence
Lufkin Rule Co., Windsor, Ont.

PROPELLERS
Kennedy & Sons, Wm., Owen Sound Ontario.

PULLEYS, CORK INSERT
American Pulley Co., Philadelphia, Pa

PULLEYS, METAL AND FIBRE
American Pulley Co., Philadelphia, Pa.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.
D. K. McLaren Co., Limited Montreal, Que.

PULP AND PAPER MILL EQUIPMENT
Dominion Engineering Works, Ltd., Montreal, Que.

PUMPS, HYDRAULIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Dominion Engineering Works, Ltd Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.

BUYERS' DIRECTORY

PUMPS, LUBRICANT AND OIL
Bowser, S. F., & Co., Ltd., Toronto.
Can Blower & Forge Co., Ltd., Kitchener, Ont.
Hepburn Ltd., John T., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.

PUMPS, POWER
Bowser, S. F., & Co., Ltd., Toronto.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hepburn Ltd., John T., Toronto, Ont.

PUNCHES, CENTER
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

PUNCHES, HAND
Brown Boggs & Co., Ltd., Hamilton.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Jardine & Co., A. B., Hespeler, Ont.

PUNCHES, POWER
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

PUNCHING MACHINES, HORIZONTAL
Bertram Ltd., Edinburgh, Scotland.

PYROMETERS, ELECTRIC
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Hiram Walker & Sons Metal Products Co., Walkerville, Ont.

RACKS, CUT
Hamilton Gear & Machine Co., Toronto.

RACKS, STORAGE
(See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ontario.

REAMER HOLDERS
Simonds Canada Saw Co., Montreal, Q.

REAMERS, EXPANDING
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

REAMERS, SOLID
Butterfield & Co., Inc., Rock Island, Q.
Morse Twist Drill & Machine Co., New Bedford, Mass.

REAMERS, TAPER
Brown & Sharpe Mfg. Co., Providence, R. I.
Butterfield & Co., Inc., Rock Island, Q.
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canad, Ltd., Dundas, Ont.

RECORDERS, TEMPERATURE
Taylor Instrument Co., Rochester, N. Y.

RECORDERS, TIME
Gisholt Machine Co., Rochester, N. Y.
Taylor Instrument Co., Toronto, Ont.

REGULATORS, TEMPERATURE
Taylor Instrument Co., Toronto, Ont.

RIVETS AND BURRS
Parmenter & Bulloch Co., Gananoque, Ont.
Steel Co., of Canada, Ltd., Hamilton.

RIVETS, CHAIN
Tittings, Limited, Oshawa, Ont.

RIVET-MAKING MACHINERY
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

RIVETING MACHINES
Can. Fairbanks-Morse Ltd., Montreal Q.
High Speed Hammer Co., Rochester, N.Y.
Parmenter & Bulloch Co., Gananoque Ont.
Petrie, Ltd., H. W., Toronto, Ont.

RUDDER FRAMES, STEEL
Can. Steel Foundries, Montreal, Que.

RUBBER MILL MACHINERY
Bertram Ltd., Edinburgh, Scotland

RULES, STEEL AND WOOD
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Windsor, Ont.

RUST PREVENTATIVES
Oakley Chemical Co., New York, N. Y.

SAND EQUIPMENT
Can. Link-Belt Co., Toronto, Ont.

SAND RAMMERS, PNEUMATIC
Cleveland Pneumatic Tool Co., Toronto

SAW FRAMES AND BLADES, HACK
Atkins & Co., Inc., E. C., Indianapolis.
Diamond Saw & Stamping Works, Buffalo, N. Y.
Rice Lewis & Sons, Ltd., Tornto, Ont.
Simonds Canada Saw Co., Montreal, Q

SAWING MACHINES, POWER HACK
Atkins & Co., Inc., E. C., Indianapolis.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

SAW SHARPENING MACHINES
Atkins & Co., Inc., E. C., Indianapolis.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

SAW SHARPENING MACHINES
Atkins & Co., Inc., E. C., Indianapolis.

SAW TABLES, UNIVERSAL
Petrie, Ltd., H. W., Toronto, Ont.

SAWS, CIRCULAR METAL
Atkins & Co., Inc., E. C., Indianapolis.
Pryibil Machine Co., New York, N. Y.
Gisholt Machine Co., Madison, Wis.

SAWS, HAND
Atkins & Co., Inc., E. C., Indianapolis
Simonds Canada Saw Co., Montreal, Q.

SAWS, HOT AND COLD
Atkins & Co., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Q.

SAWS, HIGH SPEED STEEL
Atkins & Co., Inc., E.C., Indianapolis, I.
Butterfield & Co. Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWS, METAL BAND
Atkins & Co., E. C., Indianapolis, I.

SAWS, METAL CUTTING
Brown & Sharpe Mfg. Co., Providence.
Butterfield & Co., Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.
Starrett Co., L. S., Athol, Mass.

SAWS, SCREW SLOTTING
Atkins & Co., Inc., E., C., Indianapolis.
Butterfield & Co., Inc., Rock Island, Q.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canda, Ltd., Dundas, Ont.

SAWS, SCREW SLOTTING
Atkins & Co., Inc., E. C., Indianapolis.
Butterfield & Co., Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q

SAWS, WOOD
E. C. Atkins & Co., Indianapolis, Ind

SCALES
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Ltd., Montreal, Q
Lufkin Rule Co., Windsor, Ont.

SCREENS
Dominion Engineering Works, Ltd., Montreal, Que.

SCREW DRIVERS, OPTICAL, JEWELRY AND NOVELTY
Strand & Co., N. A., Chicago, Ill.

SCREW MACHINE WORK
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Montreal, Que.

SCREW MACHINERY, WOOD AND LAG
Cook Co., Asa S., Hartford, Conn.

SCREW MACHINES
Brown & Sharpe Mfg. Co., Providence, Rhode Island.

SCREW MACHINES, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.

SCREW MACHINE PRODUCTS
National Acme Co., Montreal, Que.

SCREW PLATES
Butterfield & Co., Inc., Rock Island. Que.
Jardine & Co., A. B., Hespeler, Ont.

SCREWS, CAP AND SET
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

SCREWS, SAFETY, SET
Galt Machine Screw Co., Galt, Ont.

SECOND-HAND MACHINERY
See last page of directory.
Petrie, Ltd., H. W., Toronto, Ont.

SEPARATORS, MOISTURE AND OIL
Bowser, S. F., & Co., Ltd., Toronto, Canada.

SEPARATORS, OIL AND WASTE
Bowser, S. F., & Co., Ltd., Toronto.

SHAFTS, FLEXIBLE
Strand & Co., N. A., Chicago, Ill.

SHAFTING
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
Williams Machinery Co., A. R., Toronto.

SHAPES, COLD-DRAWN SPECIAL STEEL
Union Drawn Steel Co., Hamilton, Ont.

SHAPING MACHINES
Hendey Machine Co., Torrington, Conn.
Morton Mfg. Co., Muskegon, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Williams Machinery Co., A. R. Toronto.

SHEARS HAND
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

SHEARS, POWER
Bliss Co., E. W., Brooklyn, N. Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Stoll Co., Inc., D. H., Buffalo, N. Y.
Williams Machinery Co., A. R., Toronto, Ont.

SHEARING MACHINES, ANGLE, IRON BAR AND GATE
Bertrams Ltd., Edinburgh, Scotland.

SHEET LEAD
Canada Metal Co., Ltd., Toronto, Ont.

SHEET METAL WORKING MACHINERY
Bliss Co., E. W., Brooklyn, N. Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Stoll Co., Inc., D. H, Buffalo, N.Y.

SHEETS, NICKEL, MONEL AND FIBRE
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.

SHEETS, O.P.C.R. & B. A. AND BLUE ANNEALED
Steel Co., of Canada, Ltd., Hamilton, Ont.

SIDE FRAMES, LOCOMOTIVE
Can Steel Foundries, Montreal, Que.

SLOTTING ATTACHMENTS
Brown & Sharpe Mfg. Co., Providence, R.I.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

SLOTTING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.

SOLDERS
Canada Metal Co., Ltd., Toronto, Ont.

SPECIAL MACHINERY AND TOOLS
Brown Engineering Corp., Ltd., Toronto.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Cleveland, O.

SPIKES, RAILWAY AND PRESSED
Steel Co of Canada, Ltd., Hamilton, Ont.

SPINNING LATHES
Prybil Machine Co., P., New York City.

SPRING, MILLED
Barnes & Co., Wallace, Hamilton, Ont.

SPRINGS, SMALL SPIRAL HELICAL, COMPRESSION, EXTENSION, TORSION AND SPECIAL
Barnes Company, Wallace, Hamilton,

SPRINGS
Barnes Company, Wallace, Hamilton
Cleveland Wire Spring Co., Cleveland, O
Steele Ltd., James, Guelph, Ont.

SPRINGS, FLAT STEEL, BRUSH HOLDER, CLOCK, SMALL FLAT SPRINGS
Barnes Company, Wallace, Hamilton.

SPROCKETS AND CHAINS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Renold Hanson of Canada, Ltd., Montreal, Que.

SQUARES
Brown & Sharpe Mfg. Co., Providence, R.I.
Lufkin Rule Co., Windsor, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

STAMPING, METAL
American Pulley Co., Philadelphia, Pa.
Barnes Company, Wallace, Hamilton.
Diamond Saw & Stamping Works, Buffalo, N. Y.
Parmenter & Bulloch Co., Gananoque, Ont.

STAMPS, STEEL
Diamond Saw & Stamping Works, Buffalo, N. Y.

STEEL CONCRETE REINFORCEMENT
Steel Co. of Canada, Ltd., Hamilton.

STEEL PLATE
British Empire Steel Co., Montreal, Que.

STEEL AND IRON BARS
Steel Co. of Canada, Ltd., Hamilton.

STEELS TOOL
British Empire Steel Co. Montreal Q.

STEEL, COLD-ROLLED STRIP
British Empire Steel Co., Montreal, Q.
Barnes Company, Wallace, Hamilton.

STEEL, CRUCIBLE, SPRING
Barnes, Company, Wallace, Hamilton.
British Empire Steel Co., Montreal, Q.

SHEETS, OPEN HEARTH STEEL
Steel Co., of Canada, Ltd., Hamilton.

STEEL, SHAFTING AND FREE CUTTING SCREW
Union Drawn Steel Co., Hamilton, Ont.

STEEL, SHEET
British Empire Steel Co., Montreal, Q
Rice Lewis & Son, Ltd., Toronto, Ont.

STEEL, STAINLESS
Steel Co., of Can. Ltd., Hamilton, Ont.

STEELS, ALLOY AND CARBON
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Can. Steel Foundries, Montreal, Que
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton, Ont.

STEELS, HIGH-SPEED
Armstrong Bros. Tool Co., Chicago, Ill
Atkins & Co., Ltd., Wm., Sheffield, England.
British Empire Steel Co., Montreal, Q.
Rice Lewis & Son, Ltd., Toronto, Ont
Steel Co., of Canada, Ltd., Hamilton

STEEL TUBING, CLOSE JOINT AND WELDED
Standard Tube & Fence Co., Ltd., Woodstock, Ont.

STERN FRAMES, CAST STEEL
Can. Steel Foundries, Montreal, Que

STRAIGHTENING MACHINERY
Bertram Ltd., Edinburgh, Scotland
Williams & Co., J. H., Brooklyn, N.Y.

STUDS
Galt Machine Screw Co., Galt, Ont
Geometric Tool Co., New Haven, Conn

BUYERS' DIRECTORY

SWAGING MACHINES
Atkins & Co., Inc., E. C., Indianapolis, Indiana.

SWITCHES, RAILWAY
Can. Steel Foundries, Montreal, Que.

TACHOMETERS
Bristol Co., Waterbury, Conn.

TANKS AND PUMPS, OIL
Bowser, S. F., & Co., Ltd., Toronto.

TAP HOLDERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
William L. Procunier, Chicago, Ill.

TAPER PINS
Galt Machine Screw Co., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

TAPES, MEASURING
Starrett Co., L. S., Athol, Mass.
Lufkin, Rule Co., Windsor, Ont.

TAPPING MACHINES AND ATTACHMENTS
Burke Machine Tool Co., Conneaut, O.
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Wm. L. Procunier, Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

TAPS AND DIES
Butterfield & Co., Inc., Rock Island, Q.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Herbert, Limited, Alfred, Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

TAPS, COLLAPSING
Geometric Tool Co., New Haven, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.

TEETH, DREDGE BUCKET
Kennedy & Sons, W., Owen Sound, Ont.

THERMOMETERS
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Greenfield Tap and Die Corp., Galt, Ontario.

THREAD-CUTTING TOOLS
Butterfield & Co., Inc., Rock Island, Q.
Greenfield Tap and Die Corp., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

THREAD CUTTING MACHINES
Landis Machine Co., Inc., Waynesboro, Pa.

THREADING MACHINES
Acme Machinery Co., Cleveland, Ohio.
Geometric Tool Co., New Haven, Conn.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Williams Tool Corp., of Can. Ltd., Brantford, Ont.

THREAD LEAD TESTING MACHINES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

THREAD-ROLLING MACHINES
Bliss Co., E. W., Brooklyn, N. Y.

TIE PLATES
Steel Co. of Canada, Ltd., Hamilton.

TIME RECORDERS
International Business Machine Co., Ltd., Toronto, Ont.

TONGS
Hepburn Ltd., John T., Toronto, Ont.

TOOL CASES
Rice Lewis & Son, Ltd., Toronto, Ont.

TOOL HOLDERS
Armstrong Bros., Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Bertrams Ltd., Edinburgh, Scotland.

TOOL POSTS, LATHE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Williams & Co., J. H., Brooklyn, N. Y.

TOOLS, SMALL
(See Machinists' Small Tools)
Armstrong Bros. Tool Co., Chicago, Ill.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Lufkin Rule Co., Windsor, Ont.
National Machine Tool Co., Racine, Wis.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S. Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A.R., Toronto,

TOOL WORK
Brown Engineering Corp., Ltd., Toronto, Ontario.

TORCHES, BLOW
Rice Lewis & Son, Ltd., Toronto, Ont.

TRACKWORK, RAILWAY
Can. Steel Foundries, Montreal, Que.

TRACKWORK, MANGANESE STEEL
Can. Steel Foundries, Montreal, Que.

TRANSMISSION MACHINERY
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound.
Petrie, Ltd., H. W., Toronto, Ont.
Renold, (Hans) of Canada, Ltd., Montreal, Que.

TROLLEYS AND TRAMWAYS
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Wright Mfg. Co., Lisbon, Ohio.

TROLLEY WHEELS
Langley & Austin, Galt, Ont.

TROWELS, PLASTERING
E. C. Atkins & Co., Indianapolis, Ind.

WRENCHES, MACHINISTS'
Armstrong Bros. Tool Co., Chicago, Ill.

TRUCKS
Can. Fairbanks-Morse Ltd., Montreal, Q.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

TUBING, SEAMLESS STEEL, BRASS AND COPPER AND FIBRE
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Goldstein Mfg. Co., Ltd., Toronto, Ont.

TURRET HEADS
Bertram & Son Co., Ltd., The John Dundas, Ont.

TURRET MACHINES
(See Lathes, Horizontal Turret)
Acme Machine Tool Co., Cincinnati, O.
Cook Co., Asa S., Hartford, Conn.
Gisholt Machine Co. Madison Wis.
Herbert, Limited, Alfred, Toronto, Ont.
National Acme Co. Cleveland O.
Pratt & Whitney Co. of Canada Ltd., Dundas, Ont.
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DIRECTORY OF DEALERS

THE Buyers' Directory of CANADIAN MACHINERY was originally intended to contain information regarding lines actually manufactured by our advertisers. We now carry the advertising of leading machinery dealers, some of whom represent scores of manufacturers in addition to being manufacturers themselves in some cases. We recommend, therefore, if our subscribers cannot find what they want in our Directory that they communicate with the dealers whose names appear herewith.

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Issued in 1917 and Maturing 1st December, 1922

CONVERSION PROPOSALS

THE MINISTER OF FINANCE offers to holders of these bonds who desire to continue their investment in Dominion of Canada securities the privilege of exchanging the maturing bonds for new bonds bearing 5½ per cent. interest, payable half yearly, of either of the following classes:—

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This offer is made to holders of the maturing bonds and is not open to other investors. The bonds to be issued under this proposal will be substantially of the same character as those which are maturing, except that the exemption from taxation does not apply to the new issue.

Dated at Ottawa, 8th August, 1922.

Holders of the maturing bonds who wish to avail themselves of this conversion privilege should take their bonds AS EARLY AS POSSIBLE, BUT NOT LATER THAN SEPTEMBER 30th, to a Branch of any Chartered Bank in Canada and receive in exchange an official receipt for the bonds surrendered, containing an undertaking to deliver the corresponding bonds of the new issue.

Holders of maturing fully registered bonds, interest payable by cheque from Ottawa, will receive their December 1 interest cheque as usual. Holders of coupon bonds will detach and retain the last unmatured coupon before surrendering the bond itself for conversion purposes.

The surrendered bonds will be forwarded by banks to the Minister of Finance at Ottawa, where they will be exchanged for bonds of the new issue, in fully registered, or coupon registered or coupon bearer form carrying interest payable 1st May and 1st November of each year of the duration of the loan, the first interest payment accruing and payable 1st May, 1923. Bonds of the new issue will be sent to the banks for delivery immediately after the receipt of the surrendered bonds.

The bonds of the maturing issue which are not converted under this proposal will be paid off in cash on the 1st December, 1922.

W. S. FIELDING,
Minister of Finance.

CANADIAN MACHINERY
AND MANUFACTURING NEWS

Vol. XXVIII. No. 9 | Published Weekly by the MacLean Publishing Company, Limited, Toronto, Ont. | August 31, 1922 | $4.00 a Year Subscription Price

READ AND PASS TO	Check	See Page	READ AND PASS TO	Check	See Page

Make Canada Prosperous by Buying Canadian Products

Why go out of Canada for your Hobs and Cutters when we have the facilities for making any type of Hob or Cutter in our specially equipped plant? Write us when in need of standard or special Hobs or Cutters.

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That's the answer one foreman gave us when we asked him about the tools his men used. "What I want to see is the work done—and done right. If a man can turn out a job the way it's called for with a claw hammer and a cross cut saw—let him go to it. More power to him.

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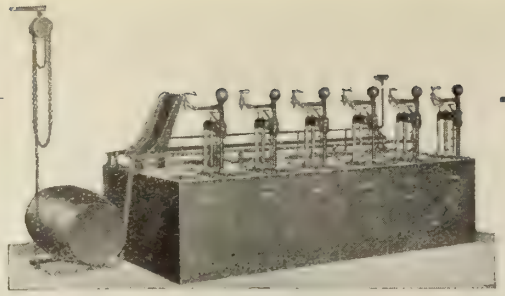

Old Man Johnson Kicked the Spigot.

Several dollars worth of expensive finishing oil was lost, accidentally of course—but gone forever, utterly wasted.

Old man Johnson is liable to kick the spigot in **your** plant if **you** are still handling valuable oils and varnishes in barrels and drums.

Prevent this danger of loss—install an accident-proof Bowser system. Oils are drawn through Bowser accurate measuring pumps in exact amounts; waste and spillage are eliminated.

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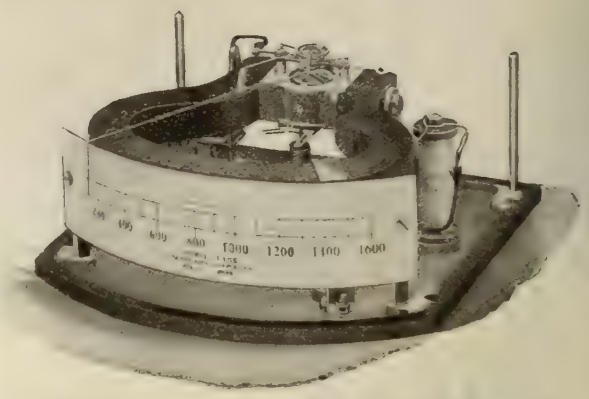

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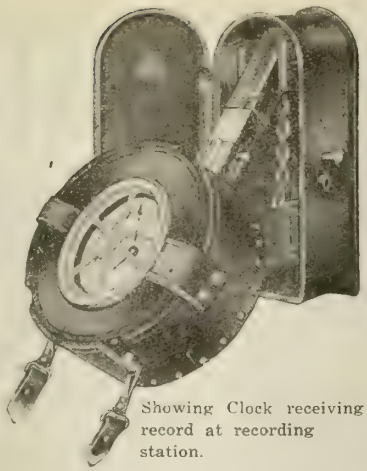

Showing Clock receiving record at recording station.

WHEN you pile into your bed every night do you ever stop to realize that you are entrusting, absolutely, the source of your income to a low-salaried watchman **without proof that he is actually "on the job"?** True, you have your fire insurance, but that is merely indemnity for buildings and material destroyed. It pays you nothing for loss of production, organization and time.

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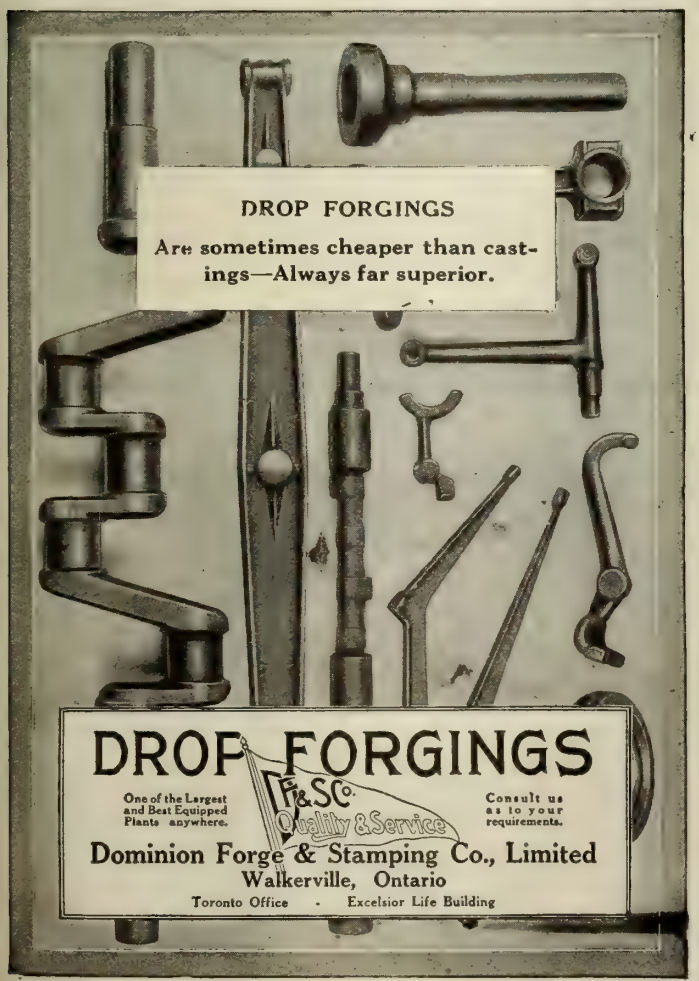
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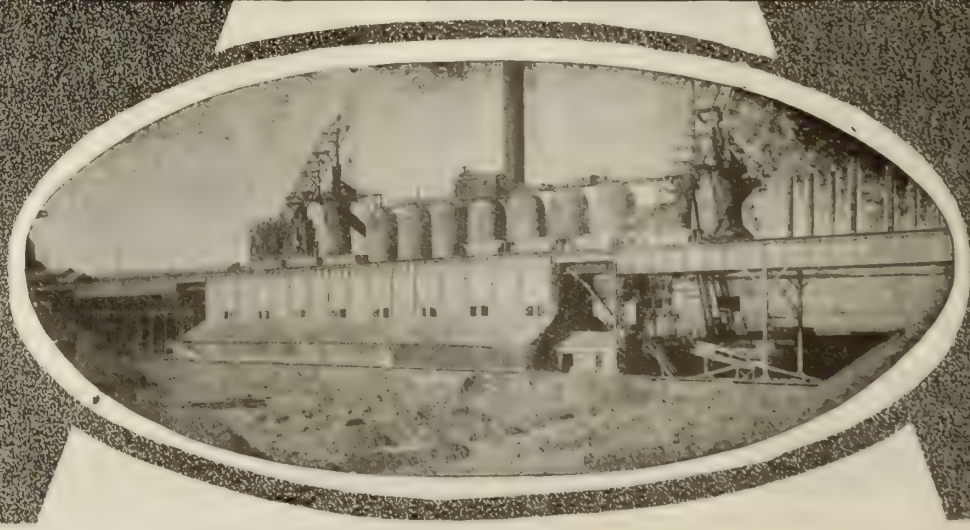

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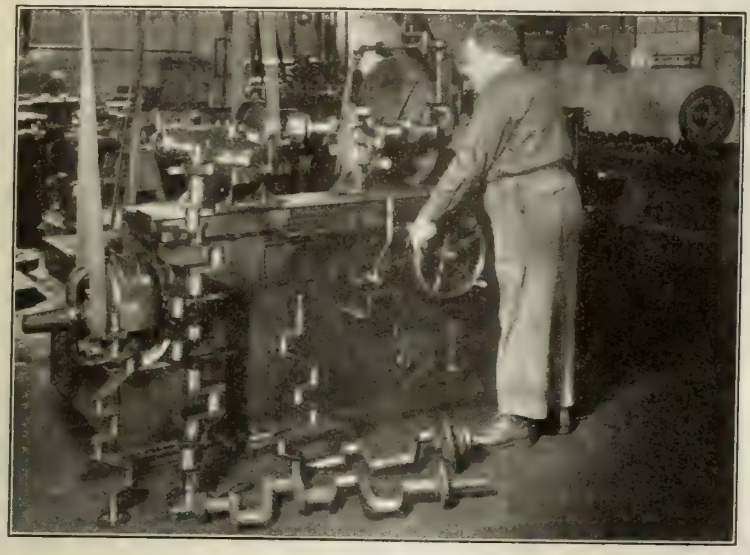
Increase Your Profits 300 Per Cent.



A LANDIS No. 4-A Special installed in the plant of Mr. D. De Jean, of Montreal, where it is demonstrating the fact that the LANDIS will produce more work, more accurately, with more profit.

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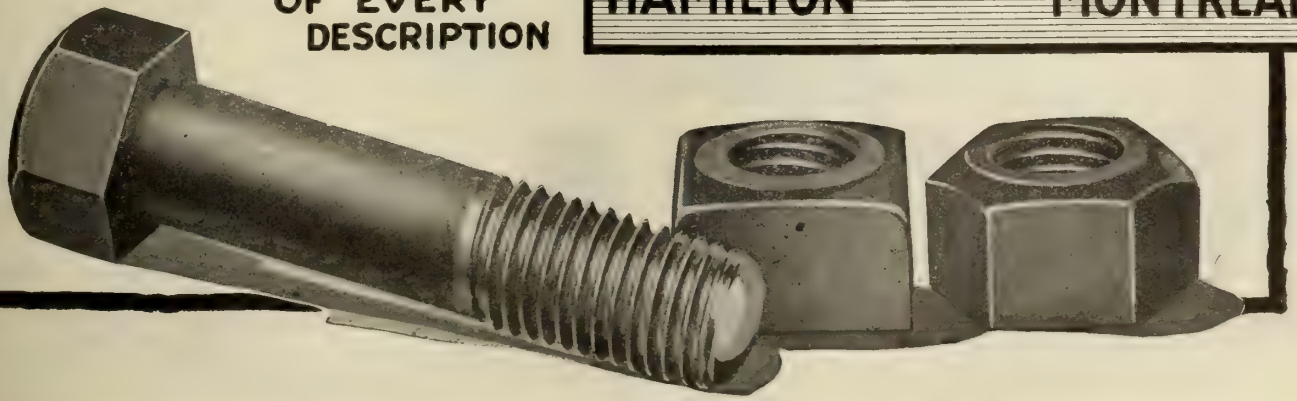

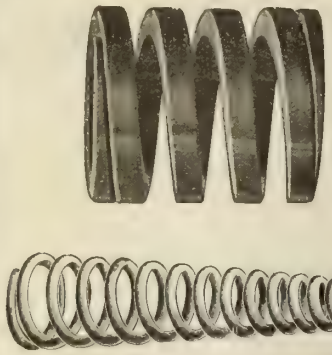

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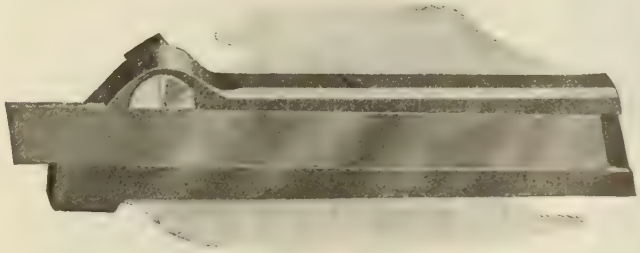

That Occasional Break Of Cutting-Off Tools

that, owing to the nature of the work, you put down as unavoidable, is a costly item. It often means reforging and grinding—with an idle lathe into the bargain.

And it's all so unnecessary, this piling up of costs. If you haven't yet realized this, do as many of the largest shops are doing and use Armstrong Cutting-Off Tools. Hardly any delay at all—just extend and point-sharpen the blade and get on with the job. **You know best what this saving of time, steel and annoyance must mean to you.—Write us.**

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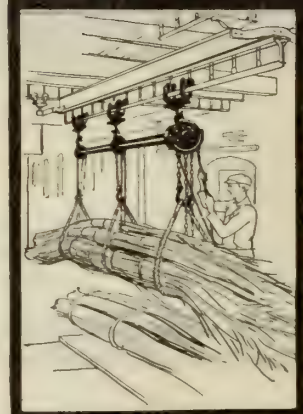

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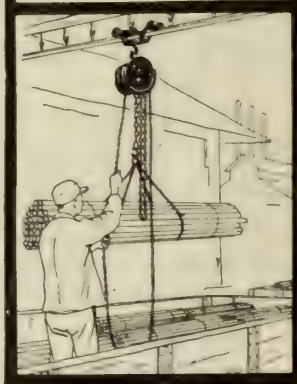

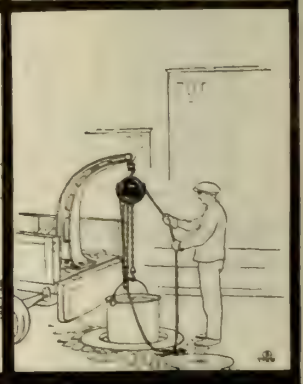

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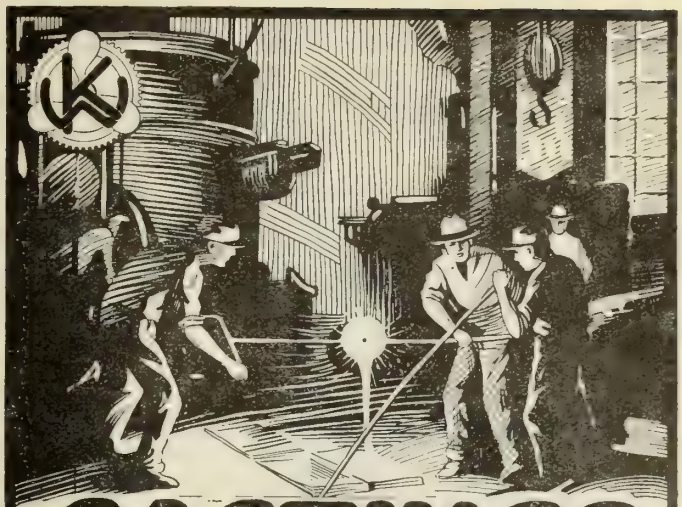

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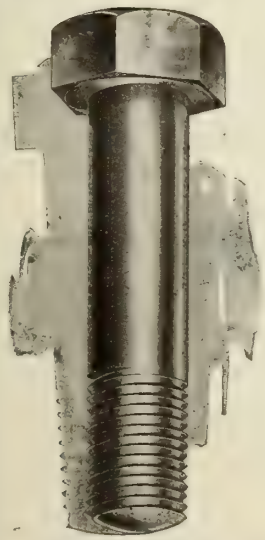

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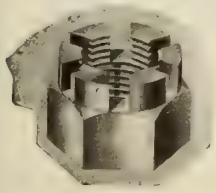

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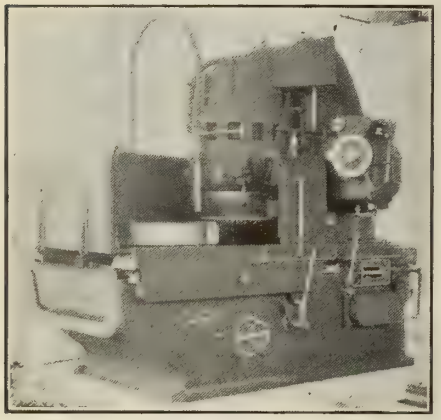

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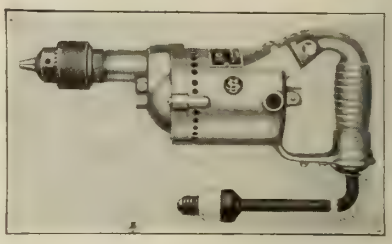

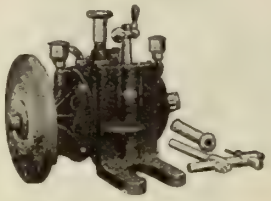

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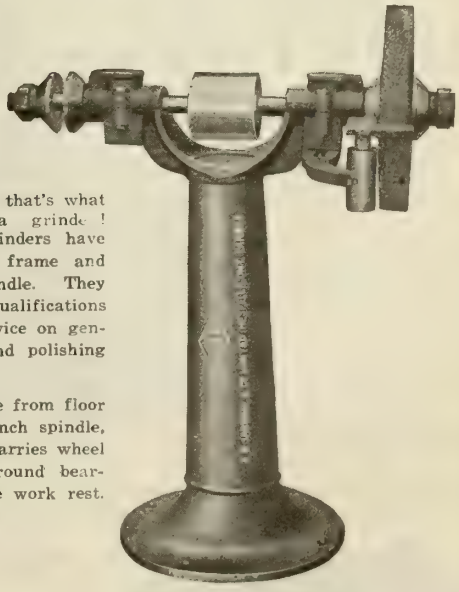

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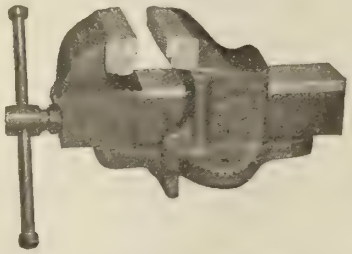

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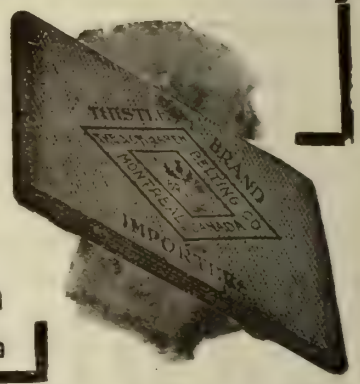

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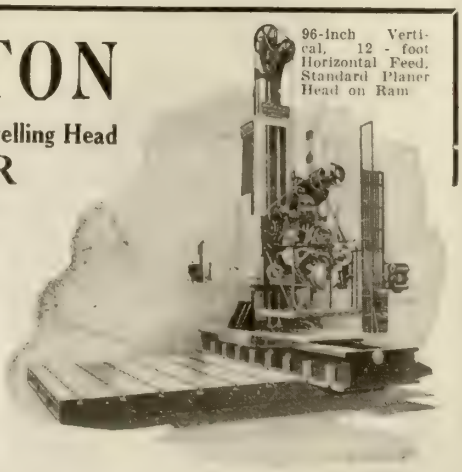

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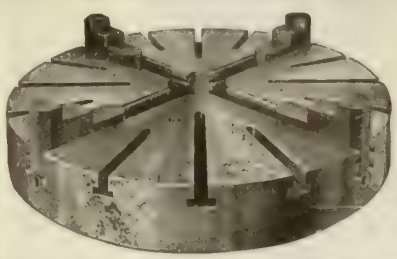

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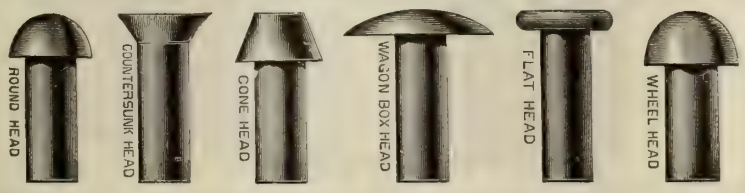

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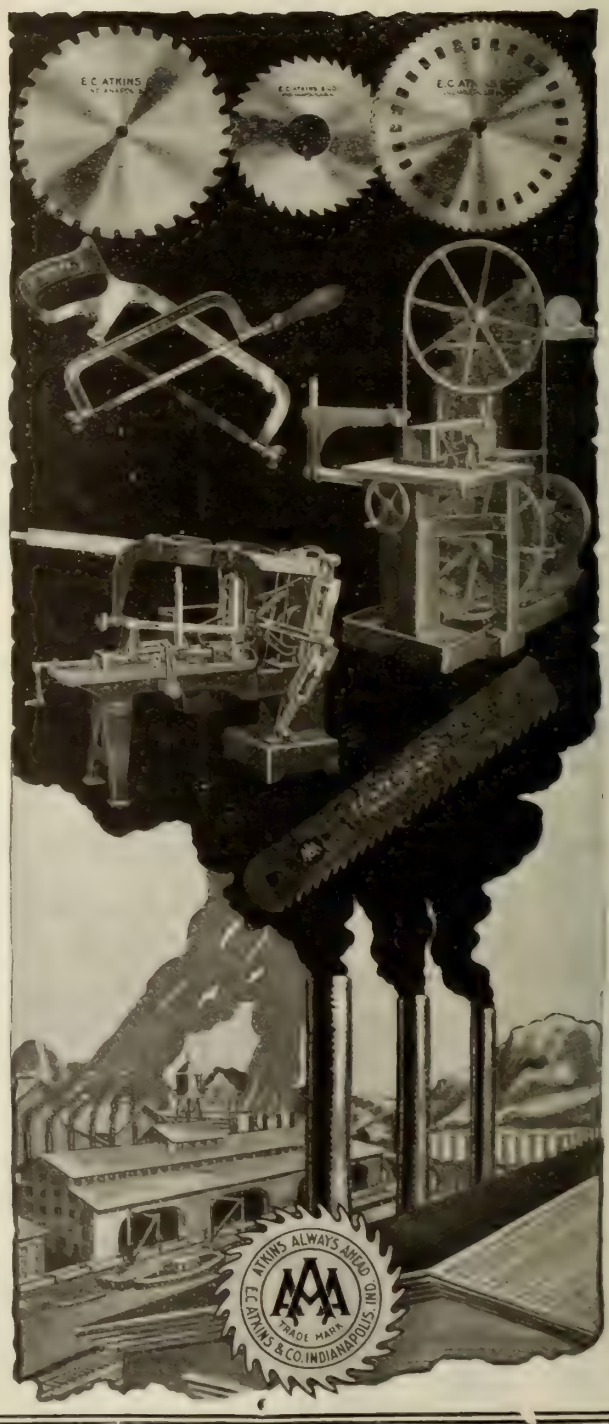

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CANADIAN MACHINERY
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MANUFACTURING NEWS

VOL. XXXVII, No. 9 AUGUST 31, 1922

Multiple Holding of Gear Blanks on Arbors

Advantages of Gang Cutting Dependent on Accuracy of Holding Fixtures—Work Faces in Contact With Clamping Pieces Must Be Parallel—Truth of Arbor Should Be Tested Frequently

By FRED HORNER

AS IS THE case with the most efforts at increased production, the practice of stringing two or more gear blanks on an arbor leads to extra complications and difficulties in handling. The new problems thus introduced demand careful consideration, otherwise the advantages of multiple cutting become nullified by the presence of inaccuracies in some or all of the gears cut. To a certain extent errors may be cumulative, that is, the more blanks included in the batch, the greater the faults developed. Sometimes this fact arises from errors in the preparation of the blanks, sometimes it is due to putting too many on an arbor that is incapable of sustaining the load or pressure, or which is insufficiently supported as regards bearings, or thrust stays. The particular difficulties encountered in a set of gears often depend upon their shapes, some of the more unusual and complicated designs needing more care in holding, and very likely special blocks or rings or distance-pieces at the ends and intermediate positions.

Stress need not be laid on the obvious necessities in connection with arbor holding, which are alike with single and multiple jobs, namely the provision of true arbors, washers, nuts, and accurately turned and faced blanks. The cumulative errors above mentioned will be induced if any of these items are untrue; thus, if some or all of the blanks have holes not square with the contacting faces, the arbor will inevitably suffer a bending stress, and the teeth when cut will not be anything like a state of accuracy. A careful examination of the arbor (with the indicator), then of the gears loosely dropped over it, and finally of the gears when the clamping nut has been tightened affords the best safeguard against defects of untruth in any or all of the vital necessities just enumerated. Testing the arbor first indicates whether it is bent, or put out of centre; trying the blanks while loose shows if their diameters are concentric with their bores; and the final test after clamping reveals if errors in the blanks have sprung the arbor. Care has to be observed also that the presence of burrs, or grit or dirt between any of the parts in contact does not produce defects of alignment. Multiple holding is always rendered more difficult and exacting because of the fact that rigid support is essential away from the bore (which is not the case with simple lathe arbor chucking) to resist the thrust of the tool or cutter. This means that the flanks of rims must be turned square with the bore of each blank, the troubles increase with diameter, and special means are often necessary for firmness of support at the rim, especially when awkward boss, or clutch, or sleeve extensions occur on wheels.

Design of Clamping Plates

The principal items for clamping a batch of ordinary spur or worm or spiral gear blanks comprise a stout faceplate on the one side and a substantial clamping plate at the other side of the set. To obtain fast cutting times these discs should reach to just below the root of the tooth, taking the pressure and vibration effectually, and the rim stay is located in the most favourable spot for thrust purposes. For all practical purposes the set of blanks

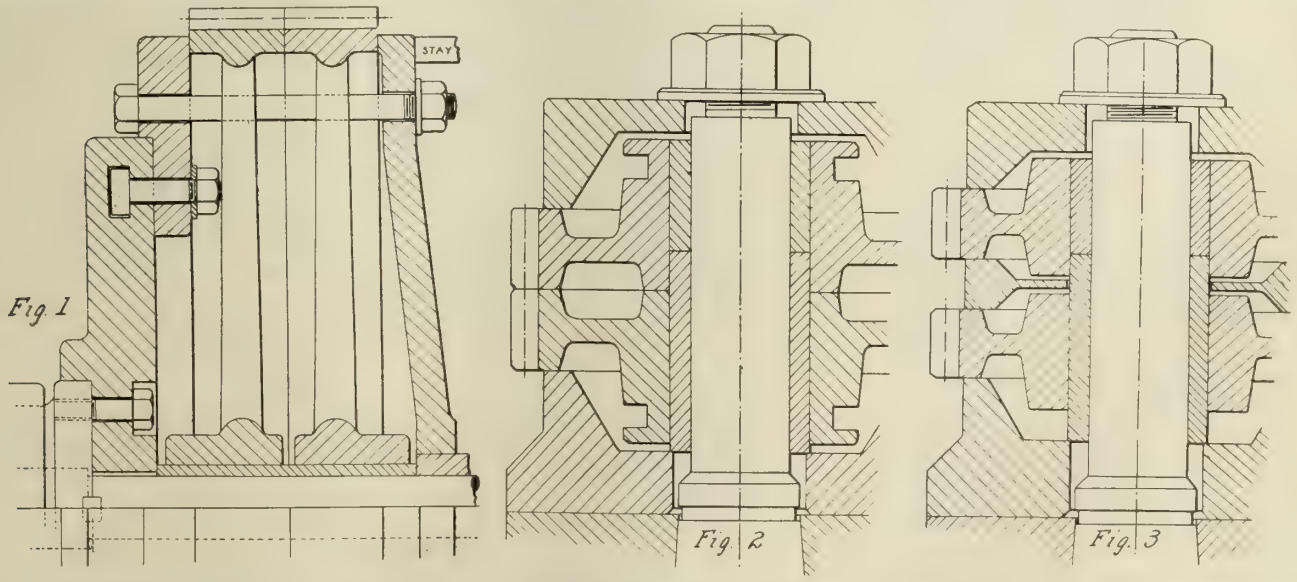
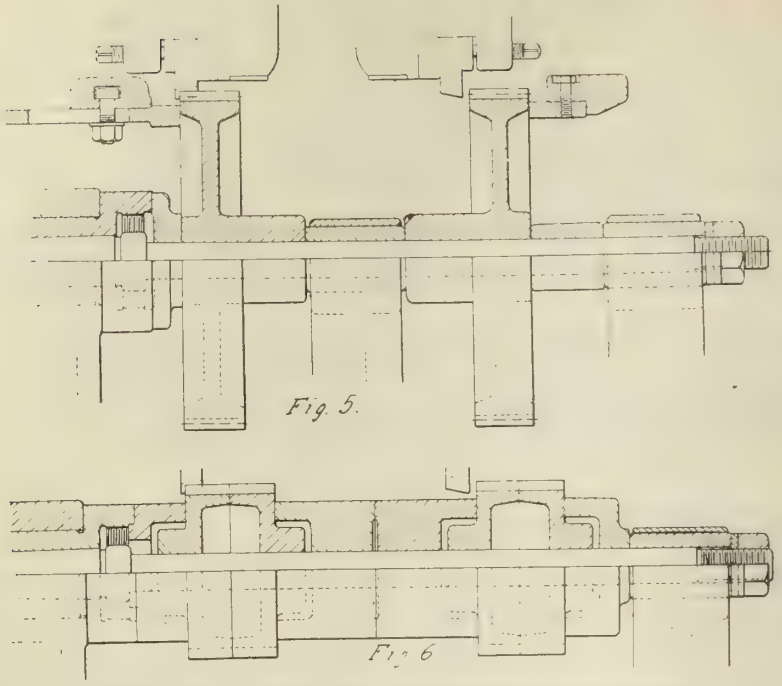


Fig. 1.—Clamping bolts in circle near outside rim. Fig. 2.—Using bushings to chuck gears with square holes. Fig. 3.—Spacer-piece between gears with projecting hubs.



Figs. 5 and 6.—Duplex arbor with intermediate spacing block.

is thus clamped in a vice. Intensive cutting at fast speeds and feeds demands very strong clamping of the faceplate and outer plate, which is best obtained in the larger gears by the use of a set of bolts around the circle, four or six as the case may be; a partial section. Fig. 1, shows this principle. Although the arbor takes care of the concentric accuracy of the blanks, it has little control over the lateral position of the faces, hence primary truth in the faceplate is of the greatest importance. Under those circumstances which happen to call for batches of large wheels for which no suitable clamping plate is available, an alternative plan to make sure of non-slip is to project arms or pegs out from the faceplate, and make these bear on opposite arms of the blanks, so that these cannot twist on the arbor, set-screws or packings being used for the contact and adjustment between one set of arms and the pegs. The hubs are then held merely with a small washer and nut.

Distance Pieces

If the holes in blanks are relatively large, the faceplate may need to be turned with a suitable projecting boss to reach up into the set of bores, as an alternative to the method of interposing bushings to make up the space. Bushings likewise come in usefully to chuck gears by their square holes, such as illustrated in Figs. 2 and 3 (from Fellows' practice). Here one bush is shown extending from the hole in the lower gear to that in the upper, in order to preserve the alignment. The faceplates, it will be noticed, are hollowed out specially to receive the collar hubs of the gears. As the rims and hubs do not come flush on either side in the case of Fig. 3, a special recessed distance-piece is shown interposed to gain a rim packing equal in rigidity to the effect in the previous drawing. Another sort of faceplate modification is outlined in Fig. 4, a kind of drum casting being mounted on the arbor, and turned to receive the ring gears, clamped by a plate and studs.

Various Types of Holders

A recent extension of the principle of multiple holding, as applied to the planing type of machine for generating gears, introduces interesting points in regard to arbor work. The Sunderland generator (made by Messrs. J. Parkinson & Son, of Shipley, England) uses a rack-shaped cutter, and can be set up to cut both on the forward and reverse stroke, using a pair of tool-boxes on the slide, with the clapper actions arranged suitably for tool relief. The blanks and their necessary clamping washers or blocks may occupy the whole working part of the arbor, or may be interrupted by a middle stay-bearing which resists deflection. This is sketched in Fig. 5, which shows the position of the cutters, and the rim stays on the outer flanks of the gears. An instance which does not demand a central bearing appears in Fig. 6 where hollowed-out blocks are utilised to receive the gear hubs. Other designs of blocks show in Fig. 7, with internal setting by the bores in one example, and by the shoulders in the other. From the view, Fig. 8, further variation in holding practice is evident, incorporating not only a special central block, but also bushes to make out the space between arbor, and bore of the gears.

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The engineering draughtsman of today is provided with very much more elaborate appliances than those enjoyed by his predecessor in the 19th century. Drawing boards are now fitted with appliances by which lines at practically any angle may be rapidly drawn on any part of the paper. Earlier types of drawing machines had the objection that there were many projecting parts which occupied a good deal of space; but the latest type introduced by a British firm has nothing at all outside the edge of the board. All the arms are inside and they are so arranged that horizontal lines can be drawn continuously right across the board, and the supplementary scales are propelled along ball-bearing runners so that section lines can be put in very rapidly and accurately. The makers claim that this machine shows a saving of 50% in time in all straight line drawing, as compared with the ordinary loose scales, set squares, and so on.

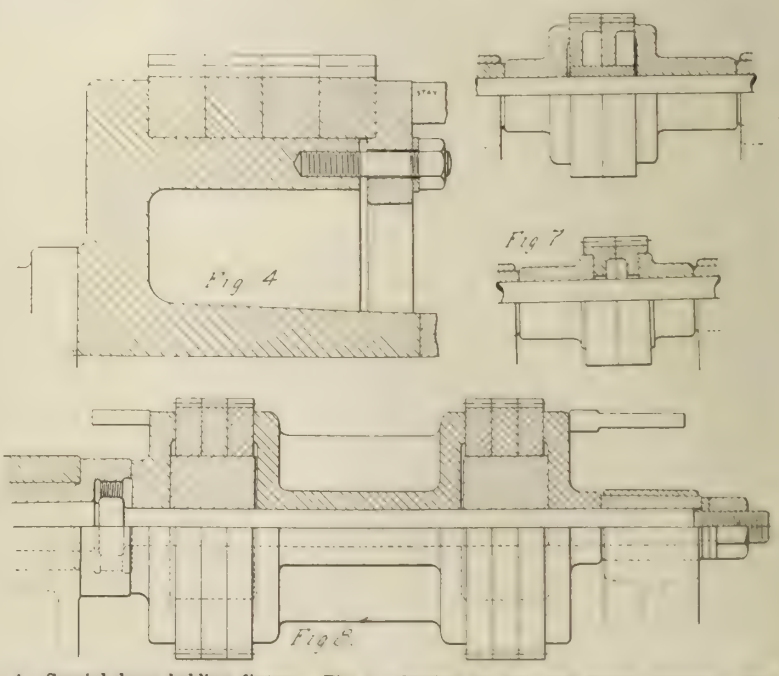


Fig. 4.—Special drum holding fixture. Fig. 7.—Setting by bore and inside shoulder. Fig. 8.—Special fixture for double lots of gears.

Say Conditions Hardly Warrant Wage Reduction

Selling Prices at a Level Which Makes Higher Rates Inadvisable —Some Machinists Taking Other Employment—Differences in Rates Paid—Unwise to Force up Producing Costs—Manufacturers Report Business to be Improving

ACCORDING to opinions expressed by manufacturers, there does not seem to be definite policy proposed on the question of reduction of mechanics' wages. There is a general feeling that wages should come down in view of reductions in selling prices, but with considerable unrest in the industrial atmosphere, and with a decided stiffening in prices of material, any movement in that direction may have to be postponed until more permanent employment is assured and until conditions are fairly free of strike influences. It is a fact that railway shopmen are prepared to fight for maintenance of a seventy-seven cent wage—a higher wage than in other industries—and that they themselves declare that rather than accept the rates paid elsewhere, there are machinists who have taken up other lines of work. This of course, applies to a greater extent in larger centres of industry, but it is a fact that owing to higher wages paid in more active lines, manufacturers in less favored fields find it necessary to come up to those figures in order to hold valuable men. Whether this condition is becoming a permanent problem in connection with labor turnover in a somewhat restricted market, or whether it is merely one of those things that cannot be avoided while industry is anticipating better things, cannot be clearly determined.

An industry with a ready market for its product is in a position to pick and choose, while an industry that is working on a restricted demand will always have the desertion problem on its hands if it cannot afford to pay the shot. This condition must apply where there is not an overplus of help. Where there is such an overplus, wage rates work out to a more or less stable basis.

The prediction is made in authoritative quarters that the time is not far distant, in the return to so-called normalcy, when there will be a decided shortage of skilled labor. In fact, some manufacturers declare that the time has already arrived, while labor organizations who might be supposed to have firsthand information, declare that there is an actual shortage, and that the best indication of the trend of affairs exists in the 20% increase of wages by the United States Steel Corporation. It must be remembered, however, that there are very few firms who can afford to consider a wage increase in its relation to production with as little concern as the Steel Corporation. On the other hand the official explanation is that the advance was necessary because the coal miners had not been compelled to take a wage cut, whereas steel workers had gone back to a pre-war level. It was felt that serious unrest would result in the steel industry unless wages in steel mills were advanced to levels prevailing in other lines of business. Upwards of 200,000 steel workers will be affected by the increase and it will swell the payroll about $50,000,000 annually. Last year with 191,700 employees the payroll was about $333,000,000. The increase brings the common labor rate based on the $3.60 a day to 80 per cent. above the pre-war level of $2 for 10 hours and to 28.9 per cent. below the high rate of $5.06 established in February, 1920. This rate was the highest in the history of the Steel Corp. On May 16, 1921, wages were cut approximately 20 per cent. On July 16, 1921, another reduction of 8.5 per cent. was effected through the abolishment of time and a half for overtime. Finally on August 22, 1921, pay was cut to the 30c an hour rate.

The danger to be guarded against in industry generally, is the too serious anticipation, in the labor market, of the return of prosperity in such shape as to assure a continuance of what are regarded in mining quarters as abnormal prices. Reading between the lines, in many expressions of opinion received by Canadian Machinery, it is evident that manufacturers are for reasonable wages for actual value received. Mutual understanding on that basis will contribute to smooth-running operations.

Thinks Wages Too High

A large engineering firm in Montreal discussing wage tendencies, has this to say:—

"There appears to be a hardening of wage rates at present around current levels, although we know that in the States the United States Steel Corporation has lately increased their wages about 20%.

"Notwithstanding the present hardening of wages, we are inclined to the opinion that the average rate of wages is still higher than what can be considered normal in relation to the cost of living, although if business revives during the next year, it seems problematical to us as to whether wages will be further reduced."

Workmen Prejudice Their Case

A large manufacturer deplores the upward trend in wage rates under present selling conditions. He states, "There has been evidenced in our plant during the last four weeks quite an aggressive movement towards returning to the wage scale in force during the latter part of 1920 and the early months of 1921. In some cases we have yielded to these requests, owing to the fact that we found a number of our men slipping away to Detroit and Walkerville automobile factories.

"We cannot but feel the workmen are prejudicing their own case by forcing costs of production up ahead of any increase in selling prices of products. There have been practically no increases in the quotations of our goods as yet.

"As to conditions of business, we would say that while they are encouraging, there has been also a falling off during the latter part of July and the first two weeks of August. This may be only seasonable dullness. We are still confident that the almost phenomenal crop being reaped in Ontario and Quebec, with an average crop in the rest of Canada, will this fall start the wheels of industry moving more rapidly than they have for a few years past.

"A subsidiary of our company has operated during the past nine months, full time, with a staff of from sixty to seventy-five employees; partly with a view to stocking up in anticipation of heavy demands from certain industries, during the next few weeks, as apparently they are entering upon an era of great prosperity."

Reductions Difficult

A manufacturer in the central manufacturing district of Western Ontario writes as follows:

"We firmly believe that wages will have to come down still further, but still at the same time while the men have only been working short hours it has been a difficult thing to determine to make any further reductions. When full time can be given no doubt the men will be satisfied with a lesser rate per hour and there is no question but that this will have to come.

"Business continues fairly good with us with a tendency to betterment which, of course, will be greatly appreciated when this state of affairs comes to hand.

"Wages here run about as follows:

"Machinists, 50 to 60 cents an hour; moulders, 55 to 65 cents; laborers, 35 to 40 cents."

Don't Demand Overtime Rates

Another manufacturer from the same section as the above, comments as follows:

"We seem to be able to get all the men we need at 45 cents just at the present time, and we don't know that anything will crop up to force us to pay any more in the near future. Our men at

the present time are apparently satisfied to work all the time we want them to, and are not insistent on being paid overtime rates for any odd hour which we might ask them to put in over and above their regular work. Just at the present time we are particularly busy, and have hopes that it will continue, although as things have been going we can look for it to ease up in another month or so.

"Our present rate in our moulding shop is 57c per hour. We pay our fitters and lathe hands from 45c to 57c per hour. We have been taking on some new hands within the last couple of months, and any new mechanics we take on are at the rate of 45c. The highest rates are paid to men we have had all along. Laborers are paid from 35c to 40c."

Conditions Improving

Another Western Ontario manufacturer observes that conditions point to a stiffening in wages. He states:—"At the present time we are paying machinists from 55 to 65c per hour; moulders, 72½c; labourers, 40c. We have found as the demand for mechanics increases that there is a tendency for prices to rise slightly instead of going any lower, so that we question very much whether there will be any further readjustment for some time to come. Regarding conditions in our industry, we are pleased to advise that they have materially improved, and that we are very busy in some departments, and fairly so in others, with fairly good prospects for the future."

A Galt shop writes that they are at present paying machinists, vise and lathe hands, 50 to 60 cents per hour. Moulders, 53 cents to 60 cents per hour. Labourers 35 to 40 cents.

From a large Montreal firm comes the report that they are working 50 hours per week, and employing 480 men. They say they have no trouble in getting men at the following rates:—Machinists, from 50 to 65 cents per hour, according to the skill of the man and the work he is doing. Their average rate is 54 cents. Moulders, from 65 to 75 cents; laborers, from 30 to 33 cents; pattern makers, from 70 to 75 cents; specialists, from 45 to 50 cents; helpers, from 35 to 38 cents.

Wage scales in Hamilton are fairly well illustrated in the following figures from a prominent manufacturing concern in that city, the rate per hour being given:—

Pattern Makers	0 60	0 65
Template Makers	0 50	....
Tool Makers	0 50	0 57½
Die Sinkers	0 52	0 65
Punch Hands	0 50	0 52
Riggers	0 35	0 45
Pipe Fitters	0 40	0 50
Crane Operators	0 43	....
Electricians	0 45	0 55
Locomotive Engineers	0 60	....
Firemen	0 40	....
Carpenters	0 45	0 50
Locomotive Crane Operators	0 60	....
Millwrights	0 45 0 48	0 52

The balance of their employees are all on piece work and their average earnings per hour, according to their ability, are as follows:—

Planer hands	0 40	0 50
Lathe hands	0 45	0 52
Drill hands	0 40	0 45
Blacksmiths	0 41	0 48
Hammermen	0 45	0 50
Shear and punch machine operators	0 42	0 50
Planing mill machine operators	0 40	0 47
Car painters	0 45	0 50
Air brake men	0 42	0 48
Steel and metal workers	0 52	....
Riveters	0 55	0 60
Cabinet Makers	0 42½	0 54
Wood workers on freight cars	0 50	0 57
Freight car truck assemblers	0 45	0 48

It will be noted that a comparison of hour rates paid by the Hamilton concern and the following as paid by a large Montreal plant, does not show very many items of difference.

Plate and angle furnacemen	0 63
Boiler shop flangers and layers out	0 63
Ship platers	0 55
Riveters	0 55
Welders	0 55
Shipwrights	0 55
Loftsmen	0 55
Chippers and caulkers	0 55
Boilermakers	0 55
Anglesmiths	0 55
Machinists	0 55
Plumbers	0 55
Steamfitters	0 55
Blacksmiths	0 55
Pipe Fitters	0 55
Coppersmiths	0 55
Sheet Metal Workers	0 55
Carpenters	0 55
Joiners	0 55
Electricians	0 55
Holders-on	0 50
Burners	0 50
Liner Fitters	0 50
Locomotive Crane Drivers	0 50
Painters	0 50
Drillers	0 50
Ship Riggers	0 47
Scarphing Machine Men	0 45
Motor Attendants	0 43
Overhead Crane Drivers	0 43
Air Compressor Attendants	0 43
Furnace-men	0 43
Planer-men	0 42
Stagers	0 42
Outside Riggers	0 42
Slingers	0 42
Packers	0 42
Firemen	0 42
Light-men	0 42
Jib crane drivers	0 42
Red Leaders	0 42
Heaters	0 40
Reamers	0 40
Rotters-up	0 40
Helpers	0 40

In connection with the above, it is gratifying to note that comments as to general business conditions are very gratifying. Not only does there appear to be a good volume of business moving, but manufacturers seem hopeful of further improvement.

QUENCHING STEEL CASTINGS

An experience of a manufacturer regarding the quenching of steel castings was recently given in the transactions of the American Society for Steel Treating. This quenching was done to improve their physical properties. The castings were mostly shrouded pinions and plain rollers, weighing from 150 to 500 lbs. each. These pieces would be immersed in the water bath for a short time, usually from one to two minutes and then withdrawn and allowed to cool in the air. It was decided to make slight modifications in the treatment so as to improve the results. One suggestion was to provide a tank filled with infusorial earth in which the castings would be placed in order that cooling might be slow and uniform. Another idea was that sodium hydrate be introduced into the bath to make the quenching less severe. It was found that rollers would break in the flange a month or more after treatment. Pinions, after above treatment, were drawn in a furance to 1,200 deg. F. for toughness. If drawn shortly after quenching no trouble was experienced, but this was not always practicable when working on day shift only.

The following statement was made by A. H. Putnam, testing engineer: "It is extremely difficult to make suggestions which will lessen the loss from cracks after quenching steel castings without having more information of this particular case. Some of the factors which are directly or indirectly responsible for these cracks will be outlined briefly below. It is imperative that the approximate chemical composition of each lot of castings be known, as it will be necessary to regulate the quenching and drawing temperatures accordingly. No doubt the loss from cracks will be larger in the casting heats showing a higher carbon content than from heats with a lower carbon content. The method of annealing which is used prior to heat treatment is often responsible for cracks in quenched castings when the original casting structure is not broken down by a sufficient anneal. If ferromanganese or ferrosilicon additions are made in the ladle just prior to pouring castings and the ferroalloys have not completely diffused, this will no doubt cause trouble when the castings are quenched. The length of time the castings are allowed to soak just prior to quenching is very important. The length of time the castings are held at the drawing temperature is more important. The length of time the castings are allowed to remain in the quenching bath will depend largely upon the carbon content and the shape and weight of the casting being quenched. The physical properties which are desired will to a large extent regulate the heat treatment. If the physical properties required are not too severe, often times an air quench or cooling in an air blast from a temperature above the upper critical point and using a low draw will furnish the desired results."

LUBRICATION OF BALL BEARINGS

The function of lubrication in ball bearings is the protection against corrosion and facilitating the longitudinal motion of the journal when such is required. Chemical abstracts states that the lubricant must be free from acids and alkalies (maximum 0.1 per cent.), lime (maximum 0.5 per cent.), resins, and all traces of impurities which might cause friction. The best lubricant is a high-grade oil of suitable viscosity, depending on the nature of the work. If grease is used, it must not melt at the temperature of the bearing. Graphite should never be used for lubricating oil bearings. Simple tests for detecting acidity, alkalinity and resins, and for determining the melting point, should be applied.

Machining Motor Base for the Reading-Standard

Interesting Operations in Machining Motor Cycle Parts—Types of Jigs and Fixtures Used—Milling Cover Joint Surface—Built on Interchangeable System

By ROBERT MAWSON

THE Reading-Standard motor cycle which is made in Reading, Penn, is made by one of the oldest firms in the industry and though they do not make a large quantity of machines, being rather modest as a manufacturing concern, endeavour to make the best, as regards material and workmanship. They are the pioneers in the adoption of the now famous "side-by-side valve" type of motor which was used by them 12 years ago and has since been adopted as the most efficient and flexible motor for motorcycles. This year they are producing only one type the distinct difference being the electrical equipment.

Many of the interesting operations are performed in the machining of the parts for the motorcycle and in this article will be shown and described those followed when making the motor base and cover.

These elements are made of aluminum which is common practice as regards the material used. In Fig. 1 is shown half of one of the finished machined motor bases and will convey some idea of the amount of work necessary to make this part. The first operation on the motor base is machining the parting line surfaces and for this purpose the casting is held in a three jawed chuck on a lathe and the surface is faced. On one part of the motor base is turned a tongue while on the other section is machined a receiving recess to suit the raised portion so that the two parts of the base are located and fit together without depending on dowels as an aligning medium.

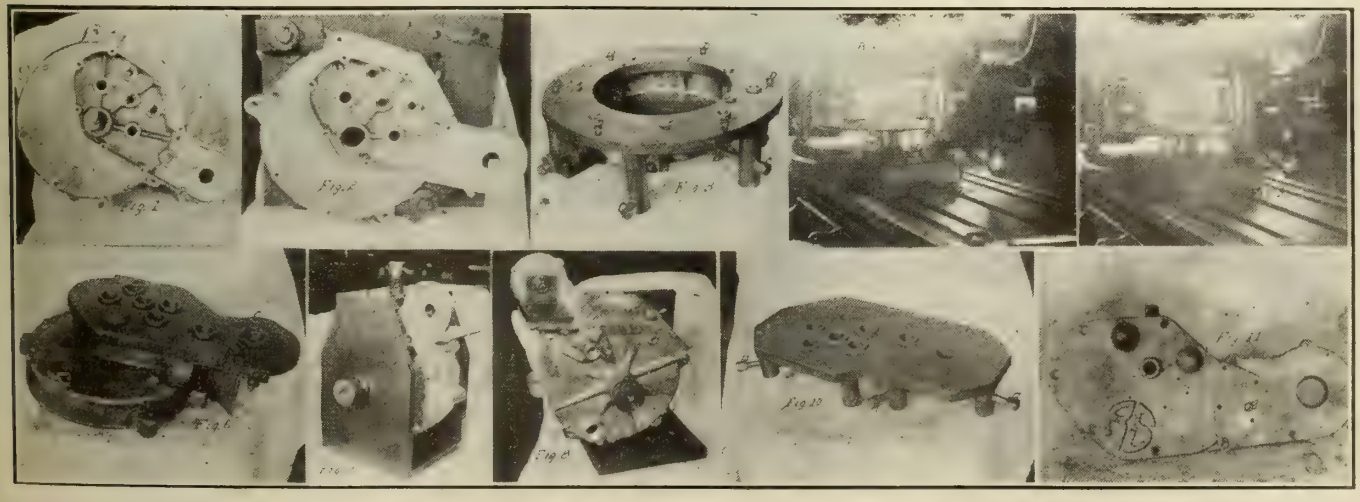
When machining the right hand section of the motor base, or part to which the gear cover is attached, the next operation is machining the joint surface and is performed with the fixture shown in Fig. 2. The casting is placed on the fixture resting on the surface machined in the previous operation and held with the two clamps A. This fixture is of the angle type and the lower side rests on the milling machine table and is located with tongues and held to the table by means of bolts in the usual manner. The cover joint surface is then milled true with the rear parting line surface using a 6½ inch inserted tooth cutter so that one passing of the cutter will machine the entire surface, as the width of the surface is less than the diameter of the cutter.

Drilling For Bolt Holes

The casting is placed into the jig and located by means of the turned register, a mating portion being provided on the tool so that by either attaching this locating tongue or removing it (thus leaving a recess) the jig will suit both portions of the motor base. The casting is then turned around on the locating register and a vee-block operated with the screw A is brought against one of the bolt bosses thus locating the part correctly in relation to the position the holes should be in the bosses. Cams as B operated by the screws C are then tightened against the under side of the casting which force the motor base upward and hold it securely in position. The following holes are then drilled, four 29/64 inch and seven ¼ inch. The jig and casting is then turned over resting with the pins D on the drill press table and the machined holes spot faced by using a standard piloted counter bore. The two parts of the motor base are then fastened together by means of bolts placed in the holes of the parting face and the cylinder's surfaces machined, this operation being performed with the fixture shown in Fig. 4.

The fixture is located with tongues and held to the machine table in the usual manner. The motor base rests on the machined surface A of the fixture and the clamp B is swung around into position. The pin or shaft C is then placed into a hole of the clamp and slid into the large driving shaft holes of the motor base elements, th having been bored and reamed in the first operation when the joint surface was machined. This milling fixture is provided with a base and sub-base, the latter sliding around on a machined center stud. The sub-base is therefore revolved until the locating pin D will enter a bushed hole in the base, the fixture is then in the proper position for machining one of the surfaces for the cylinder, the pad for the magneto is also machined at this time. The locating pin is then pulled out and the sub-base again revolved to the other position. When the fixture is in the correct relative position for milling the other cylinder joint surface, the angle between these two machined surfaces is 22½ deg. on each side of the vertical center line of the motor base or an included angle of 45 degreees. The cutter used to machine these faces is 6½ inch diameter with 12 inserted teeth.

The next operation on the motor base is machining the bores to suit the turned registers on the cylinders, and this work is performed by holding the casting in the same fixture and using it in a manner similar to that prescribed for the previous operation. The only change is to substitute the cutter Fig. 5-A which is 3-⅝ inch diameter also of the inserted tooth type having 6 blades, both holes are bored to this diameter



Jigs and fixtures used in machining motor base of Reading standard engines.

the casting being indexed around as has been already described.

Machining Holes in Right Hand Sections

The jig used when machining holes in the right hand or cover side is illustrated in Fig. 6. The casting is placed onto the pin A which fits in the driving shaft hole, and swung around until it comes in contact with the locating screw B, another screw at the rear performing this function and also holding it in position. The following holes are then machined, 10-13/64 inch for the cover screws, drill and ream 2-⅝ inch holes for the cam gear shafts, drill and ream 2-⅝ inch holes for the cam lift levers, drill and ream one ⅝ inch hole for the compression release cam shaft, one hole ⅝ inch drilled and reamed for the intermediate gear shaft and hole drilled and reamed 1 inch diameter to suit the magneto shaft.

Fig. 7 shows the jig used when machining the valve lift rod guide holes and also the cylinder stud. The two halves of the motor base are fastened together with two or three bolts and placed into the jig being centered by means of the pin A which fits into the driving shaft hole. The motor base is then swung around on pin to its proper relative position which is determined with a plug that fits into the three ⅝ inch hole, this plug being operated with the screw B. When the casting is in the correct location four ⅝ inch holes are drilled and reamed for the valve lift rod guides and eight holes drilled to suit ⅜ inch standard thread studs used to attach the cylinder to the base.

The locating plug is then withdrawn by means of the screw B and the motor base revolved on the large pin to the position for the other cylinder, again being located with the plug fitting in the bored hole of the motor base when similar holes are machined as those already noted. The two plugs are then drawn away from contact in the castings and the machined parts are easily removed from the jig.

Fig. 8 shows the jig used to drill the holes in the magneto pad, the casting is held on the fixture with the stud A which fits into the driving shaft hole. The jig proper is located by a pin B fitting into the one inch magneto shaft hole and a dowel that fits into one of the drilled holes, the face of the tool resting on the milled face of the motor base as shown. When the jig is in position as shown four holes are drilled to suit ⅜ inch 16 threads standard studs, these being used to hold the magneto on to the motor base.

Machining the Motor Base Cover

The illustration Fig. 11 shows one of the finish machined motor base covers with jig for oil pump holes attached and the jig used when machining the holes on the parting line surface is shown in Fig. 10. The casting is located by means of pins that fit against the outside contour of the piece and is held and forced against the face of the tool by means of the screws A that operate cams resting on the under side of the piece, the joint surface having been milled in a previous operation.

The following holes are then machined, ten 17/64 inch drilled, drill and ream five ⅝ inch and one ½ inch hole drilled and reamed. The last operation on the motor base cover is performed with the jig Fig. 11 and is drilling for the oil pump holding studs. The jig is located with a ½ pin at A and a 17/64 inch pin at B both of which fit into holes drilled in the previous operation. When the tool is in position as illustrated four No. 20 holes are drilled. This completes the actual machining operations on the motor base and cover after which they are given a careful inspection and if found satisfactory are ready for assembling into other units to go into the finished motorcycle.

"BIGGEST THING SINCE C.P.R. HIT VANCOUVER"

Press reports from Vancouver, B. C., discuss with considerable enthusiasm the prospect of an iron and steel industry for British Columbia. By prominent business men it is declared to be "the biggest thing that has happened for this province since the C. P. R. built into Vancouver." The Vancouver Sun states:—"An iron and steel industry for British Columbia is assured. Within 18 months a $10,000,000 blast furnace capable of turning out 500 tons of pig iron a day will be employing approximately 5,000 men in the neighborhood of Vancouver. A steel mill will follow within a few years. Industries manufacturing iron and steel products in Vancouver will be enabled to obtain their metal at low cost and Vancouver will be in position to compete in the world market for farm implements, ship plates, and the multifarious products made from iron and steel. Such is the significance, according to local men, of the decision taken by the Provincial Government in pronouncing its determination to put through at the next session of the Legislature a bill guaranteeing one third of the bonds of the Coast Range Steel Company of Vancouver."

The Colonist states:—"Provided that the Dominion Government and the Imperial Trades Facilities Committee will come forward with equal guarantees, the Provincial Government will, through legislation and in other ways, assist in the plan put forward by the Coast Range Steel Company, Limited, to establish the iron and steel manufacturing industry in British Columbia.

"The Provincial Government's promise of aid is further conditioned upon a full investigation into the whole project, covering the company's sources of raw materials, specifications, locations, contracts, management and methods of financing the project, together with the probabilities of success.

"This announcement was made by Premier Oliver following a lengthy conference which members of the cabinet had with H. J. Landahl, promoter of the Coast Range Steel Company, Limited, incorporated under the company laws of the Province with a share capital of $15,000,000.

"Landahl was accompanied by ex-Mayor R. H. Gale, of Vancouver; Mrs. Mary Ellen Smith, M. P. P.; Mr. J. A. Campbell, president of the Vancouver City Liberal Association; and Mr. C. P. Hill, of Vancouver.

"Assurances have been given the Provincial Government that the British Government, through its Imperial Facilities Committee, has agreed to finance one-third of the cost of the project, and that the Dominion Government has signified its willingness to do likewise. With the Provincial Government coming in on like basis, Mr. Landahl has explained to the cabinet, the inauguration of the great project will be assured. He stated that the three largest steel companies in Great Britain are interested in the establishment of the plant in British Columbia, these being Vickers, Limited; Simon Carves, Limited; and Wellman Smith Owen Engineering Corporation. If the necessary guarantees are forthcoming from the Province, Mr. Landahl stated, the Coast Range Steel Company will go ahead with the proposed plan of development and erect blow furnaces, blast furnaces and open electric furnaces, build open hearth steel mills and ultimately produce an outupt of 100 tons of steel per day.

"The share capital of the Coast Range Steel Company, Limited, is divided into 150,000 shares of a par value of $100 each. Following the organization of the company, Mr. Landahl agreed to turn over a number of iron properties, as well as options he possesses upon other similar properties, to the company, receiving therefore 149,992 shares of the company's stock. Other share holders, according to papers filed with the Registrar of Joint Stock Companies, are: Mr. Charles Reid, John D. Kearns, J. Fred. Noble, Zera Strong, Fred T. Congdon, Montague Moore, John Steta and H. J. Landahl, Vancouver, who hold one share each, fully paid up. The directors of the company are: Messrs. Congdon, Kearns, Moore, Steta and Landahl. The properties turned over to the company by Mr. Landahl are located at the following points:

"Fanny Bay, Seymour Inlet, on Wigwam Bay, about fifty miles north of Port Hardy; Klaanch River, near Nimpkish Lake, Vancouver Island; Alberni Canal, Louise Island, Cumshewa Inlet; Burnaby Island, Queen Charlotte Mining Division; Pitt Lake and Harrison Lake; and Mr. Landahl holds options on claims of the International Iron Mines in the Nelson district, Copper River Coal Mines, on Coal Creek, about eighty miles from the G. T. P. station of Van Arsdal; and the North Pacific Mines and the Pocher and Pitt Island Iron Mines."

The hardest working man I know always has good health and plenty of time for pleasure.

Paint as a Means of Greater Production

Poorly Lighted Workshop Now Out-of-Date—Light Well Reflected Enhances Efficiency—Dark Places Cause Accidents—White Painted Walls Improve Morale in the Shop

FACTORY illumination along scientific lines dates back only a few years yet the progress that has been made in the better lighting of industrial factory buildings shows results that are simply phenomenal, both from an efficient and economic standpoint. The passing of the poorly-lighted workshop is only a question of time. Plant officials are rapidly recognizing that the old out-of-date method of lighting —where small individual lamps were strung low down over the benches and machines, with shadows predominating in all parts of the shop—is being superseded by artificial illumination carefully worked out by experienced lighting engineers and factory executives.

Following the practice of the early days of artificial illumination when the candle, the open gas mantle and the kerosene lamp were the common medium of lighting interiors, the first attempts—and likewise those of many succeeding years—of electric lighting continued to be along the lines of direct illumination, where the rays from the source of light were directed on the surface or area requiring the most attention. The inefficiency of this method is now a recognized fact and with few exceptions modern installations are of the indirect system, where the distribution is made more effective by means of scientifically designed reflectors.

Advantages of Reflected Light

The advantages accruing from the adoption of reflected lighting systems and the better diffusion of light resulting therefrom, soon emphasized the importance of having the interior walls and ceilings of factories of such a character as would enhance the general illuminating arrangements. The necessity of good lighting in relation to factory management is quite evident from the following beneficial effects:—better working conditions; increased production; greater accuracy in workmanship; less spoilage; reduced lighting bills; neatness and sanitation of plant; less eye strain; reduction of accidents; improved morale among employees, and reduction in labor turnover.

Aside from the many advantages resulting from the installation of modern scientific electric lighting systems, the proper diffusion of such light is of prime importance. Of all contributing agencies, it is a recognized fact that white paint that reflects and diffuses light is one of the most essential factors in the solution of the lighting problem. In selecting a suitable coating for interior finishing where maximum illumination is of primary consideration, it is imperative that a surface be obtained having good light-reflecting qualities; shows no tendency to chip, flake or peel, and one that may be washed frequently without injury to the finish. In other words a surface that will stay white under all varying atmosphere conditions.

Keep Walls Clean and White

It cannot be denied that clean white walls are an aid to industrial efficiency and an economic necessity. They eliminate the dark corners and minimize the shadows, thus reducing the possibility of accident, and increasing the confidence and good will of the workmen. In coating the walls and ceiling it is good policy to use a paint with a gloss finish white that has a high-reflecting value and insures uniform diffusion of light. Glossy surfaces may be more easily cleaned after becoming soiled, the illuminating value being restored by brushing or washing without injury to the finish. With dark and dingy walls the need of artificial light is often an all-day necessity, but where due consideration has been given to the proper distribution of available light, the utilization of daylight for longer periods, results in a great saving on lighting expenses.

The Influence of First Cost

The initial cost of painting the interior of a factory has often been an influencing factor in determining the character of the coating used. It has been common practice in many large industrial plants to give the walls a coating of whitewash in an effort to improve the general appearance of the shop, but the rapid deterioration of the coating, its susceptibility to absorb dust and dirt, and the inability to clean it properly, has gradually met with disfavor by plant managers and superintendents. With unpainted walls, or those coated with low-grade paint, there is a maximum cost made up of cost of repairs; early repainting; cost of mistakes due to poor light; cost of idleness and accidents; cost of inefficiency; and cost of excess artificial light. It is undoubtedly true that the primary cost of low-grade paint is less than that of the high-class durable quality, but the ultimate cost of the former is often greater when figured over a period of years.

Dark Plants Inefficient

In dark and dingy factories production is invariably below the possible capacity of its equipment and workers. Much of this loss through inefficiency is directly chargeable to poor lighting. It has been stated by illuminating engineers that it takes at least four times as much electrical energy to light a plant with dingy walls as it does the same plant when walls and pillars are painted white. This in itself is an item well worth considering when figuring on initial cost and subsequent maintenance. The higher type of workman is influenced in no small degree by local environment. Shop atmosphere has much to do with human temperament. The clean, well-lighted, sanitary factory has a certain appeal to that class of employee who is a special asset to any organization. Like begets like. If a shop is unclean, dimly lighted and unsanitary, the workers are invariably discontented and inefficient, being unconsciously affected by their unpleasant surroundings, a condition that tends to undermine their health and reduce their ability to carry on their daily labors. The worth-while employee to-day is inclined to stick where working conditions

Showing contrast between painted and unpainted walls.

are ideal, so better lighting, improved appearance, sanitation and cleanliness make for a saving in labor turnover. Statistics prove that the majority of accidents in industrial plants occur during the darker hours of the day and that the winter months have a greater toll than during the summer period. There seems to be only one logical answer to this fact—inefficient lighting. Nothing is more destructive to the nervous system than overstrain to the eyes and this is particularly emphasized when a person's duties are associated with more or less danger.

Light and Accidents

The relation of light to industrial accidents is covered in the following paragraph, reprinted from Modern Industrial Lighting: "Statistics bearing upon industrial accidents, in which operatives or machinery both suffer, closely parallel the figures touching spoilage. Spoilage, or seconds, may by the critical be said to be due to carelessness, bad feeling among operatives, or a false economy upon the part of employers in entrusting machines and material to ignorant or untrained help. But serious personal accidents have a deeper cause, and when the two forms of accidents are found to increase with the days of diminishing daylight and to decrease as the daylight hours lengthen, it is obvious that light is the factor in reducing both.

"A prominent official of a large manufacturing company is authority for the statement that **'insufficient illumination' is frequently held by juries to be 'contributory negligence,'** and in the defence of accident suits the lawyers of this company make it a point to offer testimony by a competent witness to prove the adequacy of the lighting in this company's plants. The subject is not here considered from any humanitarian standpoint; that is something which each manufacturer must face individually. We simply point out that **each serious accident completely demoralizes a shop**; that this demoralization may last for a day or a week, that during this period of distress and excitement the operatives are inefficient and expectant of further trouble; that production drops; while spoilage and 'seconds' due to nervousness, increase; that the absence of employees is greater and that the whole spirit and morale of the plant is broken down. Facing these facts, we begin to see an economic advantage in accident prevention. As to how to accomplish this most cheaply, the authorities on industrial accidents and safeguards for operatives declare that **good illumination would prevent approximately 25 per cent of the avoidable accidents.**

"Two charts, shown herewith, tell graphically the story of loss and suffering which result from inadequate light. In the one we see the ratio between darkness, cloudiness, and sunlight, while the other shows the 'curve' of fatal industrial accidents of three successive years as reported from a large number of industrial plants."

In analyzing these charts it is clear that the greatest number of accidents occur during the months of diminishing light, and it will be recognized that illumination is sadly under-rated as a means of accident prevention. The use and application of any commodity calls for consideration of proven quality, durability and service. These are the fundamental factors which draw the line between initial saving or low first cost, and true economy.

PROPERTIES OF SEMI-STEEL

We have not read so many complaints during the last year or two about the non-progressiveness of the foundry, says the Engineering World. The fact is that the foundry industry has become very enterprising and has made greater advance since 1914 than almost any other department of engineering. It is not that there is very much that is quite new to record, says the Commonwealth Engineer, but rather that there has been a wonderful development of processes that, while introduced a long time ago, have not until recently been exploited to the fullest extent. Die casting, for instance, is at least 40 years old; the malleable process has been in use for a long time, although less than 200 of our 3,000 foundries produce malleable castings, and America is far ahead of us, and semi-steel which has come into prominence of late has been tried out in many quite small jobbing foundries, admittedly in a haphazard fashion, for many years.

Exact knowledge is indispensable to the successful production of semi-steel, which, taking its qualities into consideration, seems likely to contest the field with malleable iron castings where strength is required at less cost than for steel castings. It is much stronger than cast iron, more homogeneous, therefore less porous, and it offers greater resistance to wear. The mixture may be described as one of 10-25 per cent. of steel added to ordinary grey iron. The very greatest skill in cupola operation is necessary to get good results, and although the Americans have paid greater attention to the metal than we have done, it is being used increasingly for high-class work where sound metal is indispensable. The electric furnace is very valuable in foundries producing semi-steel because scrap can then be successfully used.

With regard to the physical and chemical properties of semi-steel, much depends, of course, on the mixture, but it has been calculated that the strength above that of ordinary iron is from 25 to 60 per cent. Tests have proved that with a 10 per cent. steel mixture the average transverse strength is 2,900 lb., as against 2,252 lb. It has been defined as a decarbonised cast iron. Its composition chemically limits both phosphorus and sulphur to 0.15 per cent. maximum, and the carbon to 3.2 per cent., of which 20 per cent. should be combined carbon.

There is still room for a great deal of experimental and research work on semi-steel.

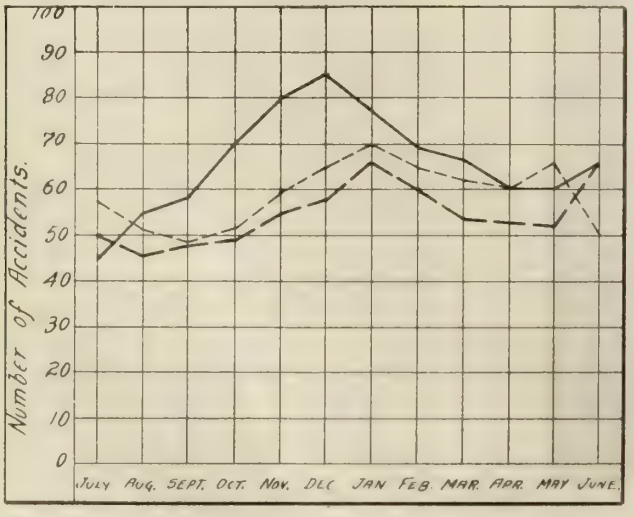
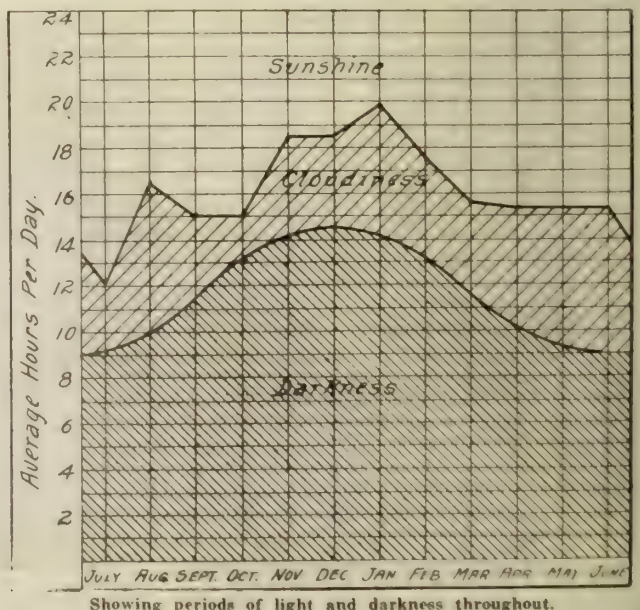


Chart shows majority of accidents occur during the darker period.



Showing periods of light and darkness throughout the year.

News From the Welding Field

Autogenous Welding Standards in Railway Practice

General Rules for Using Apparatus—Five Important Factors Are Condition of Surfaces, Bevel and Position of Sheets, Expansion and Contraction, and Proper Filling Metal

By J. M. CALMBACH

BOILER plates cracked through staybolt holes are a common occurrence and are very often very difficult to repair. One method of overcoming this difficulty is illustrated in Fig. 3 in which a new circular section of boiler plate drilled and beveled as shown at the right is applied by welding. It will be noted that the bevels are cut at an angle of 45 degrees and the weld is reinforced by adding 1-16 inch to the thickness of the original plate.

An interesting example of the method of applying mud ring and corner patches is shown in Fig. 4. This operation can be performed either by gas or electric welding, but the caution should be observed of never laying out the patch so that the weld will come lower than between the first and second rows of staybolts above the mud ring.

The method of applying a butt-welded firedoor patch is shown in Fig. 5. The corrugation to allow for expansion is shown and, as in the previous instance, the patch is beveled to an angle of 45 degrees, the well being built up an additional 1-16 inch for reinforcement.

Material prepared by the author and printed in Railway Mechanical Engineer. The first part appeared in August 17 issue.

When constant reworking of tubes and flues has damaged the flue sheet bridges, but the lower portion of the sheet is in good condition, the method of repair by welding in a new top section is shown in Fig. 6. This method effects quite a saving in time since the top flue sheet section can be more quickly laid out and formed, and the labor of cutting and reapplying staybolts in the lower section is eliminated. If any difficulty is experienced in bringing the edges of the new and old plate in alignment previous to welding, a special clamp, as shown in Fig. 7, can be used.

One of the most successful uses of welding in boiler work has been in the application of side sheets and half side sheets. The application of a full side sheet is shown in Fig. 8 with the corrugation for expansion along line A-B.

In making heavy frame welds with gas it is essential that the parts be carefully cleaned and prepared for welding by cutting the ends to the proper angle and making necessary allowance for contraction in cooling. It is also wise, wherever space permits, to build up the weld a certain proportion larger than the original cross section in order to provide additional strength.

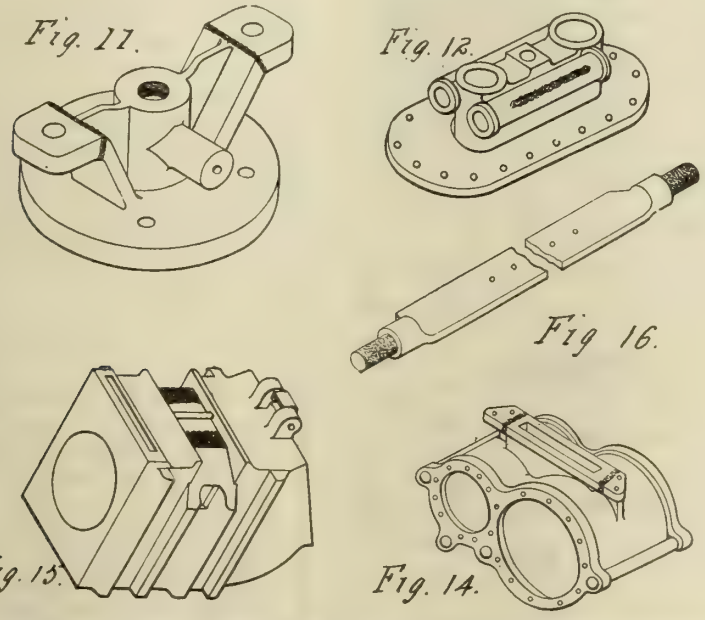


Fig. 11.—Air signal valve casting repaired by gas welding. Fig. 12.—Air compressor steam head reclaimed by gas welding. Fig. 14.—Air cylinder lugs replaced by gas welding. Fig. 15.—Building up worn journal box; gas. Fig. 16.—Building up brake shaft ends; electric.

The standard method of cutting, welding and reinforcing bolsters, truck side and engine frames, and all other steel, iron, or cast steel from ¾ to 8 inches in thickness is shown in Fig. 9 and the accompanying tables. The amount of reinforcement provided is a

Standard Reinforcement for All Heavy Welding

Thickness of Material	Proportional Increase In Thickness
¾ in.—1½ in.	A=25 per cent.
1½ in.—2½ in.	A=15 per cent.
2½ in.—4 in.	A=10 per cent.
4 in.—6 in.	A= 7 per cent.
6 in.—8 in.	A= 5 per cent.

Standard V for Heavy Welding

Thickness of Material	Angle of V
¾ in.—1½ in.	One side—45 deg.
1 in.—2 in.	One side—55 deg.
1 in.—2 in.	Both sides—45 deg.
2 in.—3 in.	One side—50 deg.
2 in.—3 in.	Both sides—55 deg.
3 in.—4 in.	Both sides—55 deg.
4 in.—5 in.	Both sides—55 deg.
5 in.—6 in.	Both sides—55 deg.
6 in.—8 in.	Both sides—55 deg.

The amount of reinforcement provided is a certain proportion of the cross section decreasing in amount as the size of the section increases. It is to be noted from the tables that the angle to which the parts are cut or V-ed varies from 45 deg. to 55 deg.; sections over 2 inches thick being V-ed and welded on both sides.

Preparation for Frame Welding

As in the usual practice the frame to be welded is lined up, trammed and checked with the opposite side as shown in Fig. 10. The weight of the engine is taken off the frame and jacks placed under the jaws on either side of the weld. Then tram over the break, locating permanent points by which the expansion will be governed. Referring to Fig. 10, the frame should be cut out from both sides to the angle shown, all surfaces being chipped and cleaned preparatory to welding. It is necessary to spread the frame a suitable amount to allow for contraction in cooling, this allowance for contraction varying slightly in amount depending upon the location of the break. Referring to Fig. 10, when

breaks occur at points marked A, ¼ inch should be allowed for contraction. At points B 3-16 inch is allowed. Whenever welds are to be made in any part of the jaw the binder should be in place if possible. A ⅜-inch plate should be tacked to the lower side of the frame on which a foundation can be made to start the weld. This plate extends out on both sides of the frame the thickness of the reinforcement and is welded firmly to the frame at all points of contact including the edges. This plate forms a base on which to start the weld.

Two operators should be employed, one on each side of the frame. After the weld reaches the thickness of 2 inches, it should be hammered, this hammering to continue at intervals until the weld is finished. It is important that at no time during the process of the weld any part should be less than red hot. That is to say, the operator should keep the finished part of the weld red hot at all times and when the weld is finished the entire weld should be brought up to an internal stress and decrease the possibility of future breaks. For the amount of reinforcement to be applied reference should be made to Fig. 9 and the accompanying tables.

Miscellaneous Welding and Building Up Jobs

The possible uses of both gas and electric welding in railroad shops are too numerous to mention and both processes have been greatly extended during the past few years, saving large sums of money annually to the railroads. The important point to be remembered, however, is that either welding process costs money and if the locomotive or car part being repaired or reclaimed is small and has a first cost less than the cost of gas or electricity and labor used, it is obviously poor economy to weld it.

For the air signal valve casting, as shown in Fig. 11, however, the cost of labor and gas used in welding on the broken lugs would be considerably less than the cost of a new casting, and it is therefore good economy to make the repair by welding. The castings after being welded by competent operators will be just as good as new.

An interesting example of what can be accomplished with gas welding is shown in Fig. 12. The steam head of the New York air compressor is located at the bottom and, without proper care in draining during the cold weather, will often become cracked through the wall to the exhaust passage as shown in Fig. 12. This steam head is quite an expensive casting with a more or less intricate system of coring in which it was found necessary to maintain walls of equal thickness. The problem in getting a successful weld on this casting is to provide for contraction and this can be accomplished only by the careful and thorough preheating of the steam head after which the crack can be welded with gas. The entire weld and adjoining walls of the casting should be brought to a uniform temperature and allowed to cool slowly

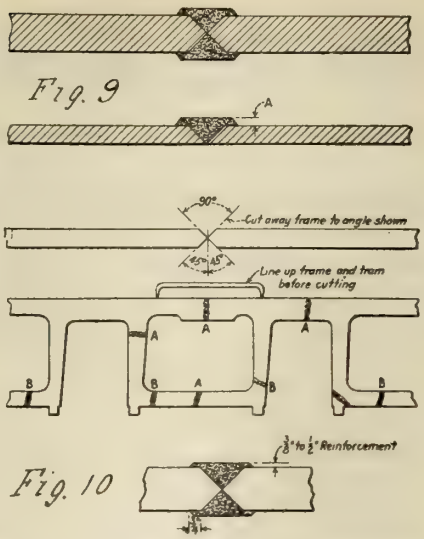


Fig. 9.—Cross section of standard welds showing single and double reinforcements.
Fig. 10.—Location of common frame breaks and method of welding with gas.

to prevent internal strain and a subsequent crack which will be worse than the first.

Building Up Worn Parts

Among the possible uses of the welding processes perhaps none is more important than the building up of worn parts, in many cases making them as good as new for further use. The example shown in Fig. 13 is a worn axle collar before and after being built up by electric welding. After the welding has been completed it is necessary to mount the axle in a lathe and remove excess metal deposited on the collar, leaving a smooth fillet of the original dimensions.

Another example of welding broken lugs is given in Fig. 14 in which both lugs have been broken from an air compressor cylinder, either through a wreck or accidental dropping or mishandling on the floor. The common method of repairing a cylinder with broken lugs is to have new lugs forged of wrought iron or axle steel in the forge shop, fitted to the cylinder which has been properly machined, and secured in place by three or more bolts through the extended sides of the lug and the cylinder. It is obvious

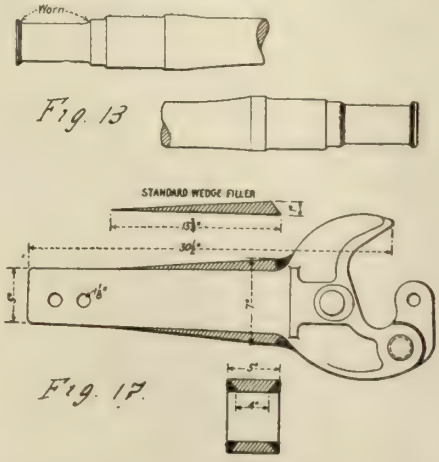


Fig. 13.—Building up axle journals.
Fig. 17.—Adding sectional area to coupler shanks.

that in both cost and length of time required to make a repair, welding is much to be preferred over the mechanical process of applying new lugs.

The method of building up a worn journal box and the ends of an engine brake beam are illustrated in Figs. 15 and 16, respectively. Both of these parts can be built up and made as good as new in a very short time and at a slight cost. In the case of the journal box it is advisable to use gas for building up, but with the brake beam the electric method would be better. In case gas is used to build up the worn brake beam ends, great care must be exercised not to overheat the ends and the entire beam should be carefully annealed before being machined and put back into service. Otherwise there is a good chance of a train delay due to dropping the brake beam.

Another interesting example of welding is shown in Fig. 17 in which a 5 inch by 5 inch coupler is changed to a 5 inch by 7 by the addition of a standard wedge filler held in place by either electric or gas welding as shown in the illustration. One end and both sides of the filler are undercut as shown in the cross sectional view, the undercut space being filled in with welding material, thus holding the wedge filler firmly to the coupler shank. The preceding are but a few of the many interesting examples of welding work performed in modern railroad shops.

ALL-METAL AEROPLANES

There was recently completed in Great Britain the first aeroplane to be made wholly of metal. The advantages of doing away with wood and other combustible material need not be emphasized; and the all-metal aeroplane gives promise of supplanting all the earlier forms. A special alloy of aluminum is used in its construction; and the Government is at present engaged in making very elaborate tests of the strength of every part. Special attention is being given to the risks of corrosion with the metal employed and investigations on this point are being carried out in the Department of Scientific and Industrial Research. So much depends on this new type of aeroplane that although the first flying tests have been very satisfactory the Government prefers to regard the model as an experiment and to suspend judgment until a most exhaustive examination over a long period is completed.

DRILLING UPSIDE DOWN

Mechanics are very apt to dodge a job of drilling from the bottom up, or to go through long processes of disassembling to avoid it. But it may actually be made easier than horizontal drilling or using body pressure for a "down" hole, as the machinist will merely pick up a stray piece of board and use it as a lever.

Practical Ideas From Practical Men

CURVED LINES IN MACHINE DESIGN

John S. Watts

Looking at most of the machinery on the market, one would almost think that the only lines known to machine designers were straight lines and circles, so seldom is it that any curved lines are used, and when a curved line is used it generally has not the graceful appearance it ought to have, but has rather that stiff ungainly form one would expect to find in a child's first attempt at freehand drawing. There are in the mechanical arts a few exceptions to this, such as the automobile, and the ship, but these exceptions simply serve to prove the above statement, as it needs only to be stated to be perceived, that if either of these were made up with such a large percentage of their lines straight ones, as are most other machines, they would not attract the eye by their beauty and fitness, but rather repel as do the straight lined machines.

This state of affairs seems to be due to the ease and accuracy with which straight lined forms can be produced, but at the same time, familiarity with the formation of curves dissipates the fear that most designers have of using them. Lack of practice in drawing curves is the only excuse for not knowing that most forms of curves can be dimensioned and specified on a small scale drawing so that they can be as accurately located and shaped in the full size product as can a straight line. Undoubtedly the curve is more expensive to produce, taking as it does longer to lay out and shape, but as the curved lines can only be desirable on main parts, which are usually castings made from a pattern, which pattern is only made once, and thousands of pieces may be cast from the one pattern, the additional cost becomes the merest trifle when allocated to one machine. When the part to be formed is of steel and is shaped in a die, the same argument applies, that the curved form can be produced to all intents as cheaply as the straight line form.

As against the trifling increase in cost of production, we have a possible saving of material, and we should have a stronger design, with a more esthetic appearance. Touching on this matter of appearance, it is not essential that one should be an artist to be able to produce a pleasing design, for all that is needed to make a machine pleasing to the eye is that all its parts be proportioned and shaped so that they obviously fill their intended purposes without either excess or skimpiness of material. Indeed beauty of outline is, in essence, none other than this skillful proportioning and placing of the material to the best advantage.

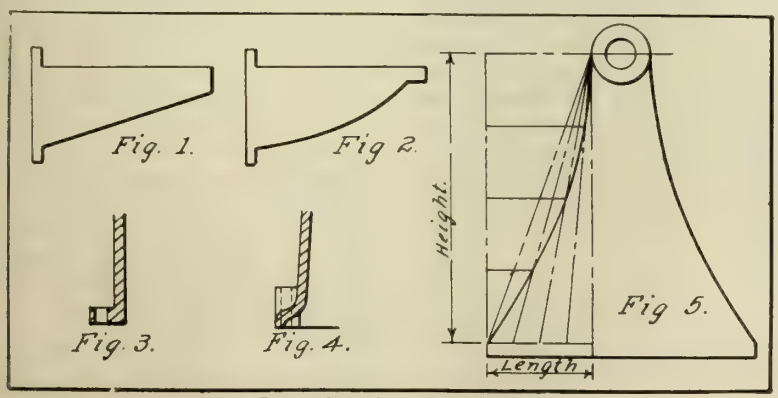
An irregular curve, that is one drawn by freehand and following no exact path, is not possible to reproduce from a drawing with sufficient accuracy for mechanical purposes, but such a curve has no place in a machine whose design is, or ought to be, based upon mathematical calculation. There are, however, plenty of curves, such as the parabolic, elliptical, involute, etc., which follow paths which can be exactly laid out, to fulfil all requirements, and have the additional advantage of being generally more correct as regards strength, etc., than the curve drawn by freehand, or the straight line.

Take for example the case of a bracket cast or bolted to the side of a machine to carry a load as a cantilever. It is all too common to see such a bracket made as shown in Fig. 1. This bracket must, if of uniform width in plan, have unequal strength, that is, there will be a section somewhere in its length, which will be under greater stress than exists at any other section, instead of being as it should under equal stresses throughout its length. The theoretically correct form for such a bracket is as shown in Fig. 2, the lower line being a parabolic curve. A bracket so made is less expensive than the one in Fig. 1, in as much as there will be no need for excess material, as the bracket is of uniform strength and has the added advantage of being more artistic in appearance.

The flanges of bases under machines are often made as shown in Fig. 3, which form has a weak, unsightly appearance, and is in fact either weak or uses more metal than would be used if a better shape such as that shown in Fig. 4 were chosen.

The methods of developing the various curves are given in most engineering text books, and need not be described here, but to illustrate my meaning in stating that a regular curve can be reproduced with accuracy, I show in Fig. 5 a common use for the parabolic curve, and the method of laying it out. The sketch scarcely needs explanation beyond saying that the vertical and horizontal lines are divided into the same number of equal parts, and the curve is drawn through the intersections of the horizontal and diagonal lines. Obviously the curve can be made as accurately as may be desired by using a larger number of divisions. To reproduce the curve in the pattern needs no other dimensions than the length of the base line and the height, therefore the drawing is no more complicated to dimension than if straight lines were used.

The point to be aimed at is to use a curve when it meets the requirements for strength better than a straight line would, and to use that form of curve which is called for, and then the machine will have a pleasing outline. To strive for an artistic effect by using such flowing lines as an artist would in sculpture, will only produce a monstrosity even more hideous than that produced by too rigid an adherence to straight lines, the appearance most desirable being not an artistic one, in the generally accepted meaning of that term, but one of efficiency.



Curved lines in machine design.

IMPROVEMENT TO DRILL PRESS TABLES

By D. A. Hampson

In all shops, there are found one or more upright drill presses of the simple type known as "sensitive" drills. This name has been applied because the design is such that the operator can feel the work the drill is doing and feed accordingly—the feed lever in one hand and the work held by the other combine to secure sensitiveness in the highest degree. Included in this general class are a variety of machines from light bench drills to the most modern design of manufacturing drill weighing half a ton and having a capacity up to nearly an inch in cast iron.

Numerically, the most of these machines are put out with a solid-top flat table. So long as the work pieces or jigs are held in the hand, this solid table

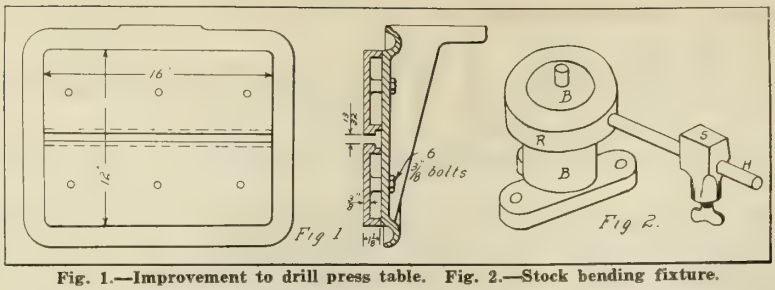


Fig. 1.—Improvement to drill press table. Fig. 2.—Stock bending fixture.

is all that could be asked; it is always ready, a stroke of the hand brushes it off clean, and there is no place for odds and ends to lodge or get mislaid. If the work is heavier, it may be held on with C clamps. The fact that the machine is always ready is a strong argument in favor of the solid table—the drill point may be started on a punch mark, the piece lifted up to get better light on the location, and returned to the table in less time than it takes to tell of it. But sooner or later, it is discovered that this very convenience is really a loser of time.

Fastening work with C clamps is not as quick an operation as it would seem. The average C clamp in the hands of average workmen soon gets "wopper-jawed" so badly that a direct pull is impossible and then the time taken to reset and to knock the work around to align it, or the time spent in trying to find better clamps around the shop may easily run into dollars.

Where manufacturing is done, time is actually saved by fastening the jigs to the table and arranging some other method of getting rid of chips than lifting the jig and dumping it, but the jigs may be small and the table so much larger that some leverage arrangement is necessary in conjunction with the clamps, or the clamps may be in poor shape, with alignment troubles referred to above, or the oil pocket around the edge may interfere with clamping. Then too, the exigencies of orders may call for the shop's entire stock of clamps on a large number of machines at the same time, which temporarily knocks out other work requiring clamps.

As stated, most machines have solid tables—probably because buyers do not realize these points or cannot visualize the growth of their business. Manufacturers do supply tables with a T slot in them but in the smaller capacity machines this is special, and in any case the slotted table carries an extra price, which the buyer cannot "see" at the time. In many shops, these solid tables are drilled for tap bolts and work, or jigs held down by this means. Lack of standardization calls for other holes for each job and soon the table is honeycombed.

A far better method is shown by the drawing. One shop has all their drills so equipped—doing the work on the entire battery of machines at one time reduced the expense considerably and it settled the costly C clamp problem once and for all.

Two castings are required for each machine. Making this false table in two parts saves intricate pattern work and cores and slow T slot cutting. The shape of the pieces is such that a minimum of weight is added to the table but a surface as firm as the original is obtained. Round lugs planed off with the rest support the center and serve for the bolts put in from below. The T slot is formed by corresponding edges which have been easy to machine, as they are plain, outside cuts. When completed, a permanent table—not a makeshift false table—has been obtained, that looks good and is convenient for all classes of work. Existing jigs can usually be re-drilled or are all ready for bolting to a center slot and new jigs can be designed with this improvement in mind.

Some shops have attempted to overcome the shortcomings of the solid table by planing a T slot through it. But because not one table in a score is thick enough for this, the slot has to be so shallow as to be practically worthless and the ledge on top soon crumbles, leaving a ragged hole that cannot well be repaired.

SHOP BENDING FIXTURE

By D. A. H.

Every shop that does manufacturing work has to produce a few trial pieces and do a certain amount of experimental work on flat or round stock formed cold —classed under the general head of "bending." The experimental and special machinery shop takes this for granted and may or may not have provided the best of tools to do this. Hand bending in a vise with the aid of pliers, bits of round and flat steel, a hammer, and punches is slow and awkward—it requires the services of a skilled workman to produce parts that are not all marred up. Where a dozen or a hundred pieces are required, the cost becomes out of all proportion.

Fig. 2 shows a bending fixture that any shop can make for a few dollars. It consists of a base casting B, that has lugs for bolting to the bench; its upper portion is turned to receive a machined ring R, which is made a snug fit but capable of being easily moved by the long handle H, which is a piece of ¾ inch round stock. The top of the base and of the ring are faced off to the same level.

A hole bored in the center of the base permits the insertion of pins, or mandrels, whose projecting end may be round, square, or V-shaped, according to the piece to be formed. The diameter of the upper face of the base is such that it offers plenty of room for screwing fast whatever former or holding block the job may require; the blank being laid in this holding block against the center pin also, is formed by turning the ring R, which is provided with suitable blocks for the purpose. A sliding stop S, on the handle, permits gaging the blank as the first bend is being formed. A little thought applied to the tools and attachments will enable a variety of shapes to be made with a minimum of equipment; and this with but a few holes drilled in the face of the two iron pieces. As new jobs come along, existing tools will be found to be adaptable and tool expense lessens. The great advantage of such a fixture is that parts can be made up immediately that look as good (free from bruises and poor shaped bends), as those turned out by automatic forming machines. The fixture is so simple that it may be made up by an apprentice in spare time.

ROLLERS FOR FINISHED WORK

It is often necessary to move heavy parts along the planer bed and this is done easiest by using rollers to bring the work to the desired position. If the work is finished, as a machine slide, the marks left by rough rollers may be serious. In such a case, lengths of cold drawn steel answer every requirement and ton weights are moved safely with ease.

A new process for using rubber latex in paper manufacture has been invented. It is claimed that it increases the strength and folding qualities of paper, gives it a better texture and greater resistance to water.

IDEAS WANTED.

We are particularly desirous of obtaining for this section of our journal, short instructive ideas. These can cover any phase of machine shop practice and should be illustrated if possible by a sketch of the idea being described.

If you are unable to make a neat sketch, do not let that stop you. Draw the idea as best you can, send it in to us and we will finish it up for you. For all accepted material we pay a good rate, so that not only do you help some one else by passing along the idea, but you benefit yourself as well.

This section should be a regular exchange of ideas. Surely Canadian mechanics have many schemes that have saved them both time and money. Send them to the Editor of Canadian Machinery, 143 University Ave., Toronto, Canada. Don't be a once in a while contributor. Become a regular. You'll find it pays.

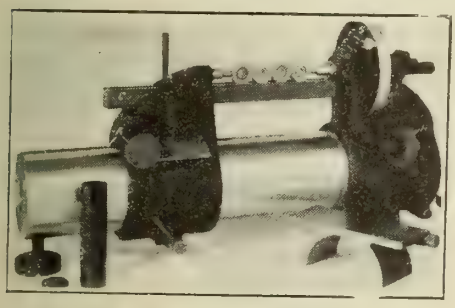
New Things in Shop Equipment

BENCH MEASURING MACHINE

A new bench measuring machine, known as the "super-micrometer" has recently been placed on the market. The machine is illustrated in the accompanying cut. It consists of a rigid cylindrical bed, and a dividing head and adjustable footstock both carrying measuring anvils similar to the standard measuring machine made by this company. The setting of the machine is obtained by the use of standard inch blocks. These standard blocks are machine lapped by a modification of the Hoke process and are accurate within five millionths of an inch.

The screw has a working range of one-half inch, indicated by graduations on a forged Duralumin index wheel and on the measuring spindle. Means are provided to compensate for wear or any slight error in lead, while springs take up back-lash and keep a constant pressure on the thrust bearing.

The footstock is moved into position



Bench Measuring Machine.

along the bed by a rack and pinion and securely clamped into place. A square bar with a channel in one side is provided to hold the standard inches in place during the set-up or to serve as a work rest. This bar passes through the footstock and is mounted on a pin under the measuring spindle as shown in the illustration. It is conveniently stored in a hole in the bed when not in use. Two tables are provided to clamp to the bed for supporting large work. The zero arm, held by friction, is adjustable to position and the knurled knob provides for fine adjustment of the zero line.

The index wheel has 500 divisions 1/32in. wide, each representing a spindle movement of .0001in. These divisions are numbered at thousandths and are direct reading. The index wheel is revolved by a fine round belt, the slipping of which enables the operator to apply the same pressure each time to the measuring anvils. Variations in belt tension do not affect the accuracy of the readings, as the same pressure is applied when setting up to 0 as when measuring the work. The knurled handwheel has two diameters, the smaller for quickly spinning the spindle up to the work and the larger for the final slow movement to the point at which the belt slips. The spindle graduations are .050in. apart with etched figures at each .100in.

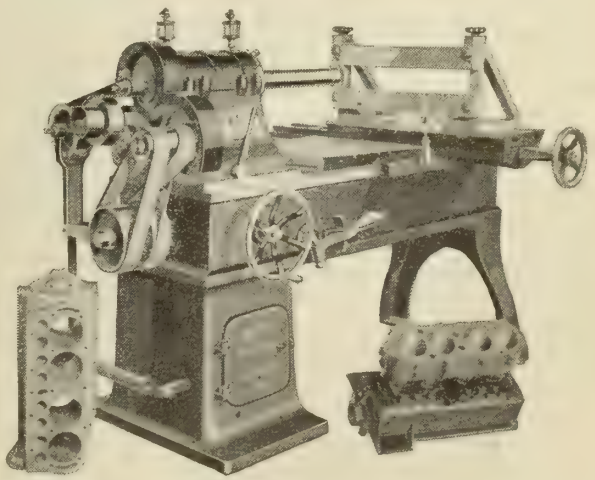
The machine has a range of eight inches between the measuring anvils and 3¼in. between anvils and table. It has a three-point support on the bench. The bed and the supports up to the measuring anvils are unusually rigid, and give a firm definite touch at the instant of contact with the work. Measurements can be repeated within very close limits by the sense of touch alone. The machine is rugged, simple and relatively inexpensive. It is designed for use on the inspector's or toolmaker's bench by any workman of average skill. It is manufactured by the Pratt and Whitney Co. of New York.

3-TON LIFTING-PLATFORM TRUCK

An electric-driven industrial truck in which the frame is made entirely of structural steel hot-riveted in place, has recently been placed on the market. This has proven to be a rigid and durable yet extremely light design of truck. It has a lifting capacity of three tons. The operating mechanism is similar in all respects to other makes of the same trucks manufactured by the Automatic Transportation Co., Buffalo, N. Y.

CYLINDER GRINDING MACHINE

Without an accurate straight smooth cylinder, it is difficult to obtain good compression in a motor, because it is impossible to fit a ring to a cylinder that is not true, or to one that is enlarged at the top, either by wear or by inaccurate machining. The grinder here shown is a development of years of study of this particular subject and several improvements have been incorporated into the original designs. The operating speed of this machine enables a man to grind three Ford blocks in eight hours and grind them right to within .0005 in. of specified size. Larger blocks can be handled at an average speed of from fifty to sixty minutes per cylinder, including set-ups. The frame is of rigid construction and vibration is reduced to a minimum. The machine is of ample range to take the block of any make of car or truck. The bed has a length of 5 ft. and a width of 20½ in. There is a distance of 12 in. from the bed to the centre of the spindle. The carriage has a travel of 26 in., and the range of work includes holes from 2½ to 6 in. in dia. by 16 in. long. Eccentric adjustment has a range from 0 to 1¼ in. The machine requires a motor of 2 h.p., occupies a floor space 5 ft. 3 in. by 3 ft. and weighs about 2,200 lbs. It is manufactured by the Webber Machine Co., Toronto. Ont.



Webber Cylinder Grinding Machine.

END TEST GAUGE

For the testing of micrometers or for the accurate gauging of internal diameters on production work, a special design of test gauge has been developed. The central section is cupped at both ends to receive commercial steel balls 5/16 in. dia., these being retained in position by a cap threaded to screw on the stem. The use of balls for gauge points provides an easy method of compensating for wear, as the balls can be moved slightly to present new places for gauging. New balls can be inserted when others become badly worn. The gauge is known as the "Everwear" and is made in all convenient sizes above 1 in. They are made by the Central Tool Co., Auburn, R. I.

DIMENSION CALCULATOR

Rapid and mechanical addition and subtraction of fractions of an inch, inches and feet, is now possible by means of a calculator recently placed on the market. The front plate carries two circular scales, one divided into 48 equal parts, and the other circle graduated into sixty-fourths. The former is used for calculations where operations involve integers of feet and

inches, and the finer scale for calculating fractions of the inch. Black figures running in clock-wise sequence are used for addition and red figures in counter-clockwise for subtraction. Mounted within each of these scales is a circular, movable disc graduated on its periphery with graduations and figures corresponding on the scale. A pinion on the shaft of each disc meshes with a gear carrying the circular scale at the top of the device. The perforations on the rotary discs are used for the insertion of a stylus.

When commencing to use the device the gears are disengaged and the dials set at zero. The different values are added or subtracted by turning the respective dials to the desired positions, in consecutive order. Calculations are always started with the disc zero mark placed opposite that of the scale. A complete revolution of the upper gear is indicated by means of a buzzer. The result is read direct from the different gears and discs. The device is made by W. Teinert, 410 West 23rd St., New York City.

INTERNAL CYLINDER GRINDING MACHINE

A new type of grinding machine has recently been introduced from Europe that differs considerably from those generally used here at present. The principal features are the capacity for a large range of sizes and the arrangement of the grinding head and work table. In most small cylinder grinding machines the grinding head remains stationary while the work table moves back and forth. In this imported design the work remains stationary while the head is given a reciprocating movement, this being carried on automatically. The grinding spindle rotates about its own axis and also revolves around a second axis parallel to its own, the eccentricity of the two axes being adjusted automatically or by hand. Several spindles are provided for a varied range of work, these spindles being mounted in bronze bushings and ball bearings. To assure the work table being absolutely true, it is finished by grinding after mounting on the machine. It is accurately adjustable, both vertically and horizontally. An exhaust fan fitted with a flexible hose is part of the tool equipment. The large machines are provided with a grinding head movement of 106 in. and all machines have a lateral adjustment of 15¾ in.

The small machine requires 4 h.p. to operate while 25 h.p. is necessary for the heavy grinder. The respective weights are 3,750 and 70,000 lbs. These machines are being marketed by Marburg Bros., of New York.

PIPE WRENCH

A pipe wrench that is simply constructed, light in weight and having great strength, has recently made its appearance on the market. The tool is known as the "Little Giant" and is of the end opening type, which design enables it to be fitted to pipes that would be difficult to work on with side openings. The handle is drop-forged and heat treated, the double central jaw being integral with the handle. The moveable jaw is likewise drop forged and heat treated, while the adjusting nut is of hardened steel. It is claimed that the wrench grips and releases freely in all positions. The moveable jaw may be inserted from either side, the double feature of the fixed jaw adding to the life of the tool. The tool, which is made in 8, 10 14, 18 and 24 in. sizes, is being placed on the market by the Greenfield Tap and Die Corp., Greenfield, Mass.

PISTOL-GRIP HACKSAW FRAME

A pistol-grip hacksaw frame has recently been offered to the trade. Springs are used to provide constant tension on the blade. This feature enables the

Pistol-grip Hacksaw Frame.

blades to be changed quickly. The adjusting pawl is set down inside the frame as low as possible. Strong but light steel tubing is used for the back and all steel parts are nickel-plated. The blade may be set to cut in any one of four directions by means of the wing nut. The frame is 3⅜in. deep and blades of from 8 to 12in. may be used. The hard rubber, checked handle provides plenty of finger room and gives a comfortable grip for the operator. These frames are made by the L. S. Starrett Co., Athol, Mass.

POWER CLAMPING DEVICE

In order to provide clamping facilities to the column of a radial drilling machine when the operator is standing in a working position, there has been developed a device for clamping by power. The clamp is controlled from the head and no air pressure is required. The air pressure is driven from the main vertical driving shaft which extends through the box at the rear of the column. By means of two friction clutches the screw may be operated in either direction. The friction clutches are engaged by the action of a cam operated by the screw. The clamping mechanism is controlled by a set of links and the hand lever under the head. Friction clutches are self-releasing and slip at either end of the movement of the tightening lever, thus protecting the parts from injury. These devices are being installed by the Drises Machine Tool Co., of Cincinnati, Ohio.

HYDRAULIC FLANGING PRESS

An exceptional large hydraulic flanging press, designed for the flanging of plates for car ends, has recently been constructed. The machine has a capacity of flanging cold steel plate 5/16 in. thick by 10 ft. in length. Two rams the used, one located at the top of each side housing, the main cylinders being 20 in. dia.; auxiliary cylinders of 5½ in. dia. are used for returning platen to upper position. The ram has a stroke of 24 in. and the maximum distance between the platens is 36 in. The press is capable of exerting a pressure of 435 tons. All the main castings are made of cast steel to withstand the heavy pressure. The machine weighs approximately 42 tons. All movements of the press are obtained by the operation of one hand lever controlling a three way, poppet-type, high-pressure valve. This press was made by the Hydraulic Press Manufacturing Co., Mount Gilead, Ohio.

VISE JAW CLAMPS

A set of vise jaw clamps specially designed for use in bench vises or in vise jaws or clamps mounted on milling machines, surface grinders and similar tools, has recently been placed on the market. Each pair of the set has different sizes of holes, for either square or round stock, so that various sizes of finished stock can be held without marring the surface, when slotting, milling, grinding, threading or other operations are being performed. The two sections of jaw are forced apart when vise is released by action of two springs. Clamps are hardened and ground all over. They are designed to take stock from 1-8 to ½ in. in size. They are manufactured by the Milliken Machine Co., West Newton, Mass.

11-INCH SLIDE REST

A slide rest especially designed for use on lathes has recently been offered to the trade. A feature of this rest is the method of securing the rest to the base. A tapered hub on the rest fits in a tapered hole in the base, and the clamping is obtained by action of a sliding segment controlled by two collar screws. The feed screws have 10-pitch square threads. The swivel is graduated and a standard toolpost is provided. All bearings are accurately finished. The travel is 5¾ in. by 2½ in. This rest has been brought out by the Milliken Machine Co., West Newton, Mass.

For anyone wishing to secure a fuller knowledge of the construction of a vacuum tube the A. B. C. of Vacuum Tubes Used in Radio Reception, by E. H. Lewis, A. I. R. E., will serve the purpose ideally. It is especially valuable to the person who knows nothing about radio and very little about electricity, as no previous technical knowledge is necessary. Starting with an explanation of elementary electrical terms, and list of symbols, the functioning of various vacuum tubes as detectors and amplifiers is explained step by step in an easily understandable manner. Speech distortion is discussed and its elimination pointed out. This is one of the recent books issued on this subject by the Norman W. Henley Publishing Co. Price $1.00.

CANADIAN MACHINERY
AND MANUFACTURING NEWS

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THE MACLEAN PUBLISHING COMPANY, LIMITED
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To Visit Busy North

THAT A party of manufacturers, representing Toronto Board of Trade will leave shortly to inspect the lumbering and mining regions of Northern Ontario indicates an appreciation of the steadily increasing business from those industries, and a desire to learn their requirements at first hand with the idea of most efficient service.

Developments in the Ontario gold mining region alone are now well beyond the infancy stage and production is such as to invite, if not challenge, world comparison. Two years ago, when activities were not attracting the attention that they are to-day, the amount paid by the mining industry in wages was well over twenty-five millions. Machine drills and parts were purchased to the value of over seven hundred thousand, while for drill steel more than half a million dollars were expended. These amounts, however, but serve to indicate the extent of the outlay for equipment of all kinds. New mines are being placed in operation, vast areas are under prospect, and the field is one of great possibility for the Canadian manufacturer and workman.

Growing Interest in Standards

MARKED progress in being made in standardizing work within Canada, and also in an international way. Co-operation among manufacturers and engineers in this matter is recognized as an absolute essential in order to guard against what are termed "individual divergencies" whereby many unnecessary varieties of parts are produced regardless of the great economic value of comparison and adoption of standard dimensions. The movement is not one that has to do with revelations of secrets, but with co-ordination in parts and products for certain operations or purposes on which superficially distinctive features perform no useful purposes. The requirements not only of domestic industry but also those of export and import business have to be considered.

Word comes from Germany that there has been great concentration on standard systems in that country. In fact an American engineer recently returned believes the time is not far distant when manufacturers on this continent will receive inquiries from many foreign countries to furnish goods according to German national standards. He points out that one of the main reasons why forward-looking Germans force their standardization work is because they want to introduce German standards in the great importing countries, and possibly in the whole world. Holland, Switzerland, Austria, Sweden and many other European countries follow the German lead very closely. In his opinion the great German deliveries in kind to France will no doubt be made as far as feasible according to German standards, thereby introducing them in that country. This enthusiasm is due to a more or less general recognition, created under the pressure of war conditions, of the great economic value of standardization, and to the very generally accepted opinion that a standardized industry would be one of the strongest weapons in Germany's stuggle for economic rehabilitation and financial reconstruction.

It is noteworthy that Canadian manufacturers are showing a keen interest in this work. England is realizing fully the importance of her standards and is promoting their recognition in the different parts of the empire.

British Want the Business

A RECENT British export journal discusses trade relations with Canada under the somewhat lugubrious caption: "Canada: British or ——? Customs reductions which please Dominion protectionists and U. S. A. tariff wall climbers." It deplores the fact that while British goods were bought to the amount of about twenty-five million pounds, American goods to the amount of one hundred and thirteen million pounds were purchased by Canadians. Then the journal proceeds towards the solution of the proposition. It points out that the Fordney tariff wall cannot but cause a slackening in business between the two countries; it does not deny that Canada requires British goods, and further considers as an encouraging factor the evidence of the British preference by the Fielding tariff and eventually asks whether the cause of the trouble may not be too great reliance on preferences and too little initiative in studying the requirements of the Canadian markets.

It must appear to our British friends that the great amount of American capital invested in Canadian industry, the geographical advantages, the fact that large American houses, whether represented in Canada by a branch factory or not, regard Canada as a definite field for direct business, requiring aggressive advertising and a service in every way as considerate and efficient as that which they give their home market—that all this must explain a certain amount of the difference in Canadian trade going to the two countries. To a remarkable extent, British manufacturers are recognizing the increasing importance of the Canadian market, and Canadian branches and Canadian representatives are making their appearance in increasing numbers. There is a decided preference here for many British lines and there is no reason why these lines should not be considerably extended. The journal concludes with this sound observation: "With adequate and enterprising propaganda, the establishment of local stocks in the Dominion, and the employment of suitable agents to do the business, there is no reason why Great Britain should not obtain a very much larger share of Canadian trade than is the case at present."

Pig Iron on Canadian Metal Market May go to $45

Advancing Coal Prices Add to Problems of Production—Pittsburgh Blames Rapacity of Labor—Predicts Economic Break—Canadian Mill Announces $39.30 Rate on Spot Pig—Montreal Market Reports Buying Curtailed

METAL DEALERS EXPECT RADICAL PRICE CHANGES

WHILE it is a fact that a few months ago the steel and iron trade thought it good for business to resist any influence that made for inflation in places, to-day it is evident such a movement is receiving some encouragement. This, it is claimed, is one result of the attitude represented by the concession to striking coal miners by the operators, a concession for which the public must pay. Advices from Pittsburgh declare that banking interests have practically acquiesced in a drifting policy until such a time as mounting production costs, to which labor demands are declared to be contributing unreasonably, must reach the breaking point and economic law brings about the inevitable remedy. This is actually reflected in the market to-day when difficulties of delivery, and uncertainties of price make for unsettled conditions.

More significance than was at first looked for seems to attach to the advance of 20 per cent. in wages by the United States Steel Corporation for it was shown that stability had been in evidence up to the present time. Coal costs must soar with the reinstatement of the 1920 wage scale, and it is this factor that has to be considered together with the possibilities of labor troubles in the steel industry. Authorities declare that such prices as are predicted cannot last indefinitely, that high wage rates, shortage of materials and transportation must bring about a crisis some time in 1923, and that stern lessons in economics are going to be taught in the readjusting process.

In the Canadian market to-day $45 pig iron is the prediction for the not-far-distant future. In fact Algoma Steel is quoting $39.30 for spot, a somewhat nominal price as there is not a great quantity available for immediate delivery. Domestic supplies on contract basis are shrinking and foundries entering the market are confronted by conditions that recall war-time problems. Canadian furnaces are confronted by the advanced coal costs, by stiffening, if not increased, wage rates, and the outlook is one that indicates a general upheaval in prices of steel and iron and their products.

As announced in last week's market reports, steel pipe prices have at last succumbed to the upward movement. Manufacturers at distance from sources of raw material are laboring under considerable difficulty in securing supplies of skelp. These are the days when the car scout has to be particularly keen, with mills on one hand consuming carloads per day, and on the other hand, with transportation beset by many uncertainties. Advances in prices all along the line have at last brought an increase, declared by some to be overdue, of $6 per ton on black piping and $4 per ton on galvanized.

Some steel companies in Pittsburgh and district have withdrawn all prices and a radical upward revision in lists may be expected. Commenting on Canadian conditions the sales manager of a large corporation observes: "They are undoubtedly improving, and we look for good business in the near future; in fact it would not be at all surprising if a distinct shortage of all steel products will have to be faced shortly. Unfortunately coal conditions are such as will not likely permit of reasonably satisfactory operations for some time to come."

Montreal markets show a slowing up that is quite suggestive of the holiday season, with this difference, that the condition cannot be attributed to that cause. Strike influences are apparent, and demand during the past week has fallen off. Quotations are swinging upward, and there appears to be curtailment of consumption, for the market is not taking kindly to speculative factors which are the usual development of protracted strikes. The policy of watchful waiting seems to be preferred by some, and this would indicate that demands of business are not so insistent in some quarters as to consider premium prices favorably. Even the quotations on Summerlee imported pig have advanced to $33 dock, and $38.50 in lots of five tons or more, warehouse. Some foundries are already in the market. There is little change in the non-ferrous section, but some interest is being shown in cast iron scrap, which is none too plentiful.

Toronto

August 30.

TORONTO markets still report good enquiry in spite of the upward trend of prices. There is no tendency to encourage sensational movement and it is remarkable that quotations in certain departments show slight differences of opinion. This is regarded as indication that some warehouses have far larger stocks available than generally supposed. Difficulties of supply are manifesting themselves more widely, and conditions that made for scarcity in sheets, are now manifesting themselves in other sections. Pig iron, naturally the basic factor, serves to illustrate most strikingly the problems of the situation. Domestic producers are not in position to deal with the situation and quotations are largely nominal. Algoma's spot price is 39.30, and it is predicted that $45 pig is not altogether out of the question.

Scrap metal markets are quiet, with some enquiry for aluminum, lead and zinc, the natural result of activities in the motor car and building industries. Some enquiry has developed for cast iron scrap but very little is available. Current prices follow:

Copper, light ..... per 100 lbs.	8 50
Copper, crucible	11 00
Copper, heavy	11 00
Copper Wire	11 00
No. 1 compositon	9 00
New brass cuttings	6 00
Red brass turnings	6 50
Yellow brass turnings	4 85
Light brass	4 00
Medium brass	5 50
Scrap zinc	3 50
Heavy lead	4 50
Tea lead	3 00
Aluminum	11 00
Boiler plate, per gross ton.	9 00
Heavy melting steel	10 00
Axles (wrought iron)	20 00
Rails (scrap)	11 00
Malleable	10 00
No. 1 machine cast iron	20 00
Pipe, wrought	7 00

Non-ferrous metal markets continue to be more or less featureless. Tin is described as weak, copper as easy, lead firm, zinc firm, antimony steady and aluminum steady. In connection with the tin market it is announced that the Canadian government merchant marine announces a fortnightly service to Swansea and Cardiff, instead of the regular monthly sailings. It will carry greatly increased exports from tin plate from South Wales and imports of Canadian goods. British tin plate manufacturers, it is claimed, are ousting United States producers from the Canadian market. Current prices:

Lake copper	17 25
Electrolytic copper	17 00
Castings, copper	17 00
Tin	36 50
Solder	8 00
Lead	7 00
Antimony	7 40
Aluminum	22 00

Sheets, bars and plates continue to play an active part in the demand with prices showing strength and the supply more or less problematical and specific requirements. Current prices:

Iron bars	3 25	3 40
Steel bars	3 25	3 40
Reinforcing bars	3 25	3 40
Steel hoops		4 25
Tire Steel		3 40
Spring steel		7 00
Band steel, No. 10 gauge and 3-16 in base	3 65	3 75
Small shapes		3 40
Sheets, black, No. 28		5 40
Sheets, blue ann., No. 10		4 25
Canada plates, dull, 52 sheets		5 75
Canada plates, all bright		6 00
Galvanized Sheets, No. 28.....		6 85

Demand for machine tools continues

to be somewhat spotty. Some orders are being placed for fairly large pieces, but this business as a rule is the reward of aggressive salesmanship. The horizon, however, is said to be lifting and the last quarter should show improvement.

Owing to increased cost in production the Landis Tool Company has found it necessary to advance prices ten (10) per cent. on all machines and machine parts. These prices were effective August 15th, 1922.

Upward revision of boiler tube prices is in immediate prospect. Reports are being received from Pittsburgh and other sources that prices for the time being had been withdrawn pending issuance of a new list.

Montreal

August 30.

THE PAST week has seen business in the iron and steel lines fall off to a very great extent. July and August are always considered as quiet months, but this year the volume of business did not contract until after the middle of July. From then on to the past week, conditions were only fair, and the further curtailment of the past week has brought business, in these lines, back to the point where it was a year ago.

The strike situations are having a very direct influence on business. Consumers of iron and steel have not come into the market as freely as they otherwise would have. The producers of pig iron, the steel mills and jobbers all feel that deliveries and prices on material for the last quarter will be largely speculative. Pig iron has advanced so also has steel. It is felt that these higher prices are only the advance notices of still higher quotations. The machine tool business is quiet but supplies are moving fairly well. The nonferrous metals are quiet, which condition also describes the scrap metal market.

Iron and Steel: The demand for iron and steel has been very light during the week. The unusual conditions, however, have been such as to bring increased quotations. The steel mills are now quoting $2.60 base, to the large consumer, which is an advance of ten cents. Heretofore contractors have been on the list of the large consumers. During the week they have been put on the jobbers' list which carries a quotation of $2.70 base. Contractors' requirements are so diversified that it was felt that with the former arrangement an injustice was being done the jobber who bought not only more consistently, but usually had a more desirable specification. Thus contractors have had the price of steel to them advanced twenty cents, the large consumer was advanced ten cents and the jobbers' figures remain unchanged.

Hard steel reinforcing bars are quoted at $2.40 base to the contractor and jobber, with a regular list of extras for size and a list of extras for bending. The action of the United States Steel Corp. and other large steel industries in the United States advancing wages 20 per cent. during the week means, eventually, higher steel quotations. There is a real labor shortage in the American mills, which were operating at about 70 per cent. of capacity. The railways have been heavy purchasers of steel as well as the automobile and agricultural interests.

The demand for merchant bars, structural steel, reinforcing bars, and plates has been very light locally. Small steel products are moving well, as also are sheets. One jobber reports that in spite of weekly replenishments to stock he has not been able to get into his warehouse any 26 or 28 gauge galvanized sheets. The trade in miscellaneous products is spotty, the total volume being somewhat less than that of last week. Local quotations are as follows:

Iron bars, base	3 15 to 3 25
Steel bars, base	3 15 to 3 25
Reinforcing bars, base	3 15 to 3 25
Steel hoops	4 25
Tire steel	3 25 to 3 40
Spring steel	7 00
Band steel, No. 10 gauge and 3-16" base	3 65 3 75
Small shapes	.... 3 40
Sheets, black, No. 28	.... 4 40
Sheets, blue ann., No. 10	.... 4 05
Canada plates, dull, 52 sheets	.... 5 50
Canada Plates, all bright	.... 7 00
Galvanized Sheets, No. 28	.... 6 50

Pig Iron: Canadian furnaces have temporarily withdrawn quotations from the local market. The nominal quotation on No. 1 iron is $36.80 car load lots on tracks. Summerlee quotations are advanced to $33.00 for car load lots on dock Montreal, and $38.50 for lots of five tons or more ex warehouse. Owing to the inability of local sales offices of Canadian furnaces to take on increased bookings, local requirements are being taken care of with Summerlee which is the only imported iron actually on the local market at the moment. A shipment of Carron iron is en route here, but is not, of course, available. The exact figure that will be asked for this iron is not definitely known. It is reported that only one furnace from the Buffalo district is quoting iron locally, others are short of coal. Until conditions improve, and coal is available, there will be little change at the furnaces. Supplies of pig are being consumed daily and some foundries are already in the market. Others will follow and it seems reasonable to expect that all the present supplies of Scotch iron will be consumed, before the atmosphere clears. Most local dealers have but little to say, their policy being one of watchful waiting. Local pig iron prices follow:

Algoma, No. 1, car lots on tracks, nominal quotation	36 80	....
Summerlee, 5-ton lots, warehouse	38 50	33 00
Summerlee, 30-ton lots, dock	33 00	....

Machine Tools and Shop Supplies: There has been little change in the machine tool situation. During the late spring and early summer a few small sales were made. This business has fallen off recently. There is practically no demand for iron working tools, and only a small demand for woodworking tools. The supply end of the business continues at about the same volume as last week. No important changes in quotations have been announced during the week. Inquiries for supplies are improving and it is felt that September promises to be a distinct improvement over August.

Non-ferrous Metals: Business was rather quiet during the week. For some weeks past, only a nominal volume of business has been done. Last week was about the average. Orders are small and widely distributed. Tin and antimony quotations each weakened a quarter of a cent. Other quotations remained stationary. Local quotations are as follows:

Lake Copper	17 75
Electrolytic Copper	17 50
Castings, Copper	17 25
Tin	35 00
Lead	7 00
Spelter	8 75
Antimony	6 25
Aluminum	22 00

Scrap Metals: There have been a few more inquiries for scrap material and some sales of iron and steel scrap have been made. Prices remain about the same, as have been prevailing for some weeks. There appears to be little desire to increase holdings locally. Foundries are manifesting a little more interest in scrap iron as the temporary conditions surrounding the pig iron market, together with the gradual improvement in conditions, have turned their attention to their supply of iron. Local quotations are as follows:

Copper, light per 100 lbs.	8 50
Copper, crucible	11 00
Copper, heavy	11 00
Copper Wire	11 00
No. 1 composition	9 00
New brass cuttings	6 00
Red brass turnings	6 50
Yellow brass turnings	5 00
Light brass	4 00
Medium brass	5 50
Scrap zinc	3 50
Heavy lead	4 50
Tea lead	3 00
Aluminum	11 00
Boiler plate, per gross ton	9 00
Heavy melting steel	10 00
Axles (wrought iron)	20 00
Rails (scrap)	11 00
Malleable	10 00
No. 1 machine cast iron	20 00
Pipe, wrought	7 00

Pittsburg

August 30

THE PAST week has been the most important one in iron and steel trade developments for a year if not for several years. In a nutshell, the trade has joined the inflationary movement that has been asserting itself in some lines for several months, and it goes farther, in that it will push inflation instead of resisting, as it was doing vigorously only two months ago.

The cause of the change in attitude is the rapacity of labor. It is necessary to be frank in order to give the news. It has been decided, with the advice of banking interests, to go with the tide, letting the unreasonable demands of labor work out into higher

costs until the inevitable break, dictated by economic laws, is precipitated.

Coal mining costs are outrageously high, by the re-establishment of the 1920 wage scale, and the scarcity produced by a five months' strike is such that coal will command tremendous prices right into, if not through the winter. Unwillingness on the part of building trades labor to do a reasonable amount of work has brought fancy wage rates in building operations, even in some cases for common labor, and the steel industry has been unable to stand the competition, hence it raises its wages to a level not warranted by economic conditions.

The costs of producing pig iron and steel will be very high by the double influence of high wage rates and shortage of materials and transportation. Instead of the steel industry drawing upon its surplus to pay the difference between old low-priced contracts still to be filled and the high costs under which the orders must be filled it will advance prices to the possible limit to make profits out of steel the consuming industries are still willing to buy. This will be a year of very moderate profits for the producers, but a year ending with prices that cannot last indefinitely. When the end comes, some time in 1923, lessons in economics will be taught labor in the hard school of adversity.

Connellsville Wages

The H. C. Frick Coke Company, the fuel subsidiary of the United States Steel Corporation, posted notices in the Connellsville region that it would revert to the wage scale of September 1, 1920, the highest scale ever paid in the region, and independents promptly followed. There was no offer of union recognition. The region has been strictly non-union for more than 30 years but the United Mine Workers, in connection with their general strike inaugurated April 1 last, organized the men to an extent. The notices were posted four days ago, but up to this writing only a few men have gone back to work, just as men were straggling back from time to time previously. The Frick Company had built up a moderate production of coke, but was shipping very little coal to the corporation's mills and by-product ovens, compared with normal. Independents have been operating very poorly. The members of the Pittsburgh Coal Producers' Association, which have had a regular union strike on their hands, offer the men the 1920 scale but without the check-off, which means without union recognition, and the strikers have failed to go back. In various other districts the operators have yielded, having suffered a defeat that was unimaginable last March.

The United States Steel Corporation announced that, effective September 1, it would advance wages at its mills and furnaces 20 per cent. Some independents followed almost instantly with announcements, and the advance will no doubt be complete. For the central west, Pittsburgh, Wheeling, the valleys, the Lake Erie front, Chicago, etc., this means an advance in common labor from 30 to 36 cents an hour. The pre-war rate, set by the advance of February 1, 1913, was about 19 cents, while in 1898 the usual rate had been 13 cents. In 1898 bars, shapes and plates sold down to a cent a pound. Now wages are practically tripled and freight rates are much higher. According to the Connellsville Courier the average value of Connellsville coke in 1894 was $1.00, and in 1898 $1.55. Now $11.50 is quoted and blast furnaces assert they will not buy until the price gets down to $7.00. Competition among merchant furnaces to get coke and be the first to resume will probably result in more than $8.00 being paid, when the time comes that coke is offered in sufficient volume to enable any furnace to run. To date, as indicated above, the offerings are too small to make it worth while to try to buy, in such tonnages as a blast furance must have.

Steel Price Advances

On August 15, independent pipe mills advanced their prices three points (a point is about $2 a net ton) on black and two points on galvanized steel pipe. Eight days later than these announcements, and one day after the Steel Corporation had announced its 20 per cent. wage advance for mills and furnaces and the advance of 40 per cent. or more in the Connellsville region, the National Tube Company, the pipe subsidiary of the corporation, announced an advance equal to that of the independents.

A fortnight ago the American Sheet & Tin Plate Company advanced its price $2 a ton on blue annealed and $4 a ton on black, galvanized and automobile sheets, to levels independents had previously been securing. Now the independents are advancing to a level $3 above the corporation prices. The market is thus quotable at 3.35c to 3.50c for common black.

The Carnegie Steel Company has withdrawn practically all prices. It had been selling bars, shapes and plates, for altogether indefinite delivery, at 1.80c. It is reported that some purchases might be made from it at 1.90c for bars and 2.00c for plates and shapes, but the company will not admit having these or any other prices. Independents generally are asking 2.25c, and obtaining the price without difficulty on anything like early delivery.

Connellsville coke has been declining and has reached $13 on foundry and $11.50 on furnace, the latter price not interesting furnaces.

The pig iron market is one for prompt shipment out of stock only. Neither producers nor consumers are disposed to consider forward deliveries. Producers do not know when they will again be able to make iron. There is no more valley foundry iron offered, and apparently the point nearest Pittsburgh from which any foundry iron can be had is Buffalo, at say $32, Buffalo furnace, making a price delivered to Pittsburgh equivalent to $33.50, valley basis, allowing for freights. A week ago the market was quotable at $30, two weeks ago at $28 and five months ago at $19. Over 2,000 tons of Bessemer iron have been picked up at $30, a $3 advance in the week, and it is thought this took all the iron to be found. Last sales of basic seem to have been at $26, valley, some time ago. Now there are no offerings but it is claimed $33 was bid.

ANTICIPATES LABOR SHORTAGE

One reason said to be behind the recent increase of 20 per cent. to employees of the U. S. Steel Corporation, is that the immigration law has cut off the supply of unskilled laborers which formerly drifted to the iron and steel centers.

Resumption of coal mining and the increasing demand for laborers in other industries, combined with the expected business revival this fall, is reported to have caused apprehension among mill managers, who feared that the higher wages elsewhere would cause sufficient desertions to hamper their operations.

The United States Steel Corporation employs approximately 220,000 men, of whom 156,000 are affected by the wage increase, the 64,000 in the mining and transportation departments being excluded. The increase will swell the company's pay roll by $35,000,000 on the basis of "full time." The increase will bring the rate for day labor up to 36 cents an hour. The present rate is 30 cents an hour.

A CONCESSION TO HOME INVESTORS

In offering to renew the five and a-half per cent. Canadian Government bonds maturing December 1st at the same rate of interest as is carried by the maturing bonds, and allowing a bonus of one month's interest, the Minister of Finance is making a material concession to the Canadian investor, as this rate is higher than was paid on the recent Canadian loan in New York. The high class of the security, which is the very best that can be offered in Canada, and the liberal rate of interest should lead to large investment in these Dominion bonds. Attention is directed to the official advertisement giving details.

BRITISH ELECTRIC SHIPS

Three vessels of a very unusual character are shortly to be built in a British shipbuilding yard. Each will be about four thousand tons and especially designed for the fruit carrying trade. They will be fitted with oil engines of a special type designed in this particular yard and recently tested under ocean-going conditions with most satisfactory results. The engines will drive electric generators which will supply current to electric motors placed on short propeller shafts at the stern of the vessel.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Toronto price:—

Silicon, 2.25% to 2.75%	35 65
Algoma, No. 1, Montreal,	36 80
Summerlee, Scotch, Montreal dock,	32.50
Summerlee, Warehouse, 5-ton,	37.50
Carron, Montreal docks	32.50
Grey forge Pittsburgh	34 76
Lake Superior, charcoal. Chicago	34 65
Standard low phos., Philadelphia	35 00
Bessmer, Pittsburgh	30 00
Basic, Valley furnace	26 00

METALS

	Montreal	Toronto
Lake Copper	$17 75	$17 25
Electrolytic Copper	17 50	17 25
Castings, Copper	17 25	17 00
Tin	35 50	36 50
Spelter	8 75	7 50
Lead	7 00	7 00
Antimony	6 25	7 00
Aluminum	22 00	22 00

Prices per 100 lbs.

BILLETS

F. O. B. Pittsburgh

	Per gross ton
Bessemer billets, 4 in. x 4 in. and larger	$35 00
Open hearth billets	35 00
O. H. sheet bars	35 00
Forging billets	45 00
Bessemer rods	45 00

IRON AND STEEL

Per 100 lbs. to Large Buyers	Cents
Iron bars, base, Toronto	$3 25 3 40
Steel bars, base, Toronto	3 25 3 40
Small shapes, base	3 40
Iron bars, base, Montreal	3 15 3 25
Steel bars, base, Montreal	3 15 3 25
Reinforcing bars, base	3 15 3 25
Steel hoops	4 25
Tire steel	3 40
Spring steel	7 00
Band steel, No. 10 gauge and 3-16 in. base	3 65 3 75
Chequered floor plate ¼" and heavier	7 00
Bessemer rails, heavy, at mill	2 35
Steel bars, Pittsburgh mill prices	2 25
Tank plates, Pittsburgh mill prices	2 25
Structural shapes, Pittsburgh mill prices	2 25
Steel hoops, Pittsburg	2 75

F. O. B. Chicago Warehouse

Steel bars	2 70
Structural shapes	2 80
Plates	2 80
Small shapes under 3-in.	2 80

PLATES

Plates, 3-16 in.	$3 75	$3 50
Plates, ¼ up	3 40	3 25

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$4 50	$5 40
Sheets, blue ann., No. 10	4 05	4 25
Canada plates, dull, 52 sheets	5 50	5 75
Can. plates, all bright	7.00	6.00
Galvanized sheets, No. 28		6 35
Queen's Head, 28 B.W.G.	7 25	
Fleur de Lis, 28 B.W.G.	7 00	
Gorbal's best, No. 28		
Colbornes Crown, No. 28		
Premier	6 85	6 35
Premier 10¾ oz.	6 85	6 75
Zinc sheets	9 25	11 00

FREIGHT RATES

	Per 100 lbs. C.L.	L.C.L.
Pittsburgh to Following Points		
Montreal	52	65½
St. John, N. B.	76	96
Halifax	77½	97
Toronto	34	48½
Guelph	34	48½
London	34	48½
Windsor	31½	45½
Kingston	48½	61

Current surcharge 1 per cent.

OLD MATERIAL

Dealers' Average Buying Prices

	Montreal Per Ton	Toronto Gross
Boiler plate	$ 9 00	$ 9 00
Heavy Melting Steel	10 00	11 00
Axles (wrought iron)	20 00	16 00
Rails (scrap)	11 00	11 00
Malleable scrap	10 00	11 00
No. 1 Machine cast iron	20 00	21 00
Pipe, wrought	7 00	6 00
Car wheel	17 00	16 00
Steel axles	10 50	15 00
Mach. shop turnings	4 00	6 00
Stove plate	16 00	14 00
Cast boring	4 00	6 00
Copper. light	8 50	$ 8 50
Copper, crucible	11 00	11 00
Copper, heavy	11 00	11 00
Copper, wire	11 00	11 00
No. 1 machine composition	9 00	9 00
New brass cuttings	6 00	6 00
Red brass turnings	6 50	6 50
Yellow brass turnings	5 00	4 85
Light brass	4 00	3 50
Medium brass	5 50	4 50
Scrap zinc	3 50	4 00
Heavy lead	4 50	4 50
Tea lead	3 00	3 00
Aluminum	11 00	11 00

COLD ROLLED STEEL

(At Warehouse)

Rounds and squares	$4.50 base
Hexagon and flats	$5.50 base

COPPER PRODUCTS

Prices per lb.

	Montreal	Toronto
Copper Bars, ½ to 2 in.	.29	.28
Brass Tube		.28
Plain sheets, 16 oz. in. 30 x 72	.30	.29
Copper sheet, tinned, 16 oz.	.37	.36
Copper sheet, planished, 16 oz. base	.42	.41
Braziers', in sheets, 6 x 4 base	.30	.29
Copper tubing, seamless		.32

LEAD SHEETS

Roll Lot Prices

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$ 8 75	$ 9 25
Sheets, 3 1-2 lbs. sq. ft.	8 75	9 25
Sheets, 4 to 6 lbs. sq. ft.	8 25	8 50

Cut sheets, ¾c. per lb. extra

Cut sheets to size, 1c. per lb. extra

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	20
Brass sheets, 24 gauge and heavier base	23
Brass tubing, seamless	28

WROUGHT PIPE

Price List No. 56. August 23, 1922.

Standard Buttweld Pipe S/C

Size	Steel Blk.	Steel Galv.	Gen. Wrot. Iron Blk.	Gen. Wrot. Iron Galv.
⅛ in.	6 00	8 00	....	....
¼ in.	3 96	6 00	7 20	9 30
⅜ in.	3 96	6 00	7 20	9 30
½ in.	5 02	6 55	7 31	8 93
¾ in.	6 10	7 82	8 86	10 70
1 in.	8 50	14 22	12 58	15 30
1¼ in.	11 50	15 18	17 02	20 70
1½ in.	13 75	8 15	20 35	24 75
2 in.	18 50	24 42	27 38	33 30
2½ in.	29 25	38 61	.....	.....
3 in.	38 25	50 49	.....	.....
3½ in.	49 68	64 40	.....	.....
4 in.	58 86	76 30	.....	.....

Standard Lapweld Pipe S/C

Per 100 feet.

Below dividing line—price per foot.

Size	Steel Blk.	Steel Galv.	Gen. Wrot. Iron Blk.	Gen. Wrot. Iron Galv.
2 in.	22 20	27 75	31 08	37 00
2½ in.	32 76	41 54	46 80	56 16
3 in.	42 84	54 32	61 20	73 44
3½ in.	50 60	66 24	72 68	89 24
4 in.	59 95	78 48	86 11	105 73
4½ in.	68 58	87 63	1 04	1 24
5 in.	79 92	102 10	1 21	1 45
6 in.	1 04	1 32	1 57	1 88
7 in.	1 38	1 79	2 02	2 45
8L in.	1 45	1 88	2 13	2 58
8 in.	1 67	2 16	2 45	2 97
9 in.	2 04	2 62	2 97	3 59
10L in.	1 89	2 43	2 75	3 33
10 in.	2 43	3 13	3 54	4 28

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4-in. and under 55 per cent.

4½-in. and larger, 45 per cent.

4-in. and under running thread, 35%.

Standard couplings 4-in. and under 25%.

Do., 4½-in. and larger 5 per cent.

MALLEABLE FITTING LIST

1 in. elbow	.32	.53
2 in. elbow	1.05	1.70
1 in. tee	.43	.70
2 in. tee	1.45	2.40
1 in. coupling	.33	.53
1 in. locknut	.15	.23

Discount to dealers 70/5 off list.

BOILER TUBES

Size	Seamless	Lapweld
1 in.	19.00	
1¼ in.	20.00	
1½ in.	20.00	
1¾ in.	21.50	
2 in.	20.00	16.00
2¼ in.	22.00	20.00
2½ in.	23.00	20.00
3 in.	27.00	24.00
3½ in.	32.00	28.00
4 in.	41.00	35.00

Prices per 100 ft., Montreal and Toronto

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, 7-16 and up	30
Carriage bolts, ⅜ in. and smaller 6 in. and shorter	40
Coach and lag screws	45
Stove bolts	72½
Wrought Washers	60
Do., corru. head	60
Machine bolts, 7-16 and over	35
Machine bolts, ⅜-in. and less	35
Blank bolts	35
Bolt ends	35
Machine screws, fl. and rd. hd., steel cut thread	37½ & 10
Machine screws, o. and fil. hd., steel cut thread	30
Machine screws, o, and fil. hd., brass cut thread	15
Standard couplings, 4-in. and under, brass cut thread	30% 30
Nuts, square, blank off net list	$1.00
Nuts, square, tapped off net list	50c.
Nuts, hex., blank off net list	50c.
Nuts, hex., tapped net list	
Copper rivets and burrs, list less	32c.
Burrs only, list plus	10%
Iron rivets and burrs	47%
Boiler rivets, base ¾ in and larger	$5.75
Structural rivets, as above	5 65
Wood screws, O. & R., bright	80
Wood screws, flat, bright	82½
Wood screws, flat brass	77½
Wood screws, O. & R., brass	75
Wood screws, flat, bronze	72½
Wood screws, O. & R., bronze	70

NAILS AND SPIKES

Wire nails, base	$3 65
Cut nails, base	4 35
Miscellaneous wire nails	72½%

MILLED PRODUCTS

(Prices on unbroken packages)

Set screws	65
Square and hexagon head cap screws	60
Round head cap screws	20
Fillister head cap screws	35
Flat head screws	25
Button head cap screws	20
Studs	45
Semi-finished nuts up to and including 9/16 in.	70
Semi-finished nuts ⅝ to 1¼ in.	65
Semi-finished nuts 1⅜ to 2 in	35
Coupling bolts	35
Taper pins, No. 2 to No 5	65
Taper pin No. 6 and over	10
Planer bolts without fillet	10
Planer bolts with fillet	Net
Patch bolts	Plus 10%
Hollow set screws	20
Thumb screws	50
Thumb nuts	70

CARBON DRILLS AND REAMERS

	Discount.
S. S. drills, wire size	60
Can. carbon cutters	plus 10
Standard drills, all sizes	60
3-fluted drills, plus	10
Jobbers and letter sizes	60
Bit stock	50
Ratchet drills	25
S. S. drills for wood	10
Wood boring brace drills	50
Electricians' bits	30
Sockets	50
Sleeves	30
Taper pin reamers	25
Drills and countersinks	20
Bridge reamers, carbon	50
Centre reamers	Net
Taps, machine screw	50 to 60
Taps, hand, sizes up to 1"	30 to 60
Chucking reamers	20 off
Hand reamers	20
High speed drills, list	40
Can. high speed cutters	plus 10
American	plus 40

FILES AND RASPS

Globe	60/5
Vulcan	50
P. H. and Imperial	60/5
Nicholson	40
Black Diamond	40
Heller	40
Jowitts	net
J. Barton Smith, Eagle	55
McClelland, Globe	50
Delta Files	20
Disston	40
Disston	50
Great Western-American	50
Kearney & Foote, Arcade	60/5

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

PROOF COIL CHAIN

B. B. B. CHAIN

⅜ in., $16.45; 7-16 in., $14.00; ½ in., $12.95; 5-8 in., $13.15; ¾ in., $12.75; ⅞ in., $12.25; 1 in., $11.85; 1⅛ and 1¼ in., $10.55. Fire weld chain same sizes respectively are $14.00; $11.50; $10.40; $10.55; $10.15; $9.75; $9.35; and $8.25.

ELECTRIC WELD COIL CHAIN B.B.B.

⅛ in. $20.00; 3-16 in. $16.50; ¼ in. $15.50; 5-16 in. $12.70.

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	30%
Standard	30 and 10%
Cut leather lacing, No. 1	1.75
Leather in side, (Lacing)	1.50

RUBBER BELTING

Standard 36 ....28% Best grades 28%

TAPES

Chesterman Metallic, 50 ft.	$5 00
Lufkin Metallic, 603, 50 ft.	3 17
Admiral Steel Tape, 50 ft.	3 00
Admiral Steel Tape, 100 ft.	4 50
Major Jun. Steel Tape, 50 ft.	3 75
Rival Steel Tape, 50 ft.	4 00
Rival Steel Tape, 100 ft.	8 75
Reliable Jun. Steel Tape, 50 ft.	5 25

PLUMBING SUPPLIES

Plumbers' oakum, per cwt.	6 30
Solder, strictly	$0 22½
Solder, guaranteed	0 24
Soldering coppers, lb.	0 62½
White lead, pure, cwt	13 20
Red dry lead, 100-lb. kegs, per cwt.	10 75
Wood alcohol, per gal.	1 75
Whiting, plain, per 100 lbs.	3 00

ROPE AND PACKING

Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope ¾ and larger, base	0 21
British Manila rope	0 17
New Zealand hemp	0 19
Jute packing, fine	15c
Jute packing, coarse	11c

OILS AND COMPOUNDS

Castor Machine Oil, per lb.	34½
Royalite, per gal. bulk	20
Palacine	23
Machine oil, per gal.	39
Black oil, per gal. (Summer)	19
Cylinder oil, Capital	69½
Petroleum fuel oil bbls., net	10.80
Pure turp., single bbls., gal.	1.75
Linseed oil, raw, single bbls.	1.10
Premier galsoline	34

WASTE

XXX Extra	16
Atlas	18
Peerless	21
X. Empire	13
XX Grand	15
Ideal	18
Superior	20
X Press	11½
X L C R	14

Colored

Lion	12
Fancy	13½
Standard	10½
Popular	9
No. 1	13
Keen	7½

Wool Packing

Arrow	24
Anvil	16
Axle	20

Washed Wipers

Select White	18
Dark colored.	13
Mixed Colored	14

This list subject to trade discount

PLATING SUPPLIES

Polishing wheels, felt	$3 25
Polishing wheels, bull-neck	1 60
Emerey in kegs, Turkish	7½
Pumice, ground	04½
Emery glue	26
Tripoli composition	08
Crocus composition	12
Emery composition	11
Rouge, silver	60
Rouge, powder, nickel	35

Prices per lb.

ANODES

Nickel	40 to .45
Copper	.38 to 22
Zinc	.16 to .12½

PLATING CHEMICALS

Acid boracic	.20
Acid, hydrochloric	.03¾
Acid, nitric	.10¼
Acid, sulphuric	.03¾
Ammonia, aqua	.20
Ammonium, Carbonate	.15
Ammonium, chloride	.18
Ammonium, hydrosulphuret	.75
Ammonium, sulphate	.10
Arsenic, white	.18
Copper carbonate, anhy.	.26
Copper, sulphate	.08
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.14
Nickel carbonate	.32
Nickel sulphate	.14
Potassium sulphide (substitute)	.40
Silver chloride (per oz.)	.85
Silver nitrate (per oz.)	.65
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.32
Sodium hyposulphite	.08
Sodium phosphate	.10
Tin chloride	.50
Zinc chloride, C. P.	.30
Zinc sulphate	.06

Prices per lb. unless otherwise stated

News From the Industrial Field

C. Victor Grantham, is the Wallace Barnes Co.'s representative in their booth in Industrial building, Toronto Exhibition. It is an interesting display of wire and steel springs.

Quebec.—The announcement was made on August 22 that ten new double truck cars were to be placed in operation within a week on the city lines of the Quebec Railway, Light, Heat and Power Co. The company is now operating thirty-seven large cars on these lines, which means that the old model cars will disappear entirely this autumn.

When freight shed No. 3 of the C. P. R. was destroyed by fire at Fort William, between 25 and 30 box cars were lost and a large quantity of merchandise. A nearby wharf was destroyed and the bow of the steamer Kenora was damaged. The shed contained 7,000 bags of cement, 1,000 tons of nails, several hundred tons of binder twine and some iron pipe. The total loss will be about $175,000.

Yarmouth, N. S.—The town council on August 21 decided to place an order for 3,000 tons of Welsh anthracite coal. The coal is available at a British channel port. The cargo will be ready for shipment early in September. It is planned to use the coal for heating the public buildings, hospitals and churches of the town. If after these requirements are taken care of there is any balance it will be sold to private citizens at cost.

Sherbrooke, P. Q.—The city council has made arrangements with the coal dealers of this city to obtain a limited supply of Welsh anthracite coal which, it is expected, will be delivered about the first of September. The coal contracted for will be in two sizes, lump and nut, and it is estimated that it can be retailed for $22.00 a ton. It is understood that this coal is being delivered at Montreal for a price of $12.00 a ton f.o.b. cars.

Sherbrooke, P. Q.—During the past few days a new Sherbrooke industry has been established. It will be known as the Manganese and Steel Foundry Ltd. and is located on Water St. The company will produce all types of steel castings. The premises occupied were formerly known as the Sherbrooke Iron Works. The capacity of the steel furnace is one ton at a heat, but three heats a day can be run. The company has several very nice initial orders on its books, and prospects for a capacity business appear to be good. P. McCullough, formerly of the Canadian Brakeshoe Co., is president and general manager, while A. S. Bayles, formerly with the Canadian Ingersoll Rand Co., is secretary-treasurer.

Five steel bridges representing the completion of the Toronto-Hamilton highway entrance to Hamilton, and also a link in the Niagara-Hamilton road were opened Wednesday, August 23, by appropriate ceremony. The actual expenditure on this work was $656,000.

The Morse Chain Co. of Ithaca, N. Y., have found it necessary to acquire larger and more desirable offices in Philadelphia. They have recently moved to 612 Franklin Trust Bldg., 18-22 South 15th St. J. A. Meaney will continue to be manager of the Philadelphia district.

Reports from Edmonton indicate that, even with a fair average crop in prospect the farmers cannot quite relieve their minds of possibilities of frost and hail and the continuation of wet weather, which in many districts has seriously delayed operations. Crops which were sown late are likely to yield particularly well. On the other hand, grains which were sown earlier were light and below an average crop. Pasture, late oats and potatoes have benefited immensely from the late rains. Many reports indicate that crops will exceed earlier forecasts.

Ed. Logan, their factory representative, is in charge of the booth of the Clipper Belt Lacer Company, of Grand Rapids, Mich., at Toronto Exhibition. The line consists of belt lacers, steel belt hooks, also twisted rawhide and waterproof fibre pins. The company has recently perfected a rustproof hook for use in damp places, such as laundries, mines, chemical plants or wherever rustproof hooks are required. A moving belt display, entirely of aluminum, is a feature. All moving parts run on ball bearings, making it practically noiseless.

The Anaconda American Brass Company, with headquarters at Waterbury, Conn., has taken over the plant and goodwill of Brown's Copper and Brass Rolling Mills at New Toronto. It is expected that the plant will resume operations about Sept. 1, with a force of two hundred and fifty. For the present no change will be made in the product of this plant, but future plans may include the addition of other lines and the extension of the plant.

It is thus that another large American industry finds location in Canada. The report that the plant is to be moved to Port Credit or that the Canadian headquarters of the company will be located there is contradicted. To Reeve Parkinson, of Port Credit, the daily press attributes a statement to that effect and that the proposed plant would be capitalized at a million and a half dollars and that it would take upwards of two years to complete the structure.

An invitation has been extended the Canadian Chamber of Commerce in London, to assist toward a Canadian section at next year's British Industries Fair. This fair is conducted on a very large scale and is attended by buyers from all parts of the world. The invitation to the Canadian Chamber is another step in the promotion of the inter-Imperial trade.

Sudbury, Ont.—A. F. A. Coyne, geologist, announced at a meeting of the Board of Trade on August 21st that, after making a survey of over one hundred square miles in the Chelmsford and Larchwood area, he and his associates had come to the conclusion that there was anthracite coal in the Sudbury district, and that same was present in commercial quantities. Mr. Coyne's associates were two mining experts from the Scottish coal fields. Samples of the purest form of anthracite coal were produced to support their statements. On some farms coal was discovered at a depth of 18 inches. Mining operations in a small way were started near the C.P.R. station at Chelmsford.

Montreal.—The Quebec provincial representative in London, England, states that at present there exist discriminatory freight rates, and that the existence of these has prevented a Quebec firm in the asbestos business from securing a large order. The firm forwarded a complaint to Col. Pelletier, Quebec's agent-general, who investigated the condition and reported that asbestos can be brought from South Africa to England for $12.00 a ton, while the rate from Canada is $17.00 a ton. At the same time, Canadian asbestos can be shipped to Cherbourg or Havre for $13.00 a ton. Local interests intend to seek an explanation.

Belleville.—The Hydro-Electric Power Commission on August 22 officially fed into the system a new block of 4,000 h. p. which was developed by one of the two new units at the Ranney falls development of the Trent valley system. The second unit will be in operation within ten days. At that time there will be 10,000 h. p. developed at Ranney falls, which is considered to be its capacity. Construction work has been under way for over eighteen months, and it is stated that the cost has been in excess of $1,000,000. The plant is situated about two miles from Campbellford, Ont. The head of water in summer is 46 feet and in winter this is increased to about 53 feet, as certain lakes can be lowered when navigation closes on the Trent Canal. It is figured that with this additional power available the district will not suffer from a power shortage such as existed during the past summer.

Canadian purchasing agents will hold their annual convention in Montreal, Oct 7.

H. S. Cook & Co., have leased the foundry and stove department of the New Burrell-Johnson Iron Co., at Yarmouth, N. S., and will conduct a general foundry business.

Discussing the future of the National Exhibition, Toronto, John G. Kent, managing director, predicts that the time will come when every nation in the world will have a representative building there.

Peckovers, Limited, Toronto, have been appointed distributors for Ontario of Monel Metal products by the International Nickel Co. The material comes in bars, sheets and plates, and shot for foundries.

Trenton's new industry, the Dominion Combing Mills, Limited, will mark a forward step in the Canadian Woollen industry. The corner stone of the new million-dollar mill was recently laid by E. Guss Porter, M. P. for West Hastings.

On investigating the death of a workman at the plant of the British-American Oil Company, Toronto, a coroner's jury recommended "to prevent the recurrence of such accidents, that the company adopt some mechanical contrivance, such as a suction draft to draw off all gases which might form in the combustion chamber of the oil still."

McGregor and McIntyre, of Toronto, have obtained the contract for the sheet metal and steel for the $600,000 collegiate and vocational school building to be erected by the school board of St. Catharines, Ont. This firm has likewise been awarded the contract to supply the structural steel for the Gledhill school in Toronto.

It is stated that the number of men employed in the steel plants of Sydney is less than those in the swordfisheries of Cape Breton. According to a despatch from Halifax, the fish are caught, cleaned, iced, boxed and shipped in a special fleet of refrigerator cars by the most direct route to Boston. The catches are enormous and there is a steady market found at 13 cents a pound on board ship.

An example of the superiority of electric power over steam is to be found in the rock-crushing plant at Hagersville, which, among many other things, supplies the M. C. R. with ballast material, says a St. Thomas report. For some time it has been impossible to make the steam-operated shovel keep up with the crushing equipment, which was electrically-driven. A few days ago one of the electric shovels used on the Chippawa Canal excavation was secured from the Hydro Commission and now this shovel only operates a small part of the time to maintain the supply for the crusher.

Hugo A. Gutenkunst, founder of the Canadian Malleable Iron plant, Owen Sound, is at present connected with the Milwaukee Malleable & Grey Iron Co. and the Milwaukee Hay Tool Co. While on a recent visit to Owen Sound, he said that business conditions in the States are rapidly improving, and with the settlement of rail and coal strikes he predicts a period of splendid business.

The Hamilton Gear Co., Van Horne St., Toronto, are at the present time making a large number of gears for rubber machinery. This firm has completed quite a number of these gears lately and if it were not for the large capacities of their gear cutting equipment, it would be impossible to handle the diameters which are at present coming through the shop. This company have also adopted the three color system on all patterns, as it avoids confusion and is much better for their class of work than the ordinary two-color system. They report business is quite a bit better and look for still further improvement in the near future.

As an indirect result of the coal strike and rail difficulties of the past months, the industrial situation in the States is rapidly assuming an acute condition. The announcement that all of the Ford plant and assembly factories will close about the middle of September, is only the commencement of a general tie-up of large manufacturing plants if the present state of affairs should continue. It is stated that the closing of the Ford plants will directly affect about 75,000 men and that several hundred thousand men in associated industries may be out of work owing to the suspension of automobile activities.

The Harmer-Knowles Motor Truck Co., Van Horne St., Toronto, are going to show a truck exhibit in the Arena Building at the Toronto Exhibition. They will display trucks from one ton capacity up to three and a half tons, and on all trucks from one and a half tons upwards, the Hamilton Reduction Axle will be used. In addition to the complete truck which will be shown, they are going to display a complete axle assembled, but mounted without the housing so that the construction can be plainly seen. The Hamilton Gear Co., Van Horne St., Toronto, who are the manufacturers and designers of this Hamilton Double Reduction Axle, make certain claims for the construction, which are as follows:— They claim that the construction and double reduction feature eliminates sliding motion, and that the patented brake design which they have has about five times the braking effect of the usual brakes, and over twice the effect of any other. They also claim several safety advantages for this class of brake, and are willing to show the features in detail to those interested. The braking surface is exceptionally large in diameter, and the construction of shoes is exceptionally rigid and has a floating effect, which helps considerably.

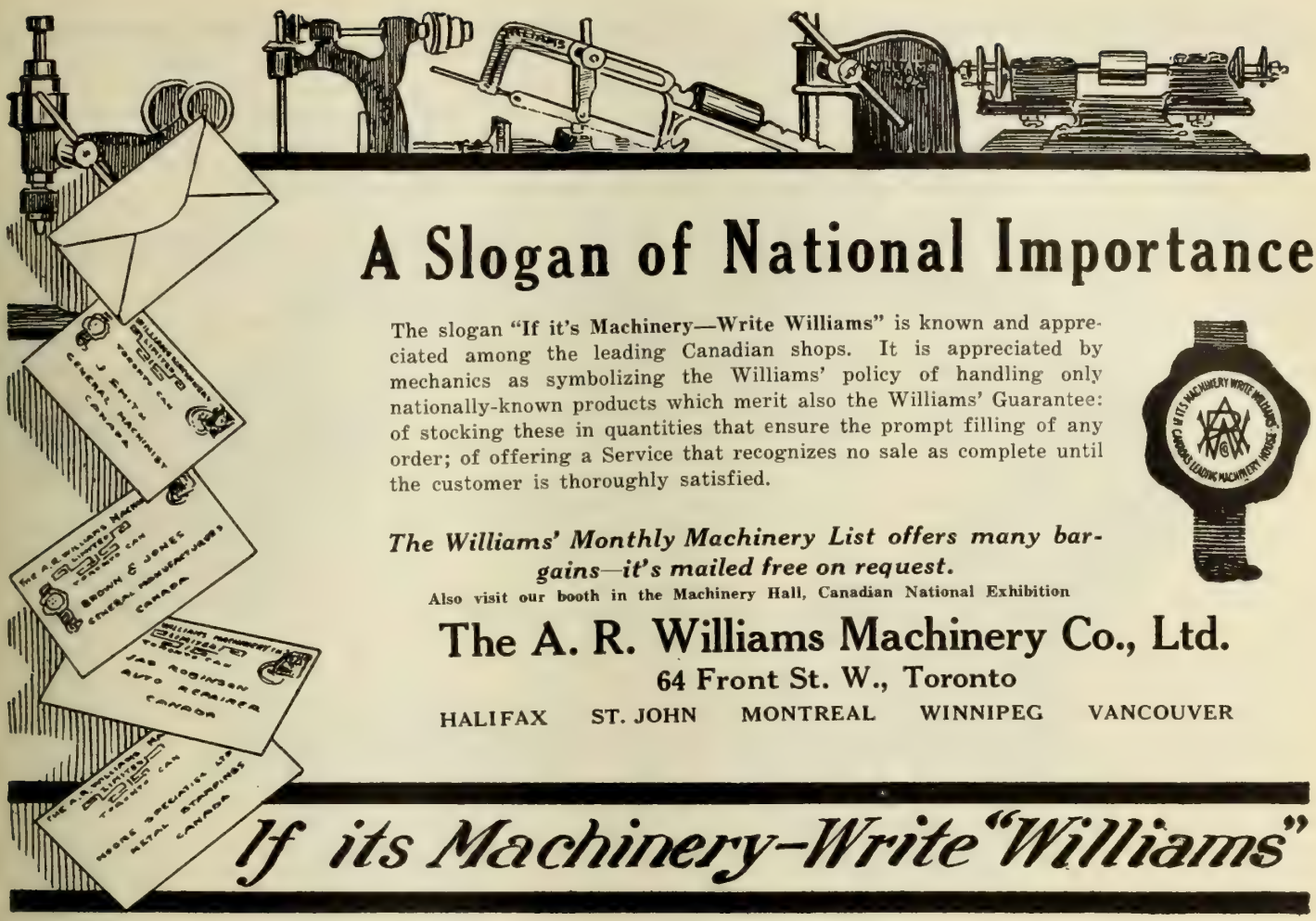
Montreal.—Roland Yeates of the Yeates Machinery and Supply Co., and Russell Wilson, for nine years with Legare Automobile & Supply Co., have been appointed exclusive agents in Montreal and vicinity for the Franklin Automobile Co., of Syracuse, N. Y. Mr. Yeates and Mr. Wilson have opened their show rooms in the new Birks building in Cathcart St., under the firm name of Franklin Montreal Motors, Ltd. The service station will be located at 767 St. James St., where H. D. Hekkema will supervise a staff of factory trained mechanics who are familiar with all the details of the Franklin car.

In the merger of the Bethlehem-Lackawanna steel interests, details of which have just been announced, there will be a readjustment of stock holdings whereby the Bethlehem and the Lackawanna combined will have $77,000,000 in preferred stock, and $82,608,500 common. Among the projected plans for enlargement growing out of the putative increases in business, the directors say that from $10,000,000 to $15,000,000 will be spent in improving and enlarging the Buffalo plant of the Lackawanna.

Montreal.—It is being intimated that the Dominion Glass Company, Limited, will shortly undertake the construction of a large, modern glass plant in the vicinity of Montreal. At the present time the company is operating two smaller plants here, one being located at Point St. Charles and the other on Delorimier Avenue in the east end. These plants have about reached the limit of their efficient expansion. The proposal is, it is understood, to erect one large plant here which will not only look after the business now being handled by these two plants, but will also provide for any expansion in the company's business which can be foreseen at present.

Ottawa, Ont.—After long drawn out negotiations the Hull Electric Co. has acquired certain holdings in Low Township on the shores of the Gatineau river. The title includes the riparian rights to the Paugun falls, which falls are situated about thirty-five miles from the city. In the course of the next year it is planned to establish a hydro-power plant which will have an ultimate capacity of 150,000 h.p. The preliminary estimates of the total cost of construction are said to be about $10,000,000.

It is stated that it will take two years to complete the work. It will be necessary to construct a large viaduct and dam, which will require about one thousand workmen. As far as possible the local men will be employed. Work will be commenced before the early summer of 1923. At the present time the total power generated by the hydro plants at Chaudiere falls on the Ottawa river between Ottawa and Hull is slightly less than 50,000 h.p. Thus it is expected that the new plant with its large additional power will be the means of attracting industrial establishments to the district.


A Slogan of National Importance
The slogan "If it's Machinery—Write Williams" is known and appreciated among the leading Canadian shops. It is appreciated by mechanics as symbolizing the Williams' policy of handling only nationally-known products which merit also the Williams' Guarantee: of stocking these in quantities that ensure the prompt filling of any order; of offering a Service that recognizes no sale as complete until the customer is thoroughly satisfied.
The Williams' Monthly Machinery List offers many bargains—it's mailed free on request.
Also visit our booth in the Machinery Hall, Canadian National Exhibition
The A. R. Williams Machinery Co., Ltd.
64 Front St. W., Toronto
HALIFAX ST. JOHN MONTREAL WINNIPEG VANCOUVER
If its Machinery-Write "Williams"

Montreal.—Frank Scott, vice-president and treasurer of the Grand Trunk Railway System, resigned on Aug. 25th after a continuous connection with the company for forty-four years. The resignation was accepted at a meeting of the board of directors, and will become effective on September 1st. James A. Yates, who has been Mr. Scott's assistant for many years, was appointed to the post vacated by Mr. Scott.

Montreal.—The Quebec division of the Canadian Manufacturers' Association has notified all members to file at headquarters a specification of their coal requirements for the balance of the year. The association has secured a small quantity of Canadian, Welsh and English coal already, and anticipates increasing this supply. The association distinctly states that it is not interested in anthracite coal, or any other fuel that is required for domestic purposes. It is understood that as soon as the requirements of the members are known that active steps to procure the coal will be taken.

Montreal.—An order for 150 street cars which was placed recently with the Canadian Car & Foundry Company, Montreal, by the Toronto Transportation Commission, is being handled by the company's Montreal plants. There is also a certain amount of repair work passing through the plants of the company as well as other equipment companies in Canada. The Grand Trunk Railway is having 100 refrigerator cars repaired by the National Steel Car, and 500 coal cars and 500 box cars repaired by the Canadian Car & Foundry and Eastern Car. The Canadian Pacific Railway has ordered 250 refrigerator cars from the National Steel Car. It is also reported that the Canadian equipment companies are also in line to receive some very fine business from the United States, owing to the strike situation there. This will be in the nature of repair business to locomotives and cars, and barring an early settlement of the strikes this business may run into large figures.

BOOM IN WELSH COAL INDUSTRY

According to a trade commission report from Bristol, Eng., the present American demand for Welsh coal has been a great thing for the industry, which was in a dead slump. It has increased its proceeds, improved wage positions, and the capacity of the industry to give more employment. The report continues: "The American demand is essentially of a temporary character. No one is in a position to say how long or how short the duration of it will be. In fact, it may have ceased before this report is printed. The boom came without any intimation; it may disappear practically without any warning. The demand for British coals will cease immediately the emergency which has created it disappears. Already soaring prices have affected orders, and there has been a big rise in shipping freights; practically all the free coal has been bought, and salesmen are holding off the market for the present. In fact soaring prices and the inability to deliver, are beginning to lessen the new orders. The boom came at a most providential time as conditions in the trade were very unsatisfactory. Steps were being taken to close down some of the older pits, and as far as possible the men displaced were being put on double shifts at the other colleries, enabling outputs to be maintained and lowering the cost of production. Indeed Welsh colliery owners have been going through, until the present boom, a bad time, having to compete very keenly with the north country, and the special steps that had been taken to uphold Welsh prices had to be abandoned quite recently when it was found that orders were being lost. Thus the American demand has been most opportune for the South Wales coal miners' area."

Do what you have to do so well that the boss won't have to do it over again.

FAVORABLE REPORT FROM CITY OF CALGARY

Discussing the western outlook, John Wilson, assistant secretary of Calgary Board of Trade, writes Canadian Machinery as follows: "It may be of interest to your readers to learn that as a city of home owners we are second out of twelve of the largest cities in the Dominion.

"With the prospect of a good crop throughout the southern area, business conditions are particularly favorable, and compare very well with those of a year ago. The coal strike and the effort to create a Wheat Board has had some effect, but we hope that with the air clearing in both these matters, that we shall again resume business on a sound and good basis.

"Like all other cities in the Dominion the unemployment problem is one that is engaging our very serious attention, and, while we look with optimism to the future, we feel very keenly that this problem is one that has to be handled firmly and intelligently. We do not hope that the same conditions that prevailed regarding the unemployed in our city last year will again obtain this winter, and are already devoting considerable time with a view to eliminating as far as possible the difficulties that presented themselves last season.

"No new industries are at present in prospect, but many inquiries have been made during the past year regarding the possibilities of industries locating in our city."

INDUSTRY IMPROVES IN SHERBROOKE, QUE.

Sherbrooke, Que. — Canadian Brakeshoe Company Limited recently associated with the Holden interests, has acquired, it is reliably reported, a large piece of land on Belvidere street, familiarly known as the old cemetery property, at $30,000. The acquisition of this property is held to be the forerunner of extensive developments to be undertaken by the Brakeshoe people, and is looked upon very favorably in industrial circles.

Contrary to the general impression that the summer season is dull and stagnant from an industrial point of view, states the report, a brief survey of conditions as they apply in the Sherbrooke industrial world shows that a steady improvement is being shown all along the line.

The Canadian Ingersoll Rand Company finds itself in a better position than it has been for many a month. The MacKinnon Steel Company reports conditions to be very favorable, with prospects bright. The Beckwith Tool Box Co. Ltd., is very satisfied with the recent trend of business, and a gradual improvement is evident.

The E. and T. Fairbanks Co. had a splendid month in June and while the early part of July dropped off a little, better prospects are in sight and the present situation is quite favorable. The Whiting-Davies Company has been fairly rushed with business of late, and conditions are much improved over last year.

The Julius Kayser Company observes that while the fall business has been decidedly poor, practically negligable, the spring business is exceptionally bright, and orders for next January are better than those of last year. The company intends closing the entire plant for a period of three weeks. This will enable the company to make a complete inventory, while the machinery will be completely overhauled. The plant will reopen at full blast on September first.

The general feeling appears to be that industrial conditions are showing a great improvement over last year, but that better business can only come gradually, without any overwhelming rush. In practically every instance an improvement is noticed and prospects are decidedly encouraging.

BIG SUM FOR MONTREAL HARBOR

Montreal.—Following the visit of the Hon. Ernest Lapointe, Minister of Marine and Fisheries, to the port of Montreal on August 18, it was officially announced that plans for the improvement of the Harbor, which involved an expenditure of $4,000,000 had been sanctioned. These plans embrace the construction of a new elevator at Tarte Pier, which will have an initial capacity of 2,000,000 bushels of grain. It will be ultimately increased to 8,000,000 bushels. The preparations of the designs for the new bridge across the river, the extension of high quay walls between sections 25 and 35, the extension of the wharf at the Imperial Oil Company's plant by 500 feet, the extension of Jacques Cartier, Alexandra, and King Edward piers, the improvement of the channel approach to Bickerdike pier, and the paving and extension of the Harbor Railway terminals to the new wharf levels east of section 25, were the other improvements that were sanctioned. Work on the various projects will be commenced immediately. The first unit of the new elevator will be completed by the autumn of 1923. The new elevator will be able to receive grain from lake vessels at a rate of 40,000 bushels per hour, and in the same time will be able to unload 24 cars or 48,000 bushels, the cars being emptied by car dumpers four at a time. The elevator will be able to ship grain to ocean vessels at the rate of 90,000 bushels an hour. Shipping can be done at seven berths, each of which will be provided with two conveyor belts.

Montreal.—Official announcement was made at the head offices of the Canadian Pacific Railway on Aug. 25th of the promotion of two of the company's higher passenger officials. C. E. Ussher is made general passenger traffic manager, and C. B. Foster who has been assistant passenger traffic manager of Eastern lines, becomes passenger traffic manager of all rail lines.

TO DEPICT SAFETY WORK

Ontario Safety League announces that through the courtesy of John G. Kent, managing director of the Canadian National Exhibition, they have been granted 1,200 square feet in the west annex of the new Arena Building, for a safety exhibit during this year's fair.

Individual, public and industrial safety exhibits will be shown with some striking examples of automobile wrecks, depicting the fatal results of carelessness in connection with traffic. H. H. Couzens, of the Toronto Transportation Commission, has had built especially for this exhibit, a section of a passenger car, to enable the Ontario Safety League to demonstrate, as far as possible, safety in connection with street car traffic.

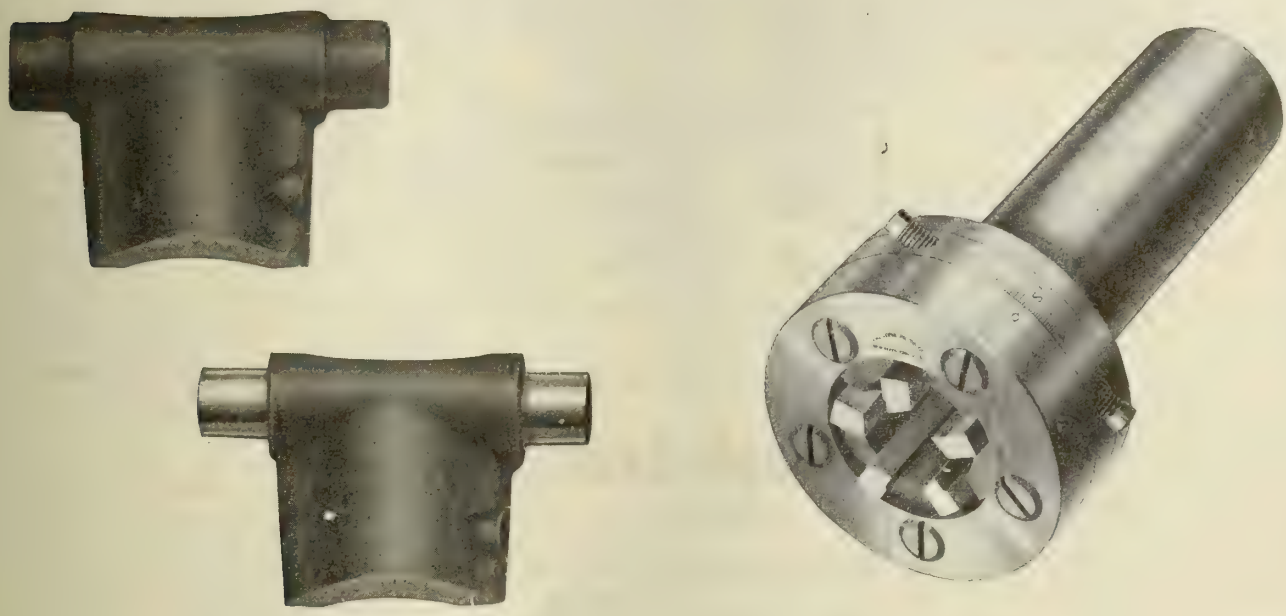
The Assistant District Commissioner of the Boy Scouts, M. E. O'Callaghan, will very kindly have some of his Boy Scouts give, two or three times a day, an exhibition of resuscitation from drowning. This, in itself, is a matter with which we should all be familiar, as fatalities from the water hazard alone costs us each year, in Ontario, some 365 lives.

IMPROVED CHAIN PUMP

No form of engineering is more ancient and at the same time more fascinating than that connected with the raising of water. Primitive races had various ingenious ways of carrying out the operation, and some of our modern methods are in a direct line of evolution from appliances used many centuries ago. One of the most remarkable kinds of pump takes the form of an endless chain, the lower part of which dips into the water to be raised. When the chain moves at high speed the water gets caught up and carried to the top of the driving pulley. Primitive and inefficient as this method may seem, it is extremely convenient for many purposes and can be developed to give most satisfactory results. One of the latest firms uses a very special chain, carrying at right angles to its length spiral coils of steel wire which fit into each other in a most ingenious way. This arrangement enables an exceptionally large volume of water to be caught up. During a recent test made in London a chain of this kind running at a speed of 840 feet per minute, raised 300 gallons per minute to a height of over 80 feet. The pump was driven by an electric motor of about 14 horse power. The largest lift possible in one stage with this pump is about 350 feet. One advantage of the pump is the ease and rapidity with which it can be installed. In one case the whole outfit was set up and started within five hours from the time that the various parts were delivered on the site. Not only water but oils, liquid manure and indeed practically any kind of semi-liquid can be raised with the chain pump, which, by the way, is easily operated by unskilled labor.

2,000 A DAY

$\frac{1}{16}$" TURNED DOWN ON 2,000 DROP FORGINGS WITH A GEOMETRIC ADJUSTABLE HOLLOW MILLING TOOL



There is an extensive quantity of milling that is done with great economy by the use of GEOMETRIC ADJUSTABLE HOLLOW MILLING TOOLS.

Like all other Geometric Tools the Hollow Mill is regarded as superior at home and abroad. A Sydney (New South Wales) man volunteers the good information that he has used different styles of GEOMETRIC DIE HEADS and GEOMETRIC HOLLOW MILLS quite a lot, and after cutting threads under all sorts of conditions with all sorts of methods on his side of the world and in England, he has arrived at the conclusion that the GEOMETRIC WAY CANNOT BE EQUALLED.

The Geometric Hollow Mills provide an efficient and economical method of reducing duplicate parts to an exact diameter prior to threading and for brass finishing.

Send for the Geometric Adjustable Hollow Milling Tool Booklet if you are interested, for it tells what these tools are doing.

THE GEOMETRIC TOOL COMPANY

NEW HAVEN **CONNECTICUT**

Canadian Agents:

Williams & Wilson, Ltd., Montreal

The A. R. Williams Machinery Co., Ltd., Toronto; St. John, N.B.; Halifax, N.S.; Vancouver, B.C.

Hook Tooth

SOME HAVE wondered
* * *
WHAT THE hook in
* * *
HACK MEANS, but
* * *
MECHANICS KNOW at
* * *
ONCE THAT it is
* * *
THE SCIENTIFIC principle
* * *
BY WHICH the teeth
* * *
OF SIMONDS hack
* * *
SAWS ARE made, they
* * *
HAVING A slight hook
* * *
AT THE point so they
* * *
CHISEL OUT the
* * *
METAL INSTEAD of
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TEARING IT out
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AND CONSEQUENTLY the
* * *
BLADES DO not
* * *
WEAR OUT, but last
* * *
LONGER, HOLD their
* * *
CUTTING EDGE and do
* * *
NOT SHELL teeth.

When you need hack saws get the best—Simonds.

Simonds

Canada Saw Co.,
Limited

"The Saw Makers"

Montreal, Que. St. John, N.B.
Vancouver, B.C.

Oil Tempered Steel Springs

Cleveland

for every purpose and the best for each use.

Special styles of all kinds to order.

THE CLEVELAND WIRE SPRING COMPANY
Cleveland, Ohio
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"Maple Leaf"
BRAND
Stitched Cotton Duck Belting

More Power At Less Cost

This is possible if you use ONLY "Maple Leaf" stitched cotton duck belting. It has a positive gripping surface which hugs the pulley. Costs less than leather, rubber or balata.
Once you use "Maple Leaf" belting you specify it always for it is the NO TROUBLE belting which helps production. Write us for samples.

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Greases will practically always show some acidity on test, but unless moisture enters the bearing, no corrosion will occur even though the acidity be as high as 5 per cent. The acidity of such acids as these is very slight as compared with the action of the mineral acids.

The fatty acids contained in animal and vegetable oils are comparatively inactive with respect to metals and when the oil contains no moisture are perfectly harmless so far as their effect on metals is concerned. They do, however, cause emulsions, sludges and deposits, when mixed with water and subjected to heat.

ONE DEATH EVERY SIX MINUTES

Detroit, Mich.—Seventy-six thousand accidental deaths—a life needlessly snuffed out every six minutes—is the astounding bill charged against careless America during 1920, according to the report of the public accident statistics committee of the National Safety Council presented at the eleventh annual Safety Congress which opened here recently.

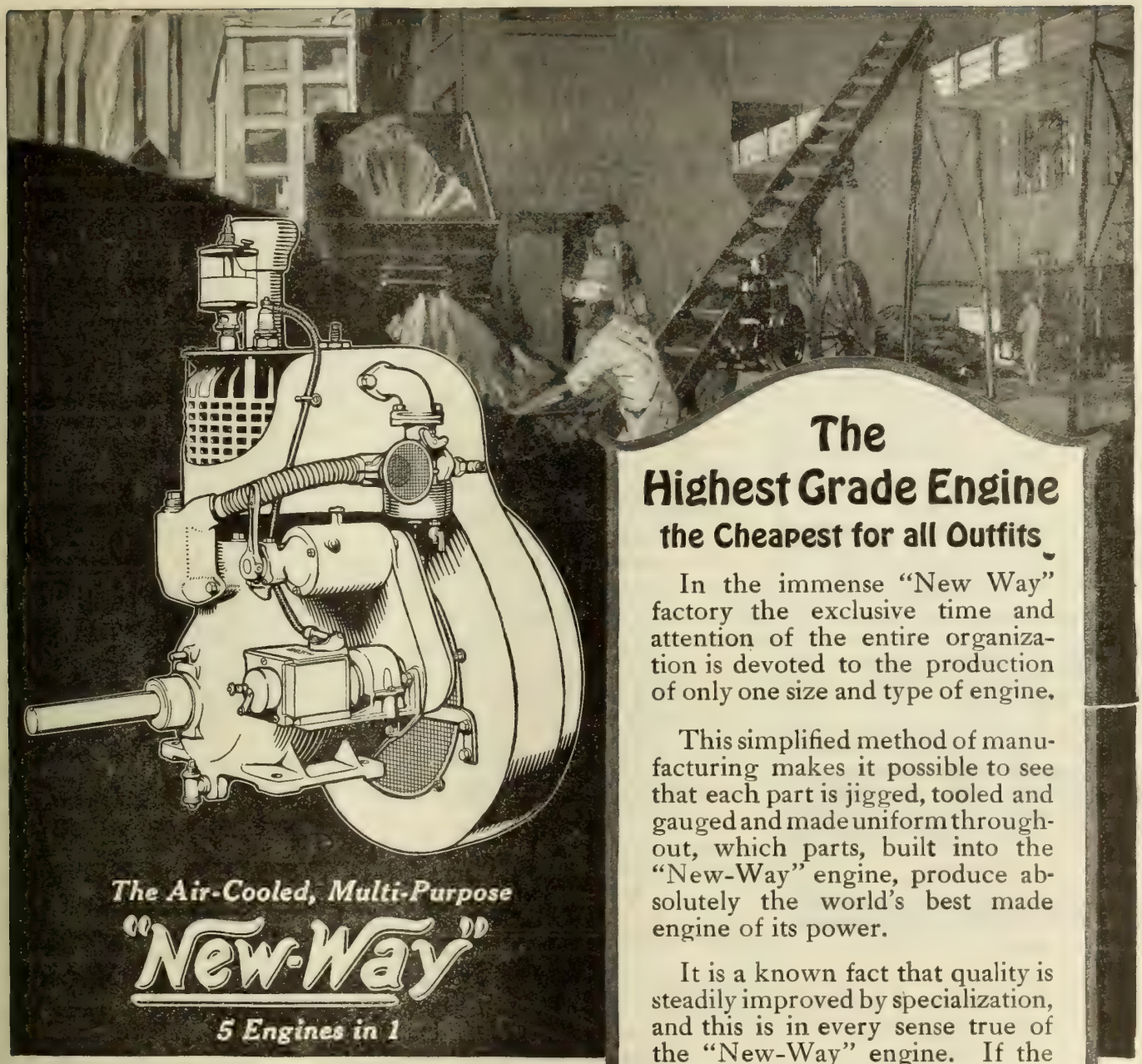
While the 1920 toll from all public and industrial accidents—representing the total population of the state of Nevada—is a decrease of 3,300 over 1911, the beginning of the decade, there is only a balance of 400 on the credit side of the ledger over the 1919 total. This record is viewed with concern by the nation's leaders of organized accident prevention since the yearly downward tendency of accidental deaths in the United States during the past decade, constant up to 1919, came to a halt in 1920.

Automobile accidents are held to be in part responsible for the unfavorable experience of 1920; in that year there were 1,200 more deaths from that cause than in 1919. The chief reason for this, it is pointed out, was the large increase in the number of automobile users. The automobile fatality frequency for 1920 was 30 deaths a day, a total for the year of 11,000. The 1921 estimate of auto deaths, based on figures now available from 50 of the largest cities, indicates a considerable increase over 1920. General traffic accidents in 1921, however, will show a 5 per cent. decrease over 1920, it is believed.

Over twice as many men died accidentally in 1920 as did women, the figures showing in round numbers 55,000 male fatalities as compared with 21,000 women. The latter, however, suffered greatly from domestic hazards, 6,000 having died from falls and 4,800 from burns; 2,756 died from injuries received in automobile accidents. Auto accidents were responsible for 8,300 deaths among men, while railroad mishaps caused 6,930 fatalities.

In commenting on the serious aspect of this continued life wastage through suppressible hazards, the report points out that had the American nation exercised the same regard for the life of the citizenry evidenced in England and Wales in 1920, there would have been 37,000 fewer lives lost in the United States. The death rate in England from 1911 to 1920 was 369 accidental fatalities for each million of population; in the United States the rate for the same period was 714, an uncontrovertible indictment in cold numbers of a national conscience which annually permits the killing and maiming of thousands through preventable accidents.

The reports adds: "The American population is sadly in need of a conscience with respect to accident prevention."



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"New-Way"

5 Engines in 1

These Twelve Superior Qualities Should Convince Anyone

1. Air Cooled. No freezing—no boiling—nooverheating—nowatertroubles.

2. Fuel. Operates as successfully on kerosene as gasoline. Select only this type engine.

3. Ignition. Bosch Magneto only—insures ignition reliability. No cheap battery or unreliable magneto used.

4. Power. Variable from 2 to 5 H. P. Controlled by automatic throttling governor. This engine meets eighty per cent of the stationary engine power requirements.

5. Weight. Delivers more horsepower per pound for its operating weight than any other complete engine.

6. Carburetor. Equipped only with float-feed automobile type instead of common mixing valve — insures easy starting, high economy and smooth operation.

7. Lubrication. Dustproof. All wearing parts are enclosed and run in a bath of oil—insures long life.

8. Balance. Mechanically and accurately balanced to eliminate vibration—makes use ideal on light portable machinery.

9. Compactness. Complete in one unit. Can be mounted in small space. With or without sub-base.

10. Dependability. Building one standardized engine only means uniform quality and superior service.

11. Dynamometer Test. Only stationary gas engine we know of using this exacting test.

12. Performance and Satisfaction. Everywhere, manufacturers and dealers of the highest class are standardizing on the "New-Way" on account of its superior merits and past performance.

The Highest Grade Engine the Cheapest for all Outfits

In the immense "New Way" factory the exclusive time and attention of the entire organization is devoted to the production of only one size and type of engine.

This simplified method of manufacturing makes it possible to see that each part is jigged, tooled and gauged and made uniform throughout, which parts, built into the "New-Way" engine, produce absolutely the world's best made engine of its power.

It is a known fact that quality is steadily improved by specialization, and this is in every sense true of the "New-Way" engine. If the "New-Way" experts spent their time over a multitude of sizes and outfits, the highest quality could not be obtained at such a low cost.

With the "New-Way" engine on your outfit you will obtain the maximum dependable service with the least expense. This means practically no idle men waiting for an engine to go. The "New-Way" always "Goes and Goes Right."

THE "NEW-WAY" MOTOR COMPANY
LANSING, MICHIGAN, U.S.A.

Eastern and Foreign Office,
WOOLWORTH BUILDING, New York City, N.Y.

Classified Opportunities

Two cents a word, including "Canadian Machinery" box numbers; minimum charge is $1.00 per insertion for 50 words or less, set in 6-pt. type. Each figure counts as a word. Display ads., or ads. set in border, are at the card rates.

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FETHERSTONHAUGH & CO.

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FOR SALE OR ROYALTY—CANADIAN PATent No. 214964 on resilient wheel for automobiles and trucks, absorbs the shock in the leaf spring spokes of the wheel, either hard rubber or pneumatic tires may be used; simple, practical and substantial in construction. Reasonable terms. Wm. H. Schlake, Yuma, Colo.

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CASH REGISTER WANTED—SINGLE DRAWer. Receipt printer. Must be in excellent condition. Box No. 807L, Canadian Machinery.

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Light and Medium-Bench and Floor Repetition Castings; Capacity 15 tons per day.
Expert Metal and Wood Pattern Work. Our advice and estimates will save you money.
Semi-finishing operations on Lathe or Grill on Castings supplied if required.
ASK US.
THE KATIE FOUNDRY, GALT, ONT.

STEEL

Air Pressure Tanks, Air Receivers, Steel Plate Tanks, Pneumatic Tanks, Tote Boxes, Shop Barrels, Steel Factory Equipment, Smoke Stacks, Gasoline Tanks.
Write For New Catalogue
THE STEEL TROUGH & MACHINE CO. LTD.
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Oxygen, Acetylene, and a complete line of Welding and Cutting Supplies.

Carter Welding Co.
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SCRAP ENDS
STEEL PLATES 9, 10, 11 Gauge
Carloads or less. Suitable for making Iron Washers.

The Graham Nail Works
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PATTERNS

TORONTO PATTERN WORKS, 65 JARVIS Street, Toronto. Patterns in wood and metal for all kinds of machinery. (ctfm)

BRANTFORD PATTERN WORKS ARE PREpared to make up patterns of any kind—including marine works—to sketches, blue prints or sample castings. Prompt, efficient service. Bell 'Phone 631; Machine 'Phone 733. Brantford Pattern Works, 49 George St., Brantford, Ont. (ctfm)

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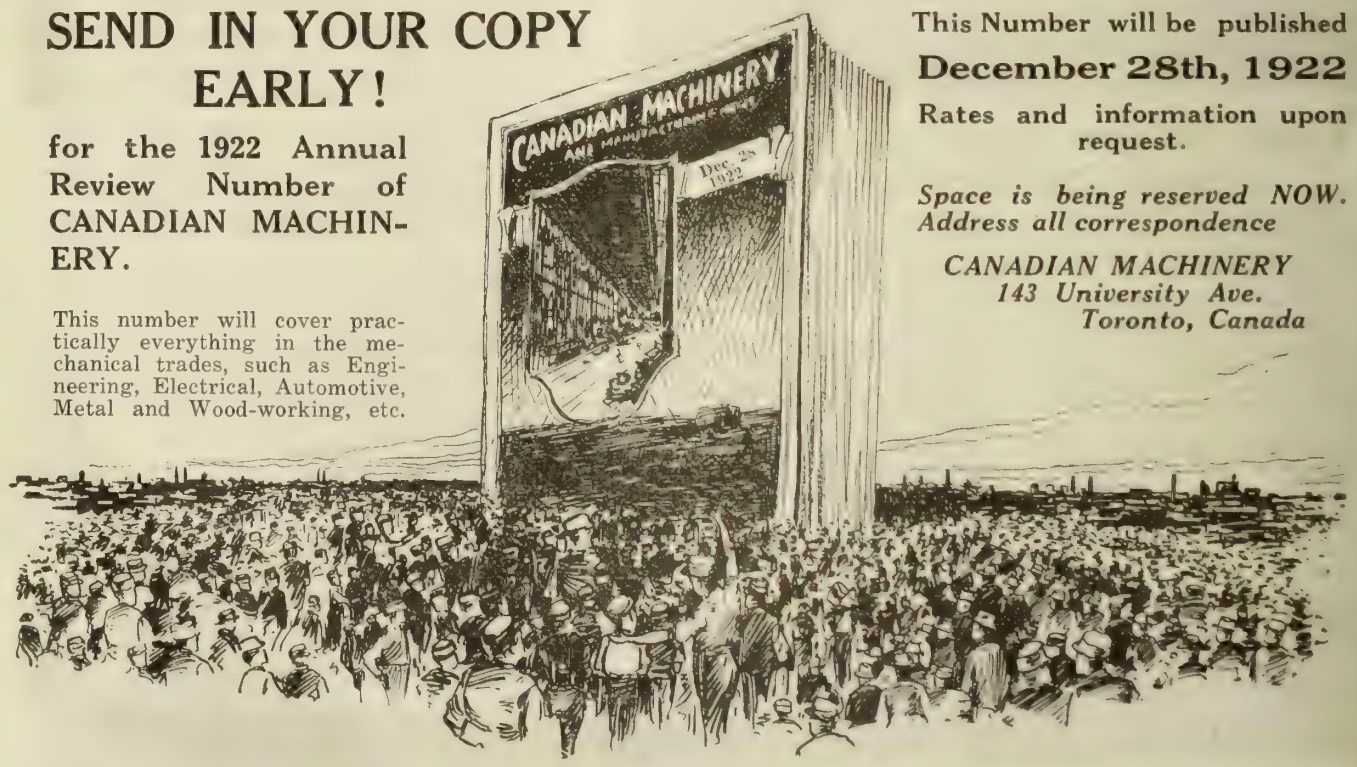

This Number will be published
December 28th, 1922
Rates and information upon request.

Space is being reserved NOW. Address all correspondence

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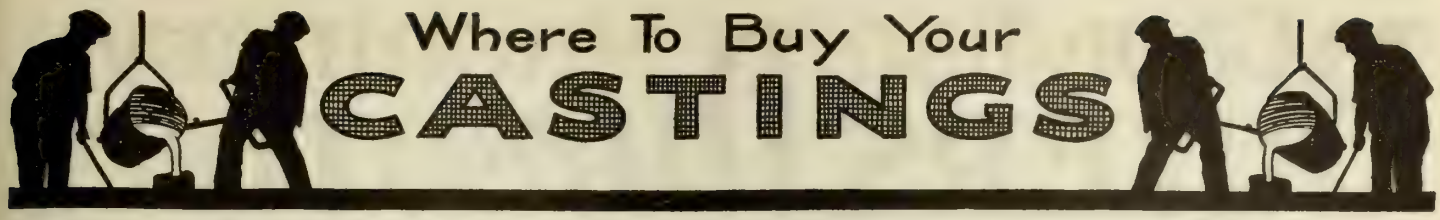
143 University Ave.
Toronto, Canada



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See Advertisement Page 7

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OSHAWA, ONT.
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OSHAWA, ONT.
Malleable, Grey Iron, Brass, Aluminum.

John T. Hepburn, Limited
TORONTO, ONT.
Grey Iron.

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Light Grey Iron.

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Langley & Austin,
GALT, ONT.
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Victoria Avenue, LINDSAY, ONT.
Grey Iron.

Dominion Engineering Works, Limited
MONTREAL, QUE.
Grey Iron.

Smith's Falls Malleable Castings, Limited
SMITH'S FALLS, ONT.
Malleable.

Aluminum Last & Metal Co.,
KITCHENER, ONT.
Aluminum, Brass, Bronze and Special Alloys.

International Malleable Iron Company, Limited
GUELPH, ONT.
Malleable.

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APPLY

Canadian Machinery & Mfg. News
143 University Avenue,
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June 27th., 1922

The MacLean Publishing Co., Limited.
Toronto, Ont.

Gentlemen;-

We wish to inform you that we have had quite satisfactory results from our advertisement in Canadian Machinery and Manufacturing News, which runs under the classified heading "Where to Buy your Castings".

Yours Truly,
Brantford Brass Foundry Company.
Per David Webster

If what you need is not advertised, consult our Buyers' Directory and write advertisers, listed under proper heading.

Canadian Machinery BUYERS DIRECTORY

If what you want is not here, write us, and we will tell you where to get it. Let us suggest that you consult also the advertisers' index— last page of book, after having secured advertisers' names from this directory. The information you desire may be found in the advertising pages. This department is maintained for the benefit and convenience of our readers. The insertion of our advertisers' names undr proper headings is gladly undertaken, but does not become part of an advertising contract.

ABRASIVE DISCS
Lion Grinding Wheels, Limited, Montreal, Que.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John, London, S.E., Eng.

ABRASIVE MATERIALS
Lion Grinding Wheels, Limited, Montreal, Que.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John, London, S.E., Eng.

ACETYLENE, DISSOLVED
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Toronto.
Liquide Air Company, Toronto.

ANCHOR BELTS
Steel Co. of Can. Ltd., Hamilton, Ont

ANGLE BARS
Steel Co. of Can. Ltd., Hamilton, Ont.

ANVILS
Atkins & Co., Inc., E.C., Indianapolis, I.
Petrie, Ltd., H. W., Toronto, Ont.

ANCHOR BOLTS
Steel Co. of Can., Ltd., Hamilton, Ont.

ANGULAR HOLE DRILLING TOOL
Globe Engineering Co., Ltd., Hamilton, Ont.

ARBORS
Atkins & Co., Inc., E. C., Indianapolis,
Brown & Sharpe Mfg.Co., Providence,R.I
Jacobs Mfg. Co., Hartford, Con.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.

BELLS, BRASS, BRONZE and STEEL
Canada Foundries & Forgings Co., Welland, Ont.
Canadian SKF Co., Toronto, Ont.

BARRELS, TUMBLING
McDougall Co., Ltd., R., Galt, Ont.

BARS, BORING
Armstrong Bros. Tool Co., Chicago, Ill.
Bertram & Son Co., td., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

BARS, BORING, PORTABLE
Underwood Corp., H. B., Philadelphia.

BARS, STEEL
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
British Empire Steel Corporation, Montreal, Que.

BEARINGS, BALL
Canadian SKF Co., Toronto, Ont.

BEARINGS, ROLLER
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

BELT CEMENT
D. K. McLaren, Limited, Montreal,
McLaren Belting Co., J. C., Montreal, Que.

BELT DRESSINGS AND FILLERS
Dom. Belting Co., Ltd., Hamilton, Ont.
D. K. McLaren, Limited, Montreal,

BELT FASTENERS
Bristol Company, Waterbury, Conn.
D. K. McLaren, Limited, Montreal.
McLaren Belting Co., J.C., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

BELT HOOKS
Bristol Co., Waterbury, Conn.
D. K. McLaren, Limited, Montreal,

BELT LACING
Bristol Company, Waterbury, Conn.
D. K. McLaren, Limited, Montreal,
McLaren Belting Co., J. C., Montreal,

BELT LACING, STEEL
Bristol Company, Waterbury, Conn.

BELT LACING MACHINES
D. K. McLaren, Limited, Montreal,
McLaren Belting Co., J. C., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

BELTING, CHAIN
Can. Link-Belt Co., Toronto, Ont.
Fittings, Limited, Oshawa, Ont.
Jones & Glassco, Montreal, Que.
Renold (Hans) of Canada, Ltd., Montreal, Que.

BELTING, FABRIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Dom. Belting Co., Ltd., Hamilton, Ont
D. K. McLaren, Limited, Montreal.
McLaren Belting Co., J. C., Montreal, Que.

BELTING, LEATHER
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Can. Fairbanks-Morse Ltd., Montreal, Q.
D. K. McLaren, Limited, Montreal.
McLaren Belting Co., J. C., Montreal, Que.
Smith Belting Co., Toronto, Ont.

BOLTS AND NUTS
British Empire Steel Corporation, Montreal, Que.
Fittings, Limited, Oshawa, Ont.
National Acme Co., Montreal, Que
Petrie, Ltd., H. W., Toronto, Ont

BOLT THREADING DIE HEADS
Landis Machine Co., Inc., Waynesboro Pa.

BOLTS, TRACK
Steel Co. of Canada, Ltd., Hamilton, Ont.

BORING and TURNING MILLS, Vertical
Bertram & Sons Co., Ltd., The John Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

BORING, DRILLING and MILLING MACHINES, Horizontal.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
Herbert, Limited, Alfred, Toronto, Ont.
Landis Tool Co., Waynesboro, Pa.
Vertical
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
McDougall Co., Ltd., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont
Rockford Drilling Machine Co., Rockford,

BORING TOOLS
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.

For list of Dealers see the last page of This Buyers Directory

BELTS, ABRASIVE
Oakey & Sons, Ltd., John, London, S.E., Eng.

BENDING MACHINES, POWER
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bertrams Ltd., Edinburgh, Scotland.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

BILLETS, BLOOMS and SLABS
Steel Co., of Can. Ltd., Hamilton, Ont.

BLOCKS
Wright Mfg. Co., Lisbon, Ohio.

BLOCKS, CHAIN (See Hoists, Hand)
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

BLOCKS, DIE
Canada Foundries & Forgings Co., Welland, Ont.

BLOCKS, PILLOW
Can. Link-Belt Co., Toronto, Ont.

BLOWERS
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

BOILERS, LOCOMOTIVE
Goldie & McCulloch Co., Ltd., Galt,

BOLT AND NUT MACHINERY
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Montreal, Que.

BOLT AND NUT MACHINERY, Automatic
National Acme Co., Cleveland, Ohio.

BUCKET CARRIERS, Pivoted
Can. Link-Belt Co., Toronto, Ont.

BUFFERS
Pryibil Machine Co., New York, N.Y.

BUFFING OR POLISHING MACHINES (See Polishing and Buffing Machines)
Blount Co., J. G., Everett, Mass.
Herbert, Limited, Alfred, Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pryibil Machine Co., New York, N.Y.
U. S. Electrical Tool Co., Cincinnati, O.

BUILDING MATERIALS
Bertram & Son Co., Ltd., The John Dundas, Ont.

BURNERS, OIL AND GAS
Rockwell Co., W.S., New York City.

BURRS
Steel Co. of Can. Ltd., Hamilton, Ont.

CABINETS, OIL
S. F. Bowser & Co., Ltd., Toronto, Ont

CALIPERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Starrett Co., L. S., Athol, Mass.

CAMS
Canada Foundries & Forgings Co., Welland, Ont.

CAN-MAKING MACHINERY (See Sheet Metal Working Machinery)
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Bliss Co., E. W., Brooklyn, N. Y.
Smooth Mfg. Co., Jersey City, N. J.

CARBONIZING
Chapman Double Ball Bearing Co., Toronto.

CEMENTS, IRON CENTERING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.

CHAINS (See Sprockets and Chains)
Reynold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

CHUCKS, DRILL
Herbert, Limited, Alfred, Toronto, Ont
Jacobs Mfg. Co., Hartford, Conn.

CARD CLOTHING
D. K. McLaren, Limited, Montreal,

CASTINGS, ALUMINUM, BRASS, BRONZE, COPPER, DIE-MOLDED, FERRO-ALLOY, IRON, SEMI-STEEL, STEEL.
See "Where to buy your castings" Section. Page number may be found by turning to Advertisers' Index.

CHAINS, DRIVING
Can. Link-Belt Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont
Jones & Glassco, Montreal, Que.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

CHASERS
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CHUCKING MACHINES
Acme Machine Tool Co., Cincinnati, O
Brown & Sharpe Mfg. Co., Providence, R. I.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

CHUCKS, DRILL AND TAP
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canadian SKF Co., Toronto, Ont
Cushman Chuck Co., Hartford, Conn
Geometric Tool Co., New Haven, Conn.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg., New Britain, Conn.

CHUCKS, LATHE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Cushman Chuck Co., Hartford, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Geometric Tool Co., New Haven, Conn.
Gisholt Machine Co., Madison, Wis.
Ker & Goodwin Machine Co., Brantford Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pryibil Machine Co., New York, N.Y.
Skinner Chuck Co., New Britain, Conn
Union Mfg. Co., New Britain, Conn.

CHUCKS, MAGNETIC
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CHUCKS, PLANER
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cushman Chuck Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn
Union Mfg. Co., New Britain, Conn.

CHUCKS, TAPPING
William L. Procunier, Chicago, Ill

CHUCKS, VERTICAL BORING MILL
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

CLAMPS, MACHINISTS'
Brown & Sharpe Mfg. Co., Providence.
Starrett Co., L. S., Athol, Mass.

CLEANERS, METAL, WASTE, GENERAL
Oakley Chemical Co., New York, N. Y.

CLOCKS
Chicago Watchman's Clock Co., Chicago.
Hardinge Bros., Limited, Toronto, Ont.

CLOCKS, TIME
Gisholt Machine Co., Madison, Wis.

CLOCKS, WATCHMEN'S
Chicago Watchman's Clock Co., Chicago, Ill.
Hardinge Bros., Limited, Toronto, Ont.

BUYERS' DIRECTORY

CLUTCHES, FRICTION
Can.-Link-Belt Co., Toronto, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.

COAL AND ASH HANDLING MACHINERY
Can.-Link Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

COAL-STORAGE SYSTEMS
Can. Link-Belt Co., Toronto, Ont.

COLLARS, SHAFT OR SET
Canada Foundries & Forgings Co., Welland, Ont.
Can. Link-Belt Co., Toronto, Ont.

COLLETS
Butterfield & Co.. Inc., Rock Island, Que.
Geometric Tool Co., New Haven, Conn.
Hardinge Bros., Inc., Chicago, Ill.
Hendley Machine Co., Torrington Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

COMPOUNDS, CLEANING
Oakley Chemical Co., New York, N.Y.

COMPOUNDS—CUTTING, DRILLING, GRINDING, SCREW CUTTING
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Oakley Chemical Co., New York, N.Y.

COMPRESSORS, AIR AND GAS
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.

CONES, FRICTION
Norton Co., of Can. Ltd., Hamilton, Ont.

CONNECTING RODS AND STRAPS
Canada Foundries & Forgings Co., Welland, Ont.

CONTRACT WORK
Victoria Foundry Co., Ltd., Ottawa, Ont.

CONVEYORS AND ELEVATORS (SEE ELEVATORS)
Jones & Glassco, Montreal, Que.

COTTERS
Steel Co. of Canada, Ltd., Hamilton, Ont.

COUNTERBORES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

COUNTERS, REVOLUTION
Starrett Co., L. S., Athol, Mass.

COUNTERSHAFTS
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Johnson Machine Co., Carlyle, Man-
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

COUNTERSINKS
Butterfield & Co., Inc., Rock Island. Que.
Pratt &Whitney Co., of Canada, Ltd., Dundas, Ont.

COUPLERS, CAR AND LOCOMOTIVE
Can. Steel Foundries, Montreal, Que.

COUPLINGS
Steel Co. of Canada, Ltd., Hamilton, Ont.

COUPLINGS, PIPE
Fittings, Limited, Oshawa, Ont.

COUPLINGS, SHAFT
Can. Link-Belt Co., Toronto, Ont.

CRANES, ELECTRIC
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can.-Link-Belt Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls Ont.
Northern Crane Works, Walkerville, Ont.

CRANES, LOCOMOTIVE
Can. Link-Belt Co., Toronto, Ont.

Bertram & Son Co., td., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

CRANK PIN TURNING MACHINE
Underwood Corp., H.B., Philadelphia, Pa.

CUTTERS, GEAR
Brown & Sharpe Mfg. Co., Providence. R. I.
Butterfield & Co., Inc., Rock Island, Q. Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CUTTERS, HIGH SPEED
Atkins & Co., Inc., E. C., Indianapolis.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CUTTERS, MILLING
Brown & Sharpe Mfg. Co., Providence, R. I.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.

CUTTERS, STAY BOLT
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.

CUTTING-OFF MACHINE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S , Athol, Mass.

CUTTING OFF MACHINES, PIPE (SEE PIPE-CUTTING AND THREADING MACHINES)
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.

CUTTING-OFF TOOLS
Armstrong Bros. Tool Co., Chicago, Ill.

CUTTING OIL FILTERS (SEE OIL FILTERING SYSTEMS
Bowser, S. F. & Co., Ltd., Toronto.

CUTTING, OXY-HYDROGEN
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Ltd., Toronto, Ont.

DETACHABLE CHAIN
International Malleable Iron Co., Guelph, Ont.

DIAMONDS, BLACK AND ROUGH
Can. Desmond-Stephan Mfg Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

DIAMOND TOOLS
Can. Desmond-Stephan Co., Hamilton,
Wheel Trueing Tool Co., Windsor, Ont.

DIAMOND CROSSINGS
Can. Steel Foundries, Montreal, Que.

DIAMONDS, IMPORTERS
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Co., Windsor, Ont.

DIES, SCREW AND THREAD CUTTING
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.

DIES, SHEET-METAL AND SUB-PRESS (See Tool Work)
Brown, Boggs & Co., Ltd., Hamilton, Ont.

DIES, FORGING
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

DIES, SELF-OPENING, ADJUSTABLE
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Landis Machine Co., Inc., Waynesboro,
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DIES, THREADING-OPENING
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas. Ont.

DIVIDING HEADS
Burke Machine Tool Co., Conneaut, Ohio.
Hendey Machine Co., Torrington, Conn.
Kearney & Treacker Co., Milwaukee, Wis.
Petrie, Ltd., H. W. Toronto, Ont.

DOGS, LATHE AND MILLING MACHINE
Armstrong Bros. Tool Co., Chicago, Ill.

DRAFTING MATERIALS
American Lead Pencil Co., New York City, N.Y.

DRESSERS, GRINDING WHEEL
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ont.
Norton Co., of Can., Ltd., Hamilton.
Wheel Trueing Co., Windsor, Ont.

DRESSING TOOLS
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Co., Windsor, Ont.

DRILL HOLDERS
Armstrong Bros. Tool Co., Chicago, Ill.

DRILLING MACHINES, BENCH
Burke Machine Tool Co., Conneaut,, Ohio.
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Hardinge Bros., Inc., Chicago, Ill.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
U. S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, ELECTRIC AND HAND
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, GANG
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

DRILLING MACHINES, HEAVY DUTY
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
Herbert, Limited, Alfred, Toronto, Ont.
Rockford Drilling Machine Co., Rockford, Ill.

BORING, DRILLING AND MILLING MACHINES, (HORIZONTAL.)
Herbert, Limited, Alfred, Toronto, Ont.
Gisholt Machine Co., Madison, Wis.

DRILLING MACHINES, Multiple Spindle
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
National Acme Co., Cleveland, Ohio.

DRILLING MACHINES, Pneumatic
Cleveland Pneumatic Tool Co., Toronto. Ont.

DRILLING MACHINES, PORTABLE
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, RADIAL
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Herbert, Limited, Alfred, Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto,

DRILLING MACHINES, SENSITIVE
Burke Machine Tool Co., Conneaut, O.
Herbert, Limited, Alfred, Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Williams Machinery Co., A. R., Toronto.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, TURRET
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wisconsin.
Williams Machinery Co., A. R., Toronto.

DRILLING MACHINES, VERTICAL
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Herbert, Limited, Alfred, Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

DRILLS, CENTRE
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DRILLS, HIGH SPEED TWIST
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Cleveland Twist Drill Co., Cleveland, O.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DRILLS, RATCHET
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

DRILLS, TWIST AND FLAT
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.

DROP FORGINGS
Steel Co. of Canada, Ltd., Hamilton.

DUST HANDLING EQUIPMENT
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

ELECTRICAL INSTRUMENTS
Bristol Co., Waterbury, Conn.

ELECTRICAL SUPPLIES
Atkins & Co., Inc., E. C., Indianapolis.
Diamond State Fibre Co., Toronto, Ont.
U.S. Electrical Tool Co., Cincinnati, O.

ELEVATING TRUCKS (See Trucks)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

ELEVATORS AND CONVEYORS
Can. Link-Belt C., Toronto, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.

EQUIPMENT, ELEVATOR SAFETY
Jones & Glassco, Montreal, Que.

EMERY WHEELS (See Grinding Wheels)
Lion Grinding Wheels, Limited, Montreal, Que.
Atkins & Co., E. C., Indianapolis, I.
Norton Co., of Canada., Ltd., Hamilton.

ENGINES, CAPSTAN
Kennedy & Sons, Wm., Owen Sound, Ont.

ENGINE LATHE MANUFACTURERS
Oliver Machinery Co., Grand Rapids, Michigan.

ENGINEERS, MECHANICAL
Dominion Engineering Works, Limited, Montreal, Que.
Gisholt Machine Co., Madison, Wis.
Hamilton Gear & Machine Co., Toronto,

EXPANDERS, TUBE
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

FANS, ELECTRIC
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

FANS, EXHAUST
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Petrie Ltd., H. W., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass.

FANS, VENTILATING
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

FIBRE
Diamond State Fibre Co., of Can. Ltd., Toronto, Ont.

FILES AND RASPS
Nicholson File Co., Port Hope, Ont.
Simmons Canada Saw Co., Montreal, Que.

FILLER, IRON (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J.

FIRE ESCAPES
Roelofson Elevator Co., Galt, Ont.

FITTINGS, PIPE
International Malleable Iron Co., Guelph.
Fittings, Limited, Oshawa, Ont.

FLEXIBLE SHAFTS
Strand & Co., N. A., Chicago, Ill

FLUXES, WELDING
Carter Welding Co., Ltd , Toronto, Ont.
Dominion Oxygen Co., Ltd, Toronto
Liquide Air Company, Toronto, Ont.

FORGING MACHINERY
Acme Machinery Co., Cleveland, Ohio
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown Boggs & Co., Ltd., Montreal.
National Machinery Co., Tiffin, Ohio.
Steel Co. of Canada, Ltd., Hamilton,

BUYERS' DIRECTORY

FORGINGS, DROP
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Ltd., Toronto, Ont.

FORGINGS, HAMMER
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Hepburn Ltd., John T., Toronto, Ont.

FOUNDRY EQUIPMENT
McDougall Co., Ltd., R., Galt, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

FOUNDRY SUPPLIES
Rice Lewis & Son, Ltd., Toronto, Ont.

FROGS, SPRING OR RIGID
Can. Steel Foundries, Montreal, Que.

FURNACES, ELECTRIC
Rockwell Co., W. S. New York City.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

FURNACES, HEAT TREATING COAL
Rockwell Co., W. S., New York City.

FURNACES, HEAT TREATING OIL AND GAS
Bellevue Industrial Furnace Co., Detroit, Michigan.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Rockwell Co., W. R., New York City.

FURNACES TEMPERING AND ANNEALING
Bellevue Industrial Furnace Co., Detriot, Mich.
Brown & Sharpe Mfg., Co., Providence R. I.
Rockwell Co., W. S., New York City.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

FURNACES AND OVENS, ELECTRIC
Petrie, Ltd., H. W., Toronto, Ont.
Rockwell & Co., W. S., New York city.
Starrett Co., L. S., Athol, Mass.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

GAGES, MEASURING (See Tool Work)
Brown & Sharpe Mfg. Co., Providence, R. I.
Greenfield Tap & Die Corp., Galt, Ont.
Lufkin Rule Co., Windsor, Ont.
Starrett Co., L. S., Athol, Mass.

GAGES, RECORDING
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GAGES, SPECIAL MEASURING (See Tool Work)
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GAGES, THREAD
Brown & Sharpe Mfg. Co., Providence R. I.
Herbert, Limited, Alfred, Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

GALVANIZING
Fittings, Limited, Oshawa, Ont.

GAS, COAL COMPRESSED
L'Air Liquid Society, Toronto, Ont.

GAS, COMPRESSED
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

GASKETS
Diamond State Fibre Co. of Ca., Ltd., Toronto, Ont.
Smooth Mfg. Co., Jersey City, N. J.

GAUGES VACUUM AND PRESSURE
Taylor Instrument Co. Toronto, Ont.

GEAR BLANKS
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.
Dominion Engineering Works, Limited, Montreal, Que.

GEAR COUNTERS
Hart Mfg. Co., R. A., Battle Creek, Michigan.

GEAR CUTTING MACHINES
Bertram & Sons Co., Ltd., The John, Dundas. Ont.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Fellows Gear Shaper Co., Springfield, Vt.
Petrie, Ltd., H. W., Toronto, Ont.
Whiton Machine Co., D. E., New London, Conn.

GEAR TESTING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.

GEARS, CAST
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Hull Iron & Steel Foundries, Hull, Que.
Dominion Engineering Works, Limited, Montreal, Que.

GEARS, CUT
Brown & Sharpe Mfg. Co., Providence, R. I.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Gardner & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto, Ont.
Hepburn Ltd., John T. Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
McDougall Co., Ltd. R., Galt, Ont.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

GEARS, DRESSED
Kennedy & Sons, Wm., Owen Sound, Ontario.

GEARS, FORGED
Canada Foundries & Forgings Co., Welland, Ont.

GEARS, HERRINGBONE
Hamilton Gear & Machine Co., Toronto, Ont.

GEARS, RAWHIDE (See Gears, Cut)
Hamilton Gear & Machine Co., Toronto.

GEAR, SILENT CHAIN
Gardner & Son, Robt., Montreal, Que.
Can. Link-Belt Co., Ltd., Toronto, Can.
Hans Renold of Canada, Ltd., Montreal, Quebec.

GEARS, WORM
Hamilton Gear & Machine Co., Toronto.

GENERATORS, ACETYLENE
L'Air Liquide Society, Toronto, Ont.

GLOVES, PROTECTIVE
Industrial Glove Co., Toronto, Ont.

GOGGLES, SAFETY
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

GRAB BUCKETS
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Cleveland Twist Drill Co., Cleveland, O.

GREASE CUPS, PRESSED STEEL AND BRASS
Can. Winkley Co., Ltd., Windsor, Ont.

GREASES, LUBRICATING
Canadian SKF Co., Toronto, Ont.

GRINDING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Norton Co., of Canada, Ltd., Hamilton.

GRINDING MACHINES, ABRASIVE BELT
Norton Co. of Can. Ltd., Hamilton, Ont.

GRINDING MACHINES, AUTOMATIC
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, BENCH
Blount Co., J. G., Everett, Mass.
Geometric Tool Co., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
McDougall Co., Ltd., R., Galt, Ont.
Norton Co. of Canada, Ltd., Hamilton, Ont.
Petrie, Ltd., H. W. Toronto, Ont.
Pratt & Whitney C of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, CENTER
U. S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES, CUTTER AND REAMER
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Petrie Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, CYLINDRICAL
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.
Norton Co., of Canada, Ltd., Hamilton.

GRINDING MACHINES, DIE
Geometric Tool Co., New Haven, Conn.
National Acme Co., Cleveland, O.
National Machinery Co., Tiffin, Ohio.

GRINDING MACHINES, DRILL
Bellevue Industrial Furnace Co., Detroit, Mich.
Bertram & Son Co., Ltd., The John, Dundas, Ont.

GRINDING MACHINES, ELECTRIC
Strand & Co., N. A., Chicago, Ill.

GRINDING MACHINES, FLOOR AND TOOL
Blount Co., J. G., Everett, Mass.
Herbert, Limited, Alfred, Toronto, Ont.
National Acme Co., Cleveland, Ohio.
Norton Co. of Canada, Ltd., Hamilton, Ontario.
Petrie, Ltd., H. W., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.

GRINDING MACHINES, INTERNAL
Garlock Machinery Ltd., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES PORTABLE
Strand & Co., N. A., Chicago, Ill.

GRINDING MACHINES, SNAGGING
Blount Co., J. G., Everett, Mass.
Norton Co., of Can. Ltd., Hamilton, Ont.

GRINDING MACHINES, SURFACE
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, THREAD
Pratt & Whitney Co., of Canada, Ltd.,

GRINDING MACHINERY, TOOL POST
Gisholt Machine Co., Madison, Wis.
Grenfield Tap & Die Corp., Galt, Ont.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES, UNIVERSAL
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Herbert, Limited, Alfred, Toronto, Ont.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co., of Canada, Ltd., Hamilton Ontario.
Petrie, Ltd., H. W., Toronto, Ont.

GRINDING WHEELS
Lion Grinding Wheels, Limited, Montreal, Que.
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Norton Co. of Can., Ltd., Hamilton, Ont.

GUN-BARREL MACHINERY
Steinle Turret Machine Co., Madison, Wisconsin.

HACK SAWS, POWER
Atkins & Co., Inc., E.C., Indianapolis, Indiana.
Petrie, Ltd., H. W., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.

HAMMERS, CHIPPING
Cleveland Pneumatic Tool Co., Toronto, Ont.
High Speed Hammer Co., Rochester.

HAMMERS, DROP
Bertram & Son Co., Ltd., The John Dundas, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

HAMMERS, ELECTRIC
Brown, Boggs & Co., Ltd., Hamilton, Ont.

HAMMERS, PNEUMATIC
Can. Steel Foundries, Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto Ont.

HANGERS, SHAFTING
Canadian SKF Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Hamilton Gear & Machine Co., Toronto,

HOBBING MACHINES
Shore Instrument Co., Jamaica, N.Y.

HARDENING, CASE-HARDENING AND TEMPERING
Barnes Company, Wallace, Hamilton.
Chapman Double Ball Bearing Co., Toronto.
Petrie, Ltd., H. W., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Cleveland Pneumatic Tool Co., Toronto Ont.

HAMMERS, POWER
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

HOBS
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

HOISTS, ELECTRIC
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

HOISTS, ELECTRIC
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

HOISTS, HAND
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

HOISTS, PNEUMATIC
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

HOLDERS-ON, PNEUMATIC
Cleveland Pneumatic Tool Co., Toronto Ont.

HYDRAULIC MACHINERY
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

IGNITERS, GAS ENGINE
Canada Foundries & Forgings Co., Welland, Ont.
Burke Machine Tool Co., Conneaut, O.

INDICATORS, SPEED AND TEST
Brown & Sharpe Mfg. Co., Providence, R.I.

INSULATION
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.

IRON BARS
Steel Co. of Canada, Ltd., Hamilton, Ont.

JACKS, HYDRAULIC
Norton, A. O., Boston, Mass.

JACKS, PLANER
Armstrong Bros. Tool Co., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

JAPANNING AND VARNISHING OVENS
Brantford Oven & Rack Co., Brantford, Ont.

JIGS AND FIXTURES (SEE TOOL WORK)
Fisher Motor Co., Ltd., Orillia, Ont.
Gisholt Machine Co., Madison, Wis.
Preston & Schwarts, Galt, Ont.

KEYSEATING MACHINES
Morton Mfg Co., Muskegon, Mich

Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

KEYS, MACHINE
Can. Dranw Steel Co., Hamilton, Ont.
Morton Mfg. Co., Muskegon, Mich.

KNIVES, MACHINE
Atkins & Co., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

KNURL HOLDERS
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

LATHE ATTACHMENTS
Hendey Machine Co., Torrington, Conn.
Petrie, Ltd., H. W., Toronto, Ont.

LATHE TOOLS
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

LATHES, AUTOMATIC AND SEMI-AUTOMATIC
Gisholt Machine Co., Madison, Wis.
Herbert, Limited, Alfred, Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, BENCH
Hardinge Bros., Inc., Chicago, Ill.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

LATHES, BORING
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, CHUCKING (SEE LATHES, HORIZONTAL TURRET, AND LATHES, VERTICAL TURRET)
Acme Machine Tool Co., Cincinnati, O.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
Herbert, Limited, Alfred, Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, ENGINE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hendey Machine Co., Torrington, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont
Rockford Lathe & Drill Co., Rockford, Illinois.

LATHES, EXTENSION AND GAP
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison Wis.
Herbert, Limited, Alfred, Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, O.
Petrie, Ltd., H. W., Toronto, Ont.
Steinle Turret Machine Co., Madison, Wis.

LATHES, PRECISION
Hardinge Bros., Chicago.

LATHES, RELIEVING
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.

LATHE, UNIVERSAL HAND
Brown & Sharpe Mfg. Co., Providence, Rhode Island.

LATHE, SPEED AND HAND
Blount Co., J. G., Everett, Mass.

LATHES, SPINNING
Pryibil Machine Co., Torrington, Conn.

LATHES, VERTICAL TURRET
Bertram & Son, Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

LATHES, WOOD TURNING
Blount, Co., J. G., Everett, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.

LEAD PIPE
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

LEATHER FILLET
D. K. McLaren, Limited, Montreal.

LIGHTING AND GENERATING SETS
Beardmore & Co., Ltd., Wm., Montreal, Que.

LINOLEUM MILL MACHINERY
Bertrams, Ltd., Edinburgh, Scotland.

LIQUID AIR PLANTS
L'Air Liquide Society, Toronto, Ont.

LOCKERS, CLOTHES
Dennis Wire and Iron Works, London, Ont.

BUYERS' DIRECTORY

LUBRICANTS
Oakley Chemical Co., New York, N.Y.

LUBRICATING SYSTEMS
Bowser, S. F., & Co., Ltd., Toronto, Canada.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Ltd., Welland, Ont.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R. Toronto Ont.

MANGANESE STEEL
Can. Steel Foundries, Montreal, Que.

MANDRELS, EXPANDING
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MANDRELS, SOLID
Greenfield Tap & Die Corp., Galt, Ont.
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Pratt & Whitney Co., of Canada. Ltd., Dundas, Ont.

MEASURING MACHINES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MECHANICS' FINE TOOLS
Lufkin Rule Co., Windsor, Ont.

METALS, ALLOY
Canada Metal Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.

METAL WORKERS
Parker Co., Charles, Meriden, Conn.

MICROMETER CALIPERS
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Rice Lewis & Son, Ltd., Toronto, Ont.

MILLING ATTACHMENTS
Burke Machine Tool Co., Conneaut, O.
Hendey Machine Co., Torrington, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Hinckley Machine Works, Hinckley, Ill.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

MILLING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Burke Machine Tool Co., Conneaut, O

MILLING MACHINES, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence, R. I.
Hardinge Bros., Inc., Chicago, Ill.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

MILLING MACHINES, BENCH
Burke Machine Tool Co., Conneaut, O.
Hardinge Bros., Inc., Chicago, Ill.

MILLING MACHINES, HAND
Brown & Sharpe Mfg. Co., Providence
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MILLING MACHINES, HORIZONTAL PLANER TYPE.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Kearney & Trecker Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto.

MILLING MACHINES, PLAIN
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, O.
Hendey Machine Co., Torrington, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

MILLING MACHINES, THREAD
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MILLING MACHINES, UNIVERSAL
Brown & Sharpe Mfg. Co., Providence,
Hendey Machine Co., Torrington, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

MILLING MACHINES, VERTICAL
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, O.
Herbert, Limited, Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto.

MILLING TOOLS, ADJUSTABLE HOLLOW
Geometric Tool Co., New Haven, Conn.

MOTORS, ELECTRIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Roelofson Elevator Co., Galt, Ont.
Williams Machinery Co., A. R., Toronto,
Wisconsin Electric Co., Racine Wis.

NAILS AND STAPLES
Canada Metal Co., Ltd., Toronto, Ont.

NIPPLES
Canada Metal Co., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton,

NITROGEN
Carter Welding Co. Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

NUT TAPPERS
(See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
National Acme Co., Cleveland, Ohio.

NUTS, FINISHED and SEMI-FINISHED
Galt Macine Screw Co., Galt, Ont.
National Acme Co., Montreal, ue.

NUTS (Up to 4-in.)
Steel Co. of Canada, Ltd., Hamilton.

NUTS, S.A.E., PLAIN AND CASTELLATED
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

OIL FILTERING AND STORAGE SYSTEMS
Bowser, S. F., & Co., Ltd., Toronto,

OIL STORAGE ENGINEERS
Bowser, S. F., & Co., Ltd., Toronto,

OIL HOLE COVERS
Can. Whitney Co., Ltd., Windsor, Ont.

OILS, SOLUABLE
Brantford Oven & Rack Co., Brantford, Ontario.

OXYGEN
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

OXY-ACETYLENE APPARATUS
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Atlas Press Co., Kalamazoo, Mich.

PAPER MILL CONVEYORS
Bertram Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd., Montreal, Que.

PATTERNS, WOOD AND METAL
Fittings, Limited, Oshawa, Ont.
Victoria Foundry Co., Ltd., Ottawa.

PHOSPHOR TIN
Canada Metal Co., Ltd., Toronto, Ont.

PHOTOGRAPHIC DUPLICATING MACHINES
Photostat Corp., Providence, R. I.

PIPE BENDING MACHINES
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Underwood Corp., H. R., Philadelphia, Pa.
Williams Machinery Co., A. R., Toronto.

PIPE CUTTING AND THREADING MACHINES
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

PIPE
Canada Metal Co., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.

PIPE FITTINGS
Canada Metal Co., Toronto, Ont.
Fittings, Limited, Oshawa, Ont.
International Malleable Iron Co., Guelph Ont.

PIPE AND NIPPLE THREADING MACHINES
Landis Machine Co., Inc., Waynesboro, Pa.

PIPE FITTERS' TOOLS
Rice Lewis & Son, Ltd., Toronto, Ont.

PIPE THREADING DIE HEADS
Landis Machine Co., Inc., Waynesboro, Pa.

PISTON-RING MACHINES
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

PLANING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.
Herbert, Limited, Alfred, Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Williams Machinery Co., A. R., Toronto.

PLANING MACHINES, ROTARY
Bertram & Son Co., Ltd., The John, Dundas, Ont.

PLATE ROLLS
Bertram & Son Co., Ltd., The John, Dundas, Ont.

PNEUMATIC TOOLS
Cleveland Pneumatic Tool Co., Toronto.

POLISHING AND BUFFING MACHINES
Lion Grinding Wheels, Limited, Montreal, Que.
Blount Co., J. G. Everett, Mass.
Brown & Sharpe Mfg. Co., Providence.
Pryibil Machine Co., New York, N.Y.

PRESSED STEEL PARTS
American Pulley Co., Philadelphia, Pa.
Fisher Motor Co., Ltd., Orillia, Ont.

PRESSES, ARBOR
Atlas Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

PRESSES, DROP AND FORGING
Brown, Boggs & Co., Ltd., Hamilton.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

PRESSES, FOOT AND HAND
Brown, Boggs & Co., Ltd., Hamilton.

PRESSES, HYDRAULIC
Bertram & Son Co., Ltd., The John, Dunldas, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Perrin Ltd., W. R., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

PRESSES, POWER
Bliss Co., E. W., Prooklyn, N. Y.
Brown, Boggs, & Co., Ltd., Hamilton,
Hepburn Ltd., John T., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Stoll Co., Inc., D. H., Buffalo, N.Y.

PRESSES, SCREW
Brown, Boggs & Co., Ltd., Hamilton.
Petrie, Ltd., H. W., Toronto, Ont.

PROFILING MACHINES
Prtt & Whitney Co., of Canada, Ltd., Dundas, Ont.

PROTRACTORS
Brown & Sharpe Mfg. Co., Providence.
Lufkin Rule Co., Windsor, Ont.

PROPELLERS
Kennedy & Sons, Wm., Owen Sound, Ontario.

PULLEYS, CORK INSERT
American Pulley Co., Philadelphia, Pa.

PULLEYS, METAL AND FIBRE
American Pulley Co., Philadelphia, Pa.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.
D. K. McLaren Co., Limited Montreal, Que.

PULP AND PAPER MILL EQUIPMENT
Dominion Engineering Works, Ltd., Montreal, Que.

PUMPS, HYDRAULIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Dominion Engineering Works, Ltd Montreal, Que.
Hepburn Ltd., John T., Toronto Ont

BUYERS' DIRECTORY

PUMPS, LUBRICANT AND OIL
Bowser, S. F., & Co., Ltd., Toronto.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Hepburn Ltd., John T., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.

PUMPS, POWER
Bowser, S. F., & Co., Ltd., Toronto.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hepburn Ltd., John T., Toronto, Ont.

PUNCHES, CENTER
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

PUNCHES, HAND
Brown Boggs & Co., Ltd., Hamilton.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Jardine & Co., A. B., Hespeler, Ont.

PUNCHES, POWER
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

PUNCHING MACHINES, HORIZONTAL
Bertram Ltd., Edinburgh, Scotland.

PYROMETERS, ELECTRIC
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Hiram Walker & Sons Metal Products Co., Walkerville, Ont.

RACKS, CUT
Hamilton Gear & Machine Co., Toronto.

RACKS, STORAGE
(See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ontario.

REAMER HOLDERS
Simonds Canada Saw Co., Montreal, Q.

REAMERS, EXPANDING
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

REAMERS, SOLID
Butterfield & Co., Inc., Rock Island, Q.
Morse Twist Drill & Machine Co., New Bedford, Mass.

REAMERS, TAPER
Brown & Sharpe Mfg. Co., Providence, R. I.
Butterfield & Co., Inc., Rock Island, Q.
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canad, Ltd., Dundas, Ont.

RECORDERS, TEMPERATURE
Taylor Instrument Co., Rochester, N. Y.

RECORDERS, TIME
Gisholt Machine Co., Rochester, N. Y.
Taylor Instrument Co., Toronto, Ont.

REGULATORS, TEMPERATURE
Taylor Instrument Co., Toronto, Ont.

RIVETS AND BURRS
Parmenter & Bulloch Co., Gananoque, Ont.
Steel Co., of Canada, Ltd., Hamilton,

RIVETS, CHAIN
Fittings, Limited, Oshawa, Ont.

RIVET-MAKING MACHINERY
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

RIVETING MACHINES
Can. Fairbanks-Morse Ltd., Montreal Q.
High Speed Hammer Co., Rochester, N.Y.
Parmenter & Bulloch Co., Gananoque Ont.
Petrie, Ltd., H. W., Toronto, Ont.

RUDDER FRAMES, STEEL
Can. Steel Foundries, Montreal, Que.

RUBBER MILL MACHINERY
Bertram Ltd., Edinburgh, Scotland.

RULES, STEEL AND WOOD
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Windsor, Ont.

RUST PREVENTATIVES
Oakley Chemical Co., New York, N. Y.

SAND EQUIPMENT
Can. Link-Belt Co., Toronto, Ont.

SAND RAMMERS, PNEUMATIC
Cleveland Pneumatic Tool Co., Toronto.

SAW FRAMES AND BLADES, HACK
Atkins & Co., Inc., E. C., Indianapolis,
Diamond Saw & Stamping Works, Buffalo, N. Y.
Rice Lewis & Sons, Ltd., Tornto, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWING MACHINES, POWER HACK
Atkins & Co., Inc., E. C., Indianapolis,
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

SAW SHARPENING MACHINES
Atkins & Co., Inc., E. C., Indianapolis,
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

SAW SHARPENING MACHINES
Atkins & Co., Inc., E. C., Indianapolis.

SAW TABLES, UNIVERSAL
Petrie, Ltd., H. W., Toronto, Ont.

SAWS, CIRCULAR METAL
Atkins & Co., Inc., E. C., Indianapolis.
Pryibil Machine Co., New York, N. Y.
Gisholt Machine Co., Madison, Wis.

SAWS, HAND
Atkins & Co., Inc., E. C., Indianapolis
Simonds Canada Saw Co., Montreal, Q.

SAWS, HOT AND COLD
Atkins & Co., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Q.

SAWS, HIGH SPEED STEEL
Atkins & Co., Inc., E.C., Indianapolis, I.
Butterfield & Co. Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWS, METAL BAND
Atkins & Co., E. C., Indianapolis, I.

SAWS, METAL CUTTING
Brown & Sharpe Mfg. Co., Providence,
Butterfield & Co., Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.
Starrett Co., L. S., Athol, Mass.

SAWS, SCREW SLOTTING
Atkins & Co., Inc., E., C., Indianapolis.
Butterfield & Co., Inc., Rock Island, Q.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canda, Ltd., Dundas, Ont.

SAWS, SCREW SLOTTING
Atkins & Co., Inc., E. C., Indianapolis.
Butterfield & Co., Inc.. Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWS, WOOD
E. C. Atkins & Co., Indianapolis, Ind.

SCALES
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Lufkin Rule Co., Windsor, Ont.

SCREENS
Dominion Engineering Works, Ltd., Montreal, Que.

SCREW DRIVERS, OPTICAL, JEWELRY AND NOVELTY
Strand & Co., N. A., Chicago, Ill.

SCREW MACHINE WORK
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Montreal, Que.

SCREW MACHINERY, WOOD AND LAG
Cook Co., Asa S., Hartford, Conn.

SCREW MACHINES
Brown & Sharpe Mfg. Co., Providence. Rhode Island.

SCREW MACHINES, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence. Rhode Island.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.

SCREW MACHINE PRODUCTS
National Acme Co., Montreal, Que.

SCREW PLATES
Butterfield & Co., Inc., Rock Island. Que.
Jardine & Co., A. B., Hespeler, Ont.

SCREWS, CAP AND SET
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

SCREWS, SAFETY, SET
Galt Machine Screw Co., Galt, Ont.

SECOND-HAND MACHINERY
See last page of directory.
Petrie, Ltd., H. W., Toronto, Ont.

SEPARATORS, MOISTURE AND OIL
Bowser, S. F., & Co., Ltd., Toronto, Canada.

SEPARATORS, OIL AND WASTE
Bowser, S. F., & Co., Ltd., Toronto.

SHAFTS, FLEXIBLE
Strand & Co., N. A., Chicago, Ill.

SHAFTING
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
Williams Machinery Co., A. R., Toronto.

SHAPES, COLD-DRAWN SPECIAL STEEL
Union Drawn Steel Co., Hamilton, Ont.

SHAPING MACHINES
Hendey Machine Co., Torrington, Conn.
Morton Mfg. Co., Muskegon, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Williams Machinery Co., A. R. Toronto.

SHEARS HAND
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

SHEARS, POWER
Bliss Co., E. W., Brooklyn, N. Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Stoll Co., Inc., D. H., Buffalo, N. Y.
Williams Machinery Co., A. R., Toronto, Ont.

SHEARING MACHINES, ANGLE, IRON BAR AND GATE
Bertrams Ltd., Edinburgh, Scotland.

SHEET LEAD
Canada Metal Co., Ltd., Toronto, Ont.

SHEET METAL WORKING MACHINERY
Bliss Co., E. W., Brooklyn, N. Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Stoll Co., Inc., D. H, Buffalo, N.Y.

SHEETS, NICKEL, MONEL AND FIBRE
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.

SHEETS, O.P.C.R. & B. A. AND BLUE ANNEALED
Steel Co., of Canada, Ltd., Hamilton, Ont.

SIDE FRAMES, LOCOMOTIVE
Can. Steel Foundries, Montreal, Que.

SLOTTING ATTACHMENTS
Brown & Sharpe Mfg. Co., Providence, R.I.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

SLOTTING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.

SOLDERS
Canada Metal Co., Ltd., Toronto, Ont.

SPECIAL MACHINERY AND TOOLS
Brown Engineering Corp., Ltd., Toronto.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Cleveland, O.

SPIKES, RAILWAY AND PRESSED
Steel Co of Canada, Ltd., Hamilton, Ont.

SPINNING LATHES
Pryibil Machine Co., P., New York City.

SPRING, MILLED
Barnes & Co., Wallace, Hamilton, Ont.

SPRINGS, SMALL SPIRAL HELICAL, COMPRESSION, EXTENSION, TORSION AND SPECIAL
Barnes Company, Wallace, Hamilton,

SPRINGS
Barnes Company, Wallace, Hamilton.
Cleveland Wire Spring Co., Clevleand, O.
Steele Ltd., James, Guelph, Ont.

SPRINGS, FLAT STEEL, BRUSH HOLDER, CLOCK, SMALL FLAT SPRINGS
Barnes Company, Wallace, Hamilton.

SPROCKETS AND CHAINS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Renold Hanson of Canada, Ltd., Montreal, Que.

SQUARES
Brown & Sharpe Mfg. Co., Providence, R.I.
Lufkin Rule Co., Windsor, Ont.
Steel Co. of Canada, Ltd., Hamilton. Ont.

STAMPING, METAL
American Pulley Co., Philadelphia, Pa.
Barnes Company, Wallace, Hamilton.
Diamond Saw & Stamping Works, Buffalo, N. Y.
Parmenter & Bulloch Co., Gananoque, Ont.

STAMPS, STEEL
Diamond Saw & Stamping Works, Buffalo, N. Y.

STEEL CONCRETE REINFORCEMENT
Steel Co. of Canada, Ltd., Hamilton.

STEEL PLATE
British Empire Steel Co., Montreal, Que.

STEEL AND IRON BARS
Steel Co. of Canada, Ltd., Hamilton.

STEELS TOOL
British Empire Steel Co. Montreal Q.

STEEL, COLD-ROLLED STRIP
British Empire Steel Co., Montreal, Q.
Barnes Company, Wallace, Hamilton.

STEEL, CRUCIBLE, SPRING
Barnes, Company, Wallace, Hamilton.
British Empire Steel Co., Montreal, Q.

SHEETS, OPEN HEARTH STEEL
Steel Co., of Canada, Ltd., Hamilton

STEEL, SHAFTING AND FREE CUTTING SCREW
Union Drawn Steel Co., Hamilton, Ont.

STEEL, SHEET
British Empire Steel Co., Montreal, Q.
Rice Lewis & Son, Ltd., Toronto, Ont.

STEEL, STAINLESS
Steel Co., of Can. Ltd., Hamilton, Ont.

STEELS, ALLOY AND CARBON
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Can. Steel Foundries, Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton. Ont.

STEELS, HIGH-SPEED
Armstrong Bros. Tool Co., Chicago, Ill.
Atkins & Co., Ltd., Wm., Sheffield, England.
British Empire Steel Co., Montreal, Q.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton.

STEEL TUBING, CLOSE JOINT AND WELDED
Standard Tube & Fence Co., Ltd., Woodstock, Ont.

STERN FRAMES, CAST STEEL
Can. Steel Foundries, Montreal, Que.

STRAIGHTENING MACHINERY
Bertram Ltd., Edinburgh, Scotland.
Williams & Co., J. H., Brooklyn, N.Y

STUDS
Galt Machine Screw Co., Galt, Ont.
Geometric Tool Co., New Haven, Conn.

BUYERS' DIRECTORY

SWAGING MACHINES
Atkins & Co., Inc., E. C., Indianapolis, Indiana.

SWITCHES, RAILWAY
Can. Steel Foundries, Montreal, Que.

TACHOMETERS
Bristol Co., Waterbury, Conn.

TANKS AND PUMPS, OIL
Bowser, S. F., & Co., Ltd., Toronto.

TAP HOLDERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
William L. Procunier, Chicago, Ill.

TAPER PINS
Galt Machine Screw Co., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

TAPES, MEASURING
Starrett Co., L. S., Athol, Mass.
Lufkin, Rule Co., Windsor, Ont.

TAPPING MACHINES AND ATTACHMENTS
Burke Machine Tool Co., Conneaut, O.
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Wm. L. Procunier, Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

TAPS AND DIES
Butterfield & Co., Inc., Rock Island, Q.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Herbert, Limited, Alfred, Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

TAPS, COLLAPSING
Geometric Tool Co., New Haven, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.

TEETH, DREDGE BUCKET
Kennedy & Sons, W., Owen Sound, Ont.

THERMOMETERS
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Greenfield Tap and Die Corp., Galt, Ontario.

THREAD-CUTTING TOOLS
Butterfield & Co., Inc., Rock Island, Q.
Greenfield Tap and Die Corp., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

THREAD CUTTING MACHINES
Landis Machine Co., Inc., Waynesboro, Pa.

THREADING MACHINES
Acme Machinery Co., Cleveland, Ohio.
Geometric Tool Co., New Haven, Conn.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Williams Tool Corp., of Can. Ltd., Brantford, Ont.

THREAD LEAD TESTING MACHINES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

THREAD-ROLLING MACHINES
Bliss Co., E. W., Brooklyn, N. Y.

TIE PLATES
Steel Co. of Canada, Ltd., Hamilton.

TIME RECORDERS
International Business Machine Co., Ltd., Toronto, Ont.

TONGS
Hepburn Ltd., John T., Toronto, Ont.

TOOL CASES
Rice Lewis & Son, Ltd., Toronto, Ont.

TOOL HOLDERS
Armstrong Bros., Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Bertrams Ltd., Edinburgh, Scotland.

TOOL POSTS, LATHE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Williams & Co., J. H., Brooklyn, N. Y.

TOOLS, SMALL
(See Machinists' Small Tools)
Armstrong Bros. Tool Co., Chicago, Ill.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Lufkin Rule Co., Windsor, Ont.
National Machine Tool Co., Racine, Wis.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S. Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A.R., Toronto,

TOOL WORK
Brown Engineering Corp., Ltd., Toronto, Ontario.

TORCHES, BLOW
Rice Lewis & Son, Ltd., Toronto, Ont.

TRACKWORK, RAILWAY
Can. Steel Foundries, Montreal, Que.

TRACKWORK, MANGANESE STEEL
Can. Steel Foundries, Montreal, Que.

TRANSMISSION MACHINERY
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound.
Petrie, Ltd., H. W., Toronto, Ont.
Renold, (Hans) of Canada, Ltd., Montreal, Que.

TROLLEYS AND TRAMWAYS
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Wright Mfg. Co., Lisbon, Ohio.

TROLLEY WHEELS
Langley & Austin, Galt, Ont.

TROWELS, PLASTERING
E. C. Atkins & Co., Indianapolis, Ind.

WRENCHES, MACHINISTS'
Armstrong Bros. Tool Co., Chicago, Ill.

TRUCKS
Can. Fairbanks-Morse Ltd., Montreal, Q.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

TUBING, SEAMLESS STEEL, BRASS AND COPPER AND FIBRE
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Goldstein Mfg. Co., Ltd., Toronto, Ont.

TURRET HEADS
Bertram & Son Co., Ltd., The John Dundas, Ont.

TURRET MACHINES
(See Lathes, Horizontal Turret)
Acme Machine Tool Co., Cincinnati, O.
Cook Co., Asa S., Hartford, Conn.
Gisholt Machine Co. Madison Wis.
Herbert, Limited, Alfred, Toronto, Ont.
National Acme Co. Cleveland O.
Pratt & Whitney Co. of Canada Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

TURRETS, TOOL POST
Gisholt Machine Co. Madison, Wis.

UNIONS, PIPE
Fittings, Limited, Oshawa, Ont.

VALVES
Canada Metal Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Mon-
Dominion Engineering Works, Limited, Montreal, Que.

VISES, DRILLING MACHINE
Burke Machine Tool Co., Conneaut, Ohio.
Charles Parker Co., Meriden, Conn.
Cleveland Pneumatic Tool Co., Toronto, Ontario.
Kempsmith Mfg Co., Milwaukee, Wis.

VISES, PIPE
Charles Parker Co., Meriden, Conn.

VISES, PLANER AND SHAPER
Bertram & Son Co., Ltd., The John Dundas, Ont.
Philip Gies Foundry, Kitchener, Ont.
Hendley Machine Co., Torrington, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

VISES, WOOD WORKERS'
Charles Parker Co., Meriden, Conn.
Parmenter & Bulloch Co., Gananoque, Ontario.

VOLTMETERS
Bristol Co., Waterbury, Conn.

WAGON LEADERS
Can. Link-Belt Co., Toronto, Ont.

WASHERS, LOCK, SPLIT AND SPRING
Barnes Company, Wallace, Hamilton.

WELDING APPARATUS, OXY-ACETYLENE
L'Air Liquide Society, Toronto, Ont.
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto, Ont.

WELDING APPARATUS
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.

WELDING, ELECTRIC, ARC, SPOT AND BUTT
International Malleable Iron Co., Guelph, Ont.

WELDING MACHINES, OXY-ACETYLENE
Carter Welding Co., Ltd., Toronto, Ont
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.

WELDING, ELECTRIC
McLaren Belting Co., J. C., Montreal, Que.
Steel Co. of Canada, Ltd., Hamilton,

WELDING ROD, TOBIN, MANGANESE, BRONZE AND ALUMINUM
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto, Ont.

WELDING SUPPLIES
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.

WHEELS, INDUSTRIAL
American Pulley Co., Philadelphia, Pa.
Hull Iron & Steel Foundries, Hull, Que.
Kennedy & Sons, Wm., Owen Sound, Ontario.

WINCHES, HEADGATE
Kennedy & Sons, Wm. Owen Sound, Ontario.

WINCHES, STOPLOG
Kennedy & Sons, Wm., Owen Sound, Ontario.

WIRE
Barnes Company, Wallace, Hamilton.
Canada Metal Co., Ltd., Toronto, Ont.
Dennis Wire & Iron Works, London, Ontario.
Greening Wire Co., B., Hamilton, Ont.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

WIRE, BLACK TEMPERED, MUSIC PHOSPHOR BRONZE AND PREMIER
Barnes Company, Wallace, Hamilton.

WIRE, COPPER AND BRASS, FINE AND HEAVY
Steel Co., of Canada, Ltd., Hamilton, Ontario.

WIRE STRAIGHTENING AND CUTTING MACHINERY
Brown, Boggs & Co., Ltd., Hamilton, Ontario.

WIRE, WELDING
L'Air Liquide Society, Toronto, Ont.
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.

WIRES, SPECIAL
Dennis Wire & Iron Works, London, Ontario.
Greening Wire Co., B., Hamilton, Ont.

WOODWORKING MACHINERY
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Williams Machinery Co., A. R., Toronto, Ontario.

WRENCHES, DROP FORGED
Armstrong Bros. Tool Co., Chicago, Ill.
Canada Foundries & Forgings Co., Welland, Ont.

"CUSHMAN" CHUCKS 1862
Building for the Future
On the Experience of the Past
THE CUSHMAN CHUCK CO.

"The Incomparable"
That New Steel Chuck
Style 214
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Unexcelled for Continuous Service
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UNIVERSAL GRINDING MACHINES
THE THOMPSON GRINDER CO.
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OF QUALITY SINCE 1878.
SMITH'S FALLS MALLEABLE CASTINGS LTD
SMITH'S FALLS, ONTARIO.

DIRECTORY OF DEALERS

THE Buyers' Directory of CANADIAN MACHINERY was originally intended to contain information regarding lines actually manufactured by our advertisers. We now carry the advertising of leading machinery dealers, some of whom represent scores of manufacturers in addition to being manufacturers themselves in some cases. We recommend, therefore, if our subscribers cannot find what they want in our Directory that they communicate with the dealers whose names appear herewith.

MACHINE TOOLS, ETC.

Bertram & Sons, Ltd., John, Dundas, Ont.
The Canadian Fairbanks-Morse Co., Montreal, Que.
Garlock Machinery Ltd., Toronto.
Herbert Ltd., Alfred, Toronto, Ont.
H. W. Petrie, Ltd., Toronto, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
Yeates Machinery Co., London, Ont.

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The Canadian Fairbanks-Morse Co., Montreal, Que.
Garlock Machinery Ltd., Toronto.
Herbert Ltd., Alfred, Toronto, Ont.
H. W. Petrie Ltd., Toronto, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
Yeates Machinery Co, London, Ont.

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The Canadian Fairbanks-Morse Co., Montreal, Que.
Herbert Ltd., Alfred, Toronto, Ont.
H. W. Petrie, Ltd., Toronto, Ont.

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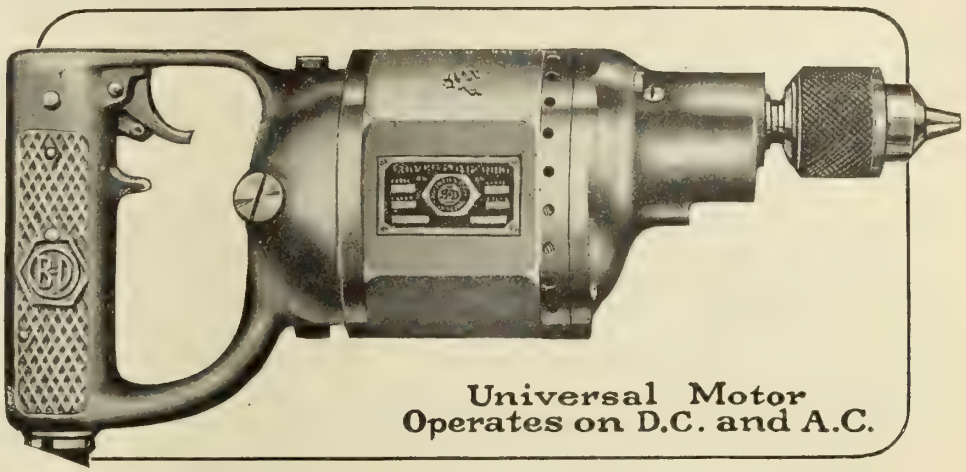
BLACK & DECKER QUARTER-INCH DRILL

"With the Pistol Grip and Trigger Switch"

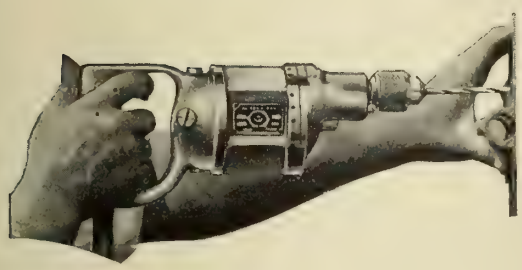
$49.00

Weight 5 lbs.

1922 Model
1922 Price



Universal Motor
Operates on D.C. and A.C.



Standard Black and Decker Portable Electric Drill, *"With the Pistol Grip and Trigger Switch."*

In design and construction the same as the larger sizes. Powerful, durable, comfortable to handle and perfectly controlled. Nothing in the way of ability or durability has been sacrificed to obtain this light weight. Particularly adapted for close corner drilling.

Very accessible. All bearings removable and renewable. By removing four screws, complete switch mechanism, motor commutator, field leads and cable terminals may be uncovered. Armature bearing is carried in a spider integral with motor case, consequently drill may be inspected or commutator cleaned while machine is running.

Brushes may be quickly and easily renewed from outside of motor case. Flexible cable is attached to screw terminals on the switch block so that cable may be renewed when necessary quickly and easily without soldering any joints.

SPECIFICATIONS

HOUSING—Aluminum alloy (No sheet metal is used)

MOTOR—Constructed and insulated the same as the larger Black & Decker Drills. Universal. Operates on direct or alternating current.

AIR COOLED—

GEARING—Double reduction stub tooth gears, cut from chrome nickel steel, heat treated (The toughest, longest wearing gears engineers have been able to design.)

NOTE—No brass gears are used in any Black & Decker tools.

CONTROL—*"The Pistol Grip and Trigger Switch."*

CHUCK—Three jaw chuck for straight shank drill bits up to ¼ inch.

FLEXIBLE CORD—Special light weight rubber covered duplex electric cable, fitted with separable attachment plug.

NO LOAD SPEED—1600 R. P. M.

NET WEIGHT—5 pounds.

The fact that Canadian Industrials insist upon the finest tools and equipment obtainable makes BLACK & DECKER a natural choice.

MADE IN CANADA

A very substantial reduction in prices has been made possible by the establishment of our Canadian factory.

CREDIT

BLACK & DECKER National Credit Service enables any reliable person in Canada to purchase Black & Decker equipment from his jobber on terms that permit the equipment to pay for itself.

THE BLACK & DECKER MFG. CO.
LIMITED
344 St. James Street
Montreal, P. Q.
A. J. HOPKINS, Manager

Miniature catalogue will be supplied on request.

To Holders of Five Year 5½ per cent. Canada's Victory Bonds

Issued in 1917 and Maturing 1st December, 1922

CONVERSION PROPOSALS

THE MINISTER OF FINANCE offers to holders of these bonds who desire to continue their investment in Dominion of Canada securities the privilege of exchanging the maturing bonds for new bonds bearing 5½ per cent. interest, payable half yearly, of either of the following classes:—

(a) Five year bonds, dated 1st November, 1922, to mature 1st November, 1927.

(b) Ten year bonds, dated 1st November, 1922, to mature 1st November, 1932.

While the maturing bonds will carry interest to 1st December, 1922, the new bonds will commence to earn interest from 1st November, 1922, GIVING A BONUS OF A FULL MONTH'S INTEREST TO THOSE AVAILING THEMSELVES OF THE CONVERSION PRIVILEGE.

This offer is made to holders of the maturing bonds and is not open to other investors. The bonds to be issued under this proposal will be substantially of the same character as those which are maturing, except that the exemption from taxation does not apply to the new issue.

Dated at Ottawa, 8th August, 1922.

Holders of the maturing bonds who wish to avail themselves of this conversion privilege should take their bonds AS EARLY AS POSSIBLE, BUT NOT LATER THAN SEPTEMBER 30th, to a Branch of any Chartered Bank in Canada and receive in exchange an official receipt for the bonds surrendered, containing an undertaking to deliver the corresponding bonds of the new issue.

Holders of maturing fully registered bonds, interest payable by cheque from Ottawa, will receive their December 1 interest cheque as usual. Holders of coupon bonds will detach and retain the last unmatured coupon before surrendering the bond itself for conversion purposes.

The surrendered bonds will be forwarded by banks to the Minister of Finance at Ottawa, where they will be exchanged for bonds of the new issue, in fully registered, or coupon registered or coupon bearer form carrying interest payable 1st May and 1st November of each year of the duration of the loan, the first interest payment accruing and payable 1st May, 1923. Bonds of the new issue will be sent to the banks for delivery immediately after the receipt of the surrendered bonds.

The bonds of the maturing issue which are not converted under this proposal will be paid off in cash on the 1st December, 1922.

W. S. FIELDING,
Minister of Finance.

CANADIAN MACHINERY AND MANUFACTURING NEWS

Vol. XXVIII. No. 10 | Published Weekly by the MacLean Publishing Company, Limited, Toronto, Ont. | September 7, 1922 | $4.00 a Year Subscription Price

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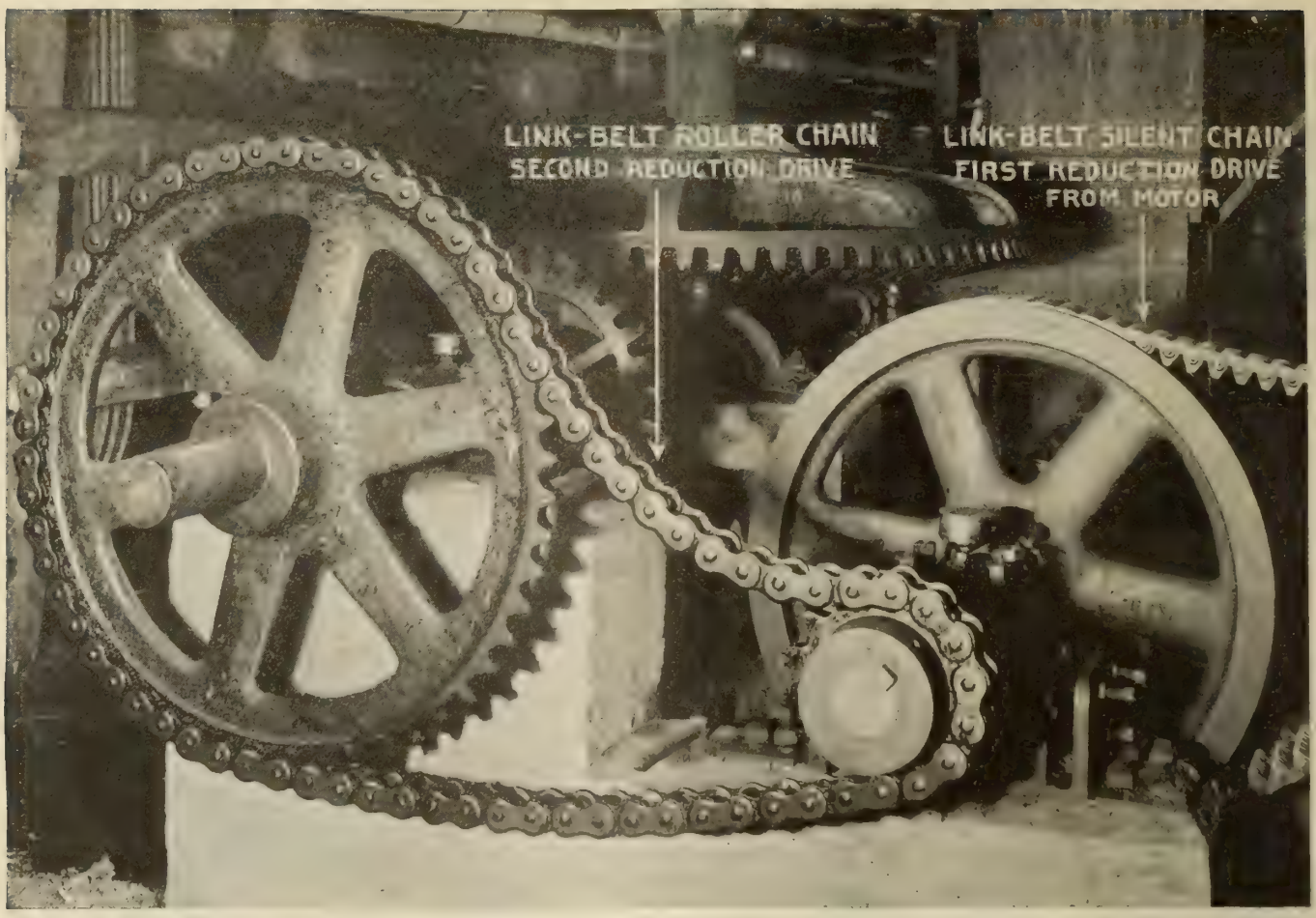
Installation of STEEL SHELVING at John Bertram & Sons Co., Ltd Dundas, Ont.

DENNISTEEL

Made in Canada by

The Dennis Wire & Iron Works Co., Limited — London, Canada



BUILDING LONGER LIFE INTO ROLLER CHAIN

Every foot of Link-Belt roller chain is "Proof Tested" for physical strength and wearing value by thorough inspection and tests.

Our data book No. 257 contains much information of interest to roller chain users. Send for a copy. Special corps of engineers at your service.

A DISTINCTIVE feature of Link-Belt roller chain which materially adds to its efficient life, is the famous Link-Belt curled roller.

This roller is made from a special grade, refinement and analysis of steel. Every process in its manufacture develops a fibrous instead of a granular structure, with the grain running around the roller, in a direction which gives the greatest strength and resilience and resistance to shock.

The break in the metal circle eliminates the possibility of internal strains, and presents an opportunity for spring or reaction, cushioning shocks.

This construction is different from that found in any other type or make of roller. Its continued success in service is proof of the superiority of this type of construction.

CANADIAN LINK-BELT COMPANY LIMITED

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LINK-BELT

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High-Speed Steel Milling Cutters, Reamers and End Mills in all standard forms can be supplied from stock and special cutters made to customers' requirements at the shortest notice.

Our "Curvex Cutters"—new formed milling cutters that are spiral fluted and eccentrically relieved—allow the use of a maximum feed and will increase production on form milling from 50 to 100 per cent.

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Write to our nearest office for Catalogue and prices

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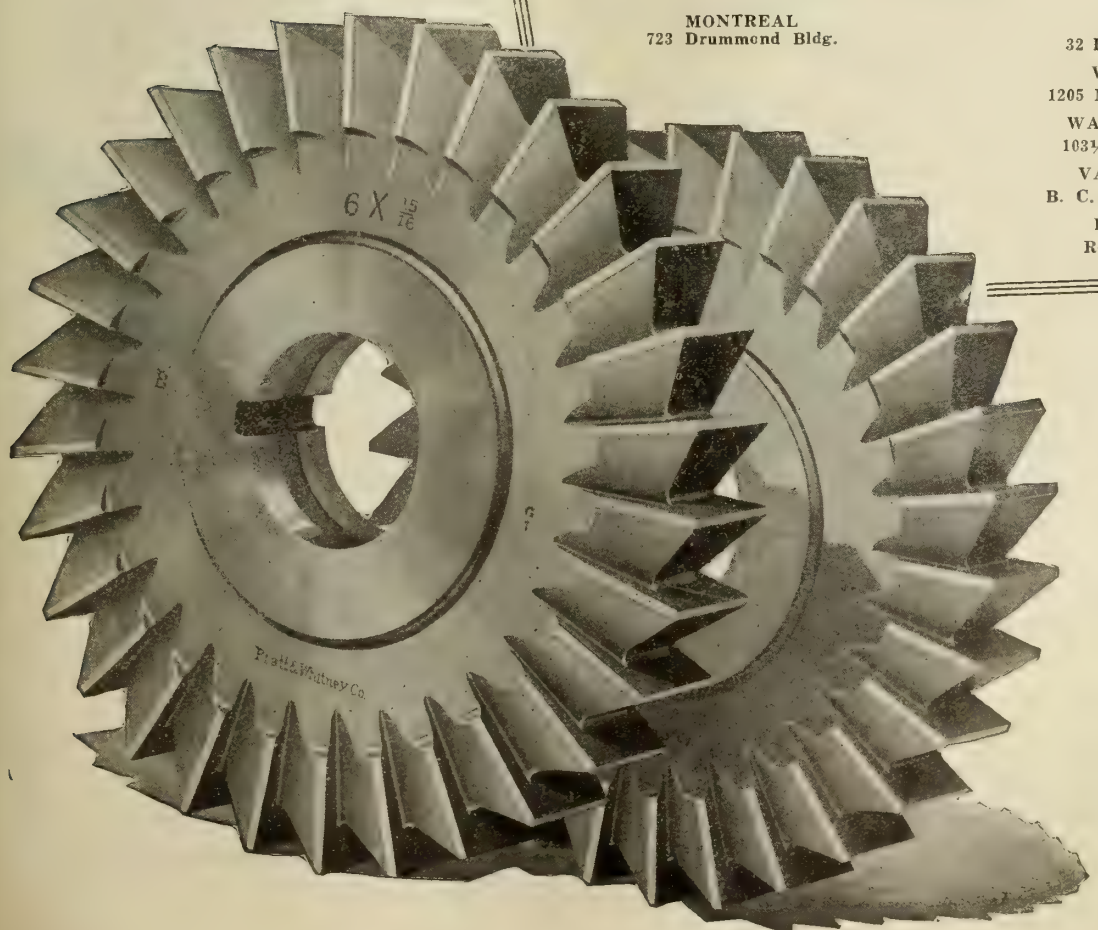
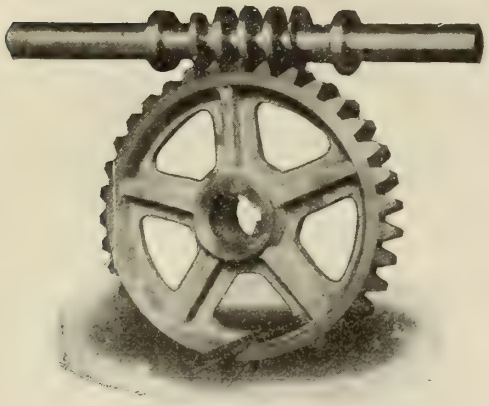


Worms & Gears



Hardened & Ground Steel Worms

Gear Data for your Note Book

Cut this out,—More Coming later

ON GEAR STEELS

from the Hamilton Gear & Machine Co., Toronto:-

The whole tendency of Modern Practice is towards the use of higher grade materials and better workmanship.

Gray cast iron, while the commonest material for gears, is unsuitable for pinions. Use steel. Steel castings make good gears if sound and properly annealed. Steel forgings are superior to castings and are especially favored for pinions.

It is not well to run a gear and pinion both of soft material together on account of wear. Case-hardened and heat-treated steel is the most durable, especially in nickel, chrome or other alloy steels.

For steel castings, use A.S.T.M. specification A-27-21. For forged or rolled carbon steel use S.A.E. specification steel Nos. 1020, 1030 or 1046 straight carbon; Nos. 2315 or 2345 nickel; Nos. 3115, 3215, 3245, 3312 or 3340 chrome nickel and Nos. 6120, 6145 or 6150 chrome vanadium. The last two figures in each indicate the carbon content. We use principally Nos. 1020, 2315, 3245 and 6145.

See our advertisement of July 20th for formula, and Aug. 3rd issue for chart to use in connection with above.

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Hamilton Gear & Machine Co.

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The Largest Selling Quality Pencil in the World

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VENUS Pencils combine the best points of every other pencil with many exclusive VENUS advantages.

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Write for booklet on pencils, penholders, erasers, VENUS EVERPOINTED and VENUS THIN LEADS.

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The Trademark Is Your Guarantee

Look for the Oakleaf

More Solid Leather to the Foot Than Any Other Belt Made

A sweeping statement—but one which is lived up to in every respect. Every operation in the manufacture of D. K. McLaren's Belting from the vigorous systems of inspection and classification of the hides by experts, to the equally vigorous system of final inspection and testing, bespeaks our right to the claim. No Shoulders, Necks, or Bellies are used in D. K. McLaren's Belting, only the flawless backs of the choicest steers are used.

Every foot of leather in D. K. McLaren's Belting is guaranteed to be

Genuine British Oak Tanned

This should not be confused with the ordinary leather tannage commonly used by belt makers and called "Oak." The Genuine British Oak Tanning is a long-time and expensive process. Years ago it was a closely guarded secret in England; even now, when no longer a secret, it is usually considered "too expensive" to be used generally.

It is this process that imparts to D. K. McLaren's Belting that combination of toughness and pliability which, in turn, gives it a remarkable gripping quality —the chief factor in reducing your transmission costs.

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D·K·McLAREN LIMITED

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For Grinding High Tensile Material

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LION GRINDING WHEELS Ltd.

BROCKVILLE, ONT.

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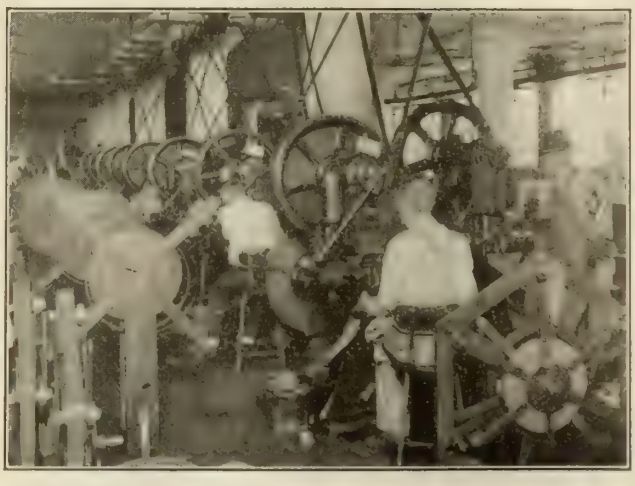
J. R. Baxter & Co., Ltd.
Montreal

Link Production



Photograph by courtesy of our customer

THE PHOTOGRAPH shows the manufacture of small chain links. Automatic feeds are used to secure maximum production. There are thirty-five BLISS Presses in this plant, some of which have been in service more than eighteen years.

BLISS Presses, built in many styles and sizes, are adapted for the economical manufacture of large and small stamped metal parts of every description. There is a BLISS Press that will exactly meet your requirements. BLISS on your machinery is more than a name, it's a guarantee.

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No. 316

If interested tear out this page and place with letters to be answered

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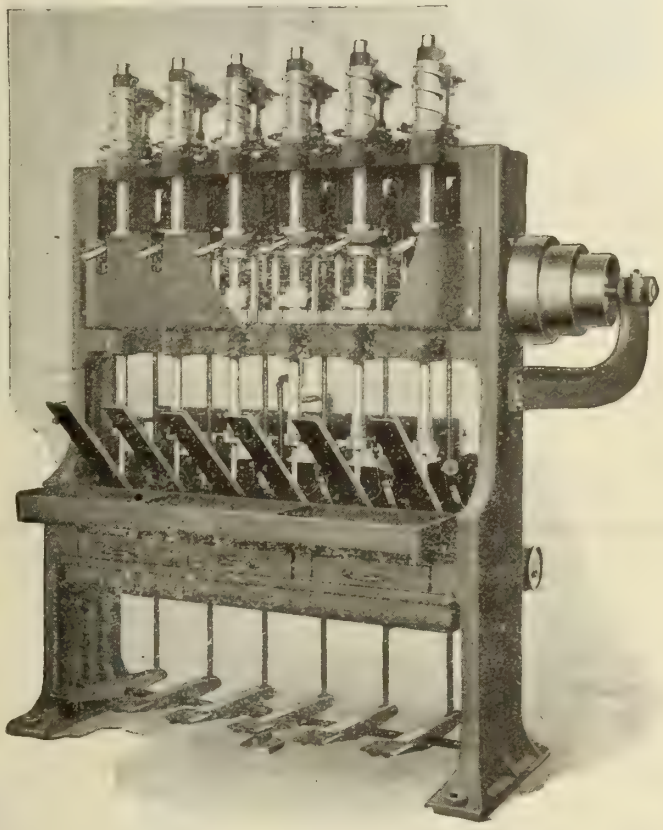
15,000 Threaded Nuts Every Nine Hours

This is the daily output of two "ACME" Tappers which have been running at the same plant for eight years—15,000 5/8 inch threaded nuts per nine-hour day with a spindle speed of 100 r.p.m., the limit of tap endurance on the tough material used.

Speed, however, is not everything. Besides being a high-speed producer, the "ACME" Tapper is capable of precision work under the most severe service.

If you want, then, a convenient tool with a speed limited only by the endurance of the taps; a tool whose accuracy may be depended upon at all times; a tool that will stand up indefinitely; a tool that reflects the long years of building experience—look for the name "ACME".

Our catalogue gives complete details of "ACME" Bolt, Nut, Rivet, Upsetting and Forging Machinery. Shall we send you a copy?



Acme Six-Spindle, Semi-Automatic Nut Tappers have many important features which facilitate operation and increased speed. Each spindle is equipped with automatic lifting device which permits automatic feed to place nut under tap. Every action has been carefully developed and proved correct in practice. Write for further details.

The Acme Machinery Company

4530 St. Clair Ave., Cleveland

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The John Bertram & Sons Co., Limited, Dundas, Ontario

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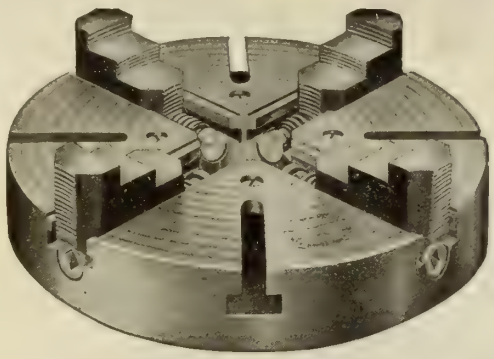
INDEPENDENT CHUCKS

are not an experiment—they have come to stay. They are a necessity with the modern machinery and high-speed steel cutting tools.



THE UNION STEEL BODY CHUCKS

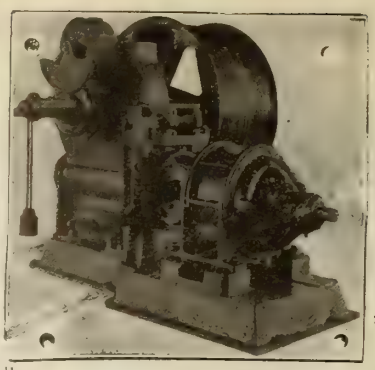
are well designed and have all the elements of strength and durability for which they are designed. We make other types in steel also, including the Geared Scroll Chucks and the Geared Scroll Combination—all designed for heavy work and hard usage.

Union Manufacturing Company

New Britain, Conn.

New York Office: 26 Cortlandt Street

Makers of a complete line of chucks



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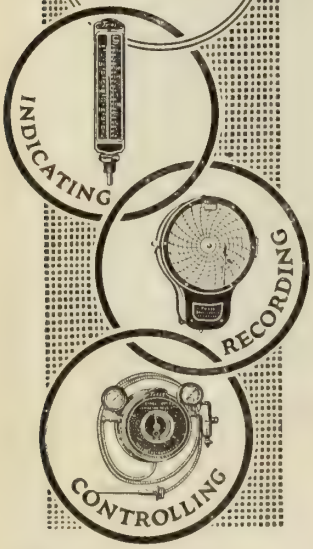
Simplicity in design cuts repair bills to an absolute minimum and ensures consistently satisfactory service. Smooth running and fast, noiseless, self-oiling dust-proof and with brake that acts automatically, they are thoroughly dependable and economical. Capacity 1,000 lbs. to 10,000 lbs.

Write for particulars of our full line of Electric, Hydraulic and Hand Power Freight and Passenger Elevators.

Roelofson Elevator Works

GALT, ONT.

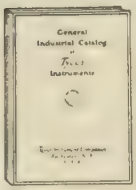
Tycos Temperature Instruments



OPERATIVES

appreciate the assistance of *Tycos* temperature instruments--indicating, recording, controlling--in the attainment of a high rate of personal efficiency.

Catalogue upon request. Give firm connection if you please.



Taylor Instrument Companies

Rochester, N.Y., U.S.A.

Theres a *Tycos* and *Taylor* temperature instrument for every purpose 825

ARMSTRONG

DOGS DROP FORGED CLAMPS

Save a Lot of Worry

You'll find that Armstrong Dogs and Clamps will stand up under the most severe conditions. Their design, quality of material and accuracy of machining make them absolutely reliable. Use an Armstrong Dog for extreme cuts and feeds no danger of springing or slipping save you a lot of worry. Catalogue free.

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"The Tool Holder People"

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Canadian Agents:

A. R. WILLIAMS MACHINERY CO., Toronto, St. John, Halifax

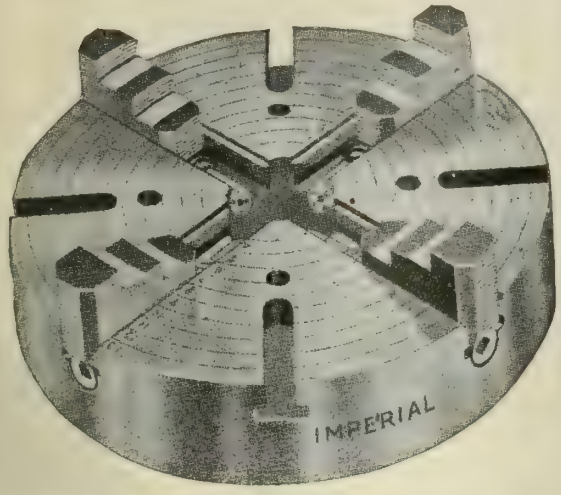
WILLIAMS & WILSON, MONTREAL

If interested tear out this page and place with letters to be answered

IMPERIAL LATHE CHUCKS

Highly Endorsed by Canada's Best Manufacturers

Sturdy long-wearing "Made-in-Canada" Chucks that are making good everywhere. Specify them in your next order.



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Manganese Steel
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Sizes—½lb. to 5,000 lbs.

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ESTABLISHED 1860

WILLIAMS' "AGRIPPA" TOOL HOLDERS

"THE HOLDERS THAT HOLD"

For all machining operations

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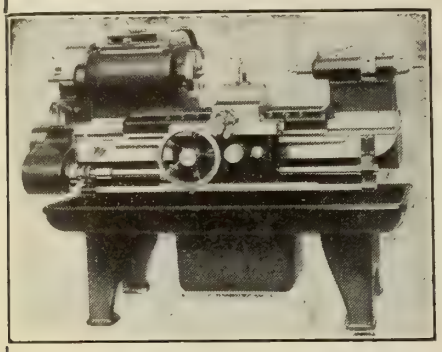
AS USED ON THE

"NEW" 12 IN. SUNDSTRAND MANUFACTURING LATHE

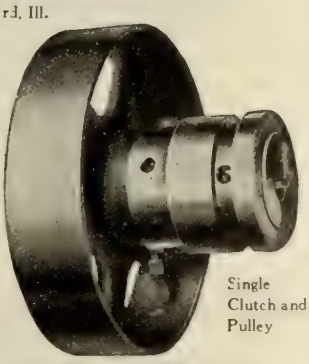


Progress in machine tool design demands a reliable and powerful friction clutch. The Johnson Friction Clutch is proving of great value in machine tool designing.

Courtesy : The Rockford Tool Co., Rockford, Ill.

The main drive pulley is mounted on a No. 5 single clutch hub. The same movement that disengages the clutch automatically applies a brake which stops the spindle instantly. The sliding sleeve is machined to act as a brake.

A feature of the Johnson Friction Clutch is the ease of application to particular machine requirements.



Single Clutch and Pulley

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Wood Screw Making Machinery

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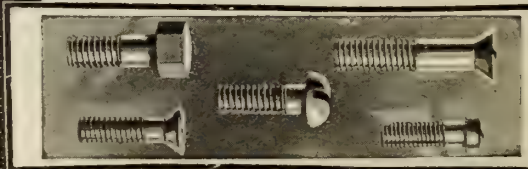

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It's a one man hoist adapted to every type of hoisting operation.
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It will cut your hoisting costs.

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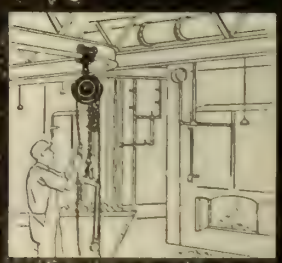

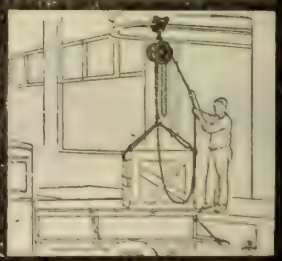

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For Floor, Flask, Bench and Core

Size No. 4F, for heavy floor and pit work.
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They have high speed, no recoil and are dust proof. They increase output.

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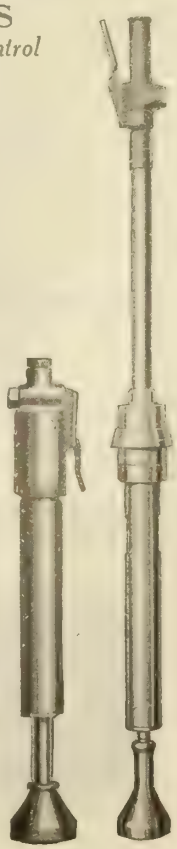

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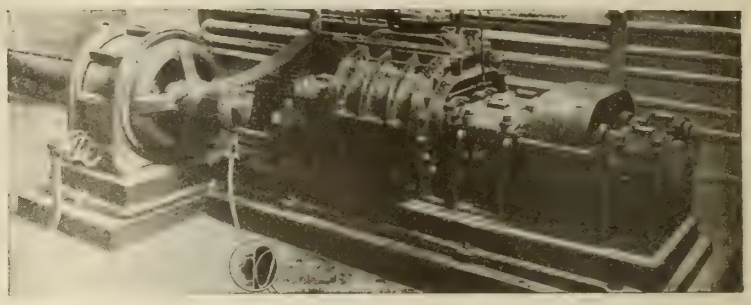
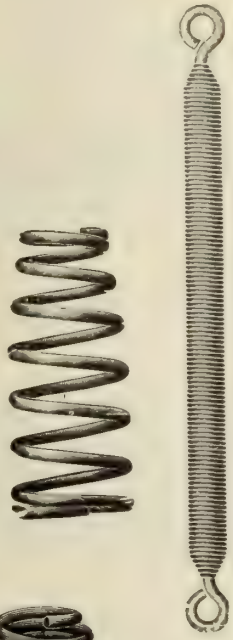


25 H.P. Morse Silent Chain to Positive Blower.

There's a RAYMOND SPRING For Every Purpose



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IT IS

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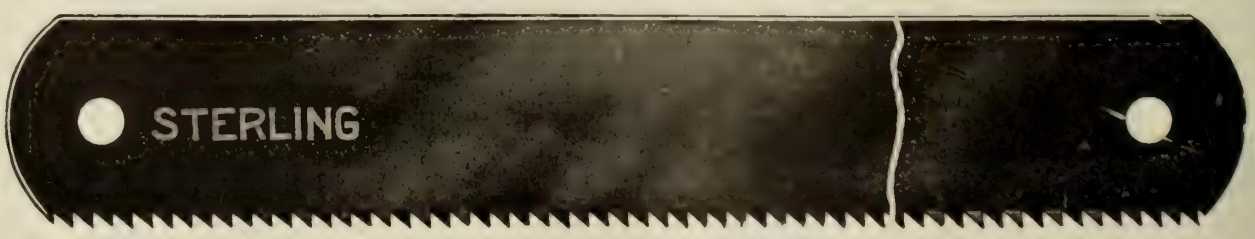

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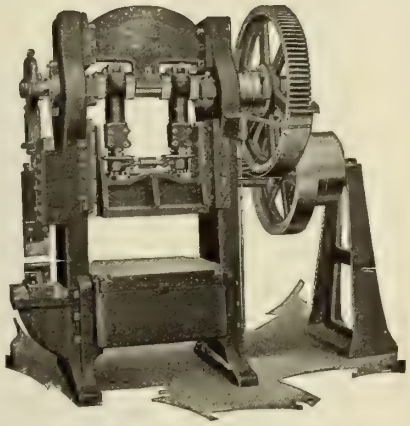
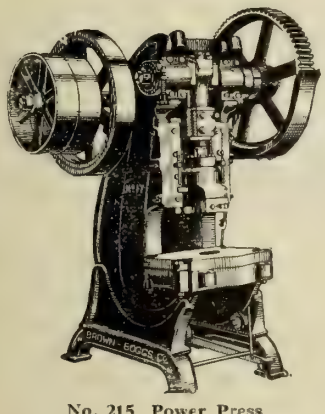


No. 140—Double Crank Trimming Press

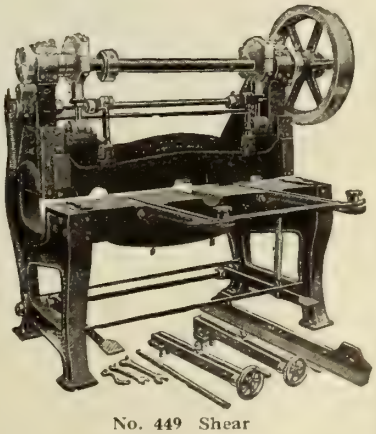
THE "B-B" LINE

The "B-B" line comprises tinsmiths' tools and sheet metal working machines of all kinds; canners' and evaporators' machinery; shears of every description; power presses for punching, forming, embossing, blanking.

We shall be glad to send you catalogs containing full descriptions of the machines and tools in which you are interested.



No. 215 Power Press



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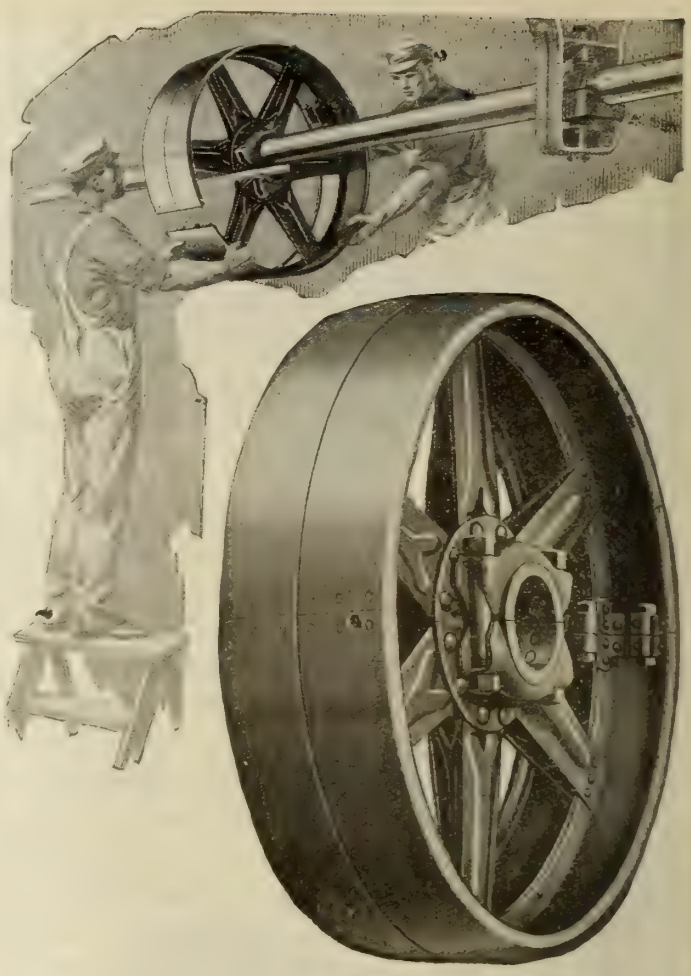

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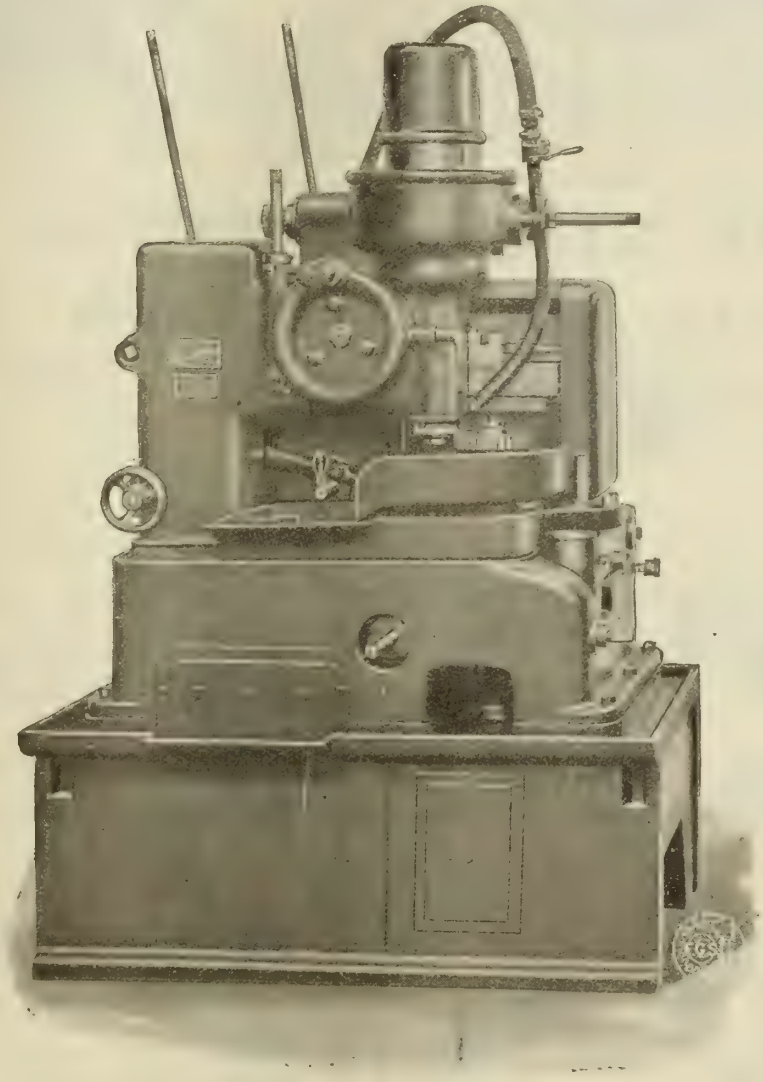
WITH THE
New Production Gear Shaper



The new production Gear Shaper, illustrated, has been designed to cut gear costs. It incorporates every feature necessary in a gear cutting machine to obtain this result, and still one of the outstanding features of the Gear Shaper principle—accuracy—has been maintained.
It is designed to cut one gear at a time and at a speed which eclipses all other methods.
All operating levers are at the front of the machine, permitting a number to be bolted together and operated as a unit, one 6 H.P. motor furnishing ample power for 10 machines
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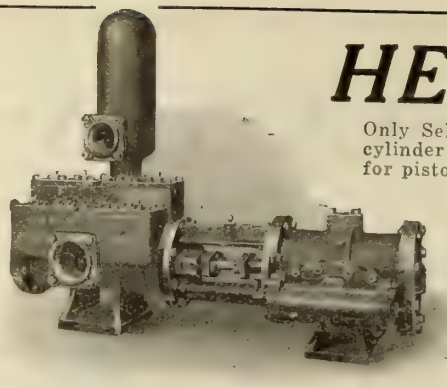

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Only Self-Draining Steam Pump Made in Canada designed with steam chest on side of cylinder; low ports automatically drain away all condensation,ensuring perfect cushion for piston. No levers, no tappets. Simple, sturdy, reliable construction.

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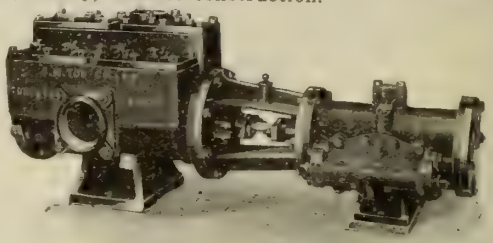

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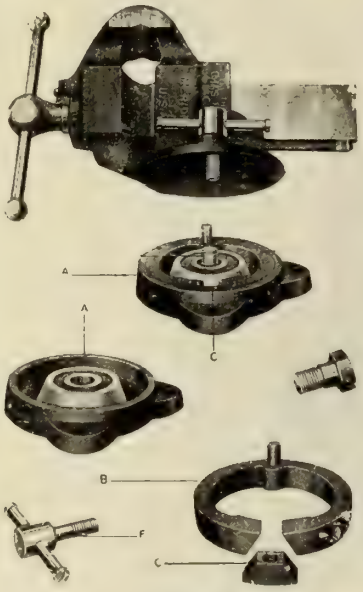
have swivels that "Grip like a Grizzly"



Here's a swivel base that sets as rigid as the vise jaws themselves. because the grip is distributed evenly around the base. Tightening Wedge "C" with Bolt "F" expands Ring "B" against Base "A." That gives you a 360° friction grip that HAS TO HOLD.

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THE cause of most belt trouble is not so much inferior quality as the **unsuitability** of the belt in regard to conditions of operation.

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Leviathan and Anaconda Belting is a **Canadian Made Product.** Our business in Leviathan is thirty-three years old—**and growing;** not because of the things we say about it, not because it meets certain laboratory specification requirements, but because an increasing number of practical, hard-headed men are proving, **on their pulleys,** that our product is the scientific and satisfactory answer to the belt problems of today.

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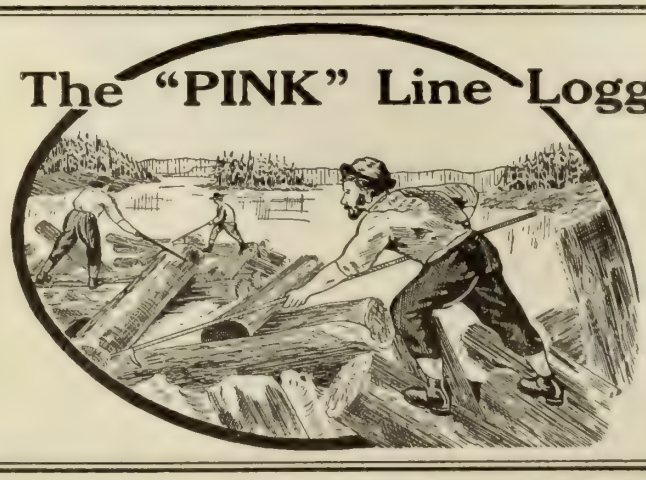
The "PINK" Line Logging Tools and Handles



MADE-IN-CANADA Products---Headquarters for British Empire for all Lumbering Tools

In every lumber camp in Canada you'll find PINK'S famous lumbering tools. They are the favorites there and have won the esteem of all woodsmen through their **superior merit.** They are world-renowned and are extensively used in Australia, New Zealand and other countries where the lumbering industry thrives.

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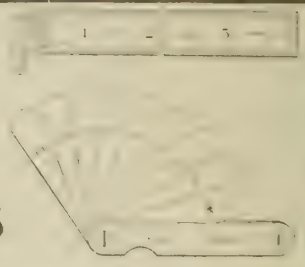

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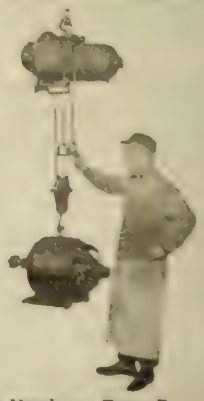

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Paramount in Production

A machine designed for the rapid production of duplicate parts.
Our literature will tell you all about it. Write for it.

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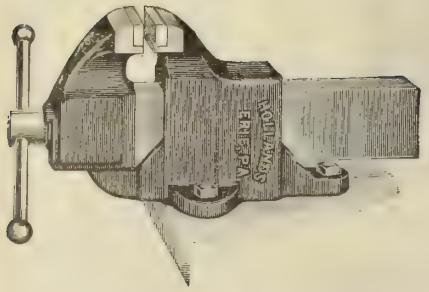
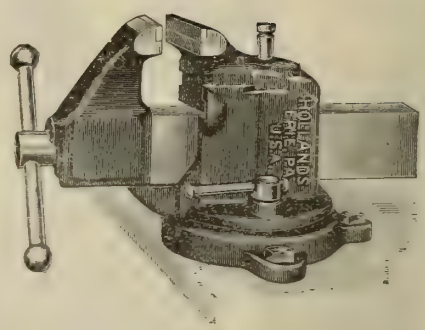


Have a record of thirty-five years of satisfactory service.

If your dealer cannot supply you, write direct for circular No. 25.



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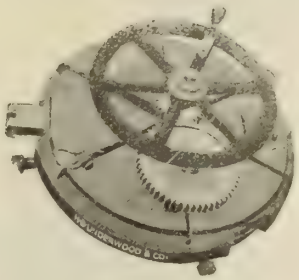
Established 1887 **Erie, Pa., U. S. A.**

Locomotive Cylinder or Dome Facing Machine



A Proven Time Saver

THIS self-contained and easily handled machine is proving a great time-saver wherever it is in use. It is designed and made to do its work efficiently—and quickly.

All working parts are covered and easily oiled. Gearing is all cut from the solid. When working, the clutch is thrown in by moving the lever with clutch pin attached (shown in cut, on top near the hand crank) and the machine will feed automatically. Made in sizes to suit requirements.

Taper socket can be furnished to take the place of hand wheel for air motor drive.

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SKINNER STEEL BODY INDEPENDENT CHUCK

POWERFUL-STURDY-DEPENDABLE-ACCURATE

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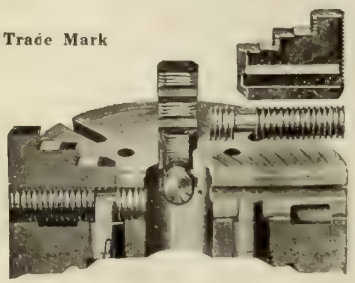

For production, where exceptional gripping power is required, where heavy cuts are often necessary and large pieces are held, this type of chuck will render most satisfactory service.

Although the Skinner Steel Body Chuck has been in use for years, we have never known of one breaking in service. It is the heaviest, strongest Independent Chuck made.

Body—Cast Steel. Jaws—Extra wide. Adjusting screws—Large diameter.
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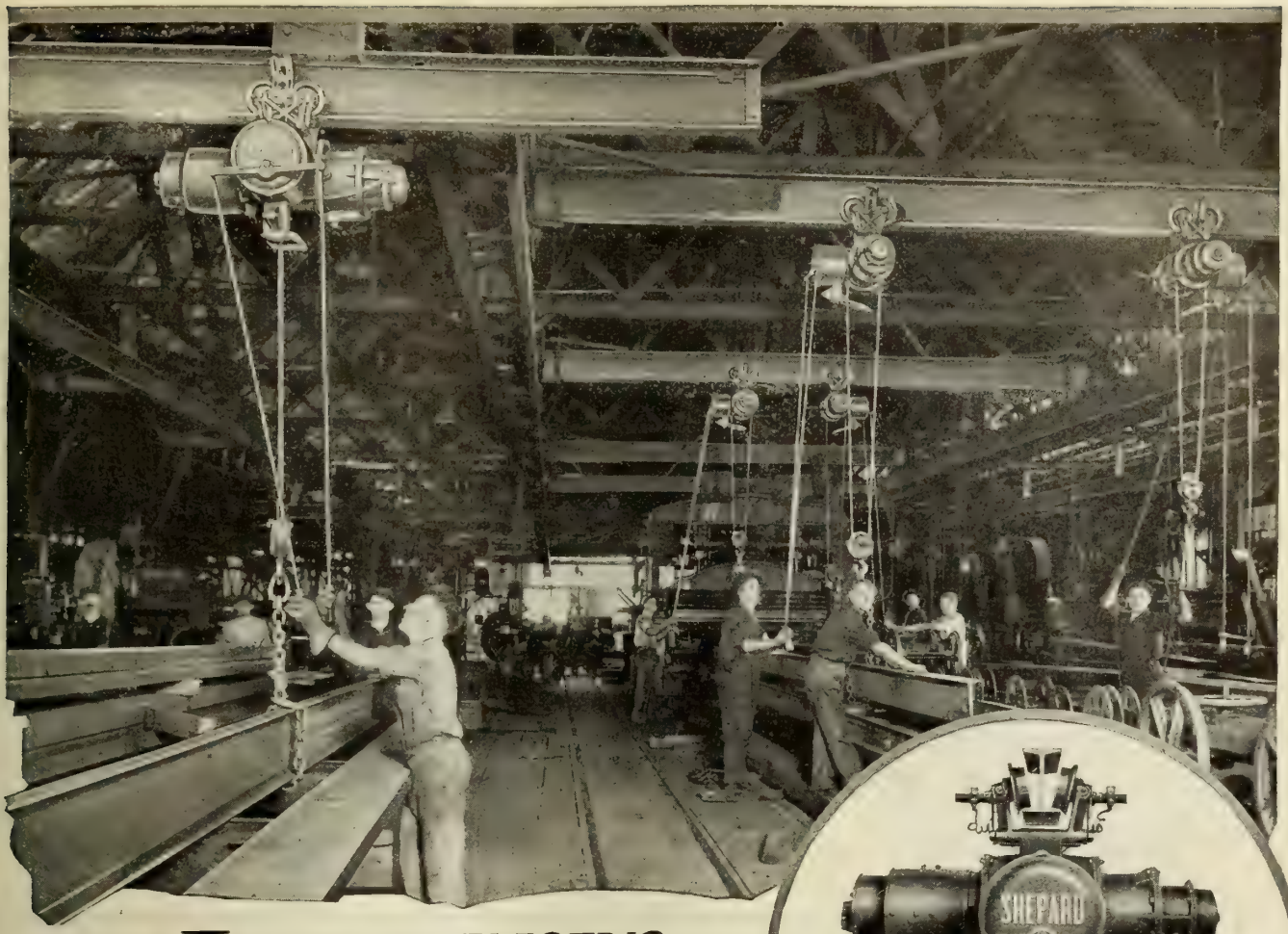

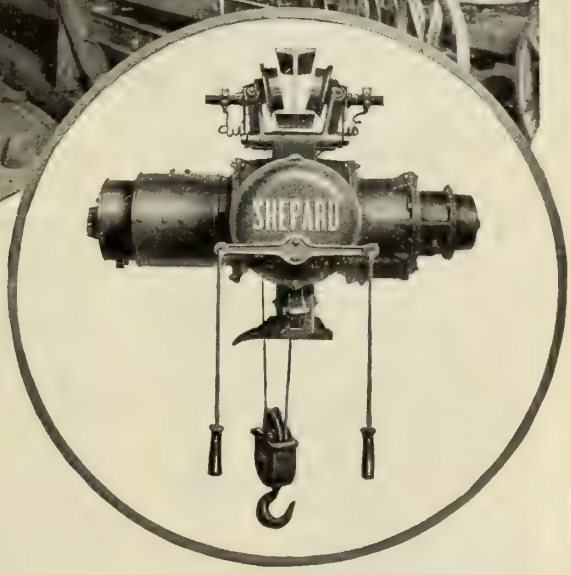

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Good Hoisting Service At Lower Cost

"JUST what we've needed," that is the consensus of opinion among the hundreds who are installing this new, small, compact, sturdy electric hoist.

The **Liftabout** is made in ½ and 1 ton capacities for alternating or direct current. It has the same features that have made "Shepards" the best known and most widely used electric hoists in America.

You will find a **Liftabout** is much lower in price than you may think a good hoist would cost—Standardized manufacture and quality production have made its price low.

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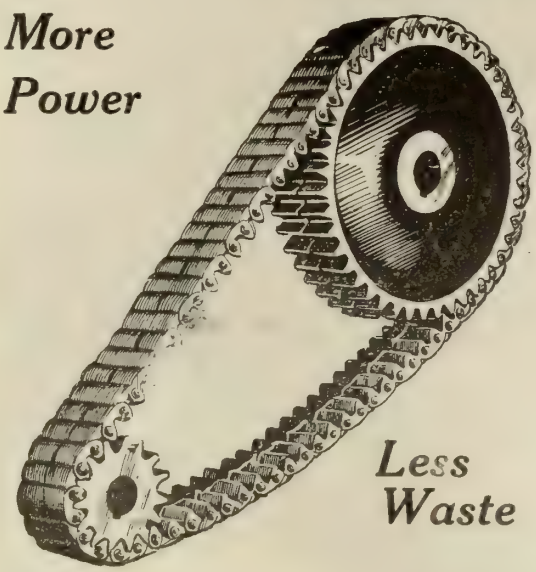

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Twenty-six years' highly efficient performance in the finest plants in the country has built up an enviable reputation for Renold Silent Chain Drives. Absolute reliability in service with maximum efficiency and minimum maintenance costs has made "Renold" the universal name for power transmission chains. Renold Silent Chain Drives are applicable to any powers, no matter how small or large and not only are they silent in operation, but also unaffected by heat, cold or moisture.

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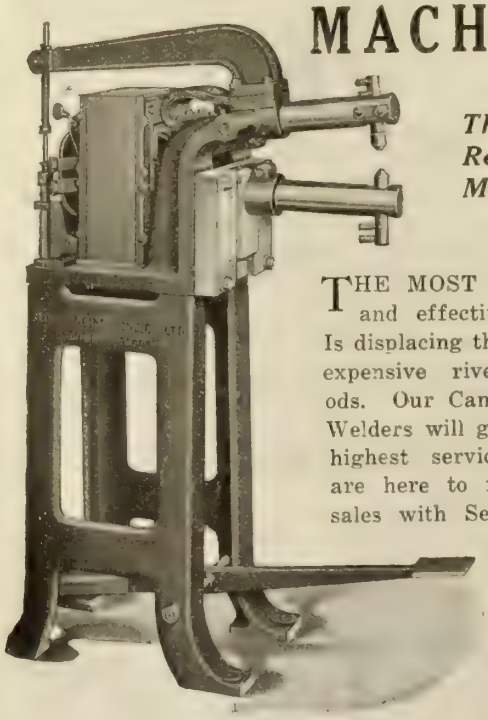

The Cost-Reducing Method

THE MOST economical and effective method. Is displacing the slow and expensive riveting methods. Our Canadian-made Welders will give you the highest service, for we are here to follow our sales with Service.

Illustration Shows our standard Spot Welder, adaptable for all classes of Spot and Lap welding up to ¼ in. thick.

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New York City
Established 1859

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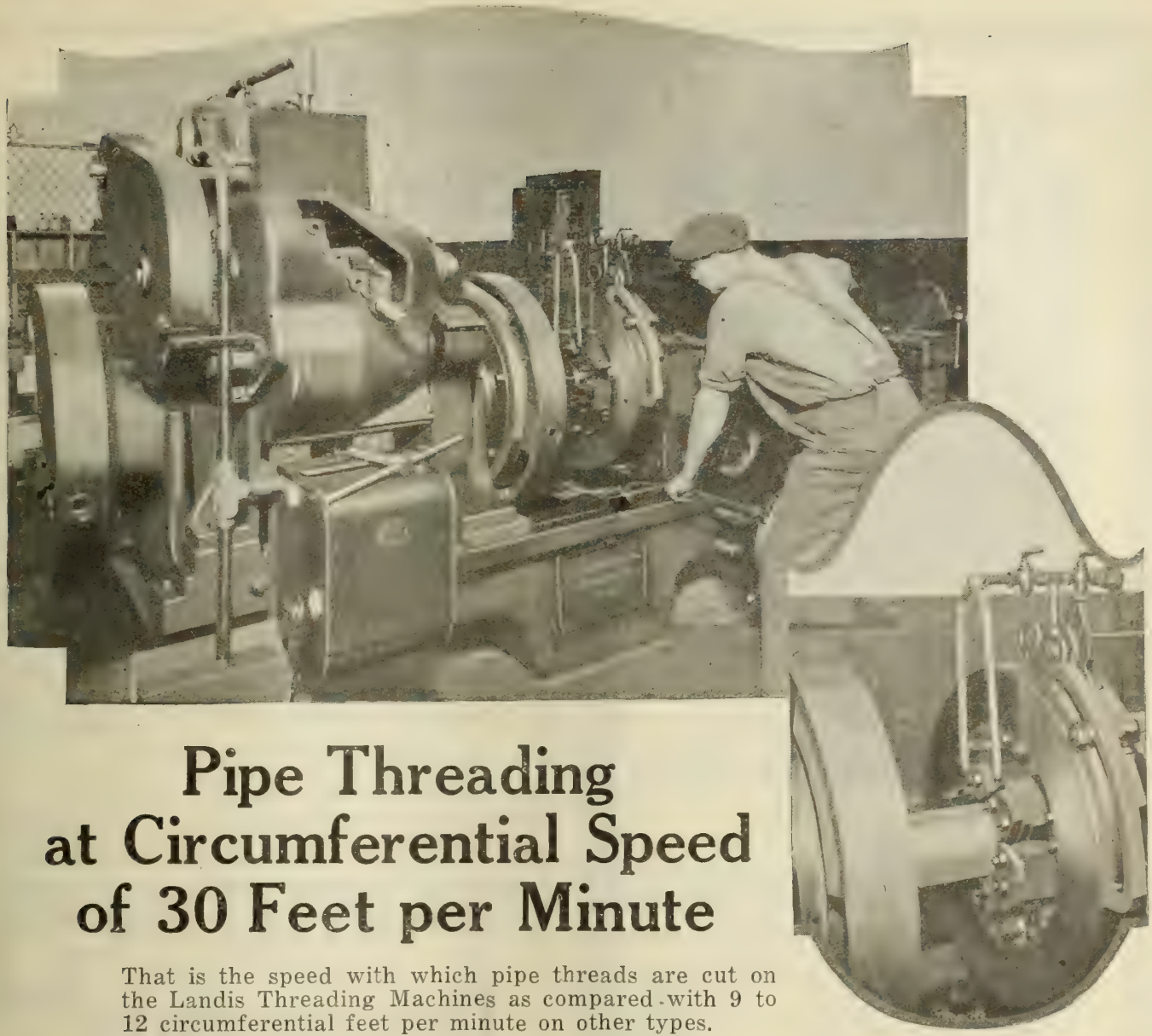

Pipe Threading at Circumferential Speed of 30 Feet per Minute

That is the speed with which pipe threads are cut on the Landis Threading Machines as compared with 9 to 12 circumferential feet per minute on other types.

The Landis Machine here shown is one of a battery of six in the plant of the Hiram Rivitz Co., of Cleveland, makers of High Quality Plumbing, Heating and Factory Supplies.

That they are well pleased with the Landis Machines is evidenced by the fact that they have just purchased four additional machines.

Repeat Orders are the strongest of all recommendations. Landis Die Heads and Landis Machines have many features of superiority that compel repeat orders. Shall we tell you the complete story? Get in touch with us today.

LANDIS MACHINE COMPANY

WAYNESBORO, PA.

LANDIS

DOMESTIC AGENTS: Marshall & Huschart Machinery Co., Chicago, Ill.; Marshall & Huschart Machinery Company of Indiana, Indianapolis, Ind.; Colcord-Wright Machinery & Supply Company, St. Louis, Mo.; R. B. Whitacre & Co., St. Paul, Minn.; Hamilton Machinery Co., Chattanooga, Tenn.; Seeger Machine Tool Co., Atlanta, Ga.; Young & Vann Supply Co., Birmingham, Ala.; Woodward Wight & Co., New Orleans, La.; Jos. T. Ryerson & Son, Houston, Texas; Hendrie & Bolthoff Mfg. & Supply Co., Denver, Colo.; Salt Lake Hardware Co., Salt Lake City, Utah; Eccles & Smith Company, San Francisco, Calif.; Los Angeles, Calif.; Portland, Ore.; Hall die Machinery Company, Seattle, Wash.; Hallidie Company, Spokane, Wash.
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Maximum service from every file is assured when you buy one of these standard brands.

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Save Time on Small Operations

When there are *small* milling operations to handle a *small* miller is the logical tool to use. Heavy, cumbersome machines use too much power and floor space.

This Burke No. 3 Machine with 23 or 28 inch column, Milling, Slotting and Drawn Collet Attachment and weighing complete only 250 lbs. is the ideal answer. May we send details?

No. 3

$155

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THE BURKE MACHINE TOOL CO.

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Write for the name of the dealer located in your city.

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BIRMINGHAM
June 15th—24th, (inclusive)

Engineering Production

The British Journal of Works Practice and Administration Circulating throughout the World will publish in the issues of

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an authoritative description of the leading exhibits at the above Exhibition.

The equipment of the foundry with modern plant and appliances is becoming more and more recognized by engineers as a matter of great importance in economical production.

Those situated in various parts of the world who are interested in, but unable to visit the Exhibition, will find these issues of great value in giving information regarding the latest developments in foundry practice.

These issues will contain further instalments of the series on

WELDING AND CUTTING

and also many articles of an interesting production character, as well as the regular features such as the review of inventions, foreign trade notes and metal markets, etc

EVERY THURSDAY 6d.

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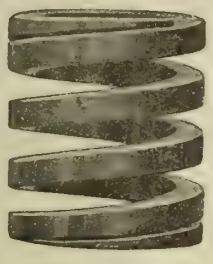

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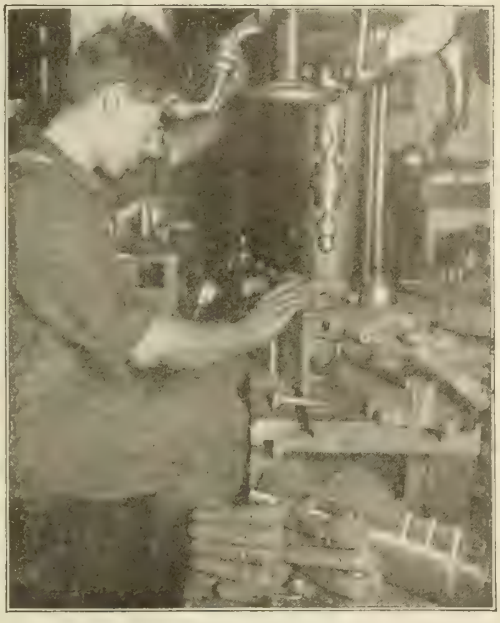
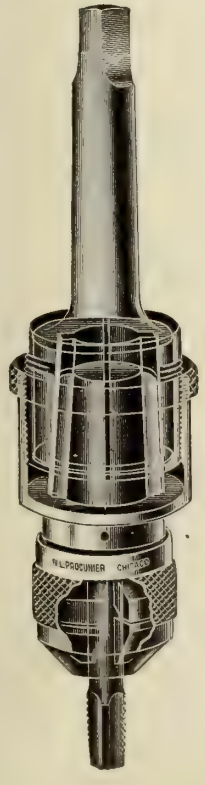
SAVE TAPS and TIME



THE "PROCUNIER" Patented DOUBLE-JAW CHUCK



is an insurance against Tap breakage. It provides a firm grip that does not mar the tool shank; a straight true drive protected by a safety friction device that releases the tap the instant it strikes a hard spot or touches bottom.

The "Procunier" is the only device on the market having a balanced reversing mechanism which eliminates all side pull or torsion. Its reverse speed is twice that of its forward speed.

The Procunier Line includes tapping devices of all kinds of work for all machines. Our illustrated circular shows them in operation. Let us send it.

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HAND POWER PUNCHES AND SHEARS

All Canadian hand power punches and Shears are made with "Armor Plate" frames.

This frame construction consists of a rolled steel plate having a tensile strength 7½ times that of cast iron. This strength permits of a machine much lighter and more compact than is possible with either cast iron or cast steel.

Let us know your punching and shearing requirements. We have an "Armor Plate" machine for the service. Remember our Armor Plate line comprises power operated machines as well as hand power.

CANADIAN BLOWER AND FORGE COMPANY LTD.

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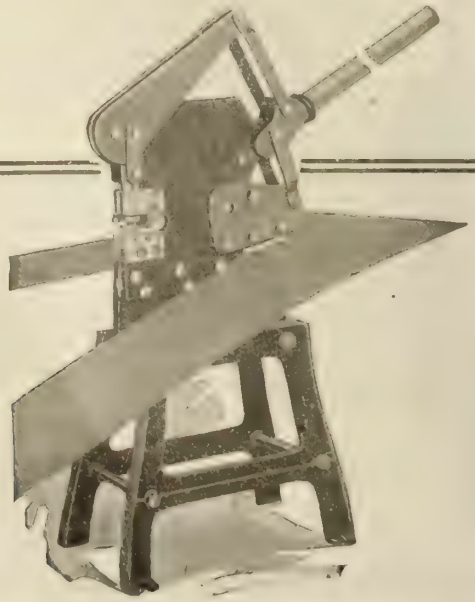


The Hammer With The Human Stroke

HEADS RIVETS COLD

Heads 'em tight or loose, flush, countersunk, or finishes heads any shape desired, and at the rate of:
A rivet a second, sizes up to 3/16".
A rivet in two seconds, size ¼" to ⅜".
A rivet in three seconds, size 7/16" to ⅝".
And on special order we build machines to handle rivets up to 1½" with proportionate rapidity.
Built in eight sizes.
Besides riveting, the High Speed Riveting Hammer does all kinds of peining, swaging, upsetting, etc.
Send us sample assembly parts with rivets or sketch of your work,

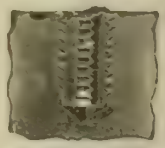
and

Let us shoulder your riveting problems.
Send for the High Speed Hammer Book.

THE HIGH SPEED HAMMER COMPANY, INC.

ROCHESTER, N.Y.

Buried in the Work and Broke!



Next time a tap breaks below the surface of a large casting, don't let some makeshift method of removing it injure the thread and waste half an hour of valuable production time. Instead—

Walton it Out in a Jiffy

And save the casting.

Special analysis steel fingers of the Walton Extractor drop into the flutes of the broken tap—and grip. Then a few turns of a wrench applied to the squared end of the Extractor backs out the buried tap.

Sixty-day trial offer proves the Walton Extractor pays for itself. Write.

The Walton Co.
Hartford, Conn.

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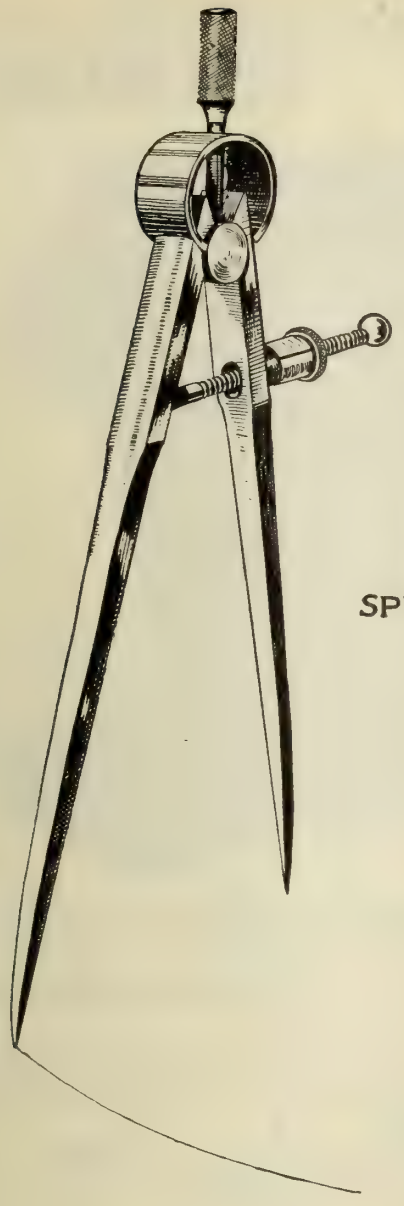

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SPRING DIVIDERS #77

The Starrett Spring Dividers No. 77 are made to please the man who is hard to please. They're different from the ordinary dividers. If you will examine the quick adjusting, automatic closing spring nut you can see at once why the 77 appeals to the critical machinist. The thread engages the screw at the slightest pressure when the leg comes in contact with the nut; when pressure is withdrawn, it releases itself immediately, sliding freely on the screw. Its use saves much valuable time in opening and closing. Also made with solid nut.

Write for Catalog No. 223 and the Supplement describing the new Starrett Tools.

THE L. S. STARRETT CO.

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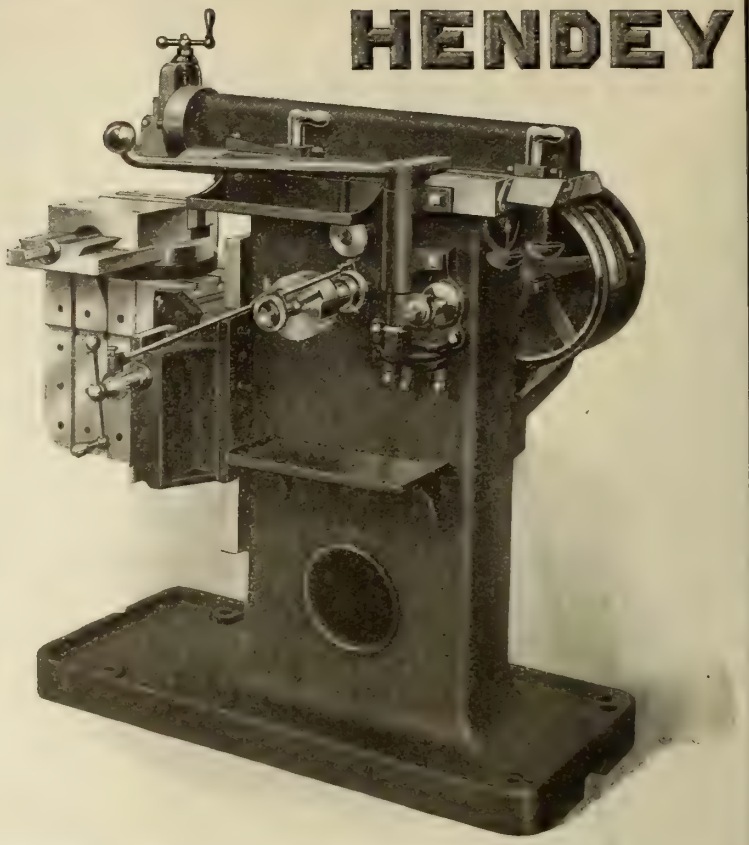
They have, wherever used, brought to light many operations formerly costing more by other methods. They eliminate the expense of building special cutters and jigs for machining small lots of intricate shapes. Their accuracy is unquestionable. Their versatility is an accepted fact.

This Hendey 15-inch Pillar Shaper is freely adjustable while in motion and can be changed at once to any length and position, without stopping.



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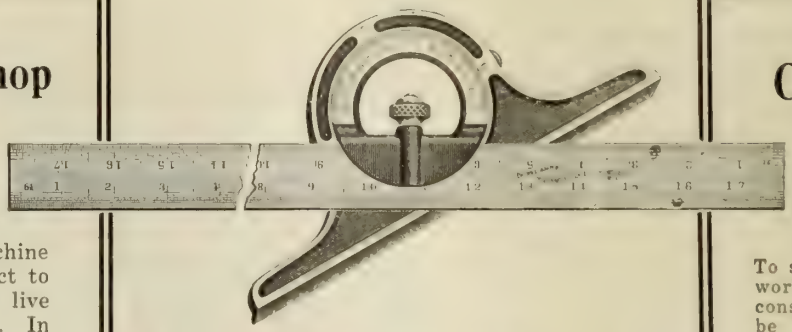
When in need of machine shop tools, come direct to our store, or, if you live out of town, write us. In either case you are sure of the very best and latest designs, for we carry only the highest grades. Every tool sold is accurate, dependable, and is made from the finest materials.

We carry an exceptionally large range and can give you very prompt delivery. Write us your requirements.



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To stand up to the exacting work placed upon them, construction tools must be solidly built of correct materials. We pride ourselves that we carry only the very best lines of construction tools and that the maker's guarantee is behind them in each case. We have a reputation second to none in the general hardware and tool business and naturally we intend to uphold our reputation by selling only well-known and proven tools. When in need of any type of construction tool write us. We can quickly handle your requirements.

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Established 1847 — TORONTO, ONTARIO — 19 Victoria St.

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To Holders of Five Year 5½ per cent. Canada's Victory Bonds

Issued in 1917 and Maturing 1st December, 1922

CONVERSION PROPOSALS

THE MINISTER OF FINANCE offers to holders of these bonds who desire to continue their investment in Dominion of Canada securities the privilege of exchanging the maturing bonds for new bonds bearing 5½ per cent. interest, payable half yearly, of either of the following classes:—

(a) Five year bonds, dated 1st November, 1922, to mature 1st November, 1927.

(b) Ten year bonds, dated 1st November, 1922, to mature 1st November, 1932.

While the maturing bonds will carry interest to 1st December, 1922, the new bonds will commence to earn interest from 1st November, 1922, GIVING A BONUS OF A FULL MONTH'S INTEREST TO THOSE AVAILING THEMSELVES OF THE CONVERSION PRIVILEGE.

This offer is made to holders of the maturing bonds and is not open to other investors. The bonds to be issued under this proposal will be substantially of the same character as those which are maturing, except that the exemption from taxation does not apply to the new issue.

Dated at Ottawa, 8th August, 1922.

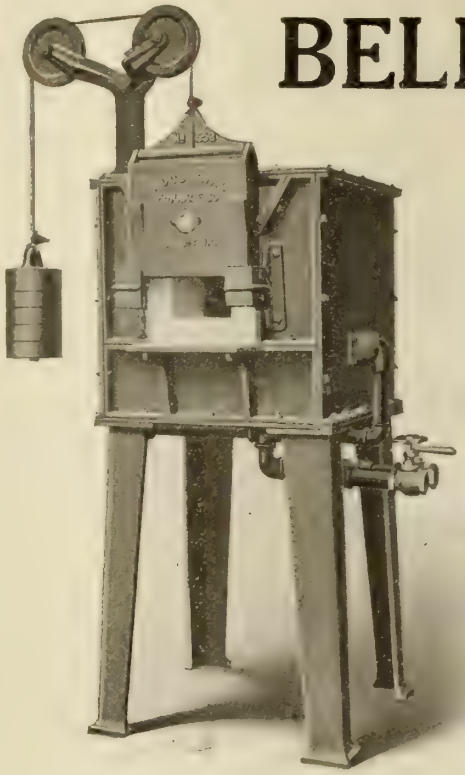
Holders of the maturing bonds who wish to avail themselves of this conversion privilege should take their bonds AS EARLY AS POSSIBLE, BUT NOT LATER THAN SEPTEMBER 30th, to a Branch of any Chartered Bank in Canada and receive in exchange an official receipt for the bonds surrendered, containing an undertaking to deliver the corresponding bonds of the new issue.

Holders of maturing fully registered bonds, interest payable by cheque from Ottawa, will receive their December 1 interest cheque as usual. Holders of coupon bonds will detach and retain the last unmatured coupon before surrendering the bond itself for conversion purposes.

The surrendered bonds will be forwarded by banks to the Minister of Finance at Ottawa, where they will be exchanged for bonds of the new issue, in fully registered, or coupon registered or coupon bearer form carrying interest payable 1st May and 1st November of each year of the duration of the loan, the first interest payment accruing and payable 1st May, 1923. Bonds of the new issue will be sent to the banks for delivery immediately after the receipt of the surrendered bonds.

The bonds of the maturing issue which are not converted under this proposal will be paid off in cash on the 1st December, 1922.

W. S. FIELDING,
Minister of Finance.



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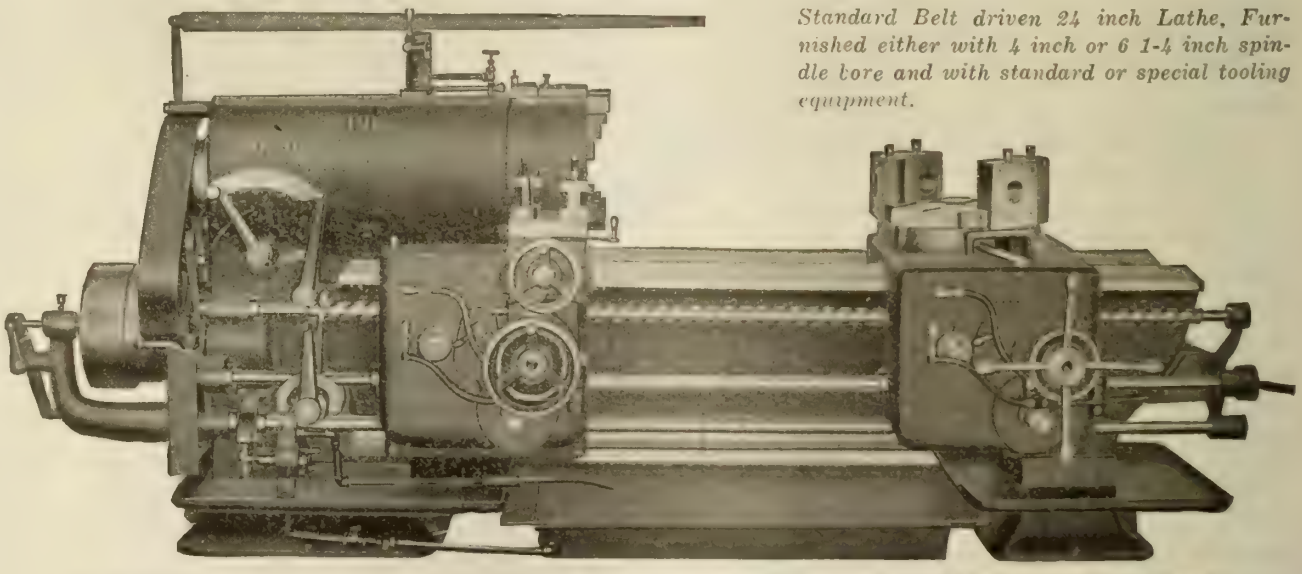

Standard Belt driven 24 inch Lathe, Furnished either with 4 inch or 6 1-4 inch spindle bore and with standard or special tooling equipment.

STEINLE TURRET LATHES FOR BAR OR CHUCKING WORK

Send us drawings of your work so that our Engineering Department can estimate STEINLE production, or ask to have a qualified representative call upon you to determine what work can be produced to advantage on our machines.

STEINLE TURRET MACHINE COMPANY

MADISON, WISCONSIN, U.S.A.

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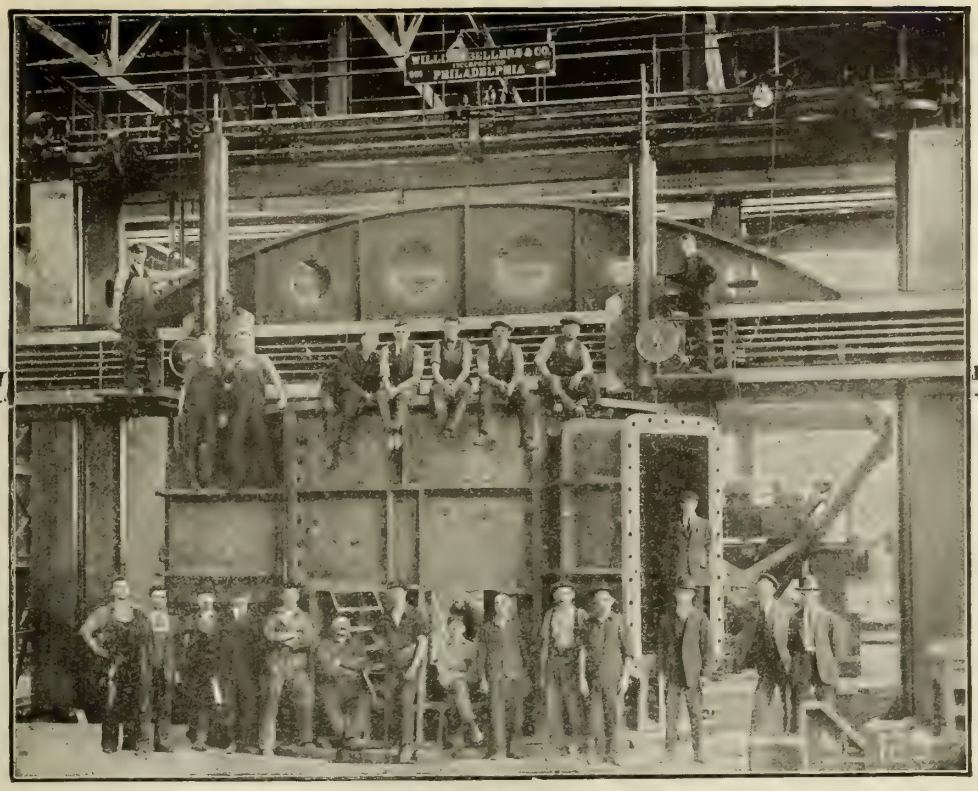

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UNUSUAL SERVICE FOR UNUSUAL NEEDS

Machine builders can procure from us castings up to 75 tons per piece, in Grey Iron or Semi-Steel, rough or machined. We can arrange to give you special mixtures, true to formula and uniform throughout. Our machining facilities will handle anything turned out by the moulding department and comprise a number of large special tools, including the 35 ft. boring, turning and facing mill shown in the cut.

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Fourdrinier Machines for Fine Papers, High-speed Machines for Newsprint or Kraft, Cylinder and Wet Machines, Millspaugh Suction Rolls, etc.

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This Generator converts surplus alternating current into heat with a loss of less than 5 per cent. The coal saving usually pays for it in a short time. May we send you information?

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Reamers

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Have a Wide Range of Expansion

From 1/16″ in the smallest to 3/16″ in the largest. With a set of eleven reamers (A to K) you can ream a hole of any desired size from 15/32″ to 1-17/32″. Strength, accuracy and ease of adjustment are features of these adjustable reamers. In them, the best materials obtainable and the experience of over half a century of reamer manufacture are combined for your benefit.

Send for descriptive circular.

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New Bedford, Mass., U.S.A.

THE GENUINE MORSE DRILLS ENCIRCLE THE GLOBE

GOODELL-PRATT
1500 GOOD TOOLS

BENCH MILLING MACHINE No. 644

For Experimental Work and Light Manufacturing

This Bench Milling Machine is a solid and substantial little machine capable of a wide range of work.

It was designed primarily for experimental work but its low price makes it an attractive proposition for light manufacturing work when fitted by the owner with various attachments for special purposes.

We can also furnish Arbors, Index Centers, or Vises for this machine.

List Price
$150.00
with liberal discount.

Write for further particulars regarding this and other low-priced Goodell-Pratt machines for light work in your shop. We make Bench Lathes, Polishing and Grinding Heads, Drill Chucks, Vises, Hack Saws and other shop equipment.

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See This Exhibit at the Warehouse of

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From this colossal display of machine tools and supplies you can select the tool exactly suited to your requirements. All high grade stock—at prices that will interest you.

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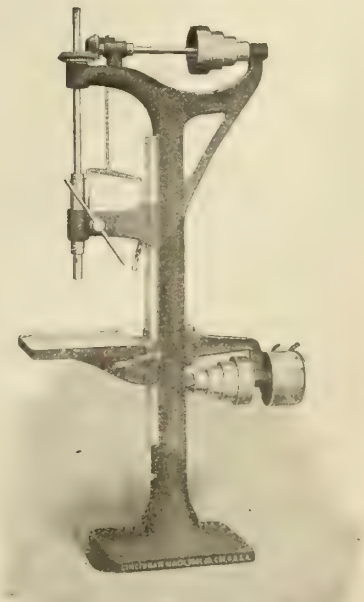

Cincinnati Sliding Head, High Speed 20-inch Drilling Machine.

NORTON TRADE MARK

Alundum Crystolon

Which Factors Influence Your Grinding Wheel Selection?

1. Actual life of grinding wheel measured in hours' service.
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or

3. Ultimate grinding costs as determined by the wheel, labor, and overhead charges for each piece ground.

Did you ever figure out—

1. How much you lose by using a slow cutting wheel.
2. How much more a glazed wheel is costing you every hour.
3. How much a fast cutting wheel saves you every hour. It may divide your total production costs by two or more.

If the physical properties of the abrasive of which the wheel is made, the grain size in the wheel and the hardness of the wheel, are not all designed for your job—whether it be tool grinding, surface grinding, cylindrical grinding, internal grinding, snagging or any grinding operation—your grinding costs are high.

Norton Alundum and Norton Crystolon wheels are made for all grinding jobs and answer every requirement. They produce at minimum cost.

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HAMILTON, ONTARIO

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Canadian Agents:
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F. H. Andrews & Sons, Quebec, Que.
Smeads Canada Saw Co., Vancouver, B.C.

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CANADIAN MACHINERY
AND
MANUFACTURING NEWS

VOL. XXVIII, No. 10 SEPTEMBER 7, 1922

Value of Die Casting to Metal Working Industry

Great Saving in Machining Operations—Product Easily Nickel-Plated—High Rate of Production—All Holes Accurately Cast in the Work—Method of Manufacture

THE die-casting process offers many opportunities for reducing manufacturing costs, when the metals from which die-castings can be made are satisfactory for the parts required. By this process holes, recesses, etc., can be cast directly in the part being made with such accuracy that in most instances subsequent machining is unnecessary. The elimination of machining operations therefore constitutes one of the main savings in the use of die-castings. Even the first cost of the dies is negligible, as compared with the first cost of the machining equipment that would be required for making parts from steel, cast iron, or brass. In any line where die-castings can be used, therefore, their application should be investigated. Many manufacturers of specialties have found that not only is it possible to start a business for the manufacture of a new article with less capital, when the die-casting process is employed (as the dies are cheaper than machine tool equipment), but it is also possible to get under way faster, as dies can be made in a fraction of the time that would be required for fitting up a machine shop.

It has been estimated that dies for making a given part on which a number of machining operations would be required would not cost more than 10 per cent. of the cost for machinery and tools. The manufacturing of the article then reduces itself mainly to an assembling proposition and to the machining and making of such parts as cannot be advantageously die-cast.

Examples of Die Castings

The accompanying illustrations show a number of die-castings that have been produced, and figures indicating the saving resulting from their use will be given. Fig. 1 shows at A a star-shaped faucet handle. This handle costs, as delivered by the die-casting company, including the tapping operation, 65 per cent. of what it cost when made from a brass casting. This includes the cost of dies distributed over a six-month period. The die-cast faucet handles are made from a zinc base alloy, having a tensile strength of 24,000 pounds per square inch. The composition is 88 per cent. zinc, 4 per cent. copper, 6 per cent. tin, and 2 per cent. aluminum. This metal is less expensive than brass, and in addition there is a saving of six machining operations, including a counter-boring operation and two facing operations on each side. To prepare the brass casting for nickel-plating it is also necessary to grind and buff it, while the die-casting needs to be buffed only. The only operations that need to be performed on the die-casting after it comes from the dies are to trim it and to tap the central hole. The counterbores on each end and the surfaces come so accurately from the dies that no further work is required except that of buffing before nickel-plating.

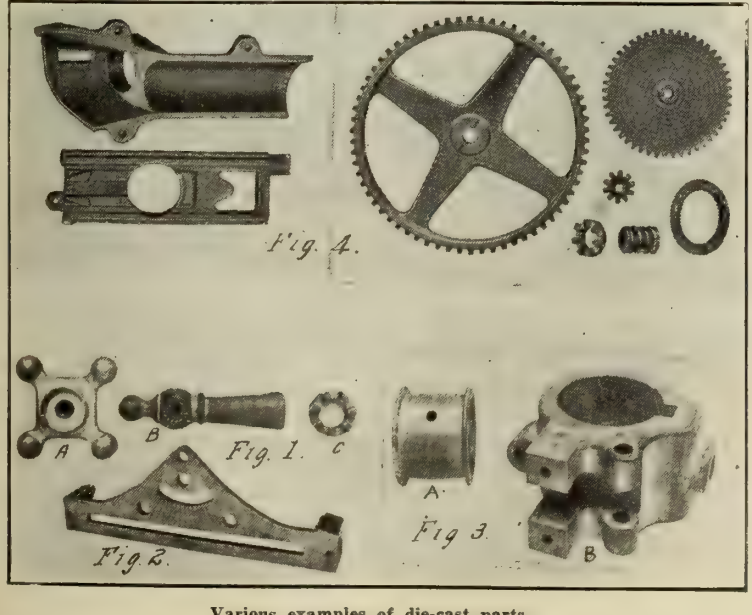
Easily Nickel-Plated

Faucet handles made in this manner have been used for a period of one year and have been found to be fully as satisfactory as brass handles. In fact, they have some advantages over those made from brass. They will take a heavier plate of nickel, and hence will wear longer, and if the nickel-plating wears off, the metal underneath will not show yellow, but the die-cast metal, being in the white metal class, will look more like nickel.

At B in Fig. 1 is shown another faucet handle, delivered at a cost of less than 5 cents, including the cost of the dies distributed over six months' production. No machining work needs to be done on this die-casting whatever. Formerly these handles had to be faced on one side, the center hole drilled and broached, and the hole for the bottom at the end counterbored.

At C is shown a roller bearing cage. In this case the die-casting costs more than the malleable iron casting that was formerly used, as there was no machining required on the malleable iron casting. However, the use of a die-casting meant a saving to the manufacturer of the roller bearings, as the die-cast cages are uniform, while the malleable iron cages are not. Therefore, in assembling the various parts, it was necessary, when using malleable iron cages, to try to fit a number of cages, which was found unsatisfactory for production work. Every one of the die-cast cages will fit, because it is possible to die-cast a part of this de-

Illustrations and information through courtesy of the Superior Die Casting Co., Cleveland, Ohio.



Various examples of die-cast parts.

sign within an accuracy of 0.001 inch. Thus the experience of this roller bearing manufacturer indicates the accuracy of die-castings, and shows that even in cases where the die-castings may cost more than a part made in some other manner, it might, nevertheless, be economical to use them because of other savings resulting from their uniformity and accuracy. The high rate of production obtainable in die-castings, assuring a supply of parts at all times, is also a point to be considered.

Brackets for an X-Ray Apparatus

Fig. 2 shows a die-cast tube stand bracket for an X-ray apparatus. This bracket was formerly made from brass and nickel-plated. When made in this way, the holes had to be drilled and the various flat surfaces milled. The lines shown on the front of the bracket had to be produced by a graduating tool. Now this part is produced by the die-casting process, and no machining is required except the tapping of two of the holes. The large holes in each end of the bracket are in line with each other, and come accurately enough for the apparatus directly from the die-casting machine. All the holes formerly drilled are cast in place. The small holes are accurate within (plus or minus) 0.005 inch, and the rest of the holes within (plus or minus) 0.001 inch. Lengthwise, an accuracy of (plus or minus) 0.001 inch is assured for each two inches, and the width of the long slot is accurate within (plus or minus) 0.001 inch. When zinc base metal is used for die-castings, it is generally possible to obtain a greater degree of accuracy in practically every dimension than can be obtained by ordinary machining methods, when producing work on a general commercial scale in interchangeable manufacture.

The total cost of this piece is less than the manufacturers' former cost of performing only one of the machining operations. In a comparatively small production, the cost of the die would be, say from 20 to 25 cents per piece, but this figure is much less in comparison than the cost of the machine and tool equipment that would be required for machining a brass casting.

Other Parts Produced

At A in Fig. 3 is shown a die-cast pulley, which was formerly made from bar stock. By die-casting, the cost was reduced 20 per cent. The feed-roll clamp B was formerly made from a gray-iron casting and required the boring and reaming of the large hole through it, the broaching of the keyway, the facing on both ends, the milling of the slot between the lugs, the facing of the lugs, the facing of two bosses, and five drilling operations.

These parts are now being die-cast; all holes are cast in place with sufficient accuracy without further machining, and the cost per piece is 55 per cent. of the cost when a gray-iron casting was used, not including the die cost. The latter cost, however, is insignificant as compared with the cost of the machining equipment formerly required, because with a production of less than 2,000 a year, the die was paid for by the first 1,000 pieces through the difference between the cost of die-casting and the machined gray-iron casting. Consequently, after 1,000 pieces had been made, there was a clear saving of 45 per cent. on every piece made thereafter.

Dies in use for two years have produced several hundred thousand castings, and are still in good order. A die for a piece of average design would cost, say $250. If there is a production of 5,000 pieces a year, it will be seen that the die cost per piece distributed over a period of five years would only be 1 cent.

Die Casting Machine

A recent model of die casting machine has a revolving table carrying four dies rotating about a central vertical shaft. The dies may be similar, or different ones may be used in each division, as the operating speed of the machines makes it possible to cast pieces of varying weight at the same time. When operating continuously and four dies in position, eight castings are produced at each complete revolution of the table.

Operating Mechanism

The four dies, which are placed at equi-distant points near the edge of the machine table, are enclosed in die-cages which support the operating mechanism. Through the center of each die-cage is a vertical shaft, enclosed in a sleeve made of steel tubing. The shaft is attached to the upper half of the die, and the tubing is attached to the mechanism that controls the core pins.

To the upper end of the shaft is attached a follower that rides in the upper one of the two grooves in the large cam attached to the main shaft. A follower attached to the sleeve rides in the lower groove. As the table revolves, the shaft and sleeve are raised and lowered by the action of the cams, thus opening and closing the die and setting or withdrawing the upper core pins. The cam grooves are so made that the core pins are placed in position just before the dies are closed, and withdrawn just after the dies are opened.

The core pins on the lower side are held by short levers that ride in curved slots in a round plate resting on the table of the machine and located midway between the four posts that support the die cage. The plate is caused to oscillate as the table revolves, thus operating the core pins as desired.

The Melting Pots

Two metal containers are used on each machine, one on either side of the machine. These boxes are retained by long arms that permit a movement of 30 deg. on either side of a neutral position. The boxes are lined with fire-brick and contain the pot for the molten metal. The fluid metal is forced, by means of a plunger, through a passage to the mouthpiece of the pot into the mold; an automatic stop is provided so that the plunger can only be operated when the nozzle is in correct contact with the die opening. The metal is kept at the proper temperature by means of a gas jet that can be regulated to suit the required conditions. As the revolving table is indexed in casting position, the metal pot moves towards the table and the spout of the pot enters the gate of the die. After the metal is forced in, the metal pot is moved back for the next indexing of the table. Directly after the two dies have received charges of metal they are automatically opened, the core pins are pulled out, the castings are ejected, the dies cleaned and closed, the core pins are pushed in, and the dies are ready for another charge. In the meantime, the other two dies are passing through the same cycle of operations.

As the upper half of the die is raised to the maximum height, carrying the casting with it, a pin knocks the casting loose and causes it to fall onto the plate which can be seen suspended between the upper and lower halves of the dies. The plate is then withdrawn and at the proper time a tripping mechanism causes the plate to turn and dump the casting. After the castings have been removed from the dies, a rotary brush attached to a rack is fed forward across the face of each die, revolving as it goes and cleaning the die. Then the brushes are returned to their places and a powerful jet of air is blown upon the face of each die for the purpose of removing any particles that may have clung to the die.

Cooling System

A complete water circulation system keeps the dies at the proper temperature at all times, the water being introduced through a swivel overhead pipe at the center of the machine, then passing through four radiating pipes that connect with both the upper and lower halves of each set of dies and eventually discharging through the base of the machine.

The pots can be operated by either the plunger method or compressed air, depending upon the kind of metal being used and the preference of the operator. When the compressed air method is used, the air is preheated so that no further expansion will take place when the air comes in contact with the metal. A system of burners surrounding the cylinder keeps the cylinder and piston at the correct temperature, in order to prevent the piston from sticking in the cylinder and to prevent any metal from adhering to the wall of the cylinder.

GOOD INTEREST AND ABSOLUTE SECURITY

A liberal rate of interest with absolute security is the attractive offer made by the Minister of Finance to holders of the Canadian Government war loan bonds maturing December 1, 1922. The offer is not made to investors generally, but only to the holders of the bonds soon to mature. The bonds to be retired, bearing interest at five and one-half per cent., will be exchanged for new bonds bearing the same rate of interest. Further details will be found on page 27 of this issue.

Preparing Molds and Machining Babbitt Bearings

Channel Irons Make Good Ingot Molds—Heavy Bearings Used in Rolling Mill Work—Strong Bracing Required When Pouring Hot Metal—Avoid Damp Molds

By W. S. STANDIFORD

IF IT IS desired to have a supply of babbitt for the stock room, use channel iron as a mold, spacing it off into desired lengths by means of short pieces of boards placed crosswise in the channel. Short sections of suitable sizes as will fit into the melting pot and weighing 50 lbs. apiece, will prove a very desirable weight for stock room shelves. To enable quick repairs to be made in emergency breakdowns of machinery, it is of the utmost importance that a good supply of bearing metal ought always to be kept on hand; as delays will be obviated. The writer has seen cases where much delay has occurred in making repairs through carelessness in keeping track of much-needed supplies by the stock room employees.

Channels For Molds

Channels make very desirable molds for casting bearing metals, as their weight can be controlled by using channels of varying widths. If it is wanted for general use, leave plenty of babbitt in the melting pot until it is needed. While the variety of machines for manufacturing articles are many, the bearings for most of them (outside of roller and ball bearings which are limited in numbers and need not be discussed here) are constructed out of brass, bronze or babbitt; some of the brass and bronze ones being lined with babbitt, those of automobiles are in the latter class. Some factory machines have cast iron shells lined with babbitt. There are two different types of bearing shells used with cast iron retaining walls to give the required strength and rigidity, viz.: Those that are cast in one solid part having no joint, and also others which are made in two-piece sections. The one-piece ones are cast on a much smaller mandrel, each one having a 1/16 inch taper so as to facilitate their removal when the metal is cold.

Machining the Bearing

The babbitt is afterwards bored out on a boring mill to such a diameter as will make a neat sliding fit, all grease slots or oil holes being either cast in or cut when the machining work is done. This style of bearing gives good service on heavy rolling mill or factory pinions. To give an idea of the amount of babbitt required in large pinion bearing retaining shells, it may be stated that some of them need 1,200 lbs. of babbitt. It is customary in doing work with large bearings of the above weight, to cast in the grease slots so as to reduce the amount of work on them to a minimum. Another important factor sometimes overlooked by machinists working on the rebabbitting of large heavy bearings is that they do not use sufficiently strong braces to hold the hot metal in place until it has set. This results in warped castings and also a possibility of the bracing giving away under the pressure of the fluid babbitt and injury to workmen. Care should be taken to place a weight and heavy clamps around the box that is usually surrounded by boards, other clamps holding the mandrel in place. This obviates all danger of a mold bursting.

Air and pouring holes should also be provided so as to obtain sound castings free from blowholes. Taken all in all, the making and handling of babbitt is a very dangerous task; outside of proper securing of molds and mandrels, great care ought to be resorted to so that no dampness or water is in the bottom of shells, while the pouring of hot metal is being done; as it will explode with disastrous results to the workmen around it. The main drawback in casting very large bearings, whether they are one or two-piece ones, exists in the time that is required to cool them so that they will stand handling. This feature can be overcome by having four mandrels of the same size for each set of heavy bearings, and pouring them one after another.

Rounding Corners

If any crankshaft has a rounded fillet, much time and money can be saved by filleting out all mandrels, the latter to contain fillets of the same radius as the crankshaft. Providing fillets on mandrels when the bearing is made not only saves time which is a vital factor in emergency breakdowns, but considerable expense on ordinary occasions by eliminating unnecessary machine work. If a supply of the ready-made finished castings are kept in a stock room, extra rapid work can be done in emergencies, the latter happening in the best regulated factories. In those classes of machinery in which the wear is extra heavy due to a succession of jerks on moving parts, some machinists usually have a narrow brass liner with the same radius of a shaft, cast in with the babbitt, the latter surrounding and holding it in place. This combination enables all such bearings to resist wear at their most vulnerable spots.

The same result can be achieved by adding a much larger percentage of tin and antimony and also some copper to the babbitt; a reduction or an entire elimination of the lead contents tending to give hardness. Increasing the amount of tin and also antimony, increases the cost of bearings, especially large heavy ones. One and two-piece shells usually have their linings held in place (to prevent rotation with their shafts) by means of dovetail grooves or round anchor studs; sometimes both are in use. The extensive employment of large and small electric dynamos and motors in modern rolling mills or other places where the temperature is high, calls for a special grade of babbitt in order to make them give the least amount of trouble, day in and day out. These machines are, as a general rule, in operation continuously for 24 hours; so that their bearings get no chance to cool off. In addition to running in a very hot atmosphere, they also operate in a very dusty one containing very small particles of iron, etc.

Special Composition

For use under such conditions of working, a special babbitt formula is appended, which has been found out by years of experience to give most excellent results.

Special babbitt formula for electric dynamos and motors:

438 lbs. tin
40 lbs. antimony
27 lbs. copper

The above metal is well suited to the high speed and heavy pressures exerted on armature shaft bearings by light and heavy mill motors. As the latter generally have their shafts oiled by revolving rings, the shells of these machines can be made out of cast iron, although bronze may be employed for this purpose if desired. Cast iron ones are the best owing to the rapidity in which they can be relined as contrasted with those of bronze. All motor bearings ought to be poured on a much smaller mandrel, with the latter having a 1/16 inch taper to facilitate ease of withdrawal; they should then be bored out carefully to desired size.

Guard Against Dirt

Extreme care must be taken by the workmen to see that no dirt, dross or iron scale from a very rusty ladle gets into this metal while pouring babbitt into their casing shells, as they will run hot and start to cut the shaft and babbitt lining; the latter melting in spite of the oil rings conveying oil to them. When the babbitt is worn down in shells and has to be replaced with new material, all old metal can be quickly removed by first carefully cleaning them from oil and dirt of all kinds, and then placing them into a pot of melted babbitt; thus melting it out. By adding old metal (providing that it has not been burnt) to the new, expense can be saved in this direction, as such material will be found most useful and again give good service in regard to fine wearing results.

Babbitt for motors and dynamos ought to be kept in a separate place from that used on shafting and other low speed machines, so as to avoid mistakes made by workmen using the wrong metal. Another place where this special motor babbitt can be used to great advantage as regards the quickness in which repairs can be effected on emergency jobs, as well as giving excellent service in regular work, is as a bearing lining for crosshead slides on steam engines, this metal replacing the usual brass ones; the latter requiring a lot of machine work to be done upon them before they are ready for use. As the babbitt ones need less work in that respect, the engine can be gotten into action quicker. The proper lubrication of all bearings of various kinds and classes of machinery does not seem to be as well understood by the average run of factory superintendents as might be the case; many executives think that all that is necessary is to supply machinery with grease or oil and let it go at that, the men accepting all wear on bearings and journals as an evil which cannot be avoided. Guard against this practice. Another factor that has an important bearing upon lubrication difficulties, exists in climatic changes. A grease of sufficient softness that will operate satisfactorily in the summer time will give trouble in the winter, especially when the temperature is down around or below the zero mark. In such cases, it is better to either use a medium thick oil in the winter or an extra thin grease that will not allow the teeth to cut a path through it; oil being preferred.

(To Be Continued)

Grinding is the Best Method of Finishing Hardened Automobile Parts

IN the early period of machine shop development the lathe was the only tool used for producing cylindrical work, but the introduction of hardened steels into mechanisms of every character demanded more efficient methods of coping with changing conditions. The greater degree of accuracy required in precision work necessitated the adoption of grinding machines for finishing work that had been hardened and tempered after being turned. Grinding was first performed by rigging up attachments on the ordinary engine lathe, but the rapid progress of this particular phase of industry soon resulted in special machines devoted exclusively to grinding operations. To-day a wide range of equipment is manufactured, each individual tool designed to take care of a definite class of work.

The development of the grinding machine has enabled manufacturers to reduce considerably the time formerly required for turning work to a definite size. In many plants it is the practice now to rough turn a very large percentage of cylindrical work, leaving the finishing operations to be performed by the grinding machine, which accomplishes the desired results with a higher degree of finish and accuracy.

The operation of grinding is not confined to hardened parts as many pieces are finish-ground direct from the casting or forging. However, it is most essential that grinding be adopted for finishing bearings on shafts that have been heat-treated, and as this process is now recognized as a very necessary part of a great number of mechanical appliances, the possibility of warping and distortion during reheating and cooling, the finishing to size is impractical until after the heat-treating has taken place. Should delicate shafts and irregular pieces be turned to final size and then hardened or heat-treated, the chance of the pieces retaining their shape and accuracy would be very remote, and the process of straightening or aligning would entail a lot of work that would be both tedious and costly. Production would suffer in consequence and efficiency would be brought to a low figure.

An interesting grinding operation is shown in the cut herewith. The view on the left illustrates the steering ball-joints for the Packard twin-six car. The centre view shows the tapered portion being ground on a Norton grinding machine. The abrasive wheel being a 50-M alundum vitrified wheel. The right hand view shows the taper portion held in a collet chuck while the ball end is ground on an automatic radial grinder using a 80-5 Norton elastic alundum wheel.

The other cut illustrates the finish grinding operations on pins and bearings of automobile crankshafts. The grinding machine has made it possible to use special tough alloy steel for crankshafts and camshafts and it would not be economical to finish such shafts in any other way.

Illustrations and information through courtesy of Norton Co. of Canada.

Grinding crank-shaft pins and journals.

Grinding ball and taper bearings.

Safety in Handling Material Lessens Costs

Proper Training of Workmen Gives Three-fold Profit—Lessens Waste Through Accidents and Compensation Costs, Increases Production—Working With and Not for the Employer—Great Modern Improvement

THIS subject quite naturally recalls to our minds the varied operations which have come under our observation during many years which have now passed into history. We can readily recall how we would pause in our own work and observe the actions of others, they being either so-called "unskilled labor" or mechanics of some special class. While watching the various operations, no doubt, there was a question in our minds—why is the work being done in that manner and not in some other? The past twenty-five years have witnessed remarkable advances in the methods employed in carrying on various industrial operations. Of these none, perhaps, are more striking than those having to do with handling material.

One remembers the old days when great gangs of men were necessary for handling almost any kind of work, because labor saving devices had not yet come into general use, nor were many of them perfected as we find them at the present time. Cars were loaded and unloaded by wheelbarrow gangs. Charging boxes, around the furnaces, were loaded by hand. To 'put over' a job, it was of first importance to secure an adequate force of men, and then followed the necessary hand equipment—just the reverse of present methods, which give first consideration to what equipment to use and then to the men who will operate it.

This paper by Clarence E. Ralston, Equitable Life Assurance Society was read and discussed at Eleventh Annual Safety Congress held recently in Detroit.

Old Methods—Frequent Accidents

With the recollection of the large gangs of men we also recall the dark side of the picture, the frequent accidents among them. Many such accidents causing serious injuries, are now considered preventable and entirely unwarranted.

Lack of proper equipment was responsible for much wasted labor and the lack of proper interest on the part of the supervisors was responsible for even a greater waste, through the methods used. Properly trained supervisors or trained men were not given much consideration and, in fact, in many cases, were never even thought of. The one consideration seemed to be to get the cheapest labor possible for such work, regardless of the nature of the material to be handled.

The two causes of waste were just as truly the causes of the many accidents which occurred, as has been clearly demonstrated where the accidents were carefully analyzed to determine the real cause. Where proper consideration has been given to these two causes, the accidents have been greatly reduced and in some cases practically eliminated.

Conveyors, Magnets, Trucks

The old time methods of handling work are fast going into the discard and whether it be on construction work, from the excavation to the completed project; or the operations in various industries, from handling the raw materials to the shipment of the finished product; or the transportation of goods, from the loading to the delivery, we find wonderful progress in all lines. Conveyors and hoists have supplanted the wheelbarrow gangs; electric magnets have taken the place of the laborer in the scrap-yard and around the charging boxes; power-operated trucks have replaced the old hand-trucks. Numerous other mechanical and electrical appliances of like nature might be added to the list.

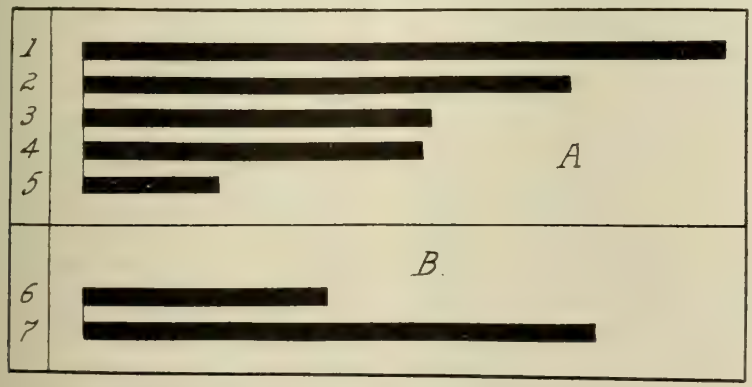
Consideration is now given, not only to equipment for the safe and efficient handling of materials, but to men and methods as well. With the consideration of methods comes first the trained worker, including both the supervisor and the man in the ranks.

Much of this great change is due to the natural growth and development of industry, but one of the most important factors has been the great safety movement. Through the study of the causes of waste through accidents have come many developments which might otherwise have been long delayed.

Accidents due to handling material have been for years entirely too frequent, in fact they are appalling. To this general cause can be charged a greater loss than to any other, yet it is not the difficult and unsolvable problem which many have credited it with being. It is only one challenge out of many which confronts the safety engineer. Whenever and wherever a definite study of the problem has been made and this followed by a well planned campaign, the hazards have been eliminated and the accidents due to this cause greatly reduced, if not entirely eliminated.

Lack of Supervision

This recalls to mind an instance during the World War which illustrates the point, particularly as it relates to one phase of transportation. The U. S. transport "West Indies" called at the Mare Island navy yard, California, for a cargo of 12 in. x 12 in. timbers which was very much needed at the Norfolk navy yard on the Atlantic coast. The shipment was quite large— over 2,000,000 ft. of timber—and orders had been issued to load the vessel with all possible speed as each hour meant just that much delay in getting the timber where it was needed. The loading of a cargo vessel, with all the loose rigging with which such vessels are equipped, is no child's play, and shortly after the work was started, a man was knocked overboard and severely injured. The investigation of the accident which was made immediately, developed two glar-

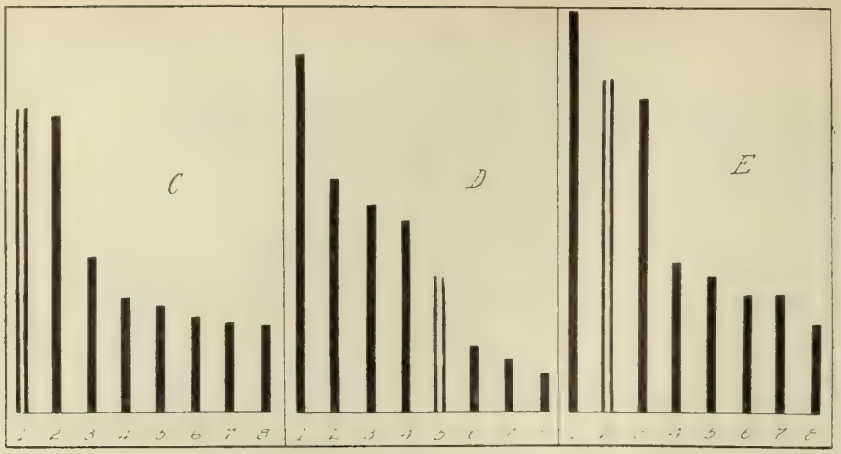


A—Chart showing percentage of accidents charged to handling material at five large industrial plants
B—Accident chart for material handling at Standard Oil Co.

Year	Company	Per Cent.
1921	Bethlehem Steel	$48.00
1919	N.Y.C.R.R.	36.00
1921	Nat. Cash Reg.	26.00
	Du Pont	25.00
1920-21	S. O. Bayonne	10.00
(Scale—100)		

Year	Total Accidents	Accidents Charged to H.M.	Total Cost of Accidents	Cost of Accidents Charged to H.M.
1920	184	18	$12,996.43	$437.39
1920	103	*10	10,962.38	*912.55
(Scale—240)		162—6		

*44% reduction—but 109% increase in cost.



C—Compensable injuries, analyzed by principal causes. D—Compensable deaths, analyzed by principal causes. E—Compensable injuries, analyzed by principal causes and medical costs.

Cause	Total Injuries	*Days Lost	Medical Aid
Falls of Persons	1,826	156,000	$ 91,165
All Machinery	3,437	102,000	116,193
Hoisting Machines	....	90,000	25,839
Falling Objects	1,063	84,000	34,275
Handling Objects	3,533	60,000	96,866
Woodworking Machines	1,028	30,000	34,384
Metalworking Machines	1,340	24,000	43,668
Hand Tools	1,267	18,000	39,487
Stepping On or Striking Against Objects	1,127	.....	.....
	(Scale—80)	(Scale—30)	(Scale—20)

*6,000 days charged for one death.

ing conditions—defective hooks on some of the rigging, although this was not the cause of the accident, and inadequate supervision, as all the hatches were being loaded at the same time. The defective hooks were replaced at once and a **force of supervisors** distributed over the deck of the vessel in order to observe the work at each hatch. There were no more accidents of any kind and the vessel was loaded and started on her voyage in record time.

Handling Accidents Come High

A glance over the accident records of the State of Wisconsin for the year 1920 reveals some very interesting data concerning this matter. During that year there were 16,246 compensable injuries and of this number 3,533, or 21.7 per cent. were charged to handling objects—more than those charged to any other cause. The Severity Classification of the injuries places this cause as 5th in time lost: 3rd in compensation cost and 2nd in medical cost.

One large steel company reports handling material as the cause of 48 per cent. of their accidents during the year 1921 while another holds it responsible for over 40 per cent. of their accidents during the last six years.

With these facts before us, I am sure we are all agreed that a concerted move must be made to eliminate the accidents due to this cause. From my own personal experience, I am fully convinced that the key to this problem will be found in the supervisor. He must first be taught to **plan his work and then work his plan.** Next must come the worker in the ranks who must be taught to think as he works—not of some foreign subject but of his work—how and why he is doing it.

The supervisor is responsible for methods, the condition of equipment and at least part of the training of the worker. After planning his work, his next move should be the careful selection and placing of his workers. They should be placed according to both physical and mental fitness as far as possible. Too much cannot be said of the importance of this part of the program as a "misfit" will cause the failure of the most carefully developed plan—he is the weak link in the chain.

The training of the workers can be done in several ways in order to be complete and effective. The training by demonstration must be done through the supervisor on the job, while the training by illustration will come within the duties of the safety engineer or director. This latter training should be through the use of lantern slides and other pictures, showing very clearly how to do and how not to do the work. These pictures can be analyzed with the men in small groups and through such group meetings their personal interest will be aroused and held. This method was used at the Mare Island Navy Yard, California, during the war and I am convinced was a big factor in enabling us to reduce the accident rate 86 per cent. in the face of a 116 per cent. increase in force and this during a 16 month period. Such training will not only decrease the accidents but will greatly increase the efficiency of all concerned—**thus giving us a three-fold profit from safety work, 1—Lessened waste through accidents and compensation costs; 2—Increased production, and 3—Lessened costs of production.**

Careful training of men along these lines will gradually bring them to that understanding which is so much to be desired in Industry—that they are working with their employer and supervisor to accomplish that which society expects of them, and not working for the employer or supervisor.

The supervisor must be made to realize that he is the personal representative of the employer and that it is his duty to see that the working conditions are safe. He must also realize that losses through accidents are an indication of his inefficiency and that the workers must be protected even better than the equipment, which can be replaced without any physical suffering. It is not to be supposed that he will personally inspect all equipment and conditions, but he should select competent men for this purpose.

CANADIAN MADE SNIPS AND BENCH SHEARS

It will be interesting to the trade to learn that sheet metal snips and bench shears are now being made in Canada. Many imported tools of this character are hand ground and it is difficult to obtain blades with the edges parallel, a condition that is necessary to retain a keen cutting edge.

The Brown, Boggs Company, Ltd., Hamilton, Ont., manufacturers of tinsmiths' tools and sheet metal working machinery, have installed special machinery whereby they claim they are able to produce a shear, machine ground, giving that smooth cutting edge not possible with hand grinding. In grinding them in this manner it is rightly claimed that the edge will last longer. The forgings are of the best steel, correctly designed, well made, and the cutting surface overlaid with Jessop's best cast steel. Great care is exercised in the tempering, which is scientifically done by the assistance of lead and oil baths, and pyrometers. The finish is also carefully looked after. Some few years ago the company manufactured snips in a small way, but since their severe fire in 1916 they have had these articles manufactured in the U. S., under their name. Their inability to obtain a satisfactory shear compelled them to resume their manufacture, and to install a special plant for that purpose, and to distinguish between the U. S. and their make, they are now marking the new product "MADE IN CANADA" and will thoroughly guarantee every pair.

They are also making bench shears, machine ground, and giving them the same careful attention as they do their snips. In bench shears the difference between hand and machine grinding is much more apparent, on account of the large cutting surface. It is almost impossible to cut true to a line with hand ground bench shears, the shear following the contour of the blade. The company is certainly to be congratulated in the splendid results in this new line of manufacture.

Jigs and Fixtures for Producing Lathe Parts

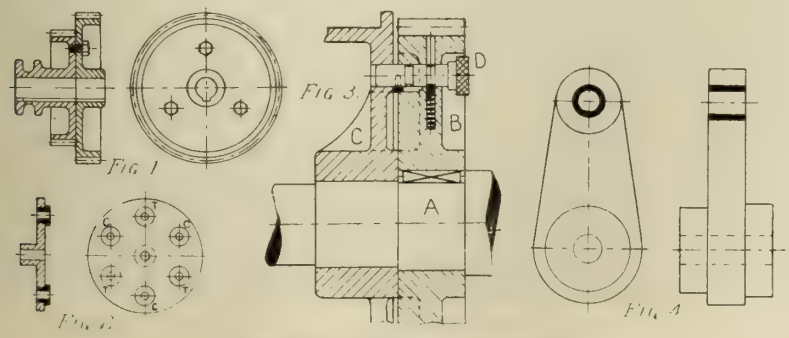
Drilling Holes in Duplex Back Gears—Locking the Drive Cone in Position—High Speed Steel Reduces Actual Cutting Time—Fixtures Used to Speed Up Production—Special Angle Plate

By HUBERT BENTLEY, A.M.I.M.E.

THE accompanying drawings show some common lathe details and the jigs and fixtures which are employed for ensuring accurate and rapid production, of the holes to be drilled. Fig. 1 is a drawing of the duplex back gears for a lathe driving headstock, which are made to slide on the back barrel or sleeve and to engage with their mating gear on the spindle, and thus obtain two different gear ratios. These gears may be moved directly by hand or they may be operated by a lever working in the groove shown and actuated by a hand lever at the front of the headstock. The method shown of securing the two gears together by means of three set screws is both simple and satisfactory, and Fig. 2 shows the jig employed in the drilling of the screw holes. There are three holes to drill in each gear. The holes in the larger gear are ⅝ ins. clearance holes while in the smaller gear there are ⅝ ins. tapping holes. The gears are drilled separately with the flat face uppermost. The jig plate is laid on the top with the turned boss fitting inside the hole in the gear and the whole is made secure to the drilling machine table by a clamp plate and bolt which passes through the centre of the jig plate and gear. Of the six hardened steel bushes which are fitted equidistant around the jig plate, three are drilled for clearance holes and three for tapping holes and these are marked respectively C and T. When the two gears have been made secure by the screws they are then ready for the keyway to be slotted.

Spring Locking Bolt

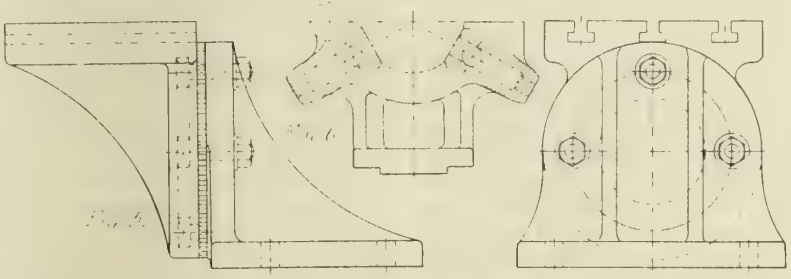
Fig. 3 shows a very simple and successful spring locking bolt employed for securing or releasing the driving cone and the main spindle gear wheel when a lathe is being run on single or double gear. The advantage of this type of bolt over the ordinary hexagon nut and bolt will be familiar to readers. A shows part of the spindle, B a section of the main spindle gear, C a part of the driving cone and D the locking bolt. When the locking bolt is out of engagement with the cone, this is free to revolve around the spindle, but when engaged as in Fig. 3 the cone and gear wheel revolve together. An inner as well as outer flange is arranged on the cone at the large end and this is connected to the boss by three webbed arms. Three holes are drilled in this flange on the arm centres for receiving the locking bolt which is made of high tensile steel. In the main spindle gear a solid strip is cast connecting the rim and the boss which supports the bolt close up to the cone. A strip cast diametrically opposite in the gear helps to maintain the balance. To disengage the locking bolt, this is pulled outwards. There are two circular grooves turned around the bolt which receive a spring operated ball seen on the underside, when the bolt is in the respective "in and out" positions. This causes a little pressure to be exerted when changing positions. The hole for the spring and ball is drilled between two teeth in the gear wheel. A small key in the locking bolt and keyway in the spindle gear prevents the locking bolt moving too far in either direction. By having three holes drilled in the cone flange, engagement can be quickly made, when pressure is applied to the locking bolt. Fig. 4 shows the jig employed to facilitate the accurate drilling of the holes in both the cone and gear wheel. The smaller turned boss is made to fit the cone bore and the jig is moved around in succession to the three positions of the holes in the cone flange. The jig plate is secured to the cone by a bolt through the centre. For drilling the single hole in the spindle gear, the larger turned boss is fitted in the gear wheel bore. The drills are guided by a hardened steel bush fitted into the jig plate.



Construction of different lathe parts.

Cutting Time Reduced

Due to the old-fashioned methods so often employed when fixing and changing work on the drilling machine, a record of the actual machine running times, would show these to be a very small proportion of the working day. This would be most marked where the employment of high speed steel makes the actual cutting time of very short duration. The provision of suitable means for quickly handling and changing the work to be drilled now appears to be receiving more attention and there are a good variety of angle plates, machine vises and work tables, which swivel in one or more directions, on the market. They are suitable for application to many other types of machine tools as well as the drilling machine.



Adjustable angle plate and steady rest.

Special Angle Plate

The swivelling angle plates shown in Fig. 5, in elevations, were designed specially to facilitate the drilling of holes in two and three paw travelling and stationary steady rests of the type shown in Fig. 6. It will be recognized that an ordinary swivel machine vise is too small for the job, while a universal tilting table was considered too large and expensive. Hence the design of the cheap but very effective angle plates shown, which it was intended should also be available for other jobs. The angle plates enable two or more holes to be drilled at various angles in the same plane without removing the casting until the job is completed. The two plates are spigoted together on their vertical faces, turned circular and secured by three bolts. These bolts fit in a circular tee slot cut in one of the vertical faces and so enable the other plate to be swung round in a complete circle and to be made secure in any desired position. Graduations in degrees are cut on the periphery of the rotating member to facilitate quick setting to any angle.

Heavy Labor in Demand-Skilled Workmen Scarce

Active Season in Lumbering Industry and Railway Construction —Five Thousand Bushmen Wanted Where Few Hundred Men Hired in 1921—Machinists Fairly Busy—Market Absorbing Highly Trained Men

HEAVY LABOR, scarce; farm help, scarce; skilled labor, building trades, scarce; machinists, fairly busy; boys scarce after Sept. 4. This sizes up the labor situation at the present time. Considerable demand for heavy labor is coming from lumbering and railway construction work. Not all men are adapted to this kind of work and there has to be considerable weeding out among applicants to meet the requirements of contractors.

Wages range from $30 to $35 monthly, everything found. An indication of the extent of lumbering activities this fall is the fact that the government employment service hopes to recruit 5,000 men from the Toronto district alone. Last year there were probably not more than 300 men placed from this source. This means that large cuts of lumber are in prospect and that the huge stocks of one and two years ago are being depleted. Activity in the building industry is undoubtedly having its effect and here again the condition of the labor market may be regarded as a barometer for there is scarcity of bricklayers, plasterers and carpenters.

When Seasonal Work Stops

Operations calling for much heavy labor will help to absorb many of those who may be allowed to go when seasonal work comes to a close. There are 1,800 men employed by the Toronto Transportation Commission. With the coming of frost the majority of these men will be out of work. The same applies to men on Welland canal work.

Some ten thousand men were drawn from the Toronto district for work in the western harvest fields. Eighty-five per cent. of these men will have returned by Nov. 1, but quite a large proportion belong to farming communities and will thus be readily absorbed. Some success is attending the movement to have farmers hire their men by the year. In not a few cases separate houses and plots of ground are being provided and a fair attempt put forth to make the lot of the hired man contented. Strange as it may appear, more progress is being made in this direction in Western Ontario than in the East, the explanation probably being that in the former there is a greater percentage of larger farms.

Good Mechanics May Be Scarce

That machinists are only fairly well employed, suggests conditions as they exist in the metal working industry. The motor car industry is running into a breathing space between seasons and some men have been let out. Full time has not yet been inaugurated generally as a regular proposition. The high-class skilled mechanic will have little trouble in securing work at the present time, however, for the market has reached that stage where it realizes that the time may not be far distant when good men are going to be scarce. Many machinists have preferred to work on other jobs this summer, claiming conditions in their trade are not acceptable.

Scarcity of boys after Sept. 4 is explained by the fact that school re-opens following Labor Day. Hundreds of boys have been industrious during the holidays and these include all classes from those whose clothing and demeanor stamp them as coming from good homes to those who, no less full of pep and quite as reliable, reflect less favorable living conditions. There are those too, who, to an extent representative of both classes, follow lines of least resistance and take a more or less indifferent view of life, evidently preferring to take circumstances as they come rather than develop a dormant ambition.

Demand for High-Class Men

All sorts and conditions come within the scope of the government employment service. In the Toronto department, for example, there are one thousand applicants for work who can only handle light or special tasks, some in fact who are only able to work a few hours each day. There are elevator men and those who try to piece out two or three jobs of a certain type in order to produce somethng like a full day or week. There are men who do cleaning of various kinds, men who prefer to work nights and those who are more or less temperamental as to their hours of service during the day. One man wanted a job in a restaurant. He was asked "What can you do? When do you want to work?" "Anything, anywhen, so long as it is near the food," was the reply.

Not a few highly-trained technical and professional men are among the applicants. Not long ago a mechanical engineer, who had never drawn less than $5,000 a year, was listed. His name was placed on the bulletins going to seventy-six employment offices and immediately there were replies, one from Oshawa, one from Winnipeg, one from St. John, N. B., and several others indicating a market for just such men. He was easily placed. Very recently a large concern wanted to import a production engineer from the States. The department makes this possible after certain formalities have been complied with. In this case, however, a Canadian was found for the position as a result of the listing and bulletin service. It is pointed out by officials that this placing of high-class men is having remarkable development. The work is done in a thorough, considerate and dignified manner, numbers being used, with careful descriptions in listing the applicants, and in this way many avail themselves of the service who might otherwise be repelled. And there is quite a market at present for well-trained, competent men in Canada.

Consideration for Employees

A manufacturer of machinery gives the following minimum and maximum rate of wages paid by him at the present time. Machinists, 50 to 70c per hour; Machinist laborers, 30 to 43c per hour; moulders, 60 to 72 per hour; moulder laborers 40c an hour; pattern makers 65 to 70c per hour; pattern shop laborers, 35 to 45c per hour; crane men, 35c to 42c per hour.

This particular manufacturer made a general reduction of 10 per cent. in wages early in the year. He adds:—"There are not enough jobs to go around, and men have been working on such short time that it has not been possible to make what is really necessary in the way of reduction of wages owing to this short time. It is hard to say what the tendency will be a little later on.

"If, business was offering sufficient to run the plant to capacity, it is possible that the increase in production over the present time, would make it possible to produce goods at a reasonable profit even at present price of wages. At the present time, our machine tool plant is operating more with the idea of holding the organization together than with any possible idea of profits, and we believe that we are one of many plants in the iron business who are operating on the same lines. We have been trying to carry on with a view to helping out the men as much as possible, and for this reason the matter of any further reduction of wages has had to be held in abeyance. Under present rates, with the very short time our men are working it is almost impossible for them to make it go financially, and although manufacturers, as a rule, are not given credit for having very much of the milk of human kindness, you know and everybody knows that consideration for the employees under present conditions is the dominating feature in the wage situation."

Wages 11 Per Cent. Higher

Higher by 11 per cent. than those of 1914 are wages throughout the country, according to the bimonthly summary of industrial economic conditions issued by the National Conference board.

A summary of wage changes by months shows fifty-four reductions and

(Continued on page 53)

Production Milling on Two-Spindle Machine

Jigs Should be Simple and Efficient—Conveniently Operated When Machine is Working—Keeping the Cutters Engaged Continuously—Roughing and Finishing at Same Time Means Economy

WHERE METAL parts are to be manufactured in reasonably large quantities a question of primary significance is the selection of the most suitable equipment for performing the machining operations. The rapid development of modern machinery makes it imperative for the superintendents of most plants to study carefully the different angles by which any mechanical problem can be attacked and economically solved. The methods that were successful in doing a certain piece of work five or ten years ago, may, at the present time, be entirely inadequate to meet existing demands. Not that the past practice is less efficient in itself, as in many instances the rate of production has shown steady increase over what was possible years ago. This has been made possible through the introduction of high speed steels and their greater ability to stand up to heavy cuts for longer periods.

However, when the question of maximum production is the point on which a decision is to be made the choice invariably falls to a selection of a tool that has been especially designed to meet specific requirements. It is seldom necessary to have a machine tool built for the machining of a single part, but the general range of any standard type of machine, gives ample opportunity of obtaining one that is 100 per cent. effective for a variety of work within its capacity.

Keeping Tools Engaged

The secret of increased output is not so much in speeding up the actual cutting time occupied by the tools in removing metal, but rather in reducing the idle time that features many of the machines of a decade ago. The aim of the tool designer, to-day, is to provide facilities whereby the cutting tools can be operated continuously. Few tools have shown greater possibilities in this direction than the vertical milling machine. The multiple cutting faces of the milling machine cutter permit of the removal of metal more rapidly and smoothly than by any other means. The adaptability of this tool is so varied that work formerly performed on shape planers, slotters, etc., can be more effectively handled in one of the many different types of horizontal or vertical milling machines.

The possibilities of the rotary table in conjunction with multiple spindles is shown in the accompanying illustration. The character of the work and the machining operations necessary are the governing factors in determining the designs of the work holding fixture. With few exceptions it is advisable to make jigs as large as conditions will permit, as in this way the presence of slightly curved surfaces will be less pronounced. Rigidity and simplicity are points of vital importance as vibration of the work under the cutting action of the tools prevents the utilization of heavy feeds and high speeds, and likewise affects the life of the tool, tending to destroy the cutting edges much sooner than when working under ideal conditions. The method of holding the work should be simple and effective, and convenient means provided for clamping the pieces in position.

Simple Jig Construction

In the construction of jigs and fixtures, efficiency is of first consideration, but as the cost of any device of this character must be carried by the particular job it is made for, it is advisable to make it as universal as the nature of the part will permit. It is often possible to design a fixture where the clamping section is distinct from its base which is used for securing to the revolving table. A little study should enable suitable work holding rings or regular sections to be secured to a standard base, thus lessening the initial cost of the fixture. In this way several top jig sections may be placed in position on the one permanent base.

Facing and Chamfering

The fixture illustrated in Fig. 1 shows a double-spindle vertical milling machine at work on automobile thrust blocks. Four cutters are used on each spindle, those on the rear spindle being spaced to mill the flats, while the cutters on the near spindle are arranged for beveling the edges as shown. It will be noted that the base of the work-holding fixture has six raised posts upon which the jig proper is located and held in position by a suitable cap screw in each of the six supports. It may be seen that the fixture is of the multiple duplex type where two rows are operated on at the one time. The clamps on top and bottom are similar, the bolt passing completely through with coil springs inserted to free the clamps from the work when the pressure on the clamps is removed. These thrust blocks are produced at the rate of 400 per hour.

Roughing and Finishing

The operation shown in Fig. 2 consists of machining the fork ends of gear shifting yokes. In milling these forgings the cutters on the rear spindle are

(Continued on page 50)

Illustration through courtesy of the Newton Machine Tool Works, Philadelphia.

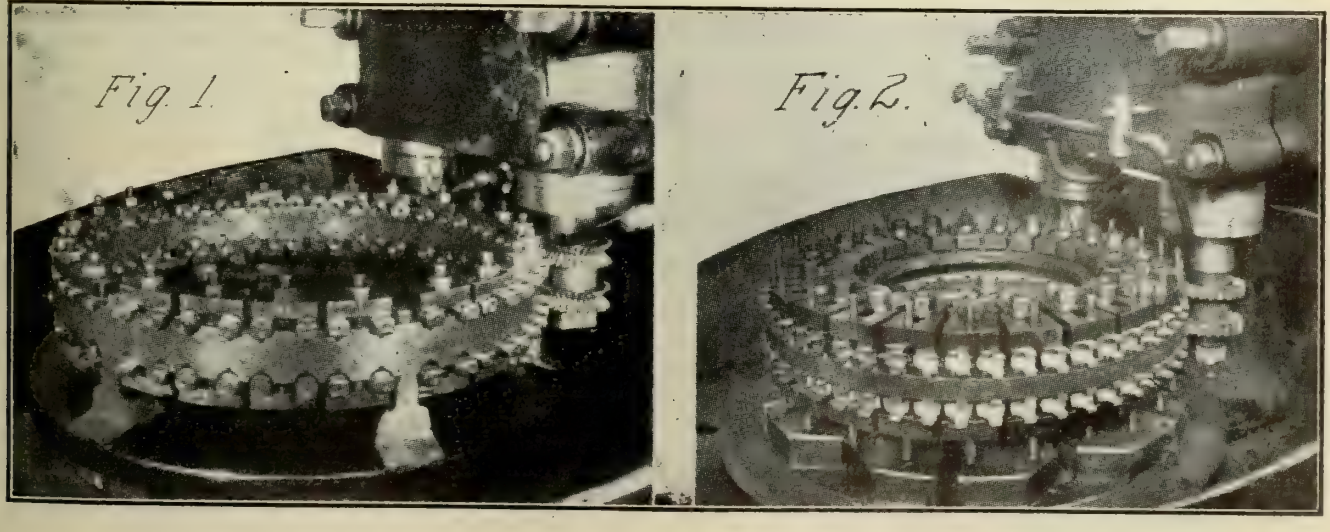


Fig. 1.—Continuous facing and chamfering of thrust blocks. Fig. 2.—Roughing and finishing fork ends of gear shifting yokes.

Introducing

JAMES GARLAND,
Supt. Dominion Engineering Works

MR. GARLAND comes from an engineering family, having served his apprenticeship in the shops of Henry Disston & Co., at Taconey, Pa. Upon the completion of his apprenticeship, he entered the shops of I. P. Morris & Co., at Philadelphia. At this time the development of power at Niagara in a large way, was just commencing. The Morris shops were building some of the first large turbines, and Mr. Garland's duties kept him in close touch with this work. He was soon given outside work erecting and installing machinery built in the shops. This work took him all over the Southern States, Porto Rico, Cuba, Mexico and Central America. A large number of sugar mills were installed in these countries by him, and in five years spent at this work he picked up a good knowledge of the Spanish language. Two revolutions occurred in Mexico while he was located there. The last one caused him to hastily vacate the country. Following this he was employed largely in installing hydro-electric units, having been engaged on some of the largest developments in the United States and Canada. Among the Canadian plants that he supervised are several of the installations at Niagara, the Cedar Rapids developments and installations at Shawinigan falls.

Mr. Garland was located at the Cedar Rapids plant when the war broke out. He was placed in charge of the Shawinigan Power Company's Acetone Plant at Shawinigan Falls. He superintended the installation of all the machinery and operated it throughout the war. This work was very strenuous, as fires and explosions were numerous. When the armistice was signed he went back to the I. P. Morris Co. as general inspector. In November 1920 he accepted the position of superintendent of the Dominion Engineering Works at Lachine, Que., in which capacity he is now employed. He came to Canada in 1904 and his first work was to install a 10,500 h.p. turbine at Shawinigan Falls. At that time this turbine was the largest powered turbine in the world. Only recently Mr. Garland built in the shops of the Dominion Engineering Works, and is now supervising the installation of, a 41,000 h.p. turbine. The case for this wheel was the largest steel casing ever made.

He is a member of the American Society of Mechanical Engineers. His chief diversion is motoring and during the season be puts his McLaughlin over several thousands of miles.

Fuel Oil In Growing Demand As Substitute For Coal

THAT THERE is an increasing demand for fuel oil for heating purposes, as a substitute for coal, is the statement made at headquarters of oil companies who are equipped to supply requirements in this field. There are already quite a number of large buildings in Toronto using fuel oil, chief among those of a public character being Osgoode Hall, and it is likely that, as a result of coal problems, the number will be increased very considerably this fall by public buildings, industrial plants and private dwellings. The persistency with which trouble each year associates itself with the coal supply causes a multiplicity of enquiries each season. Some of these install oil burning apparatus, but the great majority, on considering the initial cost, generally decide to pay the shot and continue with coal, hoping for the return of easier prices.

"It is this initial cost which causes much of the hesitancy in installing fuel oil," said the engineer of an oil company to Canadian Machinery. "In converting a heating system, the tank in which to store the oil is a big item. For private dwellings it is a mistake to install a one hundred gallon tank as some do, because this has to be filled frequently, as a rule, from barrels, and this in time becomes a nuisance. By installing a 1,000-gallon tank the problem is solved probably for the season, or, if not, a refill may be made direct from an oil wagon. The large tank may be placed underground outside and the oil is forced into the burners by a very small pump. There is no dust, no dirt in the cellar and no ashes to remove, and the lighting of the furnace becomes an exceedingly simple matter. We generally figure that one hundred and ten gallons of oil are equal to one ton of coal. This amount of oil at present prices would run about $11. It is thus seen that there is some margin in favor of oil at present prices and Osgoode Hall has a 10,000-gallon tank. This building burns, on an average, about 200 tons of coal in the winter season. Their tank would have to be filled twice in a season, depending on what was carried over as a reserve. In a large plant, when you consider the cost of handling coal and ashes, the help required in the furnace room and the dust which comes from that place, there is much to be said in favor of fuel oil. The same applies to private dwellings. In the planning of a new building the heating method very often calls for consideration of other fuel besides coal. An increasing number of engineering firms are devoting their attention to this problem."

From New York the report comes that fuel oil is becoming increasingly popular as a means of heating large office buildings but that engineers do not expect to see oil eliminate coal, as there is not sufficient low grade Mexican fuel oil in sight to supply such needs. Tankage, it is estimated, represents over 50 per cent. of conversion costs, but many residences in New York's suburban districts, where costs are not so high, are making the change.

Estimates of boiler efficiency in public buildings and industrial plants differ. One engineer states his hand-fired boilers formerly averaged 54 per cent. heat efficiency burning coal and about 78 per cent. heat efficiency at present with oil. Mexican fuel oil averages about 18,000 heat units, while coal runs between 11,500 and 12,000 heat units to the pound.

Owners of one of the big buildings using oil find considerable saving in cost of fuel and labor compared with coal. This building uses 1,640 gallons daily of 16-Beaume Mexican fuel oil at 4½ cents a gallon, a total fuel cost of $73.80 a day. When oil-burners were first installed 2,400 gallons daily were used, but increased efficiency reduced consumption.

Formerly this building used 15 tons of coal daily costing, at present quoted price of $15 a ton, $225 a day. At a normal average of $7 a ton, fuel bill would be $105 a day. In addition it has reduced its fireroom force from 14 to 10, a saving of $100 in labor. On top of this is elimination of ash removal costs which differ to the extent of ash content in coal used. Experience of management of this building was that its coal contained 17 per cent. ashes costing $180 a month to remove. Replacing old cans cost $100 a year, so that by eliminating items of ash removal and new cans annual saving of about $2,300 has been effected.

Other buildings and plants which used more coal have effected greater savings.

Practical Ideas From Practical Men

TAKING STRETCH OUT OF VERTICAL BELTS

By W. F. Schaphorst

Vertical belts give more trouble than others, because of the fact that as soon as the belt stretches, contact with the lower pulley is lost, and the power will not be transmitted. In the horizontal drive, stretch is easy to take care of, provided the belt is kept soft and pliable, with the right kind of belt dressing that not only dresses the surface but that penetrates, surrounds and lubricates every tiny fibre. It then becomes unnecessary to take up horizontal drives at all. Many drives are in daily use which have not been taken up for 18 years or more, and then they were taken up only because the belt became so slack that the slack side touched the tight side. Extreme slackness is as impractical as extreme tightness.

Where vertical drives are used, it is obviously impractical to permit slack running because it is necessary to continuously take up the belt stretch as the stretch occurs. One successful and economical method that has been brought to the writer's attention to constantly keep vertical drives in pulling condition is to have a number of "fillers" or "inserts" in stock already punched to match and ready for insertion and lacing. Thus, it is cut short by an amount depending upon the distance between the shaft centers. The belt man uses his judgment as to what this short cut should be. Let us say that he desires to make it 1 inch. He then selects a filler 7 inches long, of the same width as the new belt, and laces it into place either with rawhide or wire lacing.

In a short time the belt will stretch and will need taking up. The belt man then simply removes the 7-inch filler and replaces it with a 6-inch filler. After another week say, he replaces the 6-inch filler with a 5-inch filler, and so on until all of the stretch, or most of it, is taken out of the belt. The fillers can be kept in stock and used repeatedly. In this way there is no loss of belting material for example, when a belt is put on new due to taking up, nor is there any time lost due to the punching of new holes as they are already punched in the fillers. The writer does not recommend this filler method for horizontal or sloping drive, because he is a believer in the slack or easy drive, which gives a maximum arc of contact between the belt and pulleys, least bearing friction, and highest transmission efficiency.

MACHINING AIR COMPRESSOR PARTS

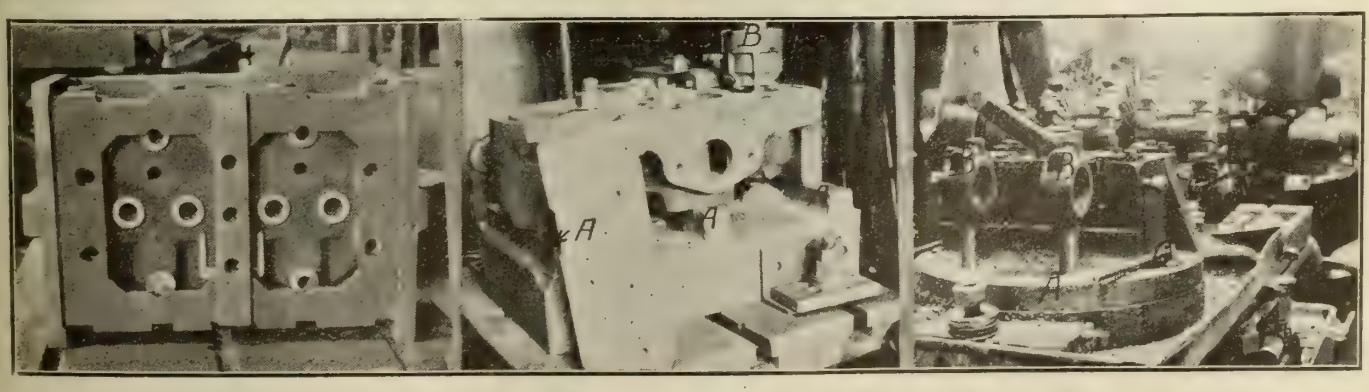
By Robert Mawson

The first operation on the compressor cylinder head here shown is the milling of the joint face used to attach the head to the cylinder. The casting is then placed into the jig shown in Fig. 1, being placed with the machined side down and held in position with the cover, which is fastened to the jig body by means of two wing screws. The jig cover is placed in the proper location in regards to the body, with two dowels at the opposite corners to the screws. A set screw then forces the piece back to the locating pin to bring the casting in the correct position for drilling. All the holes are then machined in the cylinder head for the holding down bolts, manifold screw holes, valve guide and spark plug holes. Guide bushings are provided in the jig for accurate and interchangeable production. Fig. 1 shows the jig turned on its edge, in position for drilling the holes for the manifold screws.

Fig. 2 illustrates the tool and method used to machine the valve seats of the cylinder head, which is the next operation. The casting is placed on the fixture shown, being located with the three machined pads A, the fixture resting on the drill table. Straps are used to hold the casting securely in position on the fixture. The special tool B is then fed into the valve chambers and this boring tool is provided with a pilot bar which fits into the valve guide holes machined in the previous operation. The boring bar B is made with six inserted cutters and it will be noticed that these are provided with bevelled edges or ends of 45 deg. The operation of feeding the bar down into the casting, therefore, machines the valve seat to the proper angle and the upper portion of the blades bore the valve chamber to the correct diameter. After the bar has been passed down once to the proper depth, which is determined by a stop on the machine, the bar is raised and transferred to the next valve opening and the operation repeated.

The next operation is grinding the valves into position, and for this work the valve is placed into the valve chamber after a portion of grinding compound has been placed on the bevelled seat. The valve is then oscillated on the seat until a good bearing is obtained. All four valves are treated alike and then marked to their proper positions where they were ground so that they will be placed in the same valve chamber when assembling the motor.

Fig. 3 shows a special fixture used when milling the large ends of the connecting rods. The forgings are located in the fixture by means of slots into which the small ends of the rods fit, these slots being in the plate A. The fixture is designed to hold four rods, two at B and two located in a similar manner directly opposite at the rear of the fixture. Four cutters correctly spaced are fastened on the machine arbor as shown and the machine table being fed along both sides of the connecting rods are machined. The machine table is then brought back out of the range of the cutters and the index pin C removed. The upper portion A is then revolved 180 degrees and as the moving portion of the fixture is provided with a register fitting in a machined recess in the fixed portion D the sliding element will move easily and in a concentric manner. The two connecting rods B are now in the proper location for the machining of them and the fixture is again located with the index pin C fitting in another hole 180 degrees from the former location and the rods are machined in a manner similar to that described for the



Jigs used in machining cylinder heads and connecting rods.

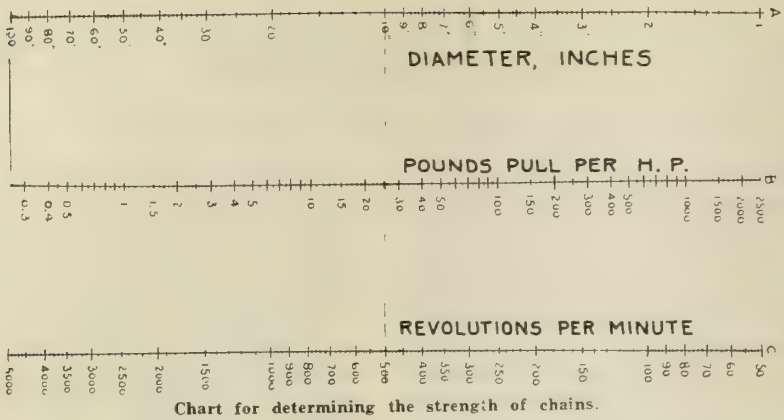


Chart for determining the strength of chains.

two rods previously milled. The advantage of this style of milling fixture is that the operation is practically continuous as while the machine is milling two rods the operator is placing another two rods into the fixture ready for machining; the only lost time being the revolving of the fixture between the milling operations.

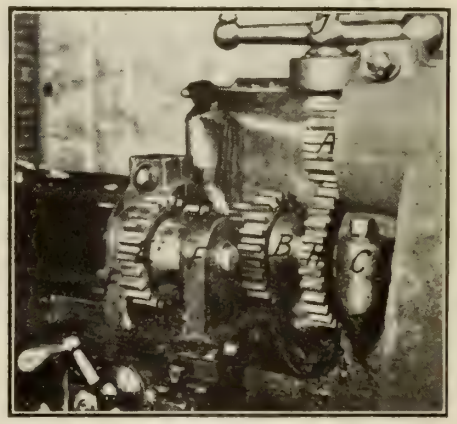
RUNNING-IN MACHINE FOR AUTOMOBILE TRANSMISSIONS

It is well known that gears which are intended to run together at any high rate of speed scarcely ever operate smoothly and silently. This is so through a number of causes; limitations in machining methods, even when these are the most modern as regards tools and manner in which the piece is held for the machining operation. If they are hardened we find that they will change in tooth outline and shape and will produce this unevenness of tooth contact.

To correct these faults the Premier Motor Co., Indianapolis, Ind., have designed and use the machine shown in the illustrations Figs. 1 and 2 to run together their transmission gears to obtain a smooth operating train. The driving gear of the set A is fastened to the driving shaft of the machine, the train of speed change gears is mounted on the same shaft that is used in the transmission and shown at B. This shaft is supported in brackets at each end C, at the opposite end to the driving gear being the other constant mesh gear D. Meshing into this latter gear is the gear E held on a shaft, supported in brackets, F.

The purpose of this machine is only to run-in the constant mesh gears, the sliding gears being made so they can be moved along the shaft and into mesh without friction. The gear E is brought into the proper tooth contact by means of the handle G which moves along the bracket holding the forward gear through the medium of a screw. The gear H which meshes with the driving gear is brought into tooth contact with the handle J which moves the bracket C up or down as desired until the proper engagement of teeth is obtained.

The obvious procedure is to adjust the gears A and H first and then set over the slide carrying the gear E. When the gears have been set, abrasive is placed onto the teeth and the machine started in operation until the gear teeth run together smoothly and silently. If the gear outlines are very much out of alignment the adjustments should again be made, bringing the gears further into mesh and the running-in operation repeated. This is often done at the plant as gears after the first running together will show too much back lash



Running-in Motor Transmission

and a smooth operating train with proper tooth contact can only be obtained by one or two adjustments and then running the gears together until the desired result is reached.

HOW MANY POUNDS PER HORSE POWER?

By W. F. S.

The accompanying chart will solve a multitude of problems that ordinarily are vexing indeed. All you have to do is—lay a straightedge across and there's the answer in the middle column. For example, I want a chain for a 10-inch sprocket running at 500 r.p.m. to transmit one horse power.

The dotted line drawn across the chart shows how it is done. Connect the 10-inch (column A) with the 500 (column C) and column B gives the answer immediately—25.2 pounds. In case a chain is wanted that will transmit 10 h.p., you would just multiply the answer by 10, which gives 252 pounds as the necessary strength. In the case of a belt drive, the chart can be used in the same way for determining "effective pull"—the difference in tension between the tight and the slack sides. For rope drives the effective pull is found in the same way. In other words, the effective pull on a 10-inch rope sheave running 500 r.p.m. must be 25.2 pounds in order to transmit one horse power. Knowing the effective pull, then, we can tell the manufacturer just how strong the chain, rope, belt or cable must be.

Whether the transmission medium is round, flat, square or triangular makes no difference. It must be "just so strong," and this chart gives the strength. Generally, after figuring the exact pull, we multiply by a factor of safety in order to be "sure" that the belt, or whatever it is, won't break. The factor of safety is "up to the designer."

LEVELLING WITH A HOSE FULL OF WATER

By W. F. S.

Not long ago I wrote an article describing a method of leveling by simply filling a hose full of water. Then by means of gauge glasses inserted into each end of the hose the exact level can be readily noted. This is an exceedingly good method for leveling shafting, foundations, floors, beams, etc. I am in receipt of a communication from a Californian who criticizes the method. He says he found it very hard to do. It occurs to me that my reply, which follows, may be of some value:

"I had a similar experience at first but I found that the best way to handle the hose it to keep one end fixed and to simply move the free end around. It is true that the job is a difficult one for one man although I have done it alone. However, I did not have any difficulty in getting the same results twice and cannot understand at this distance why W. S. should have difficulty in that respect. However, it may be that air got into the hose in which case a difference of levels would register or if there should happen to be a residue of oil or some other liquid in the hose the specific gravity of which might be less than the specific gravity of water such things would also influence the level and would make it absolutely impossible to do an accurate job with this kind of a level. Also now that W. S. has brought up the subject it occurs to me that a difference in temperature at one end would also influence the level but I believe such great differences in temperature seldom exist. However, if one end should be kept for any length of time near a radiator or near a steam boiler there would be considerable danger of differences in levels and the results certainly would not be reliable.

"The method of corking up the ends while moving the hose is all right, also the method of using valves instead of corks is all right, but during the leveling or after arriving at a point that is almost level the corks should be removed or the valves should be opened so that there will be no air pressure above the water level. The air pressure would, of course, tend to throw the water out of level."

New Things in Shop Equipment

BROACHING MACHINE

A new high-speed hydraulic broaching machine which is claimed to be capable of handling from 75 to 200 per cent. more work than any single or double-pull broaching machine of the usual type. The reasons for this increase in productive capacity are to be found in the higher speed available (360 inches per minute maximum), in the practically unlimited choice of speeds, and in the automatic control of the cutting and return strokes entirely independent of each other. Another advantage of the new machine is the decrease in the unit labor cost. The time required for a completed piece varies from 15 to 20 seconds, depending on the particular work to be done. Numerous tests have also shown that the unit power cost is lower than on other types of broaching machines. The overall efficiency is high, ranging from 70 to 90 per cent. No power is wasted in clutches, gears or screw drives.

The following actual production figures are typical of those that are being obtained on this and similar work. The work consisted of broaching four solid keys in a differential bevel gear, 1¼-inch bore, 2 inches long, and made of .22 carbon steel. The cutting speed was 288 inches per minute and the return speed 312 inches per minute. There were two broaches in the set and the draws per hour averaged 145. The maximum horsepower required was 5½ for a cutting time of 6½ seconds. On the same work, a screw machine produced 80 draws per hour. The cutting speed was 80 inches per minute. The maximum horsepower required by the screw machine was 8 for a cutting time of 23 seconds.

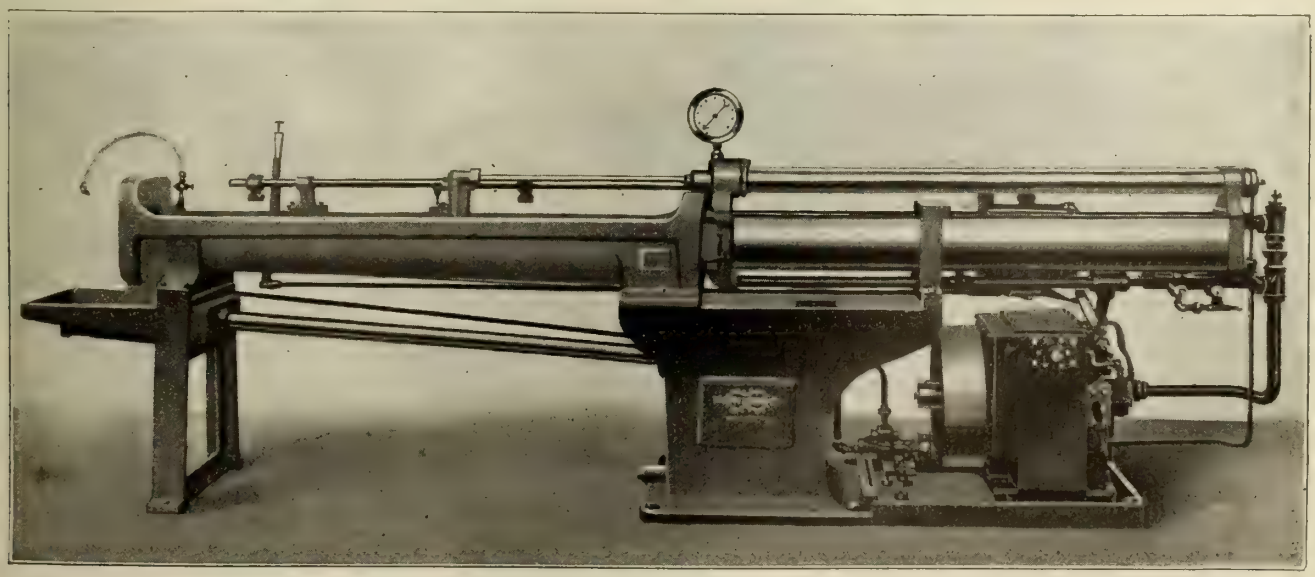
A variable-delivery pump, similar in design and operation to those used on oilgear variable-speed drives, delivers a perfectly steady flow of oil to a double-acting cylinder, whose piston rod is connected to a sliding head which operates on ways in a U-shaped trough of the usual design. The amount of oil delivered to the cylinder depends upon the length of the pump stroke and this length can be varied from zero to a maximum. As the speed of piston travel depends on the amount of oil pumped into the cylinder, this speed can be changed at will merely by changing the pump stroke. Right here it is important to note that it is primarily because of this method of controlling the speed, coupled with the even flow of oil delivered by this type of pump, that makes it possible to use high speeds. The cutting stroke is started without shock and the pull is steady.

There is practically no limit to the choice of speeds for either the cutting or return strokes within the limits of 48 inches and 360 inches per minute. Very slight variations are easily obtained. Exactly the right speeds may be selected for different materials and different broaches, higher speeds for light cutter bar work and slower speeds for heavier jobs. The speed of the return stroke is adjustable entirely independent of that selected for the cutting stroke. Automatic stops are provided; these can be set for any desired length of cutting stroke and this length will remain fixed. There is no overrunning and consequently no danger that the broach will be pulled beyond the reducing bushing and be caught on the reverse. Little effort is required to reverse the machine at either end of the stroke as there are no heavy clutches to shift. Simply pressing down on a small push button reverses the machine or the control may be set for automatic reversing. An emergency lever enables the operator to stop the machine instantly at any point of the stroke.

Quick-acting relief valves prevent the pulling apart or the buckling of a broach. These valves, one of which is placed on the cutting end and one on the return end, automatically relieve the pressure and stop the machine whenever it builds up to a predetermined point. In case a broach is caught during the cutting stroke, the relief valve, set for a pressure slightly greater than that necessary for the normal pull, will act and stop the machine before the machine or the broach can be damaged. Likewise, any excessive load on the return stroke will cause the relief valve on that end to act and stop the machine instantly.

These broaching machines are driven by vertical belts from line shafts or motors. When a motor is used, it may be mounted above the main cylinder on an adjustable support.

The principal specifications of these new machines are as follows: pulling capacity, 16,000 lb. (equivalent to that required by a 2-inch square broach designed according to standard practice); speed range for either cutting or return strokes, 48 to 360 in. per min.; stroke, 56 in.; diameter of hole in face plate, 5 in.; vertical adjustment of drawhead, 1⅝ in. above and 1⅝ in. below center; driving pulley, 600; motor size recommended, 10 h.p.; net weight, 2,900 lbs.; floor space required, 16 ft. long by 26 in. wide.



High Speed Hydraulic Broaching Machine.

AUTOMATIC WELDING MACHINE

An interesting type of automatic welding machine has just been developed and placed on the market. The torch is mounted at one end of a connecting rod that is moved by means of a crank at the opposite end. The path of the nozzle can be varied by altering the position of the pivoted guide, the welding flame having an elliptical movement when in operation. The entire machine may be given a motion at right-angle, to that imparted to the connecting rod. By manipulating the different adjustments the torch may be made to travel in a number of varied contours. The welding rod is fed automatically by gravity, as it passes through the centre of the torch and welding tip. The oscillating motion is very suitable for seam welding. When heavy pieces are being welded an additional torch precedes the welding torch for preheating purposes. The machine is arranged for two speeds, one by friction wheel and disc and the other by rheostat for motor control. This latter provides for speed variation when welding parts of varying thickness. These welders are made by the General Welding and Equipment Co., Boston, Mass.

TOOL GRINDING MACHINE

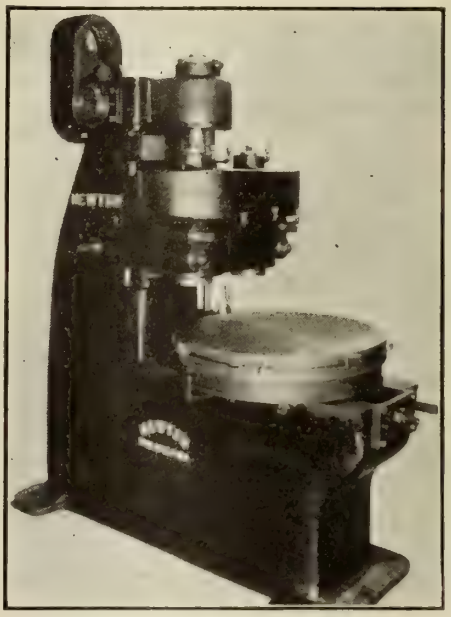
An imported machine especially designed for grinding lathe, planer, shaper and slotter tools, has recently made its appearance on the market. The machine is also supplied with attachments for grinding milling cutters and twist drills. It is claimed that high speed tools can be ground without developing cracks on the cutting faces or softening the edges. The operation provides for automatic traverse of the tools over the face of the wheel. A worm gearing and adjustable connecting rod beneath the machine provides the necessary reciprocating motion. The slide rest mechanism permits of motion either parallel or at right-angle to the wheel face. Automatic or hand feed may be used. Gauges are provided for setting to desired angle of inclination and to proper height for grinding. The grinding compound is contained in a tank at the base of the machine and is circulated by means of a Brown and Sharpe pump. The speeds are 2,000 r.p.m. for large wheels and 6,000 for small ones. An automatic stop prevents the wheels from overspeeding. The machine is made by Hotchkiss Co., Paris, France, and is marketed by J. B. Corrie and Co of London, Eng.

SOFT METAL MELTING FURNACE

A gas furnace which has a removable cast-iron pot with a capacity of 150 lbs. of metal has recently been placed on the market. The gas is delivered to the furnace through three bunsen burners and it is claimed that a temperature of 2,250 deg. F. can be developed with a consumption of 40 cu. ft. of gas per hour, and this heat maintained by the use of two burners. Shut off valves, pilot lights and regulators are fitted to each burner. Regulators may be adjusted to suit varying qualities and pressures of gas and it is stated that a solid jet of gas can be sent up the centre of the mixing tube with great pressure and without the use of a forced air blast or blower, producing a flame of high temperature. These furnaces are made by the Johnson Gas Appliance Co. of Cedar Rapids, Iowa.

CONTINUOUS MILLING MACHINE

A vertical machine especially designed for continuous operations on small parts has been placed on the market. The machine is equipped with a splash tub when using cutting lubricant. The illustration herewith shows the machine with the tub removed, in order to clearly show the controlling dogs used on the intermittent motion.



Continuous Milling Machine.

The table has two separate and distinct types of feed motion; the first for straight continuous milling, the other being intermittent feed and rapid traverse, in which the rapid traverse is at a ratio of 10 2/3 times the feed for limited quantities or where the surface to be machined is less in area than the casting itself. This table is of the solid top, arranged for bolting and dowelling the jigs; has two bearings, one being an annular bearing so that the table only overhangs the saddle ⅝ in., making any twisting or buckling impossible. The table is rotated by helical gear fully enclosed, and this gear, together with the table bearings, runs in oil. The pinion operating the table and helical gear is rotated by a large diameter worm and worm wheel, and with this combination of gearing all back lash is prevented. The feed motion is supplied with lever for disengagement and with safety clutch of the overrunning type to prevent breakage in the event of overloading or jamming the machine in any manner. Table feeds are variable through the use of pick-off change gears. Table saddle is adjustable on the base, providing ability to position the table in relation to the cutters. Spindles are of taper end construction with face keyway, Morse taper hole and draw-in bolt; are driven by hardened steel gears and supported between bearings fully enclosed to run in oil. The sleeve in which the spindle is confined provides an individual end adjustment for setting cutters of 2 in., with of course provision for clamping after it is located.

The motor is mounted on top of machine, driving through pick-off change gears to provide variation in spindle speeds. The various dimensions of machine parts are as follows:—Table, 30 in. dia.; maximum height of table top to underside of spindle faces, 12 in.; cutter capacity up to 10 in. Motor is of 7½ h. p. This machine is made by the Newton Machine Tool Works, Inc., Philadelphia, Pa.

INSIDE MICROMETER AND HEIGHT GAUGE

A low range inside micrometer having measuring facilities from 2 to 7 inches has been placed on the market. Additional rods may be provided to increase the range to 32 in. Ample provision is made on the barrel and thimble for wide graduations and comparatively large figures. By means of a small base block the device can be conveniently converted into a height gauge. The rod passes through the hardened base until it rests on the surface from which the measurement is to be taken. The rod is held in a vertical position and firmly in place by means of a quick-clamping knurled nut, easily operated with the fingers. The V-shaped groove in block provides for operation on cylindrical shafts for alignment purposes. These tools are made by the Reed Small Tool Works, Worcester, Mass.

MULTI-SPEED MOTORS

A line of multi-speed A. C. motors has recently been placed on the market. These machines are designed to supply speeds ranging from 600 to 1,800 r.p.m. Motors may be obtained for constant horsepower, constant torque or any required combination of both in two, three or four speeds, selected from 600, 720, 990, 1,200 and 1,800 r.p.m., either for circuits of 60 cycles or other frequencies and of either two or three phase. It is claimed that the speed control apparatus is suitable for both automatic and remote control. These motors are manufactured by the Mechanical Appliance Co. Milwaukee, Wis.

ANGLE PLATES

The Milliken Machine Co. of West Newton, Mass., has placed on the market a line of angle plates made in seven sizes and are planed on the outside surfaces and edges. They range in size from 3 x 3¾ x 3¾ in to 12 x 12 x 12 in. The intermediate sizes have one stiffening rib while the largest sizes are fitted with two ribs.

CANADIAN MACHINERY
AND MANUFACTURING NEWS

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B. C. Wants To Compete

"WHY should the legislature have to guarantee bonds to the extent of four million dollars to establish the industry?" asks the Winnipeg Tribune with reference to the proposal to establish a fifteen-million-dollar steel corporation in British Columbia. The paper expresses the opinion that existing steel mills can turn out more steel than the world can use, except for special occasions, and claims that there is more urgent need for a satisfactory supply of domestic fuel. There is something in the contention from the point of view that there is more stability in well-balanced industrial development than in concentrating along lines which overstrain the possible market. In that event something must break or wait. However, it is evident that British Columbia feels itself isolated and dependent as a buyer of iron and steel, and their products, and that there is something that appeals in being in a position to compete. It is pointed out that government aid is conditional upon a full investigation as to the possible supply of raw materials, management and methods of financing and prospects of success. The Western market for agricultural implements and other products, the marine and mining industries, together with export possibilities, combine to make the proposition an attractive one to the British Columbians. The question they are undoubtedly investigating most seriously is, Will the possible market guarantee the success of such an industry at the present time?

Labor Wants More Compensation

DURING the recent labor convention in Montreal, certain extensions to the Workman's Compensation law were recommended. Every worker engaged in the building industry it was argued should come within the scope of the compensation law, and it was held, further, that the compensation should be increased from 66 2-3 per cent. to the full extent of the wage.

This latter proposal represents one side of the question. Judging from the statistics presented in the last annual report employers will hardly take kindly to further increases in that respect. It is unfortunate that a certain amount of prejudice has developed largely as the result of conditions following hard upon the war when much was heard of high wages for poor values, and when there were frequent complaints as to malingering. These abuses are disappearing as workmen recognize their personal and relative responsibilities and as unscrupulous medical advisers are being eliminated. Employers, however, will declare that there is such a thing as reasonable limits.

The extension of the Act in respect to the building industry immediately suggests difficulty of operation, even if changes were acceptable. Some very absurd problems could easily develop, and the operation of the general assessment system to work in with the requirements of the compensation laws might become quite an intricate piece of business. Yet, a great many accidents occur in connection with odd jobs where no person at present admits responsibility. It would seem advisable that there should be some regulation applying to such cases.

Ford Uses Strike Weapon

THERE is considerable speculation among business men as to what may or may not be in the background of Henry Ford's move to close his plant September 16. There is always more or less conversation when Ford does anything and it has always developed that what he proposes to do generally happens, with very little variation. Imagination weaves many fantastic stories around Ford and his plant, his motor car and its future. At the present time there are those who declare that the number of cars actually in stock will make it an easy matter to suspend operations for the time being, and that present labor troubles enable him to present a plausible excuse. Those who have had any business dealings with the flivver magnate, however, do not hesitate to credit him with sincerity in the present instance, and that his position is just so strong that he can deliver quite an impressive demonstration of the significance of a strike on the part of a manufacturer against coal profiteering. He is out to prove that it is a poor rule that has only one application, and if successful he will have done a real service to industry generally.

Safety Lessens Wastage

AT A RECENT safety congress, where methods and policies in the reduction of industrial accidents and fatalities were considered, one fact had particular prominence, namely, that a certain responsibility devolves not only upon the safety engineer, superviser or foreman, but upon the rank and file of employees themselves. Carelessness in organization and in instruction, it was shown, made for great wastage of life and limb, time and money. On the other hand it is shown that when every precaution is observed, the results proved well worth while and were such as to enlist the co-operation of those concerned. It was easily demonstrated that there was lessened wastage through accidents and compensation costs and that there was not only increased production but lessened costs of production.

It is another instance where employees ignoring old-time practices and prejudices, have developed considerable benefit for themselves by working with their employers rather than merely for them or preferring to recognize no relative responsibility.

Steel Market Advances all Along the Line

Bars, Boiler Tubes, Skelp Move Upward—Deliveries Prove Serious Problem—Bookings Fairly Good for Structural and Motor Car Business—Montreal Reports Demand for Heavy Scrap Following Scarcity of Pig Iron—Some Remarkable Advances Since June

RAILWAY SHOPS NEED NEW EQUIPMENT

ADVANCES all along the line in iron and steel are the order of the day. This is the result, it is declared, of wage rate increases and the general upward trend in all factors having to do with production. Deliveries are the problem. It is declared that, at this distance from central markets, there can be no conception as to the difficulties that confront shippers. Much business is booked for Toronto for the structural and motor car business alone, and while there are instances of good work in laying down the goods here, these are regarded as exceptional. What the situation must be at points whence many sections of the continent have to be served, it is hard to imagine.

Notable examples of increases during the week are skelp, used in making pipe, which advances $8 per ton, while boiler tubes score a boost of 20 per cent. Reports from Pittsburgh show reductions of three points of discounts on lap welded and seamless boiler tubes. This amounts to $6 the ton. Makers of charcoal iron boiler tubes have issued a new card, on which discounts on all sizes have been reduced seven points. An increase of $14 per ton in boiler tubes is an item on which advances have been expected for some time. Announcement of an advance of ten cents on steel and iron bars has been made. At $3.35, this represents an advance of 60 cents since June. This is fairly representative of the movement in the market at the present time. Still the demand continues to show encouraging strength.

Montreal reports that the close of August showed an improvement and that the month on the whole measures up favorably with those preceding. Here too, it is noted that deliveries are a handicap. Imports from British mills are increasing. Practically all of the galvanized sheets and much of the blue annealed are coming from that source. Some Scotch pig iron is available in the Montreal market, but the situation in this department is responsible for a demand for heavy scrap.

Toronto

Sept. 6.

WITH pig iron ten dollars a ton higher than the quotations of eight weeks ago iron and steel bars, forty cents per hundred pounds higher and showing a boost this week of 10 cents; skelp $8 per ton higher, while wrought pipe has advanced $4 and likely to go the full distance indicated by raw material; boiler tubes higher by 20 per cent.; sheets of all kinds showing marked advances and many items in the metal list tending upward, buyers must feel that all predictions and all warnings as to a disturbed market have just about been fulfilled.

The pig iron situation shows a more or less helpless response to scarcity of coal, difficulties of deliveries and upward moving wage lists. Supplies of pig on hand have been pretty well covered by contract, and he is a fortunate buyer who landed on the ground floor when the price was around $28 a ton. With Hamilton and Port Colborne furnaces out, and Algoma with limited capacity, furnaces coming into the market for spot or future are going to find a difference. It would not be surprising to find eastern and Scotch pig invading the Western Ontario market, for there is some problem even about deliveries from Buffalo. Given the makings on one hand there is the question of transportation; given transportation, there is again the question of price, and over against that there is the danger of conservative buying and curtailment of operations due to coal scarcity. The situation, however, is not without hope. As one manufacturer puts it, "Everybody seems ready to go, the crop outlook is splendid and the general feeling is that the time is at hand when industry should hit a regular stride. We hope that time is not far off."

Algoma, No. 1, car lots on tracks, nominal quotation	40 80	....
Summerlee, 5-ton lots, warehouse	38 50	33 50
Summerlee, 30-ton lots, dock	33 50	....
Carron, 30 ton lots, dock	35 00	....

The 20 per cent. wage increase by the U. S. Steel Corporation has become general among the large steel corporations but as yet no general price advance has occurred. The increase of 25 per cent. some weeks ago is sufficient for the moment, but the last quarter may see revisions upwards.

One change, long predicted, has at last arrived—an advance of 20 per cent. is announced on boiler tubes. There is said to be scarcity in stocks on Toronto market in this department and some variance in quotations in different quarters. The advance should at least make for stability.

Bars and sheets, which have for weeks been most active on the list, still reflect an active demand. The advance of ten cents on bars is another step nearer the maximum of $3.40 set by those who claim that market conditions warrant higher prices. However, more conservative sellers have adhered to slightly lower levels. With steel bars quoted at $2.70, Chicago warehouse, the spread as between that point is estimated at from 65 to 70 cents. The sheet market is active but inclined to be more spasmodic than one month ago, indicating, it is said, that fair stocks have accumulated in anticipation of the present situation.

Large importers say the demand still holds for structural shapes and bars, and that the automobile industry is also taking fairly large quantities of material. Deliveries however, are not improving. Following are selections from local quotations:

Iron bars	3 35	3 40
Steel bars	3 35	3 40
Reinforcing bars	3 35	3 40
Steel hoops		4 50
Tire Steel		3 40
Spring steel	7 00	14 00
Band steel, No. 10 gauge and 3-16 in base		3 75
Small shapes		3 40
Sheets, black, No. 28		5 00
Sheets, blue ann., No. 10		4 05
Canada plates, dull, 52 sheets		5 75
Caanda plates, all bright		6 00
Galvanized Sheets, No. 28		6 35

Scrap metals remain quite inactive. No price changes have occurred that might be said to indicate a decided movement. Mills evidently have no desire to load up to any extent with cast iron scrap and the price has shaded 50 cents a ton, but this has little or no significance as to the general market. Current prices follow:

Copper, light, per 100 lbs.	9 00
Copper, crucible	11 50
Copper, heavy	11 25
Copper Wire	11 25
No. 1 compositon	9 00
New brass cuttings	6 00
Red brass turnings	6 50
Yellow brass turnings	5 25
Light brass	4 50
Medium brass	6 00
Scrap zinc	3 60
Heavy lead	4 50
Tea lead	3 00
Aluminum	11 00
Boiler plate, per gross ton.	9 00
Heavy melting steel	10 00
Axles (wrought iron)	20 00
Rails (scrap)	11 00
Malleable	10 00
No. 1 machine cast iron	20 00
Pipe, wrought	7 00

Non-ferrous metals have not been conspicuous features of the market for some weeks and there is very little variation in prices. Quotations of from $17.50 to $17.75 for copper represent a firm level. Tin, spelter, lead and antimony are fairly strong, and a little easing is apparent in antimony at $21. Quotations around which business is being done, follow:

Lake copper	17 75
Electrolytic copper	17 50
Castings, copper	17 00
Tin	37 00
Spelter	8 00
Lead	8 00
Antimony	8 50
Aluminum	21 00

Machine tool business, during the latter part of August showed no improvement. "We are selling some tools," seems to be the general report. A machine here and there is being sold, with an occasional sale that is declared to be worth while—this is characteristic of the market. Woodworking machinery is showing nice business, and supply departments show fairly good records. Displays at the Toronto Exhibition are attracting considerable attention and a few sales are reported. Railway shops appear to be promising ground for machinery salesmanship. A representative returning from an inspection of important shops recently reported, "They need machinery, but the time doesn't seem to have arrived for a final o.k. The government is cautious in its buying for railways and the C. P. R. have apparently adopted a similar policy. One of these days they will release some good business."

In the malleable fitting list it is predicted that dealers' discounts may have a slight reduction. At present it stands at seventy and five. The five may disappear.

Quick Changes Feature the Market

No sooner is an advance announced of $4 a ton in the pipe market than skelp, used in large quantities, is advanced to $42 a ton, a boost of $8. Deliveries on this material are difficult. Further advances in the finished article are predicted.

A slight reduction has been recorded in turpentine, the price per gallon in barrels being $1.65. Raw linseed oil is posted at $1.01 per gallon, barrel lots.

Pittsburg

Sept. 6.

THE upward swing in pig iron and steel prices continues, and with greater speed. There is the double influence of material being scarce and of sellers, as indicated in the report of a week ago, having concluded that there is no use trying to hold prices down, in the interest of stability, for the astonishing victory of the United Mine Workers and other labor matters, have forced inflation into the situation. Th individual now feels that a reaction is inevitable some time, followed by a serious depression, and that meanwhile the only reasonable course is to secure as high prices as possible. As to when the break will come there is a wide range of predictions, from say two or three months up to a year.

Of particular interest in this connection is the appearance that the United States Steel Corporation is not making its usual effort to hold prices down. The corporation does not originate price advances, but shows little hesitancy in following advances, once made, by the independents. In 1920, and in the fore part of 1917, the corporation was very conspicuous in holding its prices at levels far below what was obtainable in the open market.

Coal and Coke Strikes.—Following the "Cleveland settlement" by which about 15 per cent. of the bituminous coal capacity formerly union signed the 1920-22 wage scale of the United Mine Workers for a period up to April 1, next, various individual operators or districts held out for a time, there being a drift towards signing. The Pittsburgh district held out the longest. On one day, after the Pittsburgh Coal Company had withdrawn, the Pittsburgh Coal Producers' Association decided to sign, and the next day the Pittsburgh Coal Company also signed, whereby the regular union bituminous coal strike was practically over, with a tremendous victory for the miners.

As to the strikes in the Connellsville region, which the trade has been calling "nonunion" since the region has been nonunion for over 30 years, but which the strikers considered union as they had suddenly joined the United Mine Workers by paying $1 or $2 each initiation fee, the posting notices, August 22 and 23, restoring the scale of September 1, 1920, the record high scale of the region, did not stop the strikes instantly. Various meetings were held at which resolutions were passed to hold out for union recognition. Men drifted back to work in somewhat larger numbers than formerly. Day by day the trade watched the situation, but considered the strikes still in force, to an extent. September 1 came an almost comical denouement, for on that day car shortages were serious. There remained many strikers but the available jobs were filled. Actual shipments of coal and coke have simply increased somewhat more. They have been increasing more or less since last May. They are not large now, in proportion to requirements, and since September 1 the market has been stiffening. Connellsville steam coal is $4.75 to $5.25, furnace coke $11 to $12 and foundry coke $13 to $13.50, all per net ton f. o. b.

The Shenango Furnace Company picked up enough odd lots of coke, at $10 to $11, to enable it to resume at one small furnace, but as this is on Bessemer iron to be delivered molten on a long term contract with an ingot mold foundry, it does not affect the merchant iron situation. Merchant furnaces in general cannot pick up enough coke with which to resume, irrespective of prices.

The pig iron market remains one of spot or prompt shipment, practically out of stock. Bessemer is up, on small sales, $2 a ton to $34, valley. It is said basic could not be had under $30, valley, but there is no likelihood any could be had at that figure. As to foundry iron the last valley foundry was sold some time ago and consumers have had to go farther afield. A couple of days ago a transaction occurred disclosing the situation plainly. A consumer in Pittsburgh wanted about 400 tons of foundry iron, and had to buy it in Buffalo, paying $34 at furnace. Adding freight to Pittsburgh and deducting freight from the valleys makes a valley equivalent of approximately $35 50, or $2.50 above the valley market previously quoted. Last March the valley market was $19.

Steel Production.—While coal production is increasing it can hardly increase to anything like the level of requirements, on account of transportation limitations, and steel producers and consumers are not given sufficient preference in the railroad distribution to improve their supplies much, while the few remaining stocks of coal have been playing out. It is a question whether the rate of steel production will be materially higher 30 days hence than it has been in the past week or two, when the rate of steel mill operation in general has been between 50 and 55 per cent., or say a little over 25,000,000 tons of ingots a year. The maximum this year was between 70 and 75 per cent., reached late in June, with an ingot rate of about 37,000,000 tons a year. It is doubtful whether such a rate will again be attained at any time this year.

Small lots of sheet bars have gone at $40, following a recent sale of 2,000 tons at $38. In the first quarter of this year the market was $29. Still higher prices are predicted. One mill is "asking" $45 for sheet bars. Billets and slabs show no movement and can be quoted nominally at the same level as sheet bars. Wire rods have sold at $43 as a special accommodation, the usual asking price being $45.

The minimum on bars, shapes and plates went up from 1.80c about ten days ago to 1.90c on bars and 2.00c on shapes and plates, but it is difficult to buy at these figures, and then the delivery would be far in the future. The regular going market on all three products is really 2.25c, for ordinary deliveries, while plates for shipment in two or three weeks are bringing 2.50c quite readily.

Since the American Sheet and Tin Plate Company's advance to a basis of 3.35c for common black sheets, independents generally have gone to 3.50c, with prospects of their going higher, as the leading interest has not been selling in the open market, merely allocating tonnages to regular customers.

Recently independent wire mills advanced plain wire $2 a ton to 2.35c and nails 20 cents a keg to $3.60. The leading interest is now selling at these prices but has not made its usual formal announcement of a price change.

Hoops, bands and hot rolled strips are now firm at 2.75c.

Manufactured steel products show a sharp advancing tendency, due to the double influence of the hot rolled raw material being higher in price and of deliveries being very poor. Spikes are up $5 a ton to 2.75c for standard railroad spikes and 3.25c for small spikes and boat and barge spikes. Cold finished steel bars have advanced from 2 25c to 2.50c. On cold rolled strips 4.00c has disappeared, 4.25c now being the minimum. Rivets and various other commodities are predicted to advance shor ly.

Montreal

Sept. 6.

ALTHOUGH reports from various quarters during the last two weeks of August led one to believe, that when the total figures for the month were known, that they would be lower than those of July, quite a number of jobbers state that August business compares very favorably with those of previous months.

Steel deliveries are gradually getting more distant, and stocks are getting thinned out slowly. Prices have not advanced during the week, and material to cover all orders has been forthcoming.

Pig iron is the feature on the local market. It is daily getting harder to obtain and quotations are going up. Machine tools are quiet and there is not much movement in non-ferrous metals. The scrap metal market is a little more active and some quotations are advancing.

Iron and Steel.—Outside the fact that supplies are getting more difficult to obtain, conditions have remained much the same as last week. Merchant bars and structural steel are moving somewhat slower than during the past few weeks. Plates have been very quiet. Sheets continue to be very active, but the demand is slackening off somewhat, as the fall demand has not made itself apparent as yet. Small steel products are moving well. Practically all the galvanized sheets and some of the blue annealed sheets are coming in from British mills. More or less steel is being imported from the United States, and at the same time the local mills are doing a nice business. Quotations remain the same as last week. The mills charge $2.60 base to the large consumers and $2.70 base to the jobbers and contractors. With the increased wage to steel workers operative as from Sept. 1st, and the generally unsettled conditions, there is no doubt but that higher prices for steel are to be expected. The following are the local quotations.

Iron bars, base	3 15 to	3 25
Steel bars, base	3 15 to	3 25
Reinforcing bars, base	3 15 to	3 25
Steel hoops		4 25
Tire steel	3 25 to	3 40
Spring steel		7 00
Band steel, No. 10 gauge and 3-16" base	3 65	3 75
Small shapes		3 40
Sheets, black, No. 28		4 40
Sheets, blue ann., No. 10		4 05
Canada plates, dull, 52 sheets		5 50
Canada Plates, all bright		7 00
Galvanized Sheets, No. 28		6 50

Pig Iron.—Supplies of pig iron are very scarce. The Canadian furnaces are not attempting to get any new business as they are short of coal. Their present supplies are not more than sufficient to carry them through orders already booked. Summerlee iron is being offered in small lots, and it is expected that Carron will be on the market any day. The nominal quotation of Canadian furnaces is $40.80. Buffalo quotations on track Buffalo for delivery in Ontario are $36.00 plus freight and duty. Algoma Steel Corp. have ten thousand tons in their yards at the Sault, but it is all contracted for, and will be shipped within six weeks. Local quotations are as follows:

Algoma, No. 1, car lots on tracks, nominal quotation	40 80	.....
Summerlee, 5-ton lots, warehouse	38 50	38 50
Summerlee, 30-ton lots, dock	33 50	.....
Carron, 30-ton lots dock	35 00	.....

Machine Tools and Supplies.—The machine tool markets continue to be very quiet, but few sales having been made for several months. There are a few more inquiries for small iron working tools coming in lately. It is hoped that these are the forerunners of better business. Woodworking tools are moving somewhat better, although this movement is not brisk.

The supply business is improving slightly, having to a certain extent recovered from the small falling off noted late in August. Prices remain unchanged.

Non-Ferrous Metals.—Trading in non-ferrous metals has been rather quiet during the week. Reports from London markets indicate a tendency toward stiffening quotations. To a certain extent this is offset by unsettled business conditions in Europe. Locally the outlook possesses possibilities that might react for an improvement. Local quotations are as follows:

Lake Copper	17 75
Electrolytic Copper	17 50
Castings, Copper	17 25
Tin	35 50
Lead	7 00
Spelter	8 75
Antimony	6 25
Aluminum	22 00

Scrap Metals.—Coincident with the scarcity of pig iron, a demand for heavy scrap has appeared locally.

There have been somewhat better prices ruling and the demand in many lines is better.

Prevailing quotations are as follows:

Copper, light per 100 lbs.	9 00
Copper, crucible	11 50
Copper, heavy	11 25
Copper Wire	11 25
No. 1 composition	9 00
New brass cuttings	6 00
Red brass turnings	6 50
Yellow brass turnings	5 25
Light brass	4 50
Medium brass	6 00
Scrap zinc	3 50
Heavy lead	4 50
Tea lead	3 00
Aluminum	11 00
Boiler plate, per gross ton	9 00
Heavy melting steel	10 00
Axles (wrought iron)	20 00
Rails (scrap)	11 00
Malleable	10 00
No. 1 machine cast iron	20 00
Pipe, wrought	7 00

SALES TAX ON USED MACHINES

Dealers in machine tools declare that some misunderstanding exists as to the application of the sales tax, where an old machine is turned in as part payment on a transaction. The department of Customs and Excise has ruled that when a manufacturer or wholesaler in selling goods takes back an old machine in part payment and makes an allowance for same off in the selling price, the sales tax applies on the selling price without any deduction for the allowance. Thus if the selling price of the goods is $1,000, and the purchaser turns in an old machine or, in fact, any goods for which an allowance is made, say for example $200, sales tax applies nevertheless on the selling price of $1,000. Where a manufacturer sells and delivers from his factory a second hand machine the department of Customs and Excise regards him as a wholesaler in respect of such sale and he is required to charge and account to the Government for a sales tax of 2¼ per cent. thereon. For example, a manufacturer may take into his factory warehouse an old machine in part payment for a new machine, and when selling the second hand machine, so accepted as part payment, the manufacturer is regarded as a wholesaler and the sale is subject to a tax of 2¼ per cent. Note—Where a manufacturer sells equipment discarded from his factory such sale is not regarded as taxable under the Act. This is by reason of the fact that the manufacturer when buying machinery and equipment for his own plant is regarded as a consumer and such sales do not come within the meaning of the Act.

Scrap—The Department of Customs and Excise has ruled that scrap sold by a concern which is a consumer thereof when the goods are purchased, is not subject to sales tax when sold by such concern. This is to say, when a manufacturer is selling scrap or waste, being the deteriorated material of his scrap equipment or otherwise, but in respect of which he was rated as a consumer at the time of his purchase, the sale by him in the condition of scrap or waste, is not subject to payment of sales tax.

MACHINE TOOL EXHIBIT

A machine tool exhibit that will be of special interest to shop-superintendents, purchasing agents, master mechanics and the general public will be held in the Mason Laboratories, New Haven, Conn., on Sept. 21, 22 and 23 under the auspices of Yale University and the Connecticut section of the American Society of Mechanical Engineers. The exhibition should prove of material value to the manufacturer for it will really be the first time they have ever been able to show their goods on a large scale. There will be talks each day on the most important features of the exhibit and the talks will in most every instance be illustrated with motion pictures.

Sawmills for Poland.—The enormous forests of Bialowieza in Poland, containing thousands of acres of uncut timber, are attracting the attention of British concerns, who are negotiating for leases. United States concerns, that are interested, have also sent an agent to Warsaw, who in company with H. A. Smith, trade advisor to the American legation at Warsaw, is now on a tour of inspection of the forest lands.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Toronto price:—

Silicon, 2.25% to 2.75%	39 30
Algoma, No. 1, Montreal,	40 80
Summerlee, Scotch, Montreal dock,	33 50
Summerlee, Warehouse, 5-ton	38 50
Carron, Montreal docks	35 00
Grey forge Pittsburgh	34 76
Lake Superior, charcoal. Chicago	36 15
Standard low phos., Philadelphia	35 00
Bessemer, Pittsburgh	34 76
Basic, Valley furnace	30 00

METALS

	Montreal	Toronto
Lake Copper	$17 75	$17 75
Electroylic Copper	17 50	17 50
Castings, Copper	17 25	17 00
Tin	35 50	37 00
Spelter	8 75	8 50
Lead	7 00	8 00
Antimony	6 25	8 50
Aluminum	22 00	21 00

Prices per 100 lbs.

BILLETS

F. O. B. Pittsburgh

	Per gross ton
Bessemer billets, 4 in. x 4 in. and larger	38 00
Open hearth billets	38 00
O. H. sheet bars	38 00
Forging billets	45 00
Bessemer rods	45 00

IRON AND STEEL

Per 100 lbs. to large buyers

Iron bars, base, Toronto	$3 35	3 40
Steel bars, base, Toronto	3 35	3 40
Small shapes, base		3 40
Iron bars, base, Montreal	3 15	3 25
Steel bars, base, Montreal	3 15	3 25
Reinforcing bars, base	3 35	3 25
Steel hoops		4 50
Spring steel	7 00	14 00
Band steel, No. 10 gauge and 3-16 in. base		3 75
Chequered floor plate ¼" and heavier		7 00
Bessemer rails, heavy, at mill		2 35
Steel bars, Pittsburgh mill prices		2 25
Tank plates, Pittsburgh mill prices		2 25
Structural shapes, Pittsburgh mill prices		2 25
Steel hoops, Pittsburg		2 75

F. O. B. Chicago Warehouse

Steel bars	2 80
Structural shapes	2 90
Plates	2 90
Small shapes under 3-in.	2 90

PLATES

Plates, 3-16 in.	$3 75	$3 50
Plates, ¼ up	3 25	3 40

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$5 40	$5 00
Sheets, blue ann., No. 10	4 25	4 05
Canada plates, dull, 52 sheets	5 50	5 75
Can. plates, all bright	7.00	6.00
Galvanized sheets, No. 28		6 35
Queen's Head, 28 B.W.G.	7 25	
Fleur de Lis, 28 B.W.G.	7 00	
Gorbal's best, No. 28		
Colbornes Crown, No. 28		
Premier	6 85	6 35
Premier 10¾ oz.	6 85	6 75
Zinc sheets	9 25	11 00

FREIGHT RATES

	Per 100 lbs. C.L.	L.C.L.
Pittsburgh to Following Points		
Montreal	52	65½
St. John, N. B.	76	96
Halifax	77½	97
Toronto	34	48½
Guelph	34	48½
London	34	48½
Windsor	31½	45½
Kingston	48½	61

Current surcharge 1 per cent.

OLD MATERIAL

Dealers' Average Buying Prices

	Montreal Per Ton	Toronto Gross
Boiler plate	$ 9 00	$ 9 00
Heavy Melting Steel	10 00	11 00
Axles (wrought iron)	20 00	16 00
Rails (scrap)	11 00	11 00
Malleable scrap	10 00	11 00
No. 1 Machine cast iron	20 00	21 00
Pipe, wrought	7 00	6 00
Car wheel	17 00	16 00
Steel axles	10 50	15 00
Mach. shop turnings	4 00	6 00
Stove plate	16 00	14 00
Cast boring	4 00	6 00
Copper, light	9 00	8 50
Copper, crucible	11 50	11 00
Copper, heavy	11 25	11 00
Copper, wire	11 25	11 00
No. 1 machine composition	9 00	9 00
New brass cuttings	6 00	6 00
Red brass turnings	6 50	6 50
Yellow brass turnings	5 25	4 85
Light brass	4 50	3 50
Medium brass	6 00	4 50
Scrap zinc	3 50	4 00
Heavy lead	4 50	4 50
Tea lead	3 00	3 00
Aluminum	11 00	11 00

COLD ROLLED STEEL

(At Warehouse)

Rounds and squares	$4.50 base
Hexagon and flats	$5.50 base

COPPER PRODUCTS

Prices per lb.

	Montreal	Toronto
Copper Bars, ½ to 2 in.	.29	.28
Brass Tube		.28
Plain sheets, 16 oz. in. 30 x 72	.30	.29
Copper sheet, tinned, 16 oz.	.37	.36
Copper sheet, planished, 16 oz. base	.42	.41
Braziers', in sheets, 6 x 4 base	.30	.29
Copper tubing, seamless		.32

LEAD SHEETS

Roll Lot Prices

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$ 8 75	$ 11 50
Sheets, 3 1-2 lbs. sq. ft.	8 75	11 50
Sheets, 4 to 6 lbs. sq. ft.	8 25	10 00

Cut sheets, ¾c. per lb. extra

Cut sheets to size, 1c. per lb. extra

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	20
Brass sheets, 24 gauge and heavier base	23
Brass tubing, seamless	28

WROUGHT PIPE

Price List No. 56. August 23, 1922.

Standard Buttweld Pipe S/C

Size	Steel Blk.	Steel Galv.	Gen. Wrot. Iron Blk.	Gen. Wrot. Iron Galv.
⅛ in.	6 00	8 00	....	....
¼ in.	3 96	6 00	7 20	9 30
⅜ in.	3 96	6 00	7 20	9 30
½ in.	5 02	6 55	7 31	8 93
¾ in.	6 10	7 82	8 86	10 70
1 in.	8 50	14 22	12 58	15 30
1¼ in.	11 50	15 18	17 02	20 70
1½ in.	13 75	8 15	20 35	24 75
2 in.	18 50	24 42	27 38	33 30
2½ in.	29 25	38 61	.....	.....
3 in.	38 25	50 49	.....	.....
3½ in.	49 68	64 40	.....	.....
4 in.	58 86	76 30	.....	.....

Standard Lapweld Pipe S/C

Per 100 feet.

Below dividing line—price per foot.

Size	Steel Blk.	Steel Galv.	Gen. Wrot. Iron Blk.	Gen. Wrot. Iron Galv.
2 in.	22 20	27 75	31 08	37 00
2½ in.	32 76	41 54	46 80	56 16
3 in.	42 84	54 32	61 20	73 44
3½ in.	50 60	66 24	72 68	89 24
4 in.	59 95	78 48	86 11	105 73
4½ in.	68 58	87 63	1 04	1 24
5 in.	79 92	102 10	1 21	1 45
6 in.	1 04	1 32	1 57	1 88
7 in.	1 38	1 79	2 02	2 45
8L in.	1 45	1 88	2 13	2 58
8 in.	1 67	2 16	2 45	2 97
9 in.	2 04	2 62	2 97	3 59
10L in.	1 89	2 43	2 75	3 33
10 in.	2 43	3 13	3 54	4 28

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4-in. and under 55 per cent.

4½-in. and larger, 45 per cent.

4-in. and under running thread, 35%.

Standard couplings 4-in. and under 25%.

Do., 4½-in. and larger 5 per cent.

MALLEABLE FITTING LIST

1 in. elbow	.32	.53
2 in. elbow	1.05	1.70
1 in. tee	.43	.70
2 in. tee	1.45	2.40
1 in. coupling	.33	.53
1 in. locknut	.15	.23

Discount to dealers 70/5 off list.

BOILER TUBES

Size	Seamless	Lapweld
1 in.	19.00	
1¼ in.	20.00	
1½ in.	20.00	
1¾ in.	22.00	
2 in.	20.00	18.00
2¼ in.	22.00	20.00
2½ in.	25.00	21.00
3 in.	31.50	27.00
3½ in.	37.00	31.00
4 in.	46.75	39.50

Prices per 100 ft., Montreal and Toronto

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, 7-16 and up	30
Carriage bolts, ⅜ in. and smaller 6 in. and shorter	40
Coach and lag screws	45
Stove bolts	72½
Wrought Washers	60
Do., corru. head	60
Machine bolts, 7-16 and over	35
Machine bolts, ⅜-in. and less	35
Blank bolts	35
Bolt ends	35
Machine screws, fl. and rd. hd., steel cut thread	37½ & 10
Machine screws, o. and fil. hd., steel cut thread	30
Machine screws, o, and fil. hd., brass cut thread	15
Standard couplings, 4-in. and under, brass cut thread	30% 30
Nuts, square, blank off net list	$1.00
Nuts, square, tapped off net list	50c.
Nuts, hex., blank off net list	50c.
Nuts, hex., tapped net list	
Copper rivets and burrs, list less	32c.
Burrs only, list plus	10%
Iron rivets and burrs	47%
Boiler rivets, base ¾ in and larger	$5.75
Structural rivets, as above	5 65
Wood screws, O. & R., bright	80
Wood screws, flat, bright	82½
Wood screws, flat brass	77½
Wood screws, O. & R., brass	75
Wood screws, flat, bronze	72½
Wood screws, O. & R., bronze	70

NAILS AND SPIKES

Wire nails, base	$3 65
Cut nails, base	4 35
Miscellaneous wire nails	72½%

MILLED PRODUCTS

(Prices on unbroken packages)

Set screws	65
Square and hexagon head cap screws	60
Round head cap screws	20
Fillister head cap screws	35
Flat head screws	25
Button head cap screws	20
Studs	45
Semi-finished nuts up to and including 9/16 in.	70
Semi-finished nuts ⅝ to 1¼ in.	65
Semi-finished nuts 1⅜ to 2 in	35
Coupling bolts	35
Taper pins, No. 2 to No 5	65
Taper pin No. 6 and over	10
Planer bolts without fillet	10
Planer bolts with fillet	Net
Patch bolts	Plus 10%
Hollow set screws	20
Thumb screws	50
Thumb nuts	70

CARBON DRILLS AND REAMERS

	Discount.
S. S. drills, wire size	60
Can. carbon cutters	plus 10
Standard drills, all sizes	60
3-fluted drills, plus	10
Jobbers and letter sizes	60
Bit stock	50
Ratchet drills	25
S. S. drills for wood	10
Wood boring brace drills	50
Electricians' bits	30
Sockets	50
Sleeves	30
Taper pin reamers	25
Drills and countersinks	20
Bridge reamers, carbon	50
Centre reamers	Net
Taps, machine screw	50 to 60
Taps, hand, sizes up to 1"	30 to 60
Chucking reamers	20 off
Hand reamers	20
High speed drills, list	40
Can. high speed cutters	plus 10
American	plus 40

FILES AND RASPS

Globe	60/5
Vulcan	50
P. H. and Imperial	60/5
Nicholson	40
Black Diamond	40
Heller	40
Jowitts	net
J. Barton Smith, Eagle	55
McClelland, Globe	50
Delta Files	20
Disston	40
Disston	50
Great Western-American	50
Kearney & Foote, Arcade	60/5

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

PROOF COIL CHAIN

B. B. B. CHAIN

⅜ in., $16.45; 7-16 in., $14.00; ½ in., $12.95; 5-8 in., $13.15; ¾ in., $12.75; ⅞ in., $12.25; 1 in., $11.85; 1⅛ and 1¼ in., $10.55. Fire weld chain same sizes respectively are $14.00; $11.50; $10.40; $10.55; $10.15; $9.75; $9.35; and $8.25.

ELECTRIC WELD COIL CHAIN B.B.B.

⅛ in. $20.00; 3-16 in. $16.50; ¼ in. $15.50; 5-16 in. $12.70.

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	30%
Standard	30 and 10%
Cut leather lacing, No. 1	1.75
Leather in side, (Lacing)	1.50

RUBBER BELTING

Standard 36 ....28% Best grades 28%

TAPES

Chesterman Metallic, 50 ft.	$5 00
Lufkin Metallic, 603, 50 ft.	3 17
Admiral Steel Tape, 50 ft.	3 00
Admiral Steel Tape, 100 ft.	4 50
Major Jun. Steel Tape, 50 ft.	3 75
Rival Steel Tape, 50 ft.	4 00
Rival Steel Tape, 100 ft.	8 75
Reliable Jun. Steel Tape, 50 ft.	5 25

PLUMBING SUPPLIES

Plumbers' oakum, per cwt.	6 30
Solder, strictly	$0 22½
Solder, guaranteed	0 24
Soldering coppers, lb.	0 62½
White lead, pure, cwt	13 20
Red dry lead, 100-lb. kegs, per cwt.	10 75
Wood alcohol, per gal.	1 75
Whiting, plain, per 100 lbs.	3 00

ROPE AND PACKING

Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope ¾ and larger, base	0 21
British Manila rope	0 17
New Zealand hemp	0 19
Jute packing, fine	15c
Jute packing, coarse	11c

OILS AND COMPOUNDS

Castor Machine Oil, per lb.	34½
Royalite, per gal. bulk	20
Palacine	23
Machine oil, per gal.	39
Black oil, per gal. (Summer)	19
Cylinder oil, Capital	69½
Petroleum fuel oil bbls., net	10.80
Turp., single bbls., gal.	1.65
Linseed oil, raw, single bbls.	1.01
Premier galsoline	34

WASTE

XXX Extra	16	Atlas	18
Peerless	21	X Empire	13
XX Grand	15	Ideal	18
Superior	20	X Press	11½
X L C R	14		

Colored

Lion	12	Fancy	13½
Standard	10½	Popular	9
No. 1	13	Keen	7½

Wool Packing

Arrow	24	Anvil	16
Axle	20		

Washed Wipers

Select White	18	Dark colored.	13
Mixed Colored	14		

This list subject to trade discount

PLATING SUPPLIES

Polishing wheels, felt	$3 25
Polishing wheels, bull-neck	1 60
Emerey in kegs, Turkish	7½
Pumice, ground	04½
Emery glue	26
Tripoli composition	08
Crocus composition	12
Emery composition	11
Rouge, silver	60
Rouge, powder, nickel	35

Prices per lb.

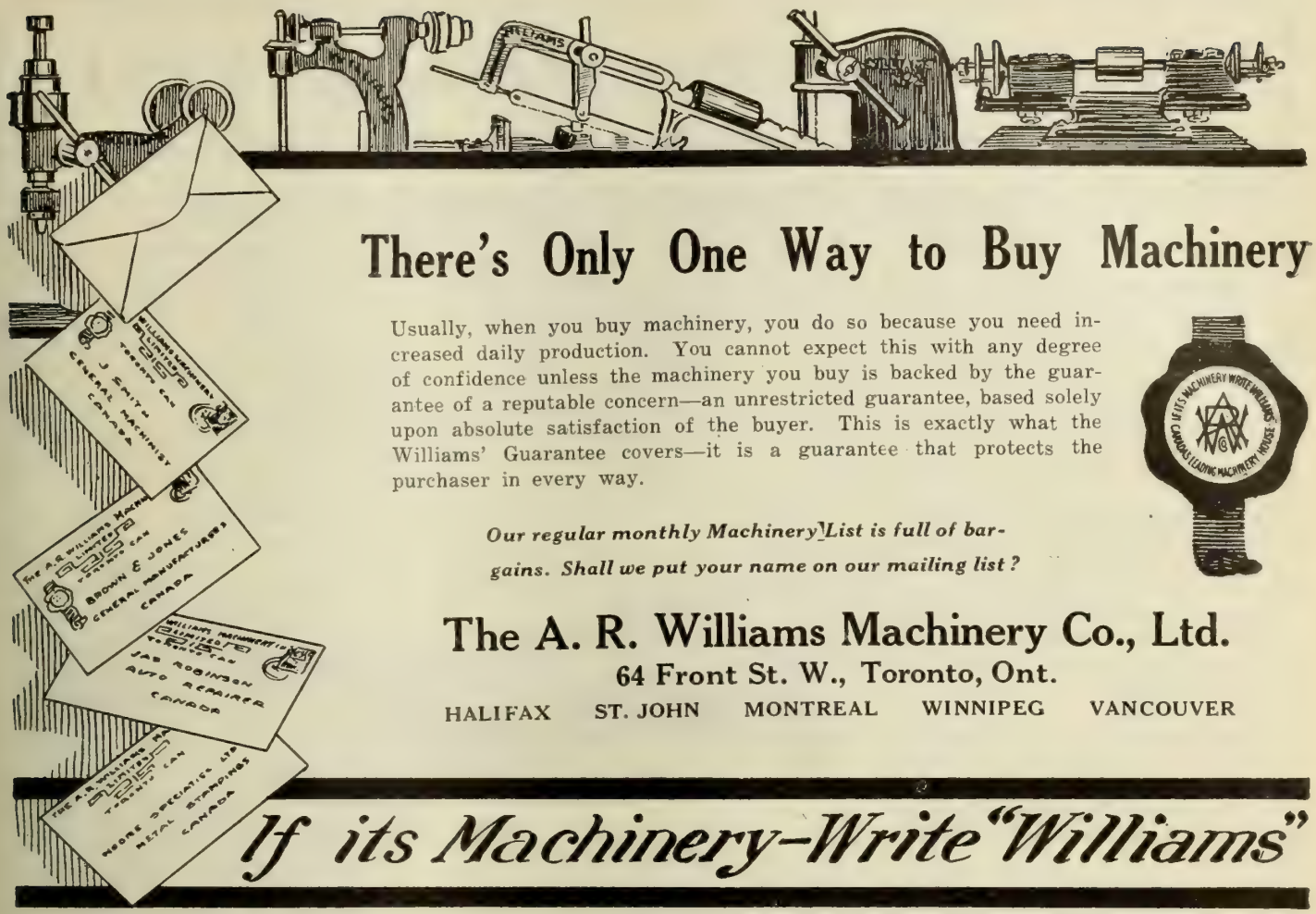
ANODES

Nickel	40 to .45
Copper	.38 to 22
Zinc	.16 to .12½

PLATING CHEMICALS

Acid boracic	.20
Acid, hydrochloric	.03¾
Acid, nitric	.10¼
Acid, sulphuric	.03¾
Ammonia, aqua	.20
Ammonium, Carbonate	.15
Ammonium, chloride	.18
Ammonium, hydrosulphuret	.75
Ammonium, sulphate	.10
Arsenic, white	.18
Copper carbonate, anhy.	.26
Copper, sulphate	.08
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.14
Nickel carbonate	.32
Nickel sulphate	.14
Potassium sulphide (substitute)	.40
Silver chloride (per oz.)	.85
Silver nitrate (per oz.)	.65
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.32
Sodium hyposulphite	.08
Sodium phosphate	.10
Tin chloride	.50
Zinc chloride, C. P.	.30
Zinc sulphate	.06

Prices per lb. unless otherwise stated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HALIFAX ST. JOHN MONTREAL WINNIPEG VANCOUVER
If its Machinery—Write "Williams"

HEAVY LABOR IN DEMAND

(Continued from page 40)

nine increases April 15 to May 15; twenty-three reduction and twenty-six increases May 15 to June 15; twenty-five reductions and twenty-one increases June 15 to July 15, and seven reductions and eight increases, July 15 to August 15.

The hourly wage of all wage earners ranged from 24.3 cents in July, 1914, up to 62.1 cents in September, 1920; then down to 48.2 cents in January this year. Hourly earnings of all male skilled labor, starting at 28 cents, advanced to 70 cents and has dropped to 55.5 cents. The hourly wage of all male common labor, starting at 20.7 cents, advanced to 54.6 cents, then fell to 39.8 cents. The hourly wage of women, beginning in July, 1914 at 15.6 cents, advanced to 41.7 cents, and has now fallen to 34.7 cents.

Weekly earnings are shown for the same classes in the same way. Thus in July, 1914, the composite rate for all wage earners was $12.36. It rose to $29.69 in July, 1920. In January this year it was $22.27. The pre-war figure for all male skilled labor was $14.19 the high figure $33.54; the figure in January, $25.66. For male unskilled labor the figures were $10.89, $27.14 and $18.95. For women the figures are $7.82, $18.79 and $15.76.

PRODUCTION MILLING

(Continued from page 41)

used for roughing out the fork while the two shown on the near spindle finish the space to the desired demension. It will be seen that this fixture varies somewhat from that shown in Fig. 1, as the one first described was of the direct clamping type while the one in Fig. 2 has a three point bearing, the front edge resting on two of the yokes and the rear of the clamp bearing on a raised rib on the inner diameter. The production on these parts is at the rate of 216 per hour.

The feed for both of these jobs is continuous at one constant speed, the parts being so close together as to allow the cutters to be engaged practically all the time. The machine however, is designed with two table speeds, the one just mentioned for cutting and the other for traversing space between the work, where the cutters are not engaged. The ratio of these two speeds are as 10 2-3 to 1. The change from one to the other is automatic, the shift being made by means of a lever which is operated by adjustable stops located in a t-e-slot around the outer edge of the milling machine table.

NOVEL COAL-HANDLING PLANT

Engineering visitors to British ports must have been struck with the great improvement made during recent years in the mechanical appliances for loading coal. An installation recently completed at a British harbor includes many interesting features introduced specially to ensure that the coal will not be broken up when being lowered into the ship's hold. The wagons are drawn up an incline shoot to an ingenious anti-breakage box which lowers it gently down to the ship's hold. This anti-breakage box consists of a vertical tube inside of which are steel plate trays fitted to a pair of endless cha ns. The coal from the shoot slides on to one tray, which then falls by gravity and brings another tray opposite to the end of the shoot to receive its charge. Each tray-load as it reaches the bottom of the tube releases its contents with the least possible shaking up and then rises up the other side of the tube to take its place once more opposite the shoot. The operations are so arranged that by the time one truck load has reached the hold another full truck is ready to despatch its load down the shoot. The work is therefore continuous and is carried out at the rate of over five hundred tons per hour. All the plant is electrically driven; and, in continuous use for about six months, it has given every satisfaction.

News From the Industrial Field

Babcock & Wilcox, Ltd., Montreal, have been awarded the $31,408 contract for boilers for hospital, costing $2,500,000 in Ottawa.

Anglin-Norcross Co., Toronto, have been awarded the general contract for erection of collegiate and technical school in Kitchener. Sarnia Bridge Co. have the structural steel contract.

Addition to the Kingston penitentiary, costing $500,000, is proposed by Dominion Government, Department of Public Works.

Goldie and McCulloch Co., Galt, have been awarded the contract for installation of a horizontal water tube boiler in Riverdale Technical School, Toronto.

National Castings, Limited, Belleville, are installing a Pittsburgh electric furnace and making other additions to building and plant. New core ovens are being installed.

Warkworth, Ont., proposes to acquire a supply of electric power by building a transformer station at Bradley's corners, three miles from the village and enter into an agreement with privately owned plant.

Moncton, N. B.—On August 29th Humphrey's mill dam near this city was washed away, together with forty feet of the new highway bridge. Recent heavy rains caused the freshet of water.

Waterous Engine Works, Brantford, are operating from 75 to 80 per cent. with overtime in some departments. Considerable pulp mill equipment is in progress.

Montreal.—The Hon. J. A. Stewart, K. C., M. P., ex-Minister of Railways, who has been confined to the Royal Victoria Hospital here for the past few weeks, suffered a slight relapse, and his condition is considered serious.

It is estimated that the settlements now being worked out in connection with the coal strike will cost the public $300,000,000 more than last year for its 1922 fuel bill. The public will also have to pay more for manufactured articles on account of higher coal costs.

No further surcharge is now to be collected on international business, either freight or passenger, according to an announcement by the Railway Commission. The rate of exchange on freight from Sept. 1 to Sept. 14 inclusive is 1-32 of one per cent.

Hamilton, Ont.—To date this year thirteen new industries have located in Hamilton and prospects are stated to be even brighter for the future. Last year Hamilton saw the establishment of twenty-four additional plants within its confines.

There is considerable activity about the plant at Welland formerly occupied by Electric Steel and Metals. It is being converted for the production of manganese and other high class steels, heavy castings and mining equipment. Electric furnace capacity is being increased.

That the Port Arthur district is undermined with coal is the opinion expressed by Jules Cross, a mining engineer. He reports frequent outcroppings of anthroxolite which burns to a slight ash and throws out an intense heat.

As indicating the extent to which surplus war equipment accumulated during the war is still moving, two lots were allocated by the Salvage Board in Chicago recently, one for 767 single purpose machines and countershafts weighing 1,000 gross tons at $18.10 per gross ton, and 141 special purpose countershafts with hangers at $1.50 each.

There will be plenty of coal for domestic purposes in Alberta, Saskatchewan and Manitoba this winter if railways co-operate in transportation, discloses a report from Calgary. There is every prospect of increased production of Alberta coal this winter and Saskatchewan mines are also operating.

Welland, Ont.—An order for a standard 3-ton capacity electric steel furnace, with transformer and switchboard complete, has been secured by the Volta Manufacturing Company, of Welland, from the Hopetown Steel Works, Bathgate, Scotland.

Vancouver, B. C.—The Ketchikan Power Company has contracted for 2,000,000 feet of spruce lumber to be shipped to Australia, according to announcement made by Eldon Daly, manager of the mill. The shipment will be ready early in August, the mill now being busy working on it.

Grande Prairie, Alberta.—Some samples of iron ore brought in from the vicinity of Hudson's Hope have been assayed and found to be 60 per cent. iron. The deposit from which the samples were taken is exposed over an area of 700 feet wide by three miles long, with indications of immense covered area.

Montreal.—In order to handle with despatch the increased flow of grain that is expected through Montreal in the near future, the Harbor Commissioners have arranged to work the port grain elevators night and day hereafter, and also to place in commission lake carriers to the waiting ocean vessels. Figures supplied by the Grain Clearance Board show that from the opening of navigation to the evening of August 9, a total of 62,378,638 bushels were shipped, compared with 58,946,969 bushels for the same period last year.

Montreal.—Reports from Quebec Legislature state that it has been decided to maintain for the coming year, the reduced stumpage duties which were put into effect last year. This was done so that lumber companies may be encouraged to employ as many men as possible during the coming winter. The action will result in a smaller government revenue, but is considered to be advantageous to the province at large.

New Westminster, B. C.—The Westminster Paper Company has been incorporated with a capital of $250,000, to manufacture tissue paper for fruit wrappers and similar purposes. Pulp will be secured from the plants already operating in British Columbia and work has commenced on the company's plant here, machinery having been ordered.

Fredericton, N. B.—All indications point to a remarkable improvement in the lumber industry. Some of the leading mills are increasing their output fifty per cent. over last year, and others are preparing to increase their cut. Several operators who have not been working for a number of years will resume this winter.

Exports from New Brunswick to the United States are practically double now what they were this time last year, largely as a result of the revival of the lumber trade with the New York and Boston markets. Of the total declared exports to the United States from here during the past quarter ending June of $751,245, about $650,000 was under the heading of "wood and manufactures of."

Returning from the Walkerville territory, a Toronto machinery dealer states that developments are proceeding slowly in connection with the proposed extension of the Ford plant, that operations in the present plant have slowed up considerably and that some of the Walkerville plants depending upon motor car activity reflect between-season recession.

Discussing present-day wage rates, a Hamilton firm writes Canadian Machinery as follows:—"The fancy rates that adhered a year or so ago are now a thing of the past, and it is not necessary to pay men worth 25c per hour, 75c. The law of supply and demand is again asserting itself, and you can get a better run for your money to-day. There is no standard scale we know of in this territory, and the majority of the manufacturers are paying their men according to their earning power. The average machinist can be secured at a rate ranging from 40c to 55c per hour; select men are paid a little more; moulders, 47½c to 62c; laborers 30c to 35c."

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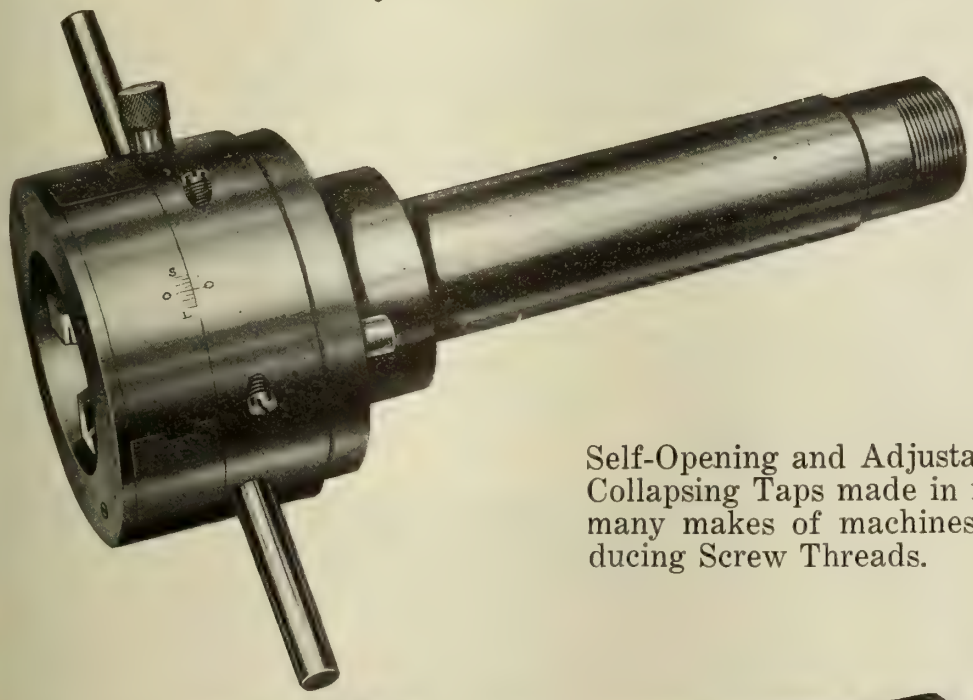
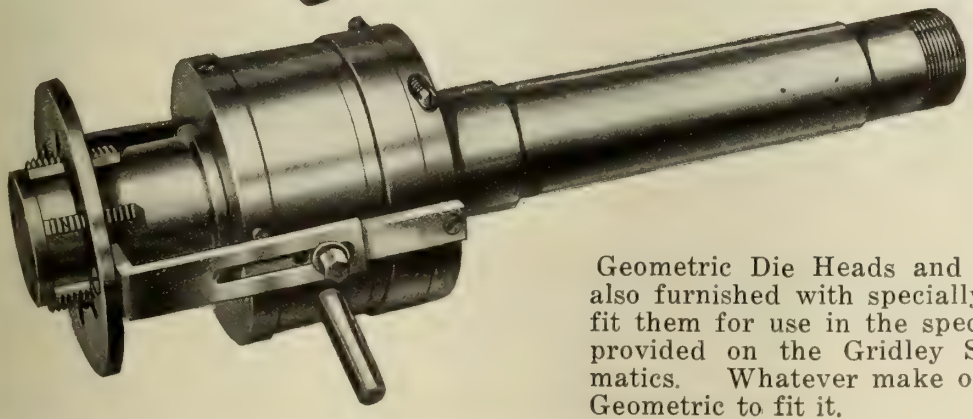


Self-Opening and Adjustable Die Heads and Collapsing Taps made in many styles for the many makes of machines employed in producing Screw Threads.



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Toronto.—Contract for the construction of new buildings at Leaside, to cost approximately $1,000,000, has been awarded by the Durant Motors, of Canada, Limited. The new plant will have a floor space of 500,000 square feet and will be used exclusively for the manufacture of the Star car. Production for 1923 calls for 18,000 cars, 10,000 for domestic trade and 8,000 for export.

Toronto.—The three paper mills of the Spanish River Pulp and Paper Co. at Soo, Espanola and Sturgeon Falls, are operating 24 hours daily in order to keep up with the demand for paper. Usually at this time of the year they have been able to stock a certain amount of their production for winter supply but so far this year their entire production has been shipped out.

Petrolia, Ont.—Operations will be commenced, it is reported, this season in the construction of the Peninsula Sugar Company's plant here, at a cost of approximately $800,000. Machinery of special design, electrically driven, will be installed, and it is expected that the plant will be in operation by September. The refinery will have a capacity for slicing 600 tons of beets every twenty-four hours.

Ottawa.—The city of Ottawa has practically decided to use oil as a fuel for heating the schools of the city. It is considered to be more economical when all points are looked at. The matter has been brought to a head by the request of a local dealer to be released from his contract which called for him to supply the needs of the schools. It is believed that the matter will be finally disposed of on September 7th.

Montreal.—On August 31st the members of the Montreal Publicity Association held their regular luncheon on board the new C. P. S. Ltd. liner "Montclare." The "Montclare" was in Montreal on her maiden voyage. Over one hundred and fifty attended the luncheon. W. P. Ballantyne, general C. P. S. passenger agent was the host, representing the C. P. R. Captain R. Latta, commander of the "Montclare," and C. W. Stokes, general C. P. R. publicity agent, also officially welcomed the guests.

Efforts to secure uniformity in the matter of registration of trade marks and patents throughout the British Empire are progressing. A conference was held this summer in London and it was discovered that no system could be effective until there was uniformity in patent laws. In the meantime a loose scheme of co-operation between the various patent offices has been agreed upon. Of course, it must receive the sanction of the various governments concerned as the members of the conference could not bind their respective countries. Plainly there would be many advantages in uniformity in the matter of patents and trade marks throughout the territories under the British flag, but the impression left by the report is that many obstacles have to be overcome before it can be achieved.

Ninety per cent. of the 380,000,000 sacks of portland cement shipped in this country last year were delivered to the consumer in cotton sacks, each sack containing 94 pounds of cement. To meet this demand it is necessary for cement mills to keep large stocks of sacks in reserve. At the present time there are approximately 200,000,000 cotton sacks, either in sack storage houses at the mills, or in customers' hands. If the cement industry were called on to replace all of these sacks at once it would require over 200,000 bales of cotton to make the necessary cloth. Thirty million new sacks must be provided annually.

That business in Australia is fairly good but that after-war conditions have had the same effect there upon industry generally as in Canada, was the observation of S. B. Chadsey, manager Brantford plant, Massey-Harris Co., who with J. N. Shenstone, vice-president Massey-Harris Co., returned recently from Australia. The Brantford plant will close for stock-taking Sept. 9 for ten days. The staff will thereafter be increased according as market conditions and deliveries warrant. A one-storey solid brick addition to the plant with 7,000 square feet of floor space, is being built by Schultz Bros., Brantford.

Montreal.—Grain shipments through Lachine Canal in August totaled 12,200,329 bushels, which is an increase of 1,561,420, bushels over that of August, 1921. The principal increase was in wheat, a total of 9,087,621 bushels passed down this year as against 6,662,593 bushels last year in August. Oats, barley, and flaxseed shipments also increased, while corn and rye showed a decrease. No flour passed down in August 1921, while last month 31,500 sacks and 500 barrels were handled. Coal shipments in the canal were nil for the month, while last year a considerable quantity was handled.

The Imperial Radiator Company, Limited, an organization formed by the bondholders of Steel and Radiation, Limited, Toronto, have taken over the assets of the latter company, including plants and properties in St. Catharines and Toronto, for $400,000. The Toronto property is situated on St. Helen's and Dora Avenues, while that in St. Catharines is located on the N. St. C. and T. electric line to Merritton and adjacent to the present Welland Canal. Steel and Radiation, Ltd., has been in the hands of a receiver for some months, but has been running since the first of the year. It will have improved financial standing under the new order of things and attention will be confined entirely to the production of radiators and heating boilers. It is proposed to concentrate the manufacturing and head office in St. Catharines, retaining sales offices in Toronto. J. E. McAllister, Toronto, is president and E. T. Wingate, general manager in the new organization.

Anthracite operators announce that on resumption of mining prices of coal at the mines will not be advanced though bids of $12 a ton or $4 more than list prices are being made. With lower freight rates they declare there will be no excuse for higher prices by retailers.

Owing to freight transportation difficulties only one ferry per day is now operating between Cobourg and Charlotte.

Booth Company, Ottawa, are building a new brick stack 280 feet high and eleven feet inside diameter.

Grand Trunk shops in Montreal recently completed ten freight locomotives, and are proceeding with the construction of five passenger locomotives. In spite of these activities, the staff was recently reduced by 25 per cent.

Montreal.—On August 31st there had been shipped overseas from the port of Montreal 80,248,953 bushels of grain, which is a record. On Monday, August 28th, 1,569,393 bushels of grain had been loaded and dispatched overseas. This is believed to be a world's record for one day. Most of the grain being handled at present is from United States sources, but it is believed that Canadian grain in quantities will soon be coming through. New facilities have recently been installed which will permit of loading an additional 72,000 bushels of grain an hour. No cases of ocean tonnage demurrage have occurred this year. Only five lake vessels awaited unloading on August 29th.

A. H. Quigley, general manager of the Canadian plant of the Anaconda American Brass, Limited, who have taken over the plant and good will of Brown's Copper and Brass Rolling Mills, New Toronto, states that cutters and workers in brass and kindred industries may locate here as the result of the extension of the company's activities. While the future may develop a greater variety of products at the New Toronto plant, the output, at the present time going almost direct to manufacturers, consists of sheet brass in flats, strips and coils in various mixtures—high brass, low brass and bronze of 65 to 95 per cent. of copper—also copper in sheets, rolls and strips plain and tinned. The Anaconda American Brass, Limited, is the Canadian end of the American Brass Co., owned by the Anaconda Copper Mining Co. The Canadian company's officers are:—President, John A. Coe; vice-president, G. H. Allen, vice-president American Brass Co.; treasurer, C. F. Hollister, treasurer, American Brass Co.; secretary, M. S. Moss; general manager A. H. Quigley. Messrs. Moss and Quigley are the local directors on the board which in addition to the other officials named includes: John D. Ryan, chairman board of directors of Anaconda Copper Mining Co.; C. F. Kelly, president Anaconda Copper Mining Co.; B. B. Thayer, vice president of Anaconda Copper Mining Co.; and Charles F. Brooker, chairman board of directors American Brass Co.

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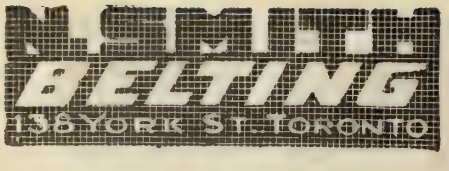

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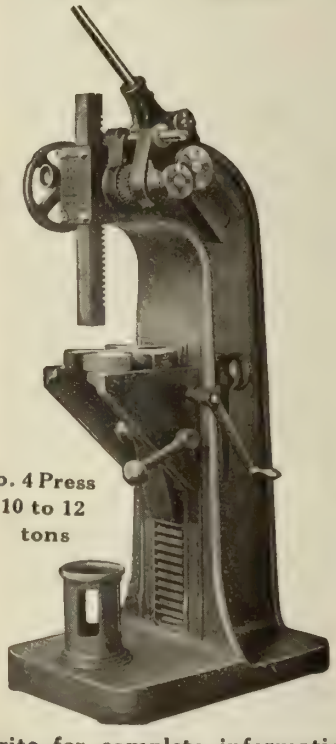
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Ottawa.—Government reports show a big advance in the production of steel for the month of July. The output in June was 32,805 tons and that for July 62,767, an increase of 91 per cent. The greatest increase was reported from the Algoma Steel Corporation mills at Sault Ste. Marie. They are working on a large rail order for the C. P. R. From the following average monthly production figures of pig iron, steel ingots, and castings in Canada for the years designated, it becomes apparent that while there has been improvement in each month so far this year, the industry has still some distance to go before getting up to the rate of production of pre-war years.

Average monthly production of pig iron, steel ingots, and castings in Canada, 1907 to 1916 in thousands of long tons follow:—

Year	—Monthly Average— Iron	Steel
1907	48	53
1908	47	44
1909	56	56
1910	60	61
1911	68	66
1912	75	71
1913	84	87
1914	58	62
1915	68	76
1916	87	106

Total production of pig, steel ingots and castings in Canada by months from 1920 to date, in the 1,000s of long tons, follow:

	1920		1921		1922	
	Iron	Steel	Iron	Steel	Iron	Steel
Jan.	73	92	41	40	32	33
Feb.	64	84	58	59	....	....
Mar.	69	97	60	53	34	42
Apr.	77	93	39	27	42	30
May	87	90	56	52	33	22
June	80	91	55	64	23	17
July	84	94	54	54	29	33
Aug.	93	105	50	72	32	63
Sept.	94	99	44	56	....	....
Oct.	105	111	50	72	....	....
Nov.	94	97	48	75	....	....
Dec.	54	56	40	43	....	....
Ttl.	974	1109	595	667	225	240
Mont. Avg.	81	92	50	56	32	34

FIGHT AGAINST CORROSION

A leading British steel maker recently estimated that rust and other kinds of corrosion cost the world five hundred million pounds every year. This figure may be no more than a clever guess, but in any case the ravages of corrosion are so great that we are not surprised to learn that in Great Britain a proposal has arisen for the formation of an association of manufacturers of products which are non-corrodible and anti-corrosive. Support has been received from British firms making stainless steel, anti-corrosive paints, and various preservative compounds. The first step which this Association of Non-corrodible and Anti-corrosive Products will take is likely to be the organization of a public exhibition in London of non-corrodible and anti-corrosive products.

COMPACT PORTABLE PUMP

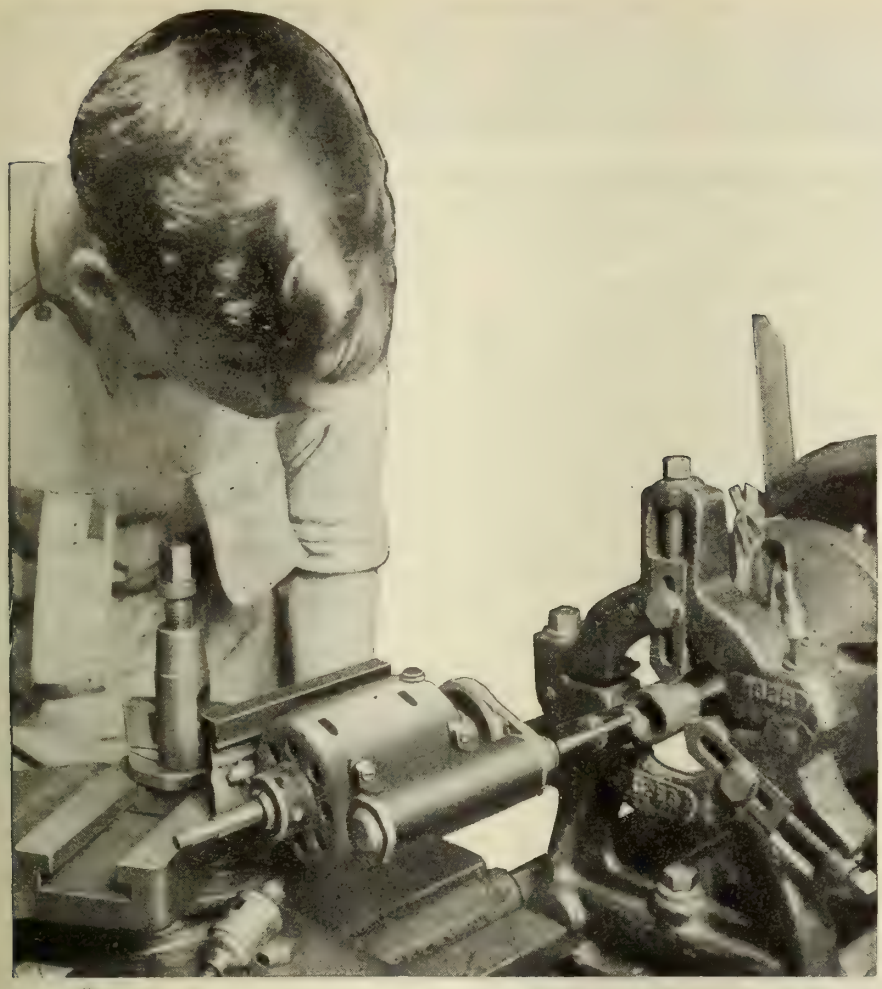
There was recently despatched to the Far East a portable pumping set specially designed to work in very constricted spaces. This pump carries a seven horse power paraffin engine; but it is so designed and mounted that it can be readily accommodated in a space 4 ft. 6 in. long and 5 ft. 6 in. high. The pump is capable of delivering 250 gallons per minute against a height of 30 ft. Water-cooling is provided, and in the event of the water available being dirty or otherwise unsuitable for cooling purposes, a radiator or fan can be brought into operation. With a view to easy transport the pump and engine are mounted on a frame with wheels, and the whole arrangement can be easily hoisted in a crane.

BURNING POWDERED COAL

Great interest has been taken during recent years in the use of coal in the form of powder. There is general agreement that such a fuel can be used to great advantage in many cases, but that the cost and other drawbacks of having to pulverise the coal may more than outweigh the benefits of using fuel in the powder form. The plant is expensive and the powdered coal cannot be stored without danger. These drawbacks are, however, avoided by the use of a new machine designed and manufactured by a British firm. This machine is self-contained and it dries and powders the coal and propels it direct into the furnace, so that there is no need to store the powdered coal or to instal plant to carry it from the grinder to the furnace. The machine works continuously and it dries and pulverises at the same time. All that an operator has to do is to feed it with coal. Tests of a most practical character have been carried out on this machine for a period of twelve months, and they showed that the cost of pulverisation was about 2s. 7d. per ton as against previous costs ranging from about 5/- to 10/- per ton. The tests also showed that a lower grade of coal can be successfully used with this pulveriser. The latest development in connection with the plant lies in the addition of a small amount of paraffin to the coal during pulverisation. Although the amount added is very small it has a remarkable effect when using coal of poor quality.

Giant Aero Engines.—The British Government have ordered six large aeroplane engines of 1,000 h. p. These engines develop their power at 1,800 r.p.m. They were designed and built by Messrs. Napier. There are 16 cylinders and they have been given bench tests of 30 hours with entirely satisfactory results. The weight is three pounds per horsepower.

Shortage of coal has caused a partial shut down to the rail mill of the Algoma Steel Corp. at Sault Ste. Marie, Ont. The period of shutdown is indefinite, as the possibilities of securing an adequate supply of coal is uncertain.



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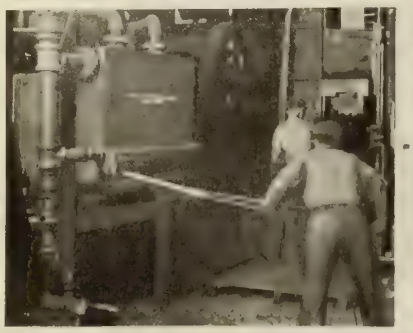

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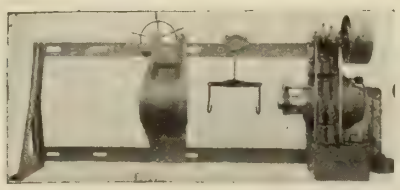

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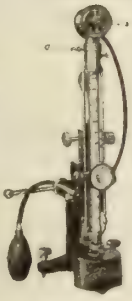

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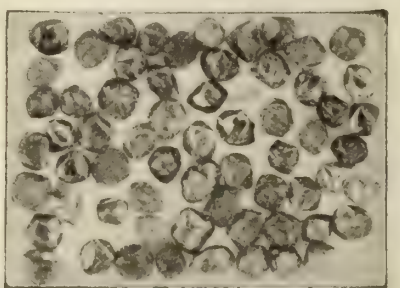

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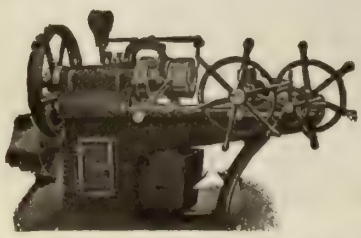

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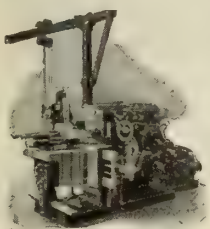

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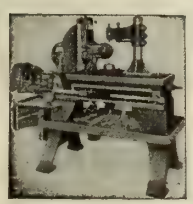

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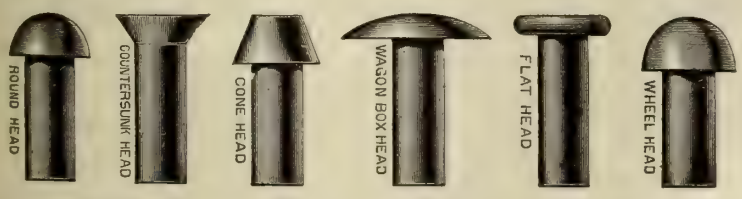

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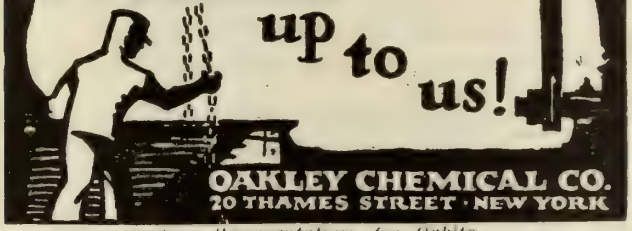

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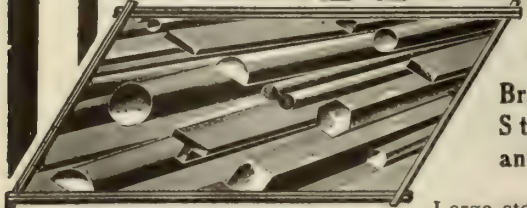

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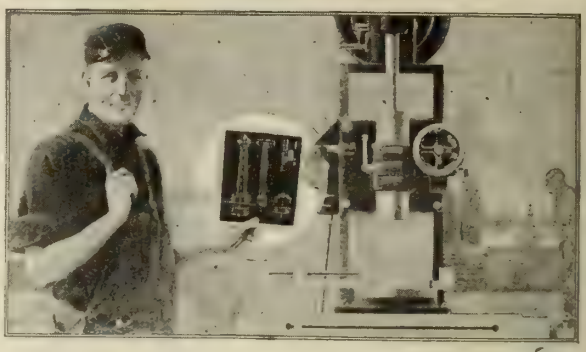

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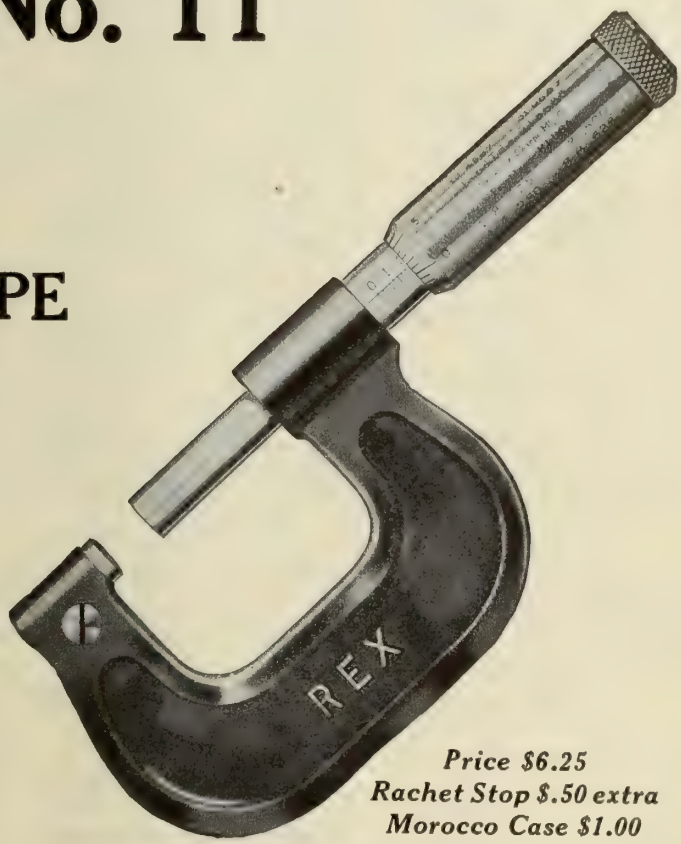

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BOILERS, LOCOMOTIVE
Goldie & McCulloch Co., Ltd., Galt,

BOLT AND NUT MACHINERY
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Montreal, Que.

BOLT AND NUT MACHINERY, Automatic
National Acme Co., Cleveland, Ohio.

BOLTS AND NUTS
British Empire Steel Corporation, Montreal, Que.
Fittings, Limited, Oshawa, Ont.
National Acme Co., Montreal, Que
Petrie, Ltd., H. W., Toronto, Ont

BOLT THREADING DIE HEADS
Landis Machine Co., Inc., Waynesboro Pa.

BOLTS, TRACK
Steel Co. of Canada, Ltd., Hamilton, Ont.

BORING and TURNING MILLS, Vertical
Bertram & Sons Co., Ltd., The John Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

BORING, DRILLING and MILLING MACHINES, Horizontal.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
Herbert, Limited, Alfred, Toronto, Ont.
Landis Tool Co., Waynesboro, Pa.
Vertical
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
McDougall Co., Ltd., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont
Rockford Drilling Machine Co., Rockford,

BORING TOOLS
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.

For list of Dealers see the last page of This Buyers Directory

BUCKET CARRIERS, Pivoted
Can. Link-Belt Co., Toronto, Ont.

BUFFERS
Pryibil Machine Co., New York, N.Y.

BUFFING OR POLISHING MACHINES (See Polishing and Buffing Machines)
Blount Co., J. G., Everett, Mass.
Herbert, Limited, Alfred, Toronto, Ont
Petrie, Ltd., H. W., Toronto, Ont.
Pryibil Machine Co., New York, N.Y.
U. S. Electrical Tool Co., Cincinnati, O.

BUILDING MATERIALS
Bertram & Son Co., Ltd., The John Dundas, Ont.

BURNERS, OIL AND GAS
Rockwell Co., W.S., New York City.

BURRS
Steel Co. of Can. Ltd., Hamilton, Ont.

CABINETS, OIL
S. F. Bowser & Co., Ltd., Toronto, Ont

CALIPERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Starrett Co., L. S., Athol, Mass.

CAMS
Canada Foundries & Forgings Co., Welland, Ont.

CAN-MAKING MACHINERY (See Sheet Metal Working Machinery)
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Bliss Co., E. W., Brooklyn, N. Y.
Smooth Mfg. Co., Jersey City, N. J.

CARBONIZING
Chapman Double Ball Bearing Co., Toronto.

CEMENTS, IRON
CENTERING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.

CHAINS (See Sprockets and Chains)
Reynold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

CHUCKS, DRILL
Herbert, Limited, Alfred, Toronto, Ont
Jacobs Mfg. Co., Hartford, Conn.

CARD CLOTHING
D. K. McLaren, Limited, Montreal.

CASTINGS, ALUMINUM, BRASS, BRONZE, COPPER, DIE-MOLDED, FERRO-ALLOY, IRON, SEMI-STEEL, STEEL.
See "Where to buy your castings" Section. Page number may be found by turning to Advertisers' Index.

CHAINS, DRIVING
Can. Link-Belt Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont
Jones & Glassco, Montreal, Que.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

CHASERS
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, a.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CHUCKING MACHINES
Acme Machine Tool Co., Cincinnati, O
Brown & Sharpe Mfg. Co., Providence, R. I.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

CHUCKS, DRILL AND TAP
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canadian SKF Co., Toronto, Ont.
Cushman Chuck Co., Hartford, Conn
Geometric Tool Co., New Haven, Conn.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg., New Britain, Conn.

CHUCKS, LATHE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Cushman Chuck Co., Hartford, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Geometric Tool Co., New Haven, Conn.
Gisholt Machine Co., Madison, Wis.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pryibil Machine Co., New York, N.Y.
Skinner Chuck Co., New Britain, Conn
Union Mfg. Co., New Britain, Conn.

CHUCKS, MAGNETIC
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CHUCKS, PLANER
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cushman Chuck Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn
Union Mfg. Co., New Britain, Conn.

CHUCKS, TAPPING
William L. Procunier, Chicago, Ill.

CHUCKS, VERTICAL BORING MILL
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Skinner Chuck Co., New Britain, Conn
Union Mfg. Co., New Britain, Conn.

CLAMPS, MACHINISTS'
Brown & Sharpe Mfg. Co., Providence.
Starrett Co., L. S., Athol, Mass.

CLEANERS, METAL, WASTE, GENERAL
Oakley Chemical Co., New York, N. Y.

CLOCKS
Chicago Watchman's Clock Co., Chicago.
Hardinge Bros., Limited, Toronto, Ont.

CLOCKS, TIME
Gisholt Machine Co., Madison, Wis.

CLOCKS, WATCHMEN'S
Chicago Watchman's Clock Co., Chicago, Ill.
Hardinge Bros., Limited, Toronto, Ont.

BUYERS' DIRECTORY

CLUTCHES, FRICTION
Can.-Link-Belt Co., Toronto, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.

COAL AND ASH HANDLING MACHINERY
Can.-Link Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

COAL-STORAGE SYSTEMS
Can. Link-Belt Co., Toronto, Ont.

COLLARS, SHAFT OR SET
Canada Foundries & Forgings Co., Welland, Ont.
Can. Link-Belt Co., Toronto, Ont.

COLLETS
Butterfield & Co., Inc., Rock Island, Que.
Geometric Tool Co., New Haven, Conn.
Hardinge Bros., Inc., Chicago, Ill.
Hendley Machine Co., Torrington Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

COMPOUNDS, CLEANING
Oakley Chemical Co., New York, N.Y.

COMPOUNDS—CUTTING, DRILLING, GRINDING, SCREW CUTTING
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Oakley Chemical Co., New York, N.Y.

COMPRESSORS, AIR AND GAS
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.

CONES, FRICTION
Norton Co., of Can. Ltd., Hamilton, Ont.

CONNECTING RODS AND STRAPS
Canada Foundries & Forgings Co., Welland, Ont.

CONTRACT WORK
Victoria Foundry Co., Ltd., Ottawa, Ont.

CONVEYORS AND ELEVATORS (SEE ELEVATORS)
Jones & Glassco, Montreal, Que.

COTTERS
Steel Co. of Canada, Ltd., Hamilton, Ont.

COUNTERBORES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

COUNTERS, REVOLUTION
Starrett Co., L. S., Athol, Mass.

COUNTERSHAFTS
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Johnson Machine Co., Carlyle, Man-
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

COUNTERSINKS
Butterfield & Co., Inc., Rock Island Que.
Pratt &Whitney Co., of Canada, Ltd., Dundas, Ont.

COUPLERS, CAR AND LOCOMOTIVE
Can. Steel Foundries, Montreal, Que.

COUPLINGS
Steel Co. of Canada, Ltd., Hamilton, Ont.

COUPLINGS, PIPE
Fittings, Limited, Oshawa, Ont.

COUPLINGS, SHAFT
Can. Link-Belt Co., Toronto, Ont.

CRANES, ELECTRIC
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can.-Link-Belt Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

CRANES, LOCOMOTIVE
Can. Link-Belt Co., Toronto, Ont.

Bertram & Son Co., td., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

CRANK PIN TURNING MACHINE
Underwood Corp., H.B., Philadelphia, Pa.

CUTTERS, GEAR
Brown & Sharpe Mfg. Co., Providence, R. I.
Butterfield & Co., Inc., Rock Island, Q. Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CUTTERS, HIGH SPEED
Atkins & Co., Inc., E. C., Indianapolis.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CUTTERS, MILLING
Brown & Sharpe Mfg. Co., Providence, R. I
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.

CUTTERS, STAY BOLT
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.

CUTTING-OFF MACHINE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

CUTTING OFF MACHINES, PIPE (SEE PIPE-CUTTING AND THREADING MACHINES)
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.

CUTTING-OFF TOOLS
Armstrong Bros. Tool Co., Chicago, Ill.

CUTTING OIL FILTERS (SEE OIL FILTERING SYSTEMS
Bowser, S. F. & Co., Ltd., Toronto.

CUTTING, OXY-HYDROGEN
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Ltd., Toronto, Ont.

DETACHABLE CHAIN
International Malleable Iron Co., Guelph, Ont.

DIAMONDS, BLACK AND ROUGH
Can. Desmond-Stephan Mfg Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

DIAMOND TOOLS
Can. Desmond-Stephan Co., Hamilton,
Wheel Trueing Tool Co., Windsor, Ont.

DIAMOND CROSSINGS
Can. Steel Foundries, Montreal, Que.

DIAMONDS, IMPORTERS
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Co., Windsor, Ont.

DIES, SCREW AND THREAD CUTTING
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.

DIES, SHEET-METAL AND SUB-PRESS (See Tool Work)
Brown, Boggs & Co., Ltd., Hamilton, Ont.

DIES, FORGING
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

DIES, SELF-OPENING, ADJUSTABLE
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Landis Machine Co., Inc., Waynesboro,
National Acme Co., Cleveland, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DIES, THREADING-OPENING
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DIVIDING HEADS
Burke Machine Tool Co., Conneaut, Ohio.
Hendey Machine Co., Torrington, Conn.
Kearney & Treacker Co., Milwaukee, Wis.
Petrie, Ltd., H. W. Toronto, Ont.

DOGS, LATHE AND MILLING MACHINE
Armstrong Bros. Tool Co., Chicago, Ill.

DRAFTING MATERIALS
American Lead Pencil Co., New York City, N.Y.

DRESSERS, GRINDING WHEEL
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ont.
Norton Co., of Can., Ltd., Hamilton.
Wheel Trueing Co., Windsor, Ont.

DRESSING TOOLS
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Co., Windsor, Ont.

DRILL HOLDERS
Armstrong Bros. Tool Co., Chicago, Ill.

DRILLING MACHINES, BENCH
Burke Machine Tool Co., Conneaut,, Ohio.
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Hardinge Bros., Inc., Chicago, Ill.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
U. S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, ELECTRIC AND HAND
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, GANG
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

DRILLING MACHINES, HEAVY DUTY
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
Herbert, Limited, Alfred, Toronto, Ont.
Rockford Drilling Machine Co., Rockford, Ill.

BORING, DRILLING AND MILLING MACHINES, (HORIZONTAL.)
Herbert, Limited, Alfred, Toronto, Ont.
Gisholt Machine Co., Madison, Wis.

DRILLING MACHINES, Multiple Spindle
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
National Acme Co., Cleveland, Ohio.

DRILLING MACHINES, Pneumatic
Cleveland Pneumatic Tool Co., Toronto. Ont.

DRILLING MACHINES, PORTABLE
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, RADIAL
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Herbert, Limited, Alfred, Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Wiliams Machinery Co., A. R., Toronto,

DRILLING MACHINES, SENSITIVE
Burke Machine Tool Co., Conneaut, O.
Herbert, Limited, Alfred, Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Williams Machinery Co., A. R., Toronto.
Wisconsin Electric Co., Racine, Wis

DRILLING MACHINES, TURRET
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wisconsin.
Williams Machinery Co., A. R., Toronto.

DRILLING MACHINES, VERTICAL
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Herbert, Limited, Alfred, Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

DRILLS, CENTRE
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DRILLS, HIGH SPEED TWIST
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Cleveland Twist Drill Co., Cleveland, O.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DRILLS, RATCHET
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

DRILLS, TWIST AND FLAT
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.

DROP FORGINGS
Steel Co. of Canada, Ltd., Hamilton.

DUST HANDLING EQUIPMENT
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

ELECTRICAL INSTRUMENTS
Bristol Co., Waterbury, Conn.

ELECTRICAL SUPPLIES
Atkins & Co., Inc., E. C., Indianapolis.
Diamond State Fibre Co., Toronto, Ont.
U.S. Electrical Tool Co., Cincinnati, O.

ELEVATING TRUCKS (See Trucks)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

ELEVATORS AND CONVEYORS
Can. Link-Belt C., Toronto, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.

EQUIPMENT, ELEVATOR SAFETY
Jones & Glassco, Montreal, Que.

EMERY WHEELS (See Grinding Wheels)
Lion Grinding Wheels, Limited, Montreal, Que.
Atkins & Co., E. C., Indianapolis. I.
Norton Co., of Canada., Ltd., Hamilton.

ENGINES, CAPSTAN
Kennedy & Sons, Wm., Owen Sound, Ont.

ENGINE LATHE MANUFACTURERS
Oliver Machinery Co., Grand Rapids, Michigan.

ENGINEERS, MECHANICAL
Dominion Engineering Works, Limited, Montreal, Que.
Gisholt Machine Co., Madison, Wis.
Hamilton Gear & Machine Co., Toronto,

EXPANDERS, TUBE
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

FANS, ELECTRIC
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

FANS, EXHAUST
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Petrie Ltd., H. W., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass.

FANS, VENTILATING
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

FIBRE
Diamond State Fibre Co., of Can. Ltd., Toronto, Ont.

FILES AND RASPS
Nicholson File Co., Port Hope, Ont.
Simmons Canada Saw Co., Montreal, Que.

FILLER, IRON (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J.

FIRE ESCAPES
Roelofson Elevator Co., Galt, Ont.

FITTINGS, PIPE
International Malleable Iron Co., Guelph.
Fittings, Limited, Oshawa, Ont.

FLEXIBLE SHAFTS
Strand & Co., N. A., Chicago, Ill

FLUXES, WELDING
Carter Welding Co., Ltd, Toronto, Ont.
Dominion Oxygen Co., Ltd, Toronto
Liquide Air Company, Toronto, Ont.

FORGING MACHINERY
Acme Machinery Co., Cleveland, Ohio
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown Boggs & Co., Ltd., Montreal.
National Machinery Co., Tiffin, Ohio.
Steel Co. of Canada, Ltd., Hamilton.

BUYERS' DIRECTORY

FORGINGS, DROP
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Ltd., Toronto, Ont.

FORGINGS, HAMMER
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Hepburn Ltd., John T., Toronto, Ont.

FOUNDRY EQUIPMENT
McDougall Co., Ltd., R., Galt, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

FOUNDRY SUPPLIES
Rice Lewis & Son, Ltd., Toronto, Ont.

FROGS, SPRING OR RIGID
Can. Steel Foundries, Montreal, Que.

FURNACES, ELECTRIC
Rockwell Co., W. S. New York City.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

FURNACES, HEAT TREATING COAL
Rockwell Co., W. S., New York City.

FURNACES, HEAT TREATING OIL AND GAS
Bellevue Industrial Furnace Co., Detroit, Michigan.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Rockwell Co., W. R., New York City.

FURNACES TEMPERING AND ANNEALING
Bellevue Industrial Furnace Co., Detriot, Mich.
Brown & Sharpe Mfg., Co., Providence R. I.
Rockwell Co., W. S., New York City.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

FURNACES AND OVENS, ELECTRIC
Petrie, Ltd., H. W., Toronto, Ont.
Rockwell & Co., W. S., New York city.
Starrett Co., L. S., Athol, Mass.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

GAGES, MEASURING (See Tool Work)
Brown & Sharpe Mfg. Co., Providence, R. I.
Greenfield Tap & Die Corp., Galt, Ont.
Lufkin Rule Co., Windsor, Ont.
Starrett Co., L. S., Athol, Mass.

GAGES, RECORDING
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GAGES, SPECIAL MEASURING (See Tool Work)
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GAGES, THREAD
Brown & Sharpe Mfg. Co., Providence R. I.
Herbert, Limited, Alfred, Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

GALVANIZING
Fittings, Limited, Oshawa, Ont.

GAS, COAL COMPRESSED
L'Air Liquid Society, Toronto, Ont.

GAS, COMPRESSED
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

GASKETS
Diamond State Fibre Co. of Ca., Ltd., Toronto, Ont.
Smooth Mfg. Co., Jersey City, N. J.

GAUGES VACUUM AND PRESSURE
Taylor Instrument Co., Toronto, Ont.

GEAR BLANKS
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.
Dominion Engineering Works, Limited, Montreal, Que.

GEAR COUNTERS
Hart Mfg. Co., R. A., Battle Creek, Michigan.

GEAR CUTTING MACHINES
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Fellows Gear Shaper Co., Springfield, Vt.
Petrie, Ltd., H. W., Toronto, Ont.
Whiton Machine Co., D. E., New London, Conn.

GEAR TESTING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.

GEARS, CAST
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Hull Iron & Steel Foundries, Hull, Que.
Dominion Engineering Works, Limited, Montreal, Que.

GEARS, CUT
Brown & Sharpe Mfg. Co., Providence, R. I.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Gardner & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto, Ont.
Hepburn Ltd., John T. Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

GEARS, DRESSED
Kennedy & Sons, Wm., Owen Sound, Ontario.

GEARS, FORGED
Canada Foundries & Forgings Co., Welland, Ont.

GEARS, HERRINGBONE
Hamilton Gear & Machine Co., Toronto, Ont.

GEARS, RAWHIDE (See Gears, Cut)
Hamilton Gear & Machine Co., Toronto.

GEAR, SILENT CHAIN
Gardner & Son, Robt., Montreal, Que.
Can. Link-Belt Co., Ltd., Toronto, Can.
Hans Renold of Canada, Ltd., Montreal, Quebec.

GEARS, WORM
Hamilton Gear & Machine Co., Toronto.

GENERATORS, ACETYLENE
L'Air Liquide Society, Toronto, Ont.

GLOVES, PROTECTIVE
Industrial Glove Co., Toronto, Ont.

GOGGLES, SAFETY
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

GRAB BUCKETS
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Cleveland Twist Drill Co., Cleveland, O.

GREASE CUPS, PRESSED STEEL AND BRASS
Can. Winkley Co., Ltd., Windsor, Ont.

GREASES, LUBRICATING
Canadian SKF Co., Toronto, Ont.

GRINDING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Norton Co., of Canada, Ltd., Hamilton

GRINDING MACHINES, ABRASIVE BELT
Norton Co. of Can. Ltd., Hamilton, Ont.

GRINDING MACHINES, AUTOMATIC
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, BENCH
Blount Co., J. G., Everett, Mass.
Geometric Tool Co., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
McDougall Co., Ltd., R., Galt, Ont.
Norton Co. of Canada, Ltd., Hamilton, Ont.
Petrie, Ltd., H. W. Toronto, Ont.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, CENTER
U. S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES, CUTTER AND REAMER
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Petrie Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, CYLINDRICAL
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.
Norton Co., of Canada, Ltd., Hamilton.

GRINDING MACHINES, DIE
Geometric Tool Co., New Haven, Conn.
National Acme Co., Cleveland, O.
National Machinery Co., Tiffin, Ohio.

GRINDING MACHINES, DRILL
Bellevue Industrial Furnace Co., Detroit, Mich.
Bertram & Son Co., Ltd., The John, Dundas, Ont.

GRINDING MACHINES, ELECTRIC
Strand & Co., N. A., Chicago, Ill.

GRINDING MACHINES, FLOOR AND TOOL
Blount Co., J. G., Everett, Mass.
Herbert, Limited, Alfred, Toronto, Ont.
National Acme Co., Cleveland, Ohio.
Norton Co. of Canada, Ltd., Hamilton, Ontario.
Petrie, Ltd., H. W., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.

GRINDING MACHINES, INTERNAL
Garlock Machinery Ltd., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES PORTABLE
Strand & Co., N. A., Chicago, Ill.

GRINDING MACHINES, SNAGGING
Blount Co., J. G., Everett, Mass.
Norton Co., of Can. Ltd., Hamilton, Ont.

GRINDING MACHINES, SURFACE
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, THREAD
Pratt & Whitney Co., of Canada, Ltd.,

GRINDING MACHINERY, TOOL POST
Gisholt Machine Co., Madison, Wis.
Grenfield Tap & Die Corp., Galt, Ont.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES, UNIVERSAL
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Herbert, Limited, Alfred, Toronto, Ont.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co., of Canada, Ltd., Hamilton Ontario.
Petrie, Ltd., H. W., Toronto, Ont

GRINDING WHEELS
Lion Grinding Wheels, Limited, Montreal, Que.
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Can Fairbanks-Morse Co., Ltd., Montreal.
Norton Co. of Can., Ltd., Hamilton, Ont.

GUN-BARREL MACHINERY
Steinle Turret Machine Co., Madison, Wisconsin.

HACK SAWS, POWER
Atkins & Co., Inc., E.C., Indianapolis, Indiana.
Petrie, Ltd., H. W., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.

HAMMERS, CHIPPING
Cleveland Pneumatic Tool Co., Toronto, Ont.
High Speed Hammer Co., Rochester.

HAMMERS, DROP
Bertram & Son Co., Ltd., The John Dundas, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

HAMMERS, ELECTRIC
Brown, Boggs & Co., Ltd., Hamilton, Ont.

HAMMERS, PNEUMATIC
Can. Steel Foundries, Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto Ont.

HANGERS, SHAFTING
Canadian SKF Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Hamilton Gear & Machine Co., Toronto.

HOBBING MACHINES
Shore Instrument Co., Jamaica, N.Y.

HARDENING, CASE-HARDENING AND TEMPERING
Barnes Company, Wallace, Hamilton.
Chapman Double Ball Bearing Co., Toronto.
Petrie, Ltd., H. W., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Cleveland Pneumatic Tool Co., Toronto Ont.

HAMMERS, POWER
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

HOBS
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

HOISTS, ELECTRIC
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

HOISTS, ELECTRIC
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

HOISTS, HAND
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

HOISTS, PNEUMATIC
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

HOLDERS-ON, PNEUMATIC
Cleveland Pneumatic Tool Co., Toronto Ont.

HYDRAULIC MACHINERY
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Dominion Engineering Works, Limited Montreal, Que.

IGNITERS, GAS ENGINE
Canada Foundries & Forgings Co., Welland, Ont.
Burke Machine Tool Co., Conneaut, O

INDICATORS, SPEED AND TEST
Brown & Sharpe Mfg. Co., Providence, R.I.

INSULATION
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.

IRON BARS
Steel Co. of Canada, Ltd., Hamilton Ont.

JACKS, HYDRAULIC
Norton, A. O., Boston, Mass.

JACKS, PLANER
Armstrong Bros. Tool Co., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

JAPANNING AND VARNISHING OVENS
Brantford Oven & Rack Co., Brantford, Ont.

JIGS AND FIXTURES (SEE TOOL WORK)
Fisher Motor Co., Ltd., Orillia, Ont.
Gisholt Machine Co., Madison, Wis.
Preston & Schwarts, Galt, Ont

KEYSEATING MACHINES
Morton Mfg. Co., Muskegon, Mich

BUYERS' DIRECTORY

Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

KEYS, MACHINE
Can. Dranw Steel Co., Hamilton, Ont.
Morton Mfg. Co., Muskegon, Mich.

KNIVES, MACHINE
Atkins & Co., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

KNURL HOLDERS
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

LATHE ATTACHMENTS
Hendey Machine Co., Torrington, Conn.
Petrie, Ltd., H. W., Toronto, Ont.

LATHE TOOLS
Armstrong Bros. Tool Co. ,Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

LATHES, AUTOMATIC AND SEMI-AUTOMATIC
Gisholt Machine Co., Madison, Wis.
Herbert, Limited, Alfred, Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, BENCH
Hardinge Bros., Inc., Chicago, Ill.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

LATHES, BORING
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, CHUCKING (SEE LATHES, HORIZONTAL TURRET, AND LATHES, VERTICAL TURRET)
Acme Machine Tool Co., Cincinnati, O.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
Herbert, Limited, Alfred, Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, ENGINE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hendey Machine Co., Torrington, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd, H. W., Toronto, Ont
Rockford Lathe & Drill Co., Rockford, Illinois.

LATHES, EXTENSION AND GAP
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison Wis.
Herbert, Limited, Alfred, Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, O.
Petrie, Ltd., H. W., Toronto, Ont.
Steinle Turret Machine Co., Madison, Wis.

LATHES, PRECISION
Hardinge Bros., Chicago.

LATHES, RELIEVING
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.

LATHE, UNIVERSAL HAND
Brown & Sharpe Mfg. Co., Providence, Rhode Island.

LATHE, SPEED AND HAND
Blount Co., J. G., Everett, Mass.

LATHES, SPINNING
Pryibil Machine Co., Torrington, Conn.

LATHES, VERTICAL TURRET
Bertram & Son, Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

LATHES, WOOD TURNING
Blount, Co., J. G., Everett, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.

LEAD PIPE
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

LEATHER FILLET
D. K. McLaren, Limited, Montreal.

LIGHTING AND GENERATING SETS
Beardmore & Co., Ltd., Wm., Montreal, Que.

LINOLEUM MILL MACHINERY
Bertrams, Ltd., Edinburgh, Scotland.

LIQUID AIR PLANTS
L'Air Liquide Society, Toronto, Ont.

LOCKERS, CLOTHES
Dennis Wire and Iron Works, London, Ont.

LUBRICANTS
Oakley Chemical Co., New York, N.Y.

LUBRICATING SYSTEMS
Bowser, S. F., & Co., Ltd., Toronto, Canada.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Ltd., Welland, Ont.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Truing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R. Toronto Ont.

MANGANESE STEEL
Can. Steel Foundries, Montreal, Que.

MANDRELS, EXPANDING
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MANDRELS, SOLID
Greenfield Tap & Die Corp., Galt, Ont.
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Pratt & Whitney Co., of Canada. Ltd., Dundas, Ont.

MEASURING MACHINES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MECHANICS' FINE TOOLS
Lufkin Rule Co., Windsor, Ont.

METALS, ALLOY
Canada Metal Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.

METAL WORKERS
Parker Co., Charles, Meriden, Conn.

MICROMETER CALIPERS
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Rice Lewis & Son, Ltd., Toronto, Ont.

MILLING ATTACHMENTS
Burke Machine Tool Co., Conneaut, O.
Hendey Machine Co., Torrington, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Hinckley Machine Works, Hinckley, Ill.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

MILLING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Burke Machine Tool Co., Conneaut, O

MILLING MACHINES, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence, R. I.
Hardinge Bros., Inc., Chicago, Ill.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

MILLING MACHINES, BENCH
Burke Machine Tool Co., Conneaut. O.
Hardinge Bros., Inc., Chicago, Ill.

MILLING MACHINES, HAND
Brown & Sharpe Mfg. Co., Providence
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MILLING MACHINES, HORIZONTAL PLANER TYPE.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Kearney & Trecker Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto.

MILLING MACHINES, PLAIN
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, O.
Hendey Machine Co., Torrington, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

MILLING MACHINES, THREAD
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MILLING MACHINES, UNIVERSAL
Brown & Sharpe Mfg. Co., Providence,
Hendey Machine Co., Torrington, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

MILLING MACHINES, VERTICAL
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, O.
Herbert, Limited, Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto.

MILLING TOOLS, ADJUSTABLE HOLLOW
Geometric Tool Co., New Haven, Conn.

MOTORS, ELECTRIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Roelofson Elevator Co., Galt, Ont.
Williams Machinery Co., A. R., Toronto,
Wisconsin Electric Co., Racine Wis.

NAILS AND STAPLES
Canada Metal Co., Ltd., Toronto, Ont.

NIPPLES
Canada Metal Co., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton,

NITROGEN
Carter Welding Co. Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

NUT TAPPERS
(See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
National Acme Co., Cleveland, Ohio.

NUTS, FINISHED and SEMI-FINISHED
Galt Macine Screw Co., Galt, Ont.
National Acme Co., Montreal, ue.

NUTS (Up to 4-in.)
Steel Co. of Canada, Ltd., Hamilton.

NUTS, S.A.E., PLAIN AND CASTELLATED
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

OIL FILTERING AND STORAGE SYSTEMS
Bowser, S. F., & Co., Ltd., Toronto,

OIL STORAGE ENGINEERS
Bowser, S. F., & Co., Ltd., Toronto,

OIL HOLE COVERS
Can. Whitney Co., Ltd., Windsor, Ont.

OILS, SOLUABLE
Brantford Oven & Rack Co., Brantford, Ontario.

OXYGEN
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

OXY-ACETYLENE APPARATUS
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Atlas Press Co., Kalamazoo, Mich.

PAPER MILL CONVEYORS
Bertram Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd., Montreal, Que.

PATTERNS, WOOD AND METAL
Fittings, Limited, Oshawa, Ont.
Victoria Foundry Co., Ltd., Ottawa.

PHOSPHOR TIN
Canada Metal Co., Ltd., Toronto, Ont.

PHOTOGRAPHIC DUPLICATING MACHINES
Photostat Corp., Providence, R. I.

PIPE BENDING MACHINES
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Underwood Corp., H. R., Philadelphia, Pa.
Williams Machinery Co., A. R., Toronto.

PIPE CUTTING AND THREADING MACHINES
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

PIPE
Canada Metal Co., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.

PIPE FITTINGS
Canada Metal Co., Toronto, Ont.
Fittings, Limited, Oshawa, Ont.
International Malleable Iron Co., Guelph Ont.

PIPE AND NIPPLE THREADING MACHINES
Landis Machine Co., Inc., Waynesboro, Pa.

PIPE FITTERS' TOOLS
Rice Lewis & Son, Ltd., Toronto, Ont.

PIPE THREADING DIE HEADS
Landis Machine Co., Inc., Waynesboro, Pa.

PISTON-RING MACHINES
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

PLANING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.
Herbert, Limited, Alfred, Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Williams Machinery Co., A. R., Toronto.

PLANING MACHINES, ROTARY
Bertram & Son Co., Ltd., The John, Dundas, Ont.

PLATE ROLLS
Bertram & Son Co., Ltd., The John, Dundas, Ont.

PNEUMATIC TOOLS
Cleveland Pneumatic Tool Co., Toronto.

POLISHING AND BUFFING MACHINES
Lion Grinding Wheels, Limited, Montreal, Que.
Blount Co., J. G. Everett, Mass.
Brown & Sharpe Mfg. Co., Providence.
Pryibil Machine Co., New York, N.Y.

PRESSED STEEL PARTS
American Pulley Co., Philadelphia, Pa.
Fisher Motor Co., Ltd., Orillia, Ont.

PRESSES, ARBOR
Atlas Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

PRESSES, DROP AND FORGING
Brown, Boggs & Co., Ltd., Hamilton.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

PRESSES, FOOT AND HAND
Brown, Boggs & Co., Ltd., Hamilton.

PRESSES, HYDRAULIC
Bertram & Son Co., Ltd., The John, Dunldas, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Perrin Ltd., W. R., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

PRESSES, POWER
Bliss Co., E. W., Prooklyn, N. Y.
Brown, Boggs, & Co., Ltd., Hamilton,
Hepburn Ltd., John T., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Stoll Co., Inc., D. H., Buffalo, N.Y.

PRESSES, SCREW
Brown, Boggs & Co., Ltd., Hamilton.
Petrie, Ltd., H. W., Toronto, Ont.

PROFILING MACHINES
Prtt & Whitney Co., of Canada, Ltd., Dundas, Ont.

PROTRACTORS
Brown & Sharpe Mfg. Co., Providence
Lufkin Rule Co., Windsor, Ont.

PROPELLERS
Kennedy & Sons, Wm., Owen Sound Ontario.

PULLEYS, CORK INSERT
American Pulley Co., Philadelphia, Pa

PULLEYS, METAL AND FIBRE
American Pulley Co., Philadelphia, Pa.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.
D K. McLaren Co , Limited Montreal, Que.

PULP AND PAPER MILL EQUIPMENT
Dominion Engineering Works, Ltd., Montreal, Que.

PUMPS, HYDRAULIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Dominion Engineering Works, Ltd. Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont

BUYERS' DIRECTORY

PUMPS, LUBRICANT AND OIL
Bowser, S. F., & Co., Ltd., Toronto.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Hepburn Ltd., John T., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.

PUMPS, POWER
Bowser, S. F., & Co., Ltd., Toronto.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hepburn Ltd., John T., Toronto, Ont.

PUNCHES, CENTER
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

PUNCHES, HAND
Brown Boggs & Co., Ltd., Hamilton.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Jardine & Co., A. B., Hespeler, Ont.

PUNCHES, POWER
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

PUNCHING MACHINES, HORIZONTAL
Bertram Ltd., Edinburgh, Scotland.

PYROMETERS, ELECTRIC
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Hiram Walker & Sons Metal Products Co., Walkerville, Ont.

RACKS, CUT
Hamilton Gear & Machine Co., Toronto.

RACKS, STORAGE
(See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ontario.

REAMER HOLDERS
Simonds Canada Saw Co., Montreal, Q.

REAMERS, EXPANDING
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

REAMERS, SOLID
Butterfield & Co., Inc., Rock Island, Q.
Morse Twist Drill & Machine Co., New Bedford, Mass.

REAMERS, TAPER
Brown & Sharpe Mfg. Co., Providence, R. I.
Butterfield & Co., Inc., Rock Island, Q.
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canad, Ltd., Dundas, Ont.

RECORDERS, TEMPERATURE
Taylor Instrument Co., Rochester, N. Y.

RECORDERS, TIME
Gisholt Machine Co., Rochester, N. Y.
Taylor Instrument Co., Toronto, Ont.

REGULATORS, TEMPERATURE
Taylor Instrument Co., Toronto, Ont.

RIVETS AND BURRS
Parmenter & Bulloch Co., Gananoque, Ont.
Steel Co., of Canada, Ltd., Hamilton,

RIVETS, CHAIN
Pittings, Limited, Oshawa, Ont.

RIVET-MAKING MACHINERY
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

RIVETING MACHINES
Can. Fairbanks-Morse Ltd., Montreal Q.
High Speed Hammer Co., Rochester, N.Y.
Parmenter & Bulloch Co., Gananoque Ont.
Petrie, Ltd., H. W., Toronto, Ont.

RUDDER FRAMES, STEEL
Can. Steel Foundries, Montreal, Que.

RUBBER MILL MACHINERY
Bertram Ltd., Edinburgh, Scotland.

RULES, STEEL AND WOOD
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Windsor, Ont.

RUST PREVENTATIVES
Oakley Chemical Co., New York, N. Y.

SAND EQUIPMENT
Can. Link-Belt Co., Toronto, Ont.

SAND RAMMERS, PNEUMATIC
Cleveland Pneumatic Tool Co., Toronto.

SAW FRAMES AND BLADES, HACK
Atkins & Co., Inc., E. C., Indianapolis,
Diamond Saw & Stamping Works, Buffalo, N. Y.
Rice Lewis & Sons, Ltd., Tornto, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWING MACHINES, POWER HACK
Atkins & Co., Inc., E. C., Indianapolis,
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

SAW SHARPENING MACHINES
Atkins & Co., Inc., E. C., Indianapolis,
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

SAW SHARPENING MACHINES
Atkins & Co., Inc., E. C., Indianapolis.

SAW TABLES, UNIVERSAL
Petrie, Ltd., H. W., Toronto, Ont.

SAWS, CIRCULAR METAL
Atkins & Co., Inc., E. C., Indianapolis.
Prybil Machine Co., New York, N. Y.
Gisholt Machine Co., Madison, Wis.

SAWS, HAND
Atkins & Co., Inc., E. C., Indianapolis
Simonds Canada Saw Co., Montreal, Q.

SAWS, HOT AND COLD
Atkins & Co., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Q.

SAWS, HIGH SPEED STEEL
Atkins & Co., Inc., E.C., Indianapolis, I.
Butterfield & Co. Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWS, METAL BAND
Atkins & Co., E. C., Indianapolis, I.

SAWS, METAL CUTTING
Brown & Sharpe Mfg. Co., Providence,
Butterfield & Co., Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.
Starrett Co., L. S., Athol, Mass.

SAWS, SCREW SLOTTING
Atkins & Co., Inc., E., C., Indianapolis.
Butterfield & Co., Inc., Rock Island, Q.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canda, Ltd., Dundas, Ont.

SAWS, SCREW SLOTTING
Atkins & Co., Inc., E. C., Indianapolis.
Butterfield & Co., Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWS, WOOD
E. C. Atkins & Co., Indianapolis, Ind.

SCALES
Brown & Sharpe Mfg. Co., Providence
Can. Fairbanks-Morse Ltd., Montreal, Q.
Lufkin Rule Co., Windsor, Ont.

SCREENS
Dominion Engineering Works, Ltd., Montreal, Que.

SCREW DRIVERS, OPTICAL, JEWELRY AND NOVELTY
Strand & Co., N. A., Chicago, Ill.

SCREW MACHINE WORK
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Montreal, Que.

SCREW MACHINERY, WOOD AND LAG
Cook Co., Asa S., Hartford, Conn.

SCREW MACHINES
Brown & Sharpe Mfg. Co., Providence, Rhode Island.

SCREW MACHINES, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.

SCREW MACHINE PRODUCTS
National Acme Co., Montreal, Que.

SCREW PLATES
Butterfield & Co., Inc., Rock Island. Que.
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National Acme Co., Montreal, Que.

SCREWS, SAFETY, SET
Galt Machine Screw Co., Galt, Ont.

SECOND-HAND MACHINERY
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SEPARATORS, MOISTURE AND OIL
Bowser, S. F., & Co., Ltd., Toronto, Canada.

SEPARATORS, OIL AND WASTE
Bowser, S. F., & Co., Ltd., Toronto.

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Prybil Machine Co., P., New York City.

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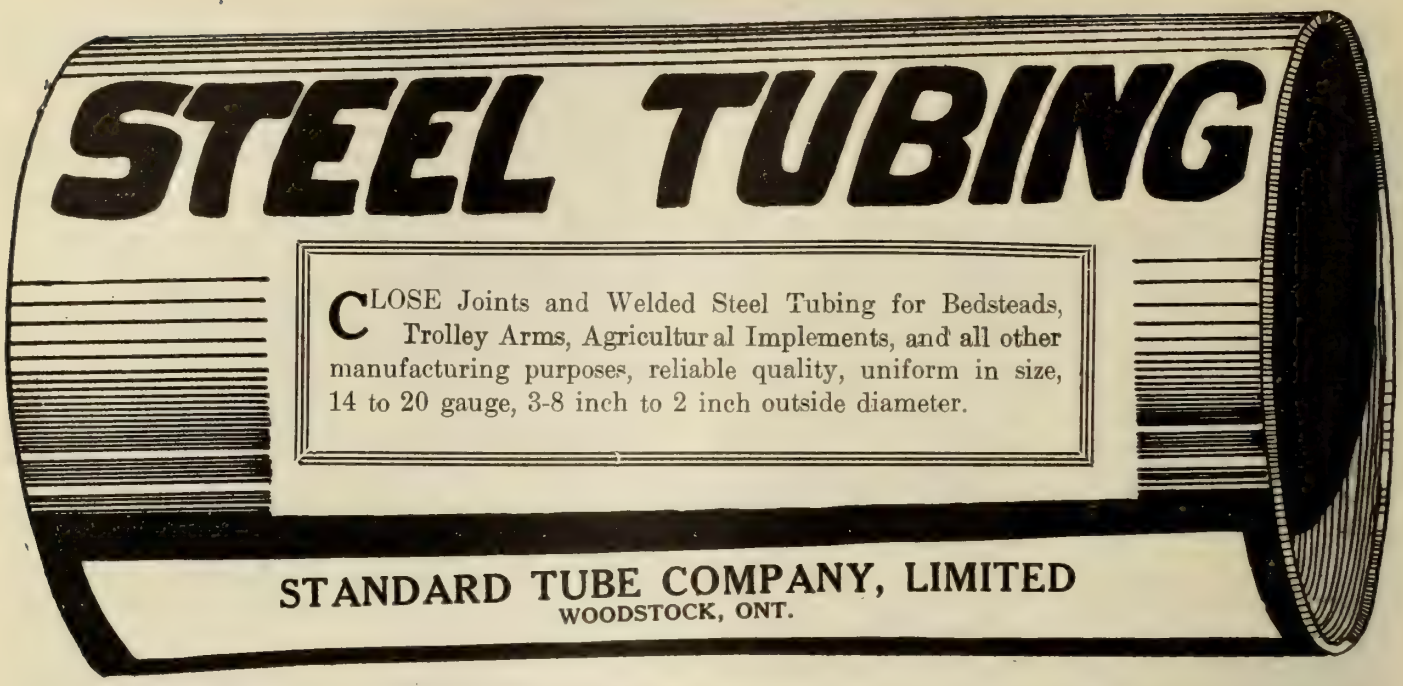
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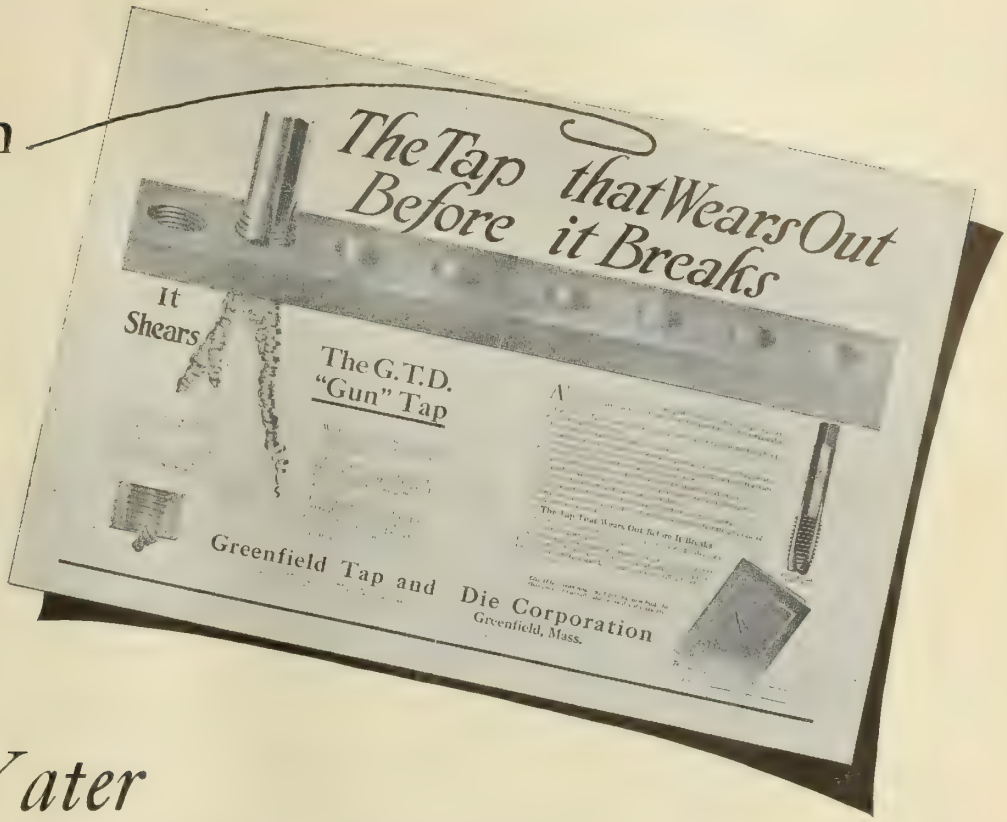

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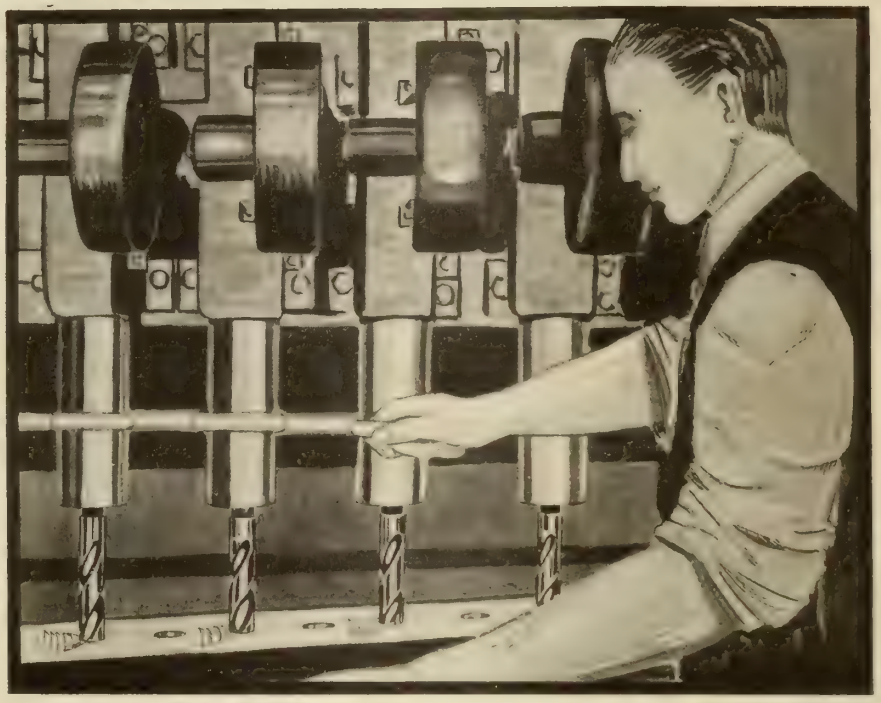

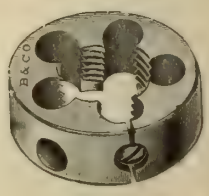

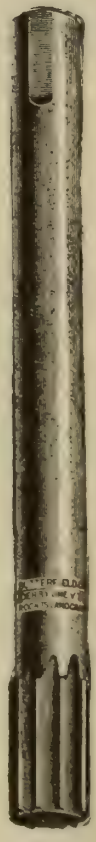

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CANADIAN MACHINERY
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TORONTO, CANADA

To Select Good Belts

Look For This Trade Mark

It is our guarantee and assurance to you that the belting bearing it is the most desirable of its kind.

It is something more than a mark bearing our name and address. It means a lot of things. It says to you, in effect: Here is belting made of selected materials, by skilled workmen, under expert supervision. This belting gives superior adhesion to pulleys, even pliability, great strength, and remarkable resistance to the action of heat, cold or moisture.

Manufactured Exclusively By

Gutta Percha & Rubber
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Head Offices and Factories, Toronto

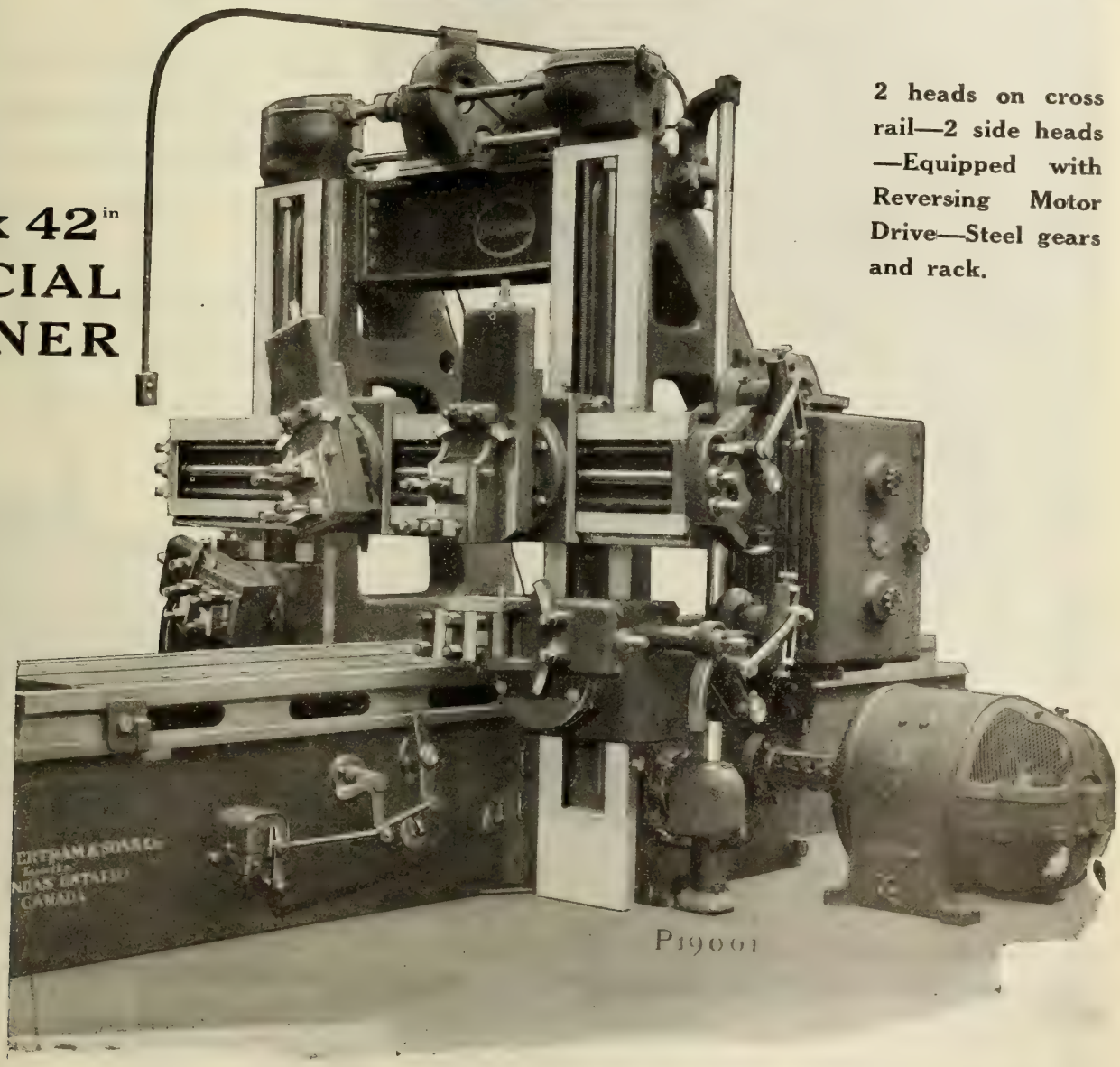
Branches in All Leading Cities of Canada

The BERTRAM Page

MACHINE TOOLS

42 in. x 42 in SPECIAL PLANER

2 heads on cross rail—2 side heads —Equipped with Reversing Motor Drive—Steel gears and rack.



The John Bertram & Sons Co., Limited

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Steel Car and Locomotive Axles, Marine Shaft and other Heavy Forged Products of every description made from fluid compressed and ordinary open hearth steel

Forging Intermediate Line Shaft on 4000 ton Forging Press

From ore to finished product - All within the Empire

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A Unit of

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CANADA CEMENT BUILDING, MONTREAL

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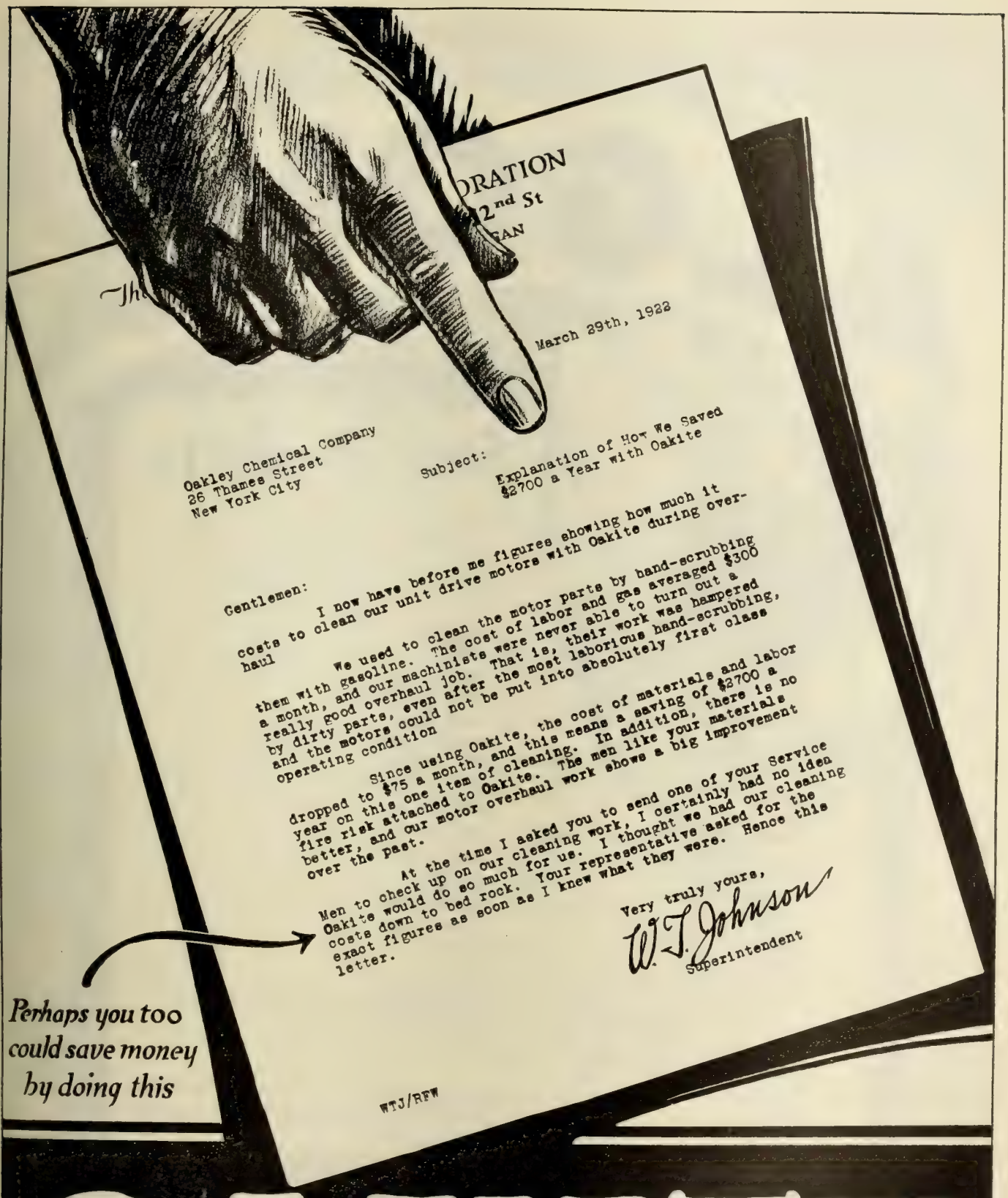
ORATION
2nd St
EAN
March 29th, 1922
Oakley Chemical Company
26 Thames Street
New York City
Subject: Explanation of How We Saved $2700 a Year with Oakite
Gentlemen:
I now have before me figures showing how much it costs to clean our unit drive motors with Oakite during overhaul
We used to clean the motor parts by hand-scrubbing them with gasoline. The cost of labor and gas averaged $300 a month, and our machinists were never able to turn out a really good overhaul job. That is, their work was hampered by dirty parts, even after the most laborious hand-scrubbing, and the motors could not be put into absolutely first class operating condition
Since using Oakite, the cost of materials and labor dropped to $75 a month, and this means a saving of $2700 a year on this one item of cleaning. In addition, there is no fire risk attached to Oakite. The men like your materials better, and our motor overhaul work shows a big improvement over the past.
At the time I asked you to send one of your Service Men to check up on our cleaning work, I certainly had no idea Oakite would do so much for us. I thought we had our cleaning costs down to bed rock. Your representative asked for the exact figures as soon as I knew what they were. Hence this letter.
Very truly yours,
W. T. Johnson
Superintendent
WTJ/RFW
Perhaps you too could save money by doing this
OAKITE
MANUFACTURED BY OAKLEY CHEMICAL CO. 44 THAMES ST. NEW YORK

Resident Canadian Representatives: MR. C. BURGIN, Montreal. MR. C. P. MURPHY, Toronto.

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PIG IRON
BASIC, FOUNDRY
MALLEABLE
SULPHATE OF AMMONIA
BLOOMS
BILLETS
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STRUCTURAL STEEL
MERCHANT BARS
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OPEN HEARTH ALLOY STEELS
CHROME-VANADIUM
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NICKEL
All of these steels we supply in
HOT ROLLED BARS
We also furnish in
BLOOM, BILLET AND SLAB FORM.
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Our extensive warehouse facilities enable us to ship quickly from stock

ALGOMA STEEL CORPORATION
LIMITED

SAULT STE. MARIE, ONTARIO, CANADA
Sales Offices: Montreal: 606 McGill Building Toronto: Bank of Hamilton Building

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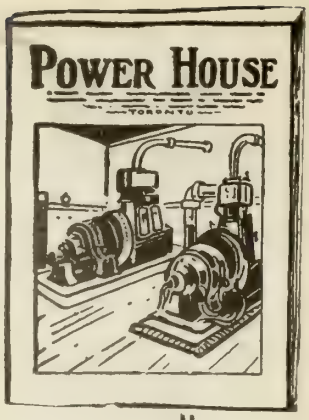

DO YOU Manufacture Industrial Equipment?

Are you a manufacturer of twist drills, hack saws, mechanics' tools, wire guards, bolts, rivets, paints—do you manufacture lines of any description that can be used in machine shops, metal-working plants, power plants or foundries? If you do the publications you see illustrated here (Canadian Machinery, Canadian Foundryman, and Power House) can build a bigger demand for your products.

This group of technical newspapers is read by the men who are prospective buyers of your lines. You can bring to the attention of these men the reason why they should demand your goods when purchasing from their dealers. You can effectively do this by placing a message in the paper which serves the field in which your products are sold.

CANADIAN MACHINERY AND MANUFACTURING NEWS is published weekly and covers the machinery, iron and steel and general metal-working industries of Canada.

POWER HOUSE is published semi-monthly; it serves steam, electrical, water and gas power plants, and the power houses of all general manufacturing plants.

CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS is published monthly; it serves the grey iron, steel and non-ferrous foundries.

Each one of these publications reach proprietors, managers, purchasing agents, foremen—the men who direct the purchasing of goods. A message to these men in any of the MacLean Technical Newspapers is certain to have a strong influence.

Write for complete Data.

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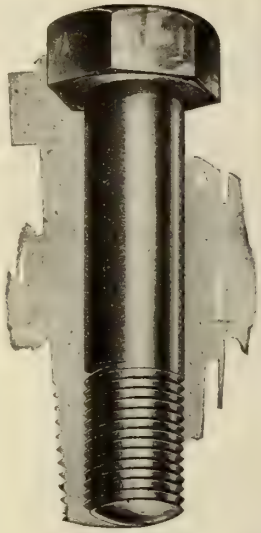

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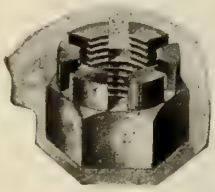
Just now all jobbers should have a complete stock of SAE Cap Screws, Plain and Castellated Nuts and Taper Pins to meet the automobile repair trade requirements.

Your rush orders filled promptly by



The Galt Machine Screw Co., Limited

GALT, ONTARIO

Eastern Representatives:
Messrs. F. BACON & COMPANY
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CONFIDENCE—

born of thirty-five years of
BABBITT SERVICE
Warrants us Giving You
IMPERIAL GENUINE

AND

HARRIS HEAVY PRESSURE
BEARING METALS

IT IS

a great and glorious feeling to serve you, knowing that your troubles will disappear with the touch of our knowledge of bearing problems.

Give us a chance to help you. WHAT ARE YOUR PROBLEMS?

THE CANADA METAL CO. LIMITED
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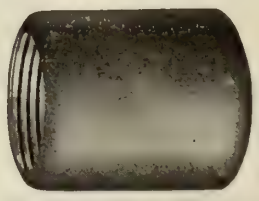
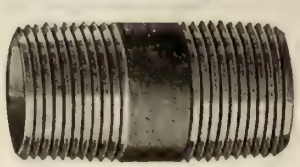
WROUGHT PIPE
COUPLINGS and NIPPLES





Each length of M.R.M. Pipe is tested to withstand a pressure of 700 pounds per square inch.

Supplied in black or galvanized.

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HAMILTON MONTREAL

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Where Simplicity Means Accuracy

Just as a straight line is the shortest distance between two points, so a Bristol Recording Thermometer is the shortest route from temperature to record.

Simplicity, it happens, is the keynote of the accuracy in Bristol thermometers. The two are complementary and Bristol users appreciate one as much as the other.

It is this simplicity that makes Bristol equipment so popular with firms that buy for service. You will appreciate it, whatever your thermometer applications may be.

Have you Catalog I-1202?

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THE BRISTOL CO., Waterbury, Conn.

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MALLEABLE IRON, GREY IRON, STEEL, ALUMINUM, BRASS and BRONZE.

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Distributors :

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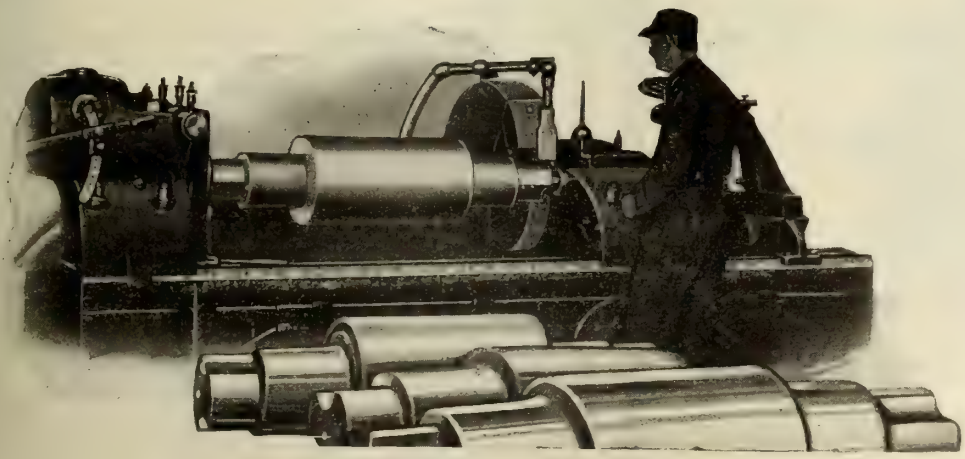
Whether the Work is Large or Small—There's a



LANDIS

To Handle the Job

Grinding Necks of Rolls with a LANDIS Roll Grinding Machine.

To meet the requirements of progressive manufacturers, who found that grinding machines permitted greater accuracy, LANDIS Grinders have been developed along various lines to meet the many exacting demands for greater accuracy and production.

Here are a few of the LANDIS types: plain, roll, camshaft, crank pin, piston, universal, internal, ball race and cylinder grinding machines.

Let us send you a catalog.

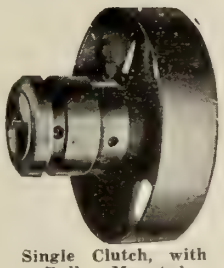
Landis Tool Co., Waynesboro, Pa., U.S.A.

CANADIAN AGENTS: A. R. Williams Machinery Co., Halifax, St. John, Winnipeg, Vancouver; Williams and Wilson, Montreal; F. F. Barber Machinery Co., Ltd., Toronto.

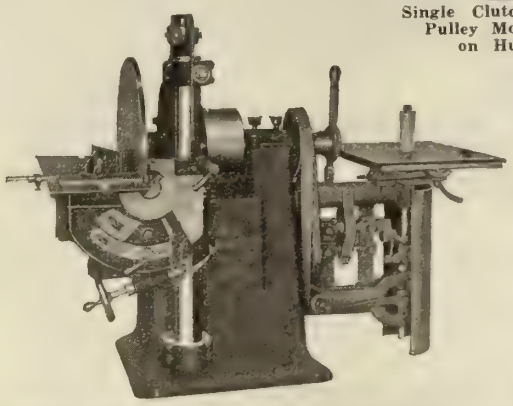
THE JOHNSON FRICTION CLUTCH

IS USED ON THE BESLY PATTERN MAKERS' DISC GRINDER

A No. 4 single clutch, as shown by cut, drives the roll sanding attachment. On account of the high speed a roller bearing is used in the clutch hub. Absolute control is assured when a Johnson friction clutch is used on a machine of any kind.



Single Clutch, with Pulley Mounted on Hub



Made in both a single and a Double Type

Write for Yellow Catalog

Courtesy Charles H. Besly & Co., Beloit, Wis.

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GISHOLT

LABOR SAVING EQUIPMENT

TURRET LATHES
Hand Operated
For Chucking and Bar Work
AUTOMATIC TURRET LATHES
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VERTICAL BORING and TURNING MILLS
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REAMERS, "SOLID ADJUSTABLE"
Shell and Chucking
BORING BARS
With Adjustable Cutters
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For Time Recording in Factories
Separate Catalogs on each Product
Send for the ones you want

GISHOLT MACHINE CO.

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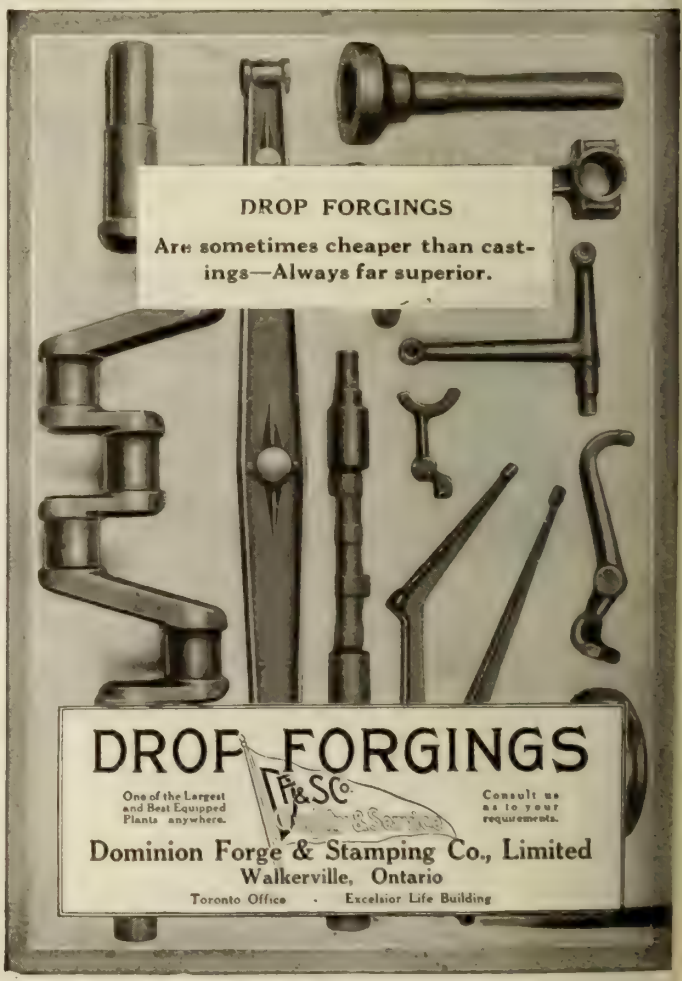
DROP FORGINGS
Are sometimes cheaper than castings—Always far superior.
DROP FORGINGS
One of the Largest and Best Equipped Plants anywhere.
Consult us as to your requirements.
Dominion Forge & Stamping Co., Limited
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Next to the full Dinner Pail–

comes the full tool kit. At least, that's the way *I* look at it. Having the right tools when you want 'em is just about as important as the old three squares per day. You can't do good work with half the tools you need any more than you can work on half rations.

"I've got a set of Starrett Tools that'll handle anything and I'll tell the world I've seen some tough jobs. When it comes to doing a job *right*—I've got the tool it takes to do it.

"Borrow 'em? Not while I know it. You've got about as much chance of getting my Starrett Tools as you have of borrowing my dinner pail."

Write for Catalog No. 22"3" and the Supplement describing the new Starrett Tools.

THE L. S. STARRETT CO.
The World's Greatest Toolmakers
Manufacturers of Hacksaws Unexcelled
ATHOL, MASS.

Starrett Tools

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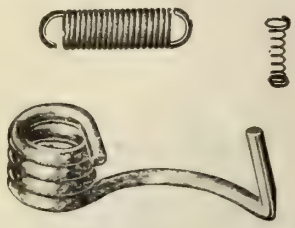
SPECIAL TORSION AND SMALL WIRE SPRINGS



THE WALLACE BARNES CO. LIMITED
WIRE
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HAMILTON, ONTARIO
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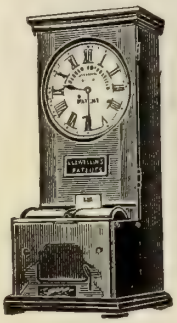
FLAT AND FLAT COIL SPRINGS OF ALL DESCRIPTIONS

Time Checking Machines, Time Recorders, Watchman's Watches, Recorders for all purposes

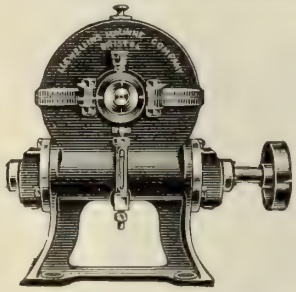


18 Class, Patent Card Recorder

WATCHMAN'S Watches check the rounds of watchmen ensuring less risk from fire etc., with a consequent reduction in insurance premiums

Watchman's Watch

GEARS Machine Cut Machine Moulded — All Sizes and Descriptions



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Specialists in High Speed-Reducing and Accelerating Gears.

D.H. Stag Tooth Wheel & Pinion

Llewellin Machine Co., Bristol, Eng.

TELEGRAPHIC AND CABLE ADDRESS: Llewellins, Bristol, Eng.

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Sizes 180, 160, 140, 120, 110, 100, 90, 80, 70, 60, 54, 46, 40, 36, 30, 24, 20, 18, 16, 14, 12, 10, 9, 8, hole.

EMERY FLOUR AND WASHED FLOUR

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In Sheets, Rolls, Discs, Bands, Strips and Tapes, &c.

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a science in itself

Only the institution operating on a major scale can maintain that type of fully-manned, thoroughly-experienced Traffic Department which best guards a buyer from shipping delays, needless freight charges and interruption of production-schedules. It is more than a man-sized responsibility—it is an organization-sized job for a specialized staff such as M. A. Hanna & Co. maintain at all times.

M-A HANNA & Co.

HANNA

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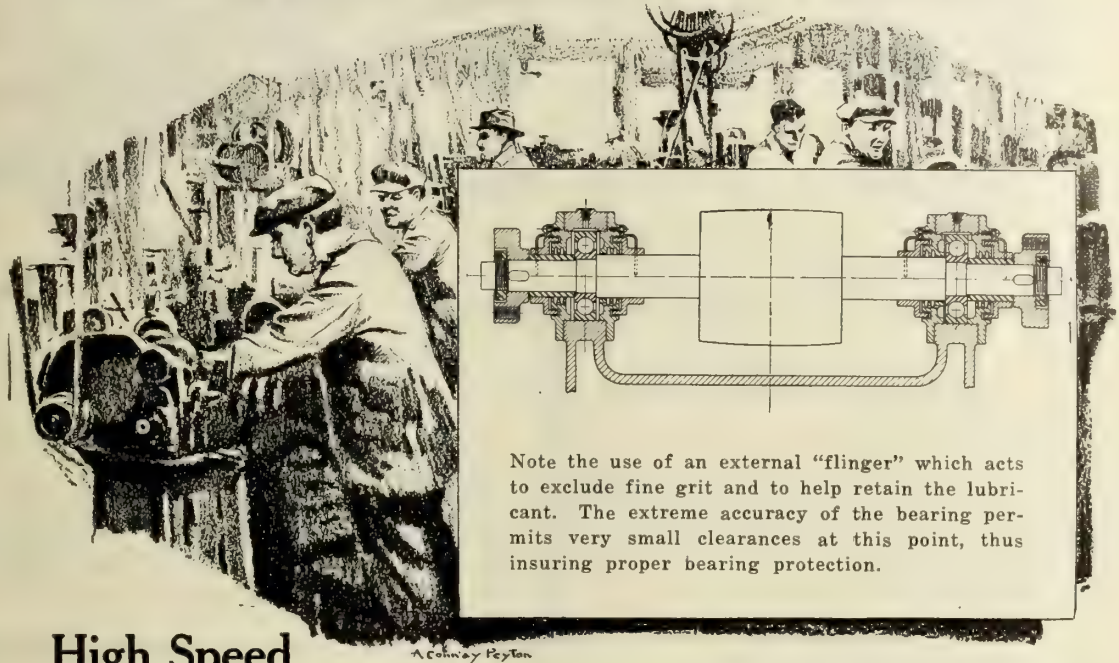
SKF

Modern Machine Tools



Note the use of an external "flinger" which acts to exclude fine grit and to help retain the lubricant. The extreme accuracy of the bearing permits very small clearances at this point, thus insuring proper bearing protection.

High Speed For Months with Practically No Attention

Double end disc grinders must be accurately mounted, well balanced and practically vibrationless to be successful. This means that the bearings must be almost frictionless and that wear must be kept at a minimum so that the original accuracy of both the bearings and the spindle may be maintained.

Manufacturers of double end disc grinders are finding that SKF marked ball bearings enable these machines to run continuously and without attention for long periods of time. The bearings support both the thrust and radial load as transmitted from the belts and grinding wheels and maintain high speed safely without danger of heating, binding or chatter. Even under the severest duty they are practically wearproof.

SKF marked ball bearings need no "take up" or adjustment and so little lubricant that replenishment once in several months is sufficient. In every way they make a trouble-proof part which increases the reliability and life of the machine.

CANADIAN SKF COMPANY, LIMITED
TORONTO AND MONTREAL

708

What Bill says to Jim Doesn't Pay Dividends

When Bill meets Jim at the oil barrel, they are sure to gossip—for Bill has to wait while Jim fills his oil can. That's six minutes of your time wasted—three by Bill and three by Jim.

And oil is wasted, too—for oil overflows with the conversation.

Stop these wastes. Install the complete Bowser Oil Storage equipment. It is so flexible that it meets any need. All receipts and disbursements of oil are registered. Every drop of oil is clean—no grit can possibly get into the storage tank.

Write to-day for Booklet C-13 and let our engineers suggest the way you can save from 17% to 32% on present oil costs.

Bowser Equipment is MADE IN CANADA by

S. F. BOWSER & CO., LTD.
Toronto - Canada

BOWSER
ESTABLISHED 1885
ACCURATE MEASURING PUMPS

BOWSER PRODUCTS

For Handling Gasoline and Oils Wherever Sold or Used

Filling Station Pumps and Tanks for Gasoline.
Portable Tanks for Oil and Gasoline.
Storage and Measuring Outfits for Paint Oils, Kerosene and Lubricating Oils.
Carload Oil Storage Tanks.
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Save Steel!

Armstrong Tool Holders are convenient, economical and efficient. They meet every objection to the use of high-speed steel, the comparatively excessive cost of which makes the question of its economical use one of first importance. No "stub ends" wasted with an Armstrong Tool Holder.

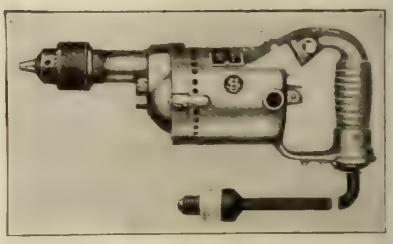
Write for Catalogue.

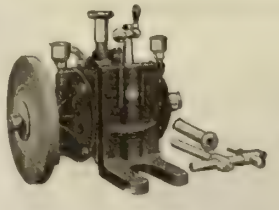
Armstrong Bros. Tool Co.
"The Tool Holder People"
305 N. Francisco Ave., Chicago, U.S.A.

CANADIAN AGENTS—A. R. Williams Machinery Co., St. John, Halifax, Toronto; Williams & Wilson, Montreal.

U. S. ELECTRIC
Drills and Grinders
Can be Attached to any Lamp Socket

For drilling in metal these drills are the superior of every other kind of portable drill. Their operating cost is only half that of air drills. And they can be attached to any lamp socket.





Made in several sizes from 3-16" to 1¼". Motors wound for alternating or direct current, or both, 110 or 220 volts.

A trial will prove that our drills and grinders will save you time, labor, and expense. Order a few today.

For Sale By
The Canadian Fairbanks-Morse Co., Limited
Montreal, St. John, N.B., Toronto, Winnipeg, Calgary, Vancouver

THE UNITED STATES ELECTRICAL TOOL CO.
CINCINNATI, OHIO

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Specialists in Metal Working Machinery

Business is improving. Are you fully equipped to take care of your share of it? Worn out and old types of machines are only a handicap to showing profits. Look over your plant. See what machines you really need to increase your production and write us particulars. We will have a representative call upon you prepared to quote prices and give full information. We have a large modern plant located at 163 Dufferin Street, Toronto, for the re-building of used machinery and guarantee all our rebuilt machines to be in first class working order. At the present time have a large stock of rebuilt machines in stock, of all classes, ready for prompt shipment on which we can quote very interesting prices.

Let Us Quote on All Your Needs in New Machinery

GARLOCK MACHINERY LIMITED

WOOD WORKING AND METAL WORKING MACHINERY

163 DUFFERIN ST. TORONTO TELEPHONE, PARKDALE 7855

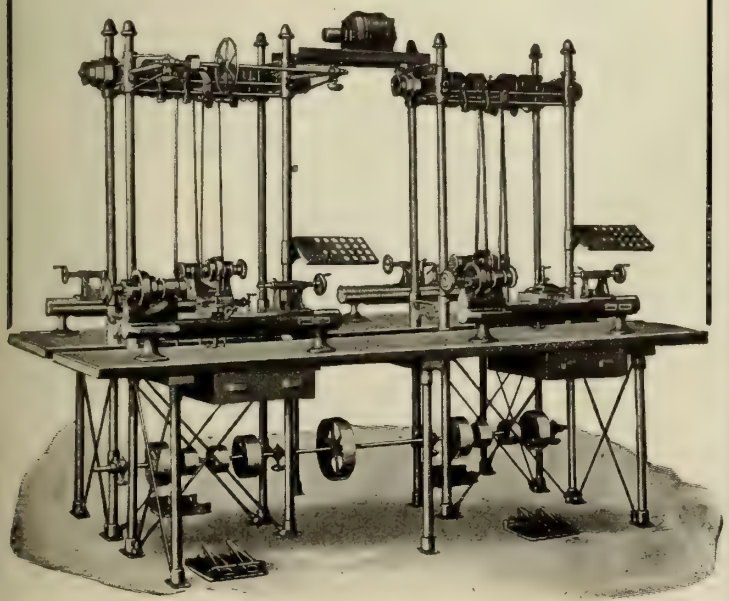
See Us About All Your Machinery Needs

CATARACT LATHES

This Cataract Standard R-4 Double Bench Unit with Under-Drive Jackshaft is particularly adapted to tool-room work and for rapid production of duplicate parts. It may be erected entirely independent of walls or ceiling, and therefore may be set in any desired position.

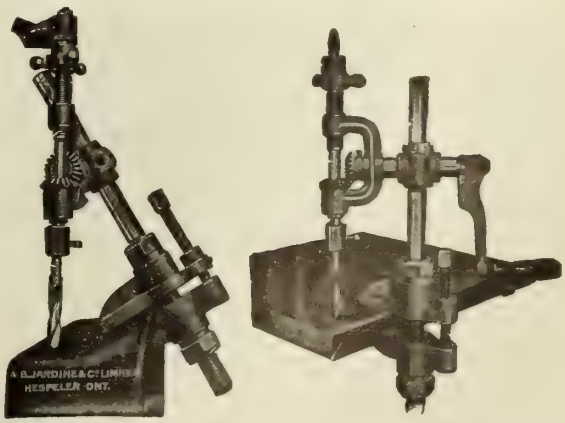
Hardinge Brothers

CHICAGO



Jardine Universal Ratchet Drill

Time is expensive when a machine is standing idle, waiting for repairs.



On the average repair job, this machine completes the drilling in less than the time required to set an ordinary ratchet to begin.

Weight, 40 lbs. Price, $26.50 net.
Sold by all Machinery and Supply Houses.

A. B. JARDINE & CO., Limited

HESPELER, ONTARIO

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To Holders of Five-Year $5\frac{1}{2}$ per cent. Canada's Victory Bonds

Issued in 1917 and Maturing 1st December, 1922

CONVERSION PROPOSALS

THE MINISTER OF FINANCE offers to holders of these bonds who desire to continue their investment in Dominion of Canada securities the privilege of exchanging the maturing bonds for new bonds bearing 5½ per cent. interest, payable half yearly, of either of the following classes:—

(a) Five year bonds, dated 1st November, 1922, to mature 1st November, 1927.

(b) Ten year bonds, dated 1st November, 1922, to mature 1st November, 1932.

While the maturing bonds will carry interest to 1st December, 1922, the new bonds will commence to earn interest from 1st November, 1922, GIVING A BONUS OF A FULL MONTH'S INTEREST TO THOSE AVAILING THEMSELVES OF THE CONVERSION PRIVILEGE.

This offer is made to holders of the maturing bonds and is not open to other investors. The bonds to be issued under this proposal will be substantially of the same character as those which are maturing, except that the exemption from taxation does not apply to the new issue.

Dated at Ottawa, 8th August, 1922.

Holders of the maturing bonds who wish to avail themselves of this conversion privilege should take their bonds AS EARLY AS POSSIBLE, BUT NOT LATER THAN SEPTEMBER 30th, to a Branch of any Chartered Bank in Canada and receive in exchange an official receipt for the bonds surrendered, containing an undertaking to deliver the corresponding bonds of the new issue.

Holders of maturing fully registered bonds, interest payable by cheque from Ottawa, will receive their December 1 interest cheque as usual. Holders of coupon bonds will detach and retain the last unmatured coupon before surrendering the bond itself for conversion purposes.

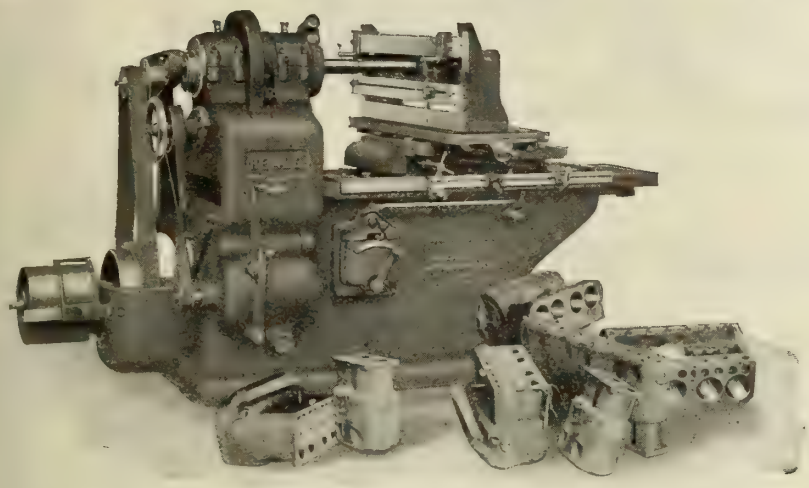
The surrendered bonds will be forwarded by banks to the Minister of Finance at Ottawa, where they will be exchanged for bonds of the new issue, in fully registered, or coupon registered or coupon bearer form carrying interest payable 1st May and 1st November of each year of the duration of the loan, the first interest payment accruing and payable 1st May, 1923. Bonds of the new issue will be sent to the banks for delivery immediately after the receipt of the surrendered bonds.

The bonds of the maturing issue which are not converted under this proposal will be paid off in cash on the 1st December, 1922.

W. S. FIELDING,
Minister of Finance.

If interested tear out this page and place with letters to be answered.

Cylinder Regrinding in Canada



A new Heald Style No. 50—solid base, extra wide, table mechanically driven, self contained, equipped with Heald universal jig,—it is an excellent machine for either manufacturing purposes or regrinding.

THE demand for reground cylinders by motor owners of the United States has resulted in the installation of over 1,500 Heald grinders in various parts of the country in the last two years. Small machine shops and individuals who have taken it up find it to be an unusually profitable business.

For the auto repair shops already established it not only is an excellent investment on the capital required but also the results are so satisfactory to the motor owners that they become definite customers and the shop's best booster.

While the same conditions hold true in Canada among those already established there are still several other localities which offer unusual opportunities to a good, energetic mechanic. Remember, however, that the heart of a regrinding shop is the machine itself and that without exception the successful ones in the States own Healds for they are designed and built especially for this work. Also, every motor manufacturer that grinds his cylinders uses Healds.

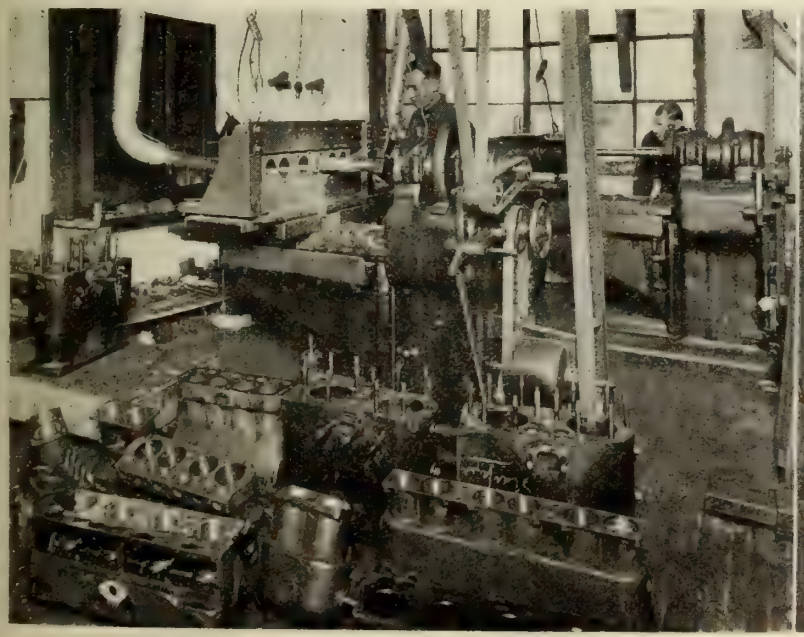
We would be glad to advise you candidly what the opportunities are in your locality if you will communicate with

THE HEALD MACHINE COMPANY

51 New Bond Street **Worcester, Mass.**

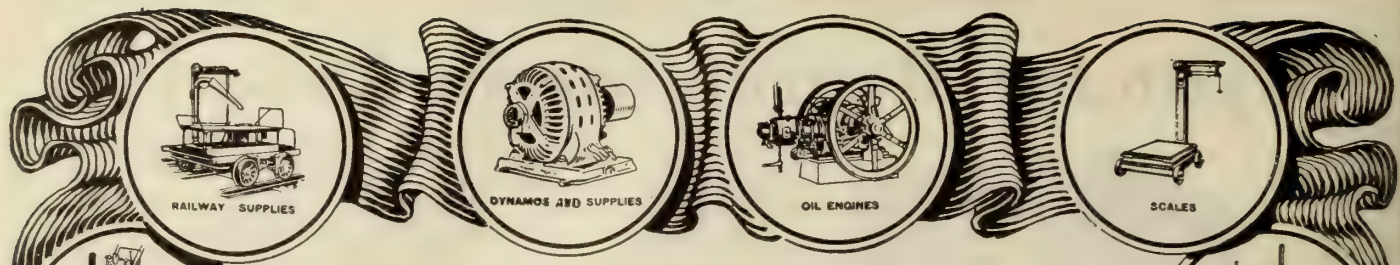
BRANCHES AT New York, Philadelphia, Chicago, Detroit, Cincinnati, Cleveland, Milwaukee and St. Louis.

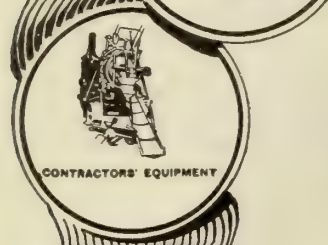
CANADIAN AGENTS: H. W. Petrie, Ltd., Toronto. Geo. F. Foss Machinery Co., Montreal.

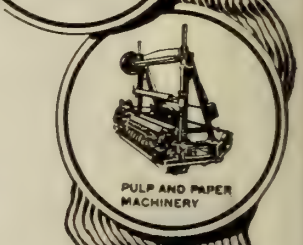


The two Healds at the Allatt Machine Tool Co., Toronto are proving to be excellent business getters.

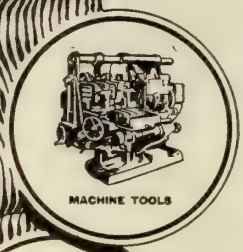
Heald at the shop of the Packard-Ontario Motor Co. East Toronto.







An economy when buying machines or supplies



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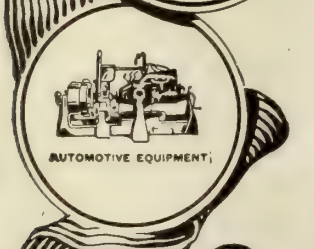

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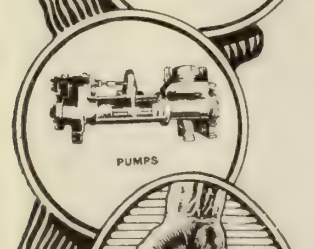

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CANADIAN MACHINERY
AND
MANUFACTURING NEWS

VOL. XXVIII, No. 11 SEPTEMBER 14, 1922

Keeping the Industrial Plant Fit to Work In

Making Surroundings More Attractive to the Workmen—Northern Exposure Best for Lighting—Cleanliness Essential to Good Health—Working Conditions Affect Production—Welfare Work

A CENTURY ago all manufacturing of iron and steel products was done in comparatively small shops, and in consequence, many of the present day problems of sanitation and workman's welfare, that are present in the medium and large plants, were not encountered. Then too, many of the practices of to-day along such lines, were not known. One can imagine, however, that most establishments of those days were dingy, poorly lighted, and poorly ventilated. As the shops developed in size with the passing years, there was a correspondingly greater amount of attention paid to these problems. It was found by making shops more attractive, workmen were able to accomplish more work. Thus not only from a humanitarian standpoint, but also from a point of view of efficiency, it was found to be very profitable to study shop conditions with the idea of improving same.

Natural and Artificial Lighting

In a modern shop, after its location has been determined, one of the principal factors that are considered is one of lighting. The nature of the manufacturing operations, as well as special processes peculiar to the work being handled, are duly considered. All conditions being equal, when light enters through windows in the side walls, a northern exposure is considered best, in these countries so far north of the equator, because an eastern, southern, or western exposure always permits the direct rays of the sun to enter at some time during the working day, which is not considered a desirable condition, as in most seasons of the year these rays communicate excessive heat and tend toward poor distribution and diffusion of the light. In such instances it is invariably necessary to use some form of shade or awning to reduce the undesirable effects.

Outside Wall Construction

Some factory walls may be described as one steel frame to support the roof and carry one huge sash, about ninety per cent. of the area of the walls being glass. This is an extreme condition, but not infrequently seen. It is not the intention of the writer to condemn such construction, but it does appear that a product must, indeed, be delicately constructed, to require such a degree of light. Further it is sometimes suggested that the advantages do not offset the disadvantages, for machine shops. The large area of glass is exposing a very fragile surface to the risk of damage, from both external and internal sources. Then there is the probability of it not being weather proof, and even if it is initially so, it soon deteriorates, unless a great deal of attention is given to its maintenance. It presents a large area to be kept clean, and also allows, in our rigorous climate, a great deal of heat to radiate, in the severe winter weather. Structurally it is not the strongest construction. Its single advantage is the excellent lighting, if kept clean.

On the other hand one occasionally sees a shop where the windows are extremely small, representing but only a very small proportion of the area of the walls. One cannot lay down any hard and fast figures, but as a guide, if fifty per cent. of the wall area above a line four feet above the floor level were

Illustrations through courtesy of the Northern Electric Co., Montreal.

Individual light equipped with proper type of reflector.

Same machine with reflector removed showing bad distribution of light.

glazed, it would ordinarily appear that an area in excess of this, would give but little additional useful light. If the ceiling, or roof, were high, and manufacturing was conducted below a point say, six or eight feet above the floor, the figure just expressed would be excessive. The use of ribbed or frosted glass tends to better diffuse the light. The interior of all shops should be painted a dark color for a reasonable distance above the floor. Above that point a light color should be employed.

Skylight and Roof Design

Skylights, and windows in cupola or monitor roofs, are good methods of increasing the natural lighting. Some buildings are well lighted through the saw-tooth roof construction. In these roofs it is usually arranged to run the ridges east and west, have the southern slopes opaque, and the sash in the northern slope, which usually more closely approaches the vertical, and consequently is shorter in linear measurement. These last three methods are only applicable to one storey buildings, or to the top storey of buildings with several storeys.

Should it be impossible to obtain a northern exposure, there are many ways of overcoming the difficulties mentioned before, which only slightly reduce the efficiency of a window. Working under a skylight or window, with the rays of the sun beating directly down on one, is a very unpleasant task, except in the cold weather. Special shades and awnings do away with the difficulty.

Passing on to artificial lighting, one launches into a very large subject, which has occupied the attention of many organizations and many prominent men. The principle of indirect lighting has not been, to any great extent, applied to industrial buildings. The larger plants are commonly lighted by overhead electric fixtures, which are fitted with reflectors to throw the light downward. Incandescent electric lamps are usually used. These high power lamps are frequently nitrogen filled and are almost invariably found with tungsten filaments. The nitrogen filled lamps have their lower portions frosted, if the whole lamp is not frosted, in order to eliminate the intense brilliance, that is very trying to the eyes.

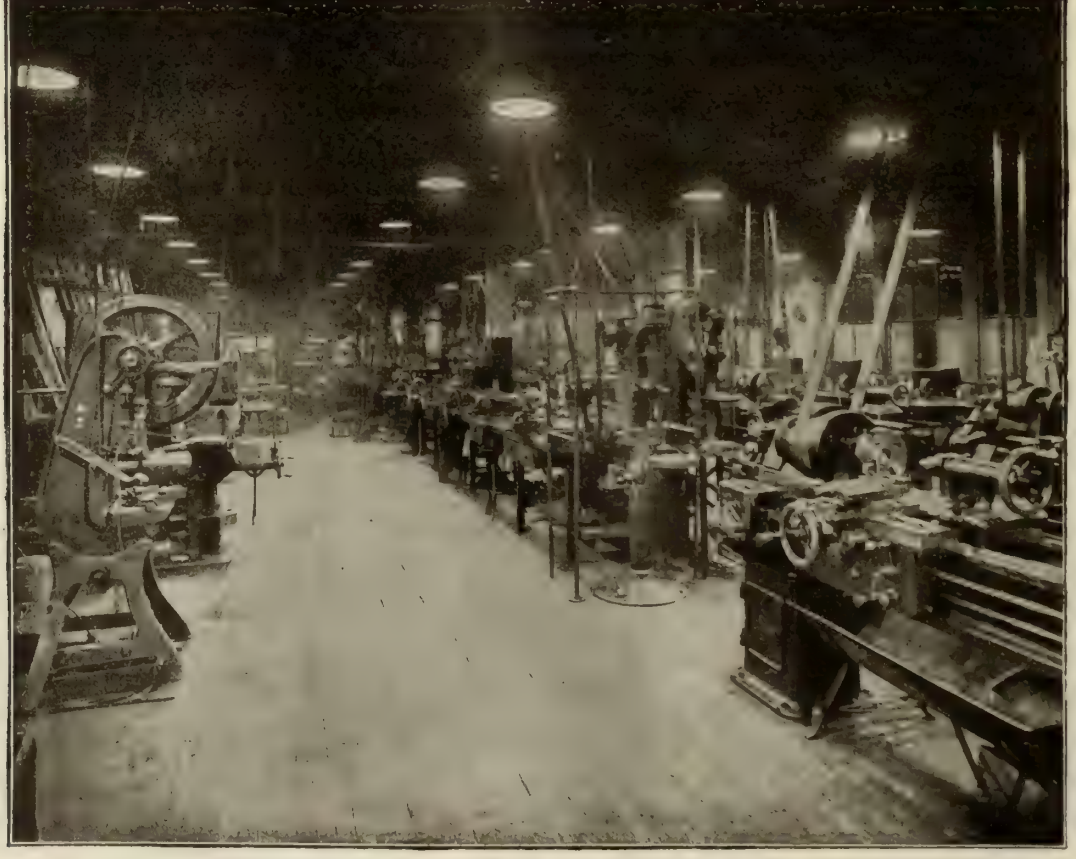
Mercury arcs are occasionally used to light factories, and several other applications have been more or less successfully tried out. The experience of the writer is that a 60-cycle alternating current is more restful to the eyes than the 25-cycle. This, however, is a point that presents a fruitful field for controversy.

Individual Lighting

To supplement the general overhead lighting it is almost a necessity to provide individual lights for each machine, and for each filer or bench hand. These individual lights are fitted with special holders or carriers, and long leads. It is always well to have wall plugs well distributed, enabling the leads to be plugged in at convenient points. In order that the provisions for lighting be most effective at all times, it is necessary to have machines and tools intelligently located, so that the best use can be made of both natural and artificial light. Actual records show that production has been increased from ten to twenty-five per cent. by the proper lighting of factories. The overhead expense of installing and maintaining good lighting facilities is small, when compared to the returns shown by the above figures of increased production.

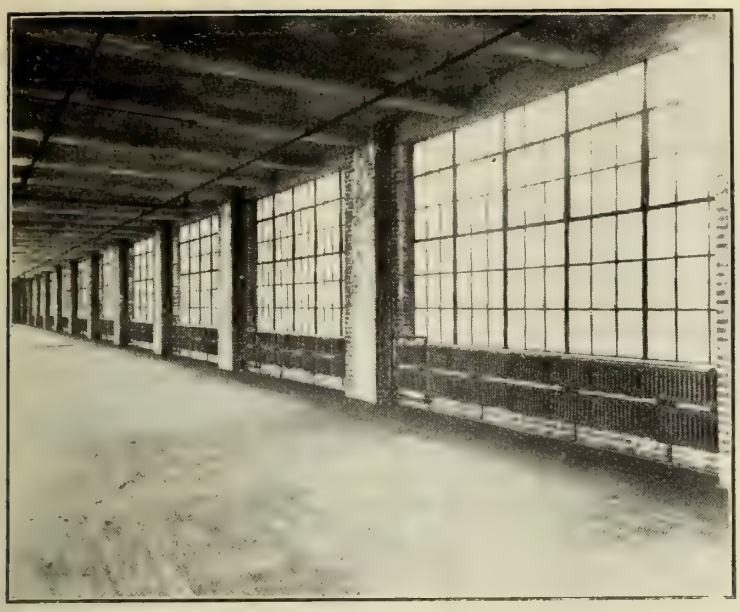
Ventilation

No man can do himself justice if he is allowed to work in a badly ventilated shop. Fumes from furnaces, or from the use of lard oil as a cutting compound on high speed machines, dust from snagging foundry castings, fumes from plating rooms, and dust from the wood working departments, should be expelled by exhaust fans from all shops. In the summer months the windows and doors provide for good ventilation. Windows in skylights or monitors provide an easy exit through which foul air is naturally expelled. In winter, when doors and windows are usually found closed, the ventilating problem presents more difficulties. There are many factories where there really is no attempt at installing a thorough ventilating apparatus. If hot air heating is the system employed, it is usual to have a fan pass clean air through steam heated coils and then pipe this warm air through the shop. This system provides for a good supply of fresh air at all times. If direct radiation is used to heat a building



Good example of properly lighted machine shop.

A well-lighted machine shop should have the illumination so distributed that the minimum amount of shadows will be cast around the machines. The arrangement of the overhead lights and reflectors should give the proper diffusion.



Manufacturing floor in Northern Electric plant at Montreal.

the only practical method is to install exhaust fans to remove the foul air.

The ability of workmen to apply themselves to better advantage in well ventilated shops is not questioned. It is, however, a rather difficult matter to express such convictions in actual figures. Some efficiency experts, have, nevertheless, done this, but to the average individual, the many varying factors employed to qualify the results, would cause the figures to convey but little concrete information.

Heating the Plant

There are many factories to-day that require steam in some of their manufacturing processes and are thus forced to maintain boilers. Other concerns use steam engines for prime movers. These firms usually install sufficient boiler capacity to also take care of their heating requirements. In this one instance, steam from the boiler, reduced to the desirable pressure, is passed into the heating coils, and in the other instance the exhaust steam from the engine is passed directly into the coils. Some firms have boilers which are used for no other purpose than for heating.

It is generally accepted to-day that steam is the best medium for heating large buildings. Two general methods of application are used, the first is by means of direct radiation from coils placed throughout the factory, and the second is to have the coils concentrated in a special chamber, and by means of a fan pass air through this chamber and on into conductor pipes, which deliver this warmed air to all parts of the factory. The first method is used where ceilings are low, and the latter method is used where ceilings and roofs are high. The temperature of a machine shop should be about 60 degrees F. if the mechanic is to work to best advantage. If a man is too warm he slows down, and if he is too cold he seeks warmer quarters at every opportunity. Thus maximum production is maintained when a constant temperature of approximately 60 degrees F. is provided.

Wash and Toilet Rooms

In connection with every wash room there should be a locker room where a workman can remove his street clothes, overcoat, and such other garments that he may wish to, before putting on his overalls. There should be sufficient wash room accommodation to permit all hands to wash up, in a reasonably short time, at noon and at the end of the day. The cost of white porcelain ware to-day is so reasonable, that this class of equipment is most usually provided. The ease with which this ware is cleaned is another good argument in favor of its use. The locker, wash, and toilet rooms should be put in charge of some particular individual, and he should be responsible for keeping them in order. A slightly higher temperature should be maintained in these rooms than in the shop. Warm water is a necessity. The workmen should have full use of these quarters, in as far as his requirements necessitate, but foremen should see that this privilege is not abused in any manner whatsoever.

Shop Cleanliness

In most shops good arrangements are provided for the removal of chips, cuttings and borings, from the machines. Unless this matter is taken care of regularly and systematically, a shop that might otherwise be in good order, appears slovenly. On those machines where cutting compounds are used it should be seen that all pans, piping, valves and connections are tight and are not leaking, as there are few more disagreeable messes than pools of lard oil or cutting compound on the floor of a shop. In addition to the unsightliness of it the machine operator often stands in it and gets his feet saturated.

Steel cuttings and turnings on the floor are not only hard on shoes but are very unpleasant underfoot. Oil slopped on machines, and carelessly spilled about, does not add to the attractiveness of a machine, and is a sure sign of carelessness. In fact an oil spattered machine is usually an indication of a careless and neglectful employee, and upon examining a spattered machine tool it is more often than not discovered that the machine has been given but indifferent attention.

Cement floors are very hard and tiring upon the feet of operators who are forced to remain standing throughout a shift. A small wooden platform placed on the floor will conserve their strength and enable them to attain greater production.

A miscellaneous accumulation of tools, jigs, straps, bolts, nuts, spoiled work, etc., etc., under and behind machines is an eye-sore to any self-respecting mechanic, and it is not reasonable to suppose that he can produce to advantage under such conditions of mental depression. Cupboards, racks, shelves, storerooms, and tool cribs should be supplied for all equipment, and it is the duty of foremen to see that all portable equipment is replaced each time a workman finishes the operation requiring its use.

There are many shops that provide all these receptacles for portable equipment, but at the same time have their machine tools badly arranged. In these shops the passageways are always cluttered up with work in progress. This condition of affairs is only one step removed from absolute untidiness, and is not conducive to workmen applying themselves to advantage. In every shop, one will always find workmen that eat their mid-day meal in the shop It is a good measure to provide for these men a small room, that they can use for this purpose. A table or two, and a few chairs, would answer the purpose.

Revenue Producing Factors

It has not been the purpose of this article to recommend any particular type of construction, method of lighting or heating, or of manufacturing. Rather it was decided that we treat upon the human side of these problems. Labor and capital have wandered far apart during the evolution of the big shops and interchangeable manufacturing. They have, to a certain extent, lost sight of each other's viewpoint, although they have many common interests. Everything has been figured out along mechanical lines, and the human side of the question has not been considered. It is the foregoing fact that has been capitalized by radical union leaders, and has resulted in the present misunderstanding between capital and labor. The average mechanic, if treated reasonably and made to feel that he has the confidence of his employer, can be depended upon to consider most things just as reasonably. If the shop conditions are such that he can do his work efficiently, surrounded by livable conditions, he is far more apt to pass over trivial difficulties, than he

(Continued on page 37)

Accurate Camshafts Produced by Grinding

Treatise on British Methods—Location of Master Cams—Dividing Head Forms Part of Attachment—Points to Consider in Obtaining Accurate Work—Provide Ample Support

By R. HARRISON

COMBUSTION engine manufacturers of to-day are generally familiar with the possibilities of precision grinding in connection with the production of their camshafts. The exceptional success, however, which has been realized with the attachments and methods set out below will doubtless appeal as a matter of considerable interest to both the production engineer and the man in the shop.

The grinding of cams, when made integral with the shaft, is accomplished by means of a self-contained attachment made in various lengths, arranged for mounting on the table of a plain or universal grinding machine. The attachment consists of an oscillating table carrying a driving head integral with it, the camshaft being mounted between centres, and supported by suitable steadies. The oscillating table is carried in trunnion bearings located on the table of the machine, and oscillates to and from the grinding wheel at each revolution of the work, the motion being positively controlled by a master cam.

Master cams may be of single, double, or triple form, but are always made from one piece of tool steel, the single cam being used where only one shape of cam is required, the double where inlet and exhaust cams are formed on one shaft, and the triple for camshafts on which the air-pump eccentric is additional to the inlet and exhaust cams. The master cams are generated, hardened, and ground to the correct shape, and with exact angular relationship between the inlet and exhaust, so that no variation can occur in use.

To take care of the varying number of engine cylinders, and their respective cams, a dividing plate forms part of the attachment. This plate is accurately divided corresponding to the number of cylinders used. The above combination of master cams with index plate covers any number of cams on the same shaft and reduces the operation of camshaft grinding to its simplest form.

The generating of master cams is an operation which cannot be efficiently carried out on the above attachments as it is impossible when working from a small model to reproduce with sufficient accuracy the necessary motion to generate the correct master. The grinding machine makers have special facilities and experience in the generating of master cams, and strongly recommend that users of attachments take advantage of same for the production of accurate master cams, all that is required being a correctly dimensioned drawing.

When ordering a new master cam it is essential that the makers be supplied with the following particulars together with any other data which in the user's opinion may affect the successful operation of the cam shaft which it is desired to produce.

Note.—The greatest care should be exercised in the preparation of the drawings to ensure that the shaft as designed will give the results required to conform to the predetermined fly wheel diagram.

It not infrequently happens that the makers are requested to provide master cams to conform to a fly wheel diagram which is not obtainable with the type of tappet mechanism provided, the most frequent sources of error in this connection being caused by a misconception on the part of the engine designer with regard to the points of tangency and contact on the cam motor. The error is shown magnified to an exaggerated degree in fig. 21 on the attached sheet of diagrams.

1. A complete working drawing of the cam shaft is required on which must be shown in addition to the usual complete dimensioning. (a) Direction of rotation when looking at driving end of shaft (b) Radial disposition of cams looking at shaft from the same position.

2. Type of tappet which it is intended to use in conjunction with the cam shaft. (a) Roller type (in which case diameter of roll must be given, (b) Mushroom type (in which case diameter of mushroom end and type of contact surface, whether concave or flat, must be given).

3. Disposition of tappet centre.

4. Clearance allowed in valve lifting mechanism (up to .010").

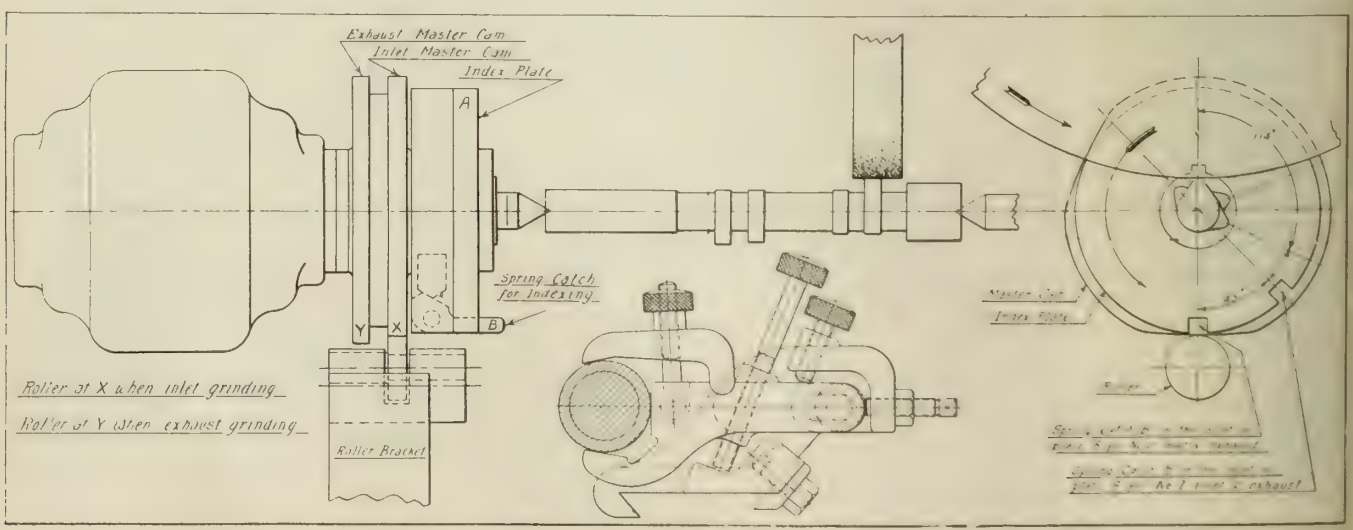
5. Diameter of roller on attachment

6. Diameter of grinding wheel on machine.

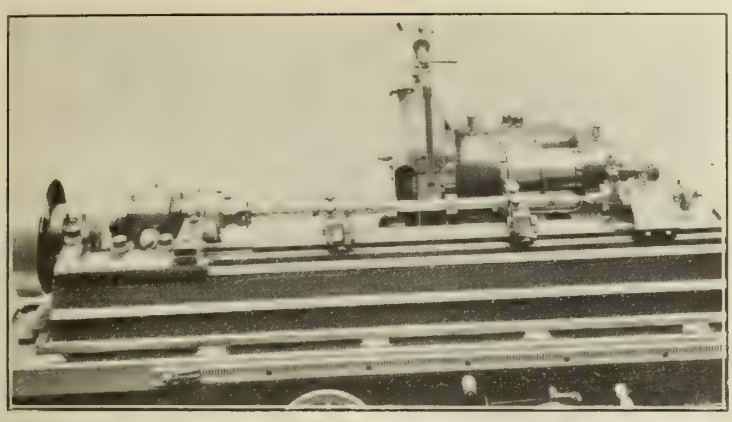
Items 5 and 6 not required when a new machine complete with attachment is being supplied.

Method of Operation

1. Centres.—The finished product can only be as accurate as the centres on which it is produced. It is therefore imperative that the centres in the attachment be ground to and maintained at the correct angle (usually 60°) and in addition be strictly concentric. The centre in the work should on the other hand be as large as possible consistent with the shafts being dealt with and should be made with a proper centre drill, this ensures adequate clearance to the point of the centre together with the correct



Plan view of the operating mechanism. Lower centre shows type of steady head used.



General view of the grinding machine.

angle. It should not be necessary to mention that both of the above be kept absolutely clean, but cases have been known where complaints re the production of inaccurate work has been directly traced to carelessness on the part the operator in not ensuring that the above simple precautions had been looked to.

2. Adjustment.—All working parts of the machine and attachment should be oiled at regular intervals and such adjustments made as are deemed necessary to ensure the correct functioning of the different movements. The master cam should be kept scrupulously clean on its working surfaces as should also the roller which makes contact with it. The two, however, should not be oiled on their contours when in use, as this oil tends to collect grit and dirt which make for the production of inaccurate work.

3. Steady rests.—There are always provided with a cam grinding attachment sufficient steady rests to take care of the longest shaft which the attachment will accommodate. The fullest use of these steady rests should be made and it should be seen that they properly support the wheel against the thrust of the grinding wheel.

4. Cutting compound.—Full advantage should be taken of the maximum amount of cutting compound available. This will keep the temperature of the shaft down, prevent local heating and help to prevent distortion. The power behind the grinding wheel and the sturdiness of the camshaft grinding attachment make it possible to economically produce an accurate cam-shaft from the rough turning, thus cutting out the form milling operation which was previously necessary to reduce the cam to within grindable limits. This enables a considerable saving to be effected in the total machining time necessary to give us the finished camshaft.

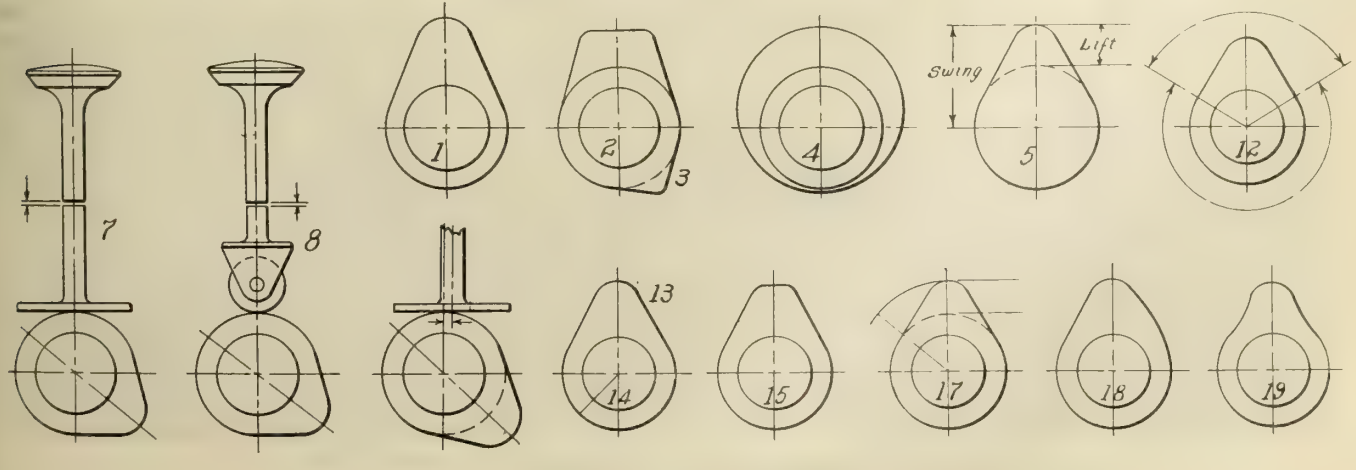
Roughing Out

Sequence of operations. No. 1. It is essential in all cases to first rough grind the cam shaft bearings and thus provide a true surface on which the work stays can operate. This operation is performed before the attachment is out on the machine. No. 2. Rough out inlet cams. No. 3. Rough out exhaust cams. No. 4. Rough out relief cam. No. 5. Rough out eccentric.

It is advisable in the interests of cheap production to put the work through in as large batches as possible, this saves time in changing wheels, etc. Using a moderately hard coarse wheel the average cam blank met with in present day motor car practice can be roughed down to within .015in. of finished size in three minutes. The actual allowance which it is advisable to leave on for the finishing operation depends of course on the steel from which the shaft is made. Where case-hardening heat treatment is adopted the allowance for final grinding should be kept uniform within the limits of a few thousandths of an inch throughout. Where the shaft is made from one of the alloy steels the texture of the steel being more or less uniform throughout, a greater tolerance as regards sizing in the roughing out operation may be allowed; .015in. to .020in. is the usual amount but no hard and fast rule can be laid down as each case must be judged on its merits if the most rapid production is to be obtained. The amount left for final grinding must, therefore, be varied up to or down as dictated by the experience gained with the particular design of shaft being produced.

The most rapid production of stock is effected by first roughing up the wheel surface by turning a thread across it with the diamond tool and then using the automatic wheel feed and a short fast table traverse under power, full advantage being taken of the automatic knock-off sizing device incorporated in the machine. Where the arrangement of the cams on the shaft is such that there is very little space between them the straight-in-feed method may be used with good results but in the interests of economical wheel wear it is advisable wherever possible to use the table traversing auto feed method. It is always advisable to commence grinding the cam blanks from the driving end of the attachment. This ensures that any possible interference in the angular relationship caused by torque will be kept uniform. It cannot be too strongly emphasized that the work must be very rigidly supported by the steadies provided for the purpose, and it is for this reason that the makers recommend that the journals be rough ground as a first operation. After rough grinding all over the shafts are heat treated and returned to the grinding machine for the final operation.

In cases where there are threaded portions on the cam-shaft some manufacturers who use the case-hardening method of heat treatment prefer to leave a surplus of metal on the portions which are to be threaded. This involves an intermediate lathe operation during the heat treatment as the shafts after carbonizing must be screwed before harden-



Various types of cams and tappets.

ing, the surplus of metal being first turned away and of course taking the carbonized skin with it.

Finish Grinding

This follows a sequence of operations similar to those employed in roughing and is briefly as follows:—1. Grind to within .005in. of finished size the two journals on which the work stays will operate, thus bringing them true with the new axis of the heat treated shaft (this operation is performed with the ordinary plain grinding equipment of the machine and does not entail the use of the cam grinding attachment). 2.—Mount the shaft in the cam grinding attachment and finish grind all the inlet cams with the master inlet cam making contact with the roller. 3.—Transfer the master cam roller to the exhaust master cam and finish grind all the exhaust cams. 4.—The same for relief cam. 5.—The same for air, oil or water pump eccentric. 6.—Remove cam grinding attachment from the machine and finish grind all journal wheel seats, etc.

Synopsis of Terms

Inlet Cam.—1. The actual cam which opens the inlet valve on the engine.

Exhaust Cam.—2. The actual cam which opens the exhaust valve on the engine.

Half Compression Cam.—3. This is an auxiliary small lift cam, usually operating alongside the exhaust cam.

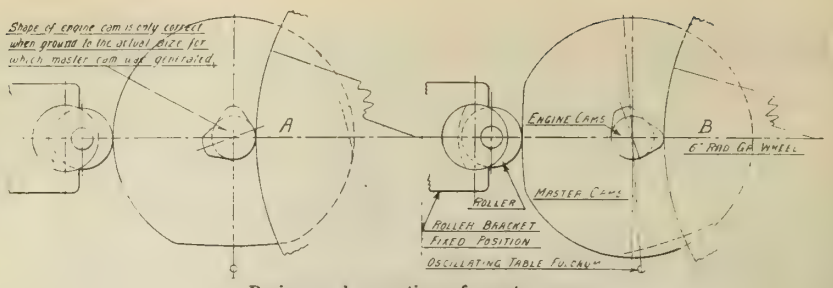
Eccentric.—4. This cam is sometimes fitted to the camshaft for operating either a water circulating pump or oil circulating pump.

Lift—5. Is the difference in height between the centre and circumference of the concentric portion and the centre and highest portion of the cam.

Tappet Rod.—6. This is that portion of the valve mechanism which transmits the motion of the cam to the valve stem. It is usually fitted with either a roller end or flat mushroom end.

Mushroom Type Tappet Rod.—7. This in shape resembles a mushroom and may be either curved or flat on the portion which comes in direct contact with the cam profile.

Roller Type Tappet Rod.—8. This is in shape a U-piece carrying at the bottom end a hardened steel roller which rolls along and transmits the motion from the engine camshaft.


Shape of engine cam is only correct when ground to the actual size for which master cam was generated
A
ENGINE CAMS
B
6" RAD GR WHEEL
ROLLER
MASTER CAMS
ROLLER BRACKET FIXED POSITION
OSCILLATING TABLE FULCRUM

Design and operation of master cam.

Clearance.—9. Is the idle distance travelled by the tappet rod before it makes contact with the valve stem (up to .010 inch).

Clearance Circle.—10. Is a circle so much larger in radius as the clearance indicated above i.e. the diameter of clearance circle equals diameter of concentric portion of cam, plus twice the clearance.

Fly Wheel diagram.—11. This is usually in the form of a circle on which are set out the various angles of opening and closing of the inlet and exhaust valves as controlled by the crankshaft.

Opening Angle.—12. This represents the number of degrees through which the cam travels from the time at which the valve it controls opens till it closes.

Toe or Peak of Cam.—13. This is the highest point from centre of cam.

Heel of Cam.—14. This is the concentric portion.

Toe or Peak Flat.—15. This is that portion which is sometimes arranged on inlet cams and often arranged on exhaust cams, which lies between the two radii enclosing the toe or peak.

Point of Tangency.—16. This is the point on the contour of the cam where the side of the cam becomes tangent to the concentric portion.

Contour.—17. This is the outline which indicates the shape of the cam.

Straight Side Cam.—18. This is a cam on which the sides are flat and can be represented by a straight line tangential to the concentric portion and radius of the peak.

Curved Side Cam.—19. This is a cam on which the sides between the two points indicated above are either curved outwardly or inwardly, when they are curved inwardly they are known as re-entrant curves. (The radius of these latter curves is limited by the radius of the grinding wheel employed).

Opening or Closing Points.—20. These are the points where, when all the clearances in the valve lifting mechanism have been taken up the valve starts to rise. It will be obvious that the point of contact and the point of tangency are never located in the same place when clearance is allowed.

Cam Grinding Attachment

Integral Cams.—22. This is the method usually adopted in present day automobile practice, where the camshafts are produced from forgings.

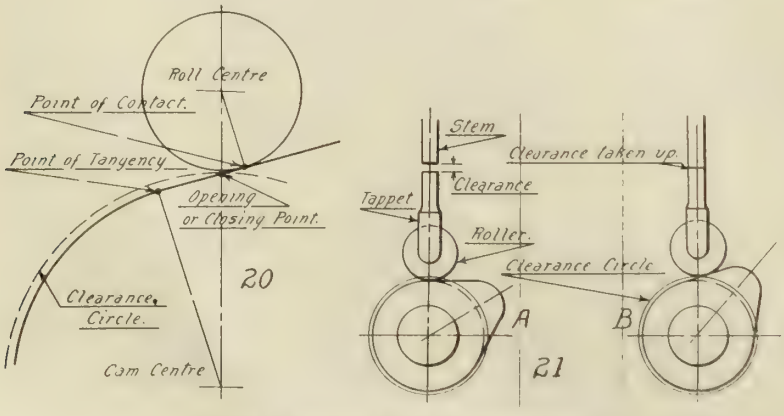
Individual Cams.—23. This type of cam is somewhat restricted to the larger sizes and is used mostly in heavy gas and Diesel engine design.

Model Cams.—24. These are exact duplicates of the theoretically correct shape cams used on the engine camshaft. The models are made exactly four times larger than the actual cams and are produced to very fine limits of inaccuracy. It therefore follows that when their shape is reproduced by the cam grinding attachment, any error in the model cam is reduced in the proportion of four to one.

Master Cams—25. These are the negative cams usually made two or three from high grade heat treated steel and represent in the negative form four times enlarged the contour of the engine cam. The master cams are made in the correct angular relationship with each other and being en bloc are therefore permanent. It is, however, possible to make slight alterations to them providing the cam which it is desired to produce does not differ to any great extent to that for which the master cam was originally ground.

Master Cam Roller.—26. This is a small diameter roller used on the cam grinding attachment to slide in contact with the various contours of the master cams and thereby transmit an oscillating motion to the swinging table of the attachment. This roller is hardened and ground to the same diameter as the small grinding wheel which is used in generating the master or negative cams.

Dividing Plate.—27. This is an accurately finished plate notched in the correct angular relation to which the finished camshaft contours must conform to meet the requirements called for on the fly wheel diagram. By the use of this dividing plate it is therefore possible to produce a six, eight or twelve cylinder engine camshaft from the one master cam.



Details in connection with cam construction.

Success in Combating Accidents at Algoma Plant

Special Educational Features of Great Assistance—Getting the Co-operation of the Employees—Big Reduction in Time Lost Through Injuries—Accident Investigation and Home Visiting

CARELESSNESS is accountable for a very large percentage of the accidents that occur in industrial plants. This has been proven time and time again. The human factor is the one element that prevents the attainment of complete success in the absolute elimination of hazard from life in its many and varied phases. Numerous attempts have been made and will continue to be made by those interested in the safety movement to adpot means for minimizing accidents to factory workers, and in a great majority of cases the results have been very encouraging, but just when we feel that a certain difficulty has been surmounted an injury is reported that sends our castle of optimism tumbling to the ground. The cause of the accident when investigated is found to be, not the faulty construction of machine or equipment, but the momentary failure of that human factor which makes the solution of the safety problem almost impossible.

In order to obtain an equation where the uncertainty of the human factor will be less of an unknown quantity, and one that we can take into consideration for finding an answer to this momentous question, it is essential that the workmen themselves be educated to the imperative need of adequate protection and of their own responsibilities in any scheme of accident prevention that executives may promote.

Reducing Accident Hazard

In this connection it is interesting to note the progress that has been made in regard to the method adopted by the Algoma Steel Corporation for obtaining the co-operation of their workmen for reducing the hazard that is generally associated with the operation of steel mills and similar activities. Comparative records indicate that they have achieved remarkable results in reducing the number and the severity of injuries sustained. For eleven months ending November 30, 1920, the number of accidents in which time was lost reached 571, while for the corresponding period in 1921 similar accident records showed that only 174 employees were injured. This figures out at a 69 per cent reduction. Owing to the fact that the operating staff for the last period was only about two-thirds of that employed during 1920, the above figures may not seem conclusive, but when calculated on a basis of full time operations the rate figures are 1.64 per 100 in 1920 and .84 per 100 in 1921.

Severity of Injury

The severity of an accident is based on the time lost as a result of the injury. This is considered by experts as one of the most vital factors in all hazard statistics. It is in this class of accidents that Algoma claims to show the beneficial results of their safety policy. For the eleven months in 1920 the records indicate a total loss of 10,772 days as a direct consequence of accidents. For the corresponding period of last year the time was reduced to 2,985 days. This shows an approximate reduction of 72 per cent., a remarkable and creditable showing. The compensation figures for the respective periods were roughly $95,772 for 1920 and $32,089 for 1921, a decline of over 66 per cent.

Replacing Absent Workers

Other factors must be taken into consideration when men are absent from the plant on account of injury. Temporary replacement is necessary to carry on the regular work. Very often a new man must be employed so as to maintain the efficiency of the organization. If an experienced man can be secured the drop in production may be very trivial, but if the right man is not available the time required to teach the new hand the duties of his office may entail a loss in output far exceeding the wage he earns. It has been stated by Algoma officials that approximately $250 a week has been lost on different occasions due to disorganization of a certain group of men carrying on specific work. The capacity of the new man very often determines the speed of the others, as a gang of men may be likened to a chain, where the strength must be reckoned as that of the weakest link. Therefore, the saving effected by the reduction of accidents is much greater than that represented in the actual compensation cost and minor losses resulting therefrom. On the other hand the uninterrupted operations of a well-balanced gang, everyone of whom is thoroughly alive to the disastrous results of industrial accidents, will maintain production at such a rate as to make the saving almost inestimable.

Creating Spirit of Goodwill

Mass psychology is a study well worth while for the large manufacturer. The employer who is vitally interested in the welfare of his workmen, and takes the trouble to show it, will create a spirit of goodwill and co-operation among the men which will react to the benefit of all concerned. They look upon him in a more friendly manner, realizing and recognizing that his efforts in their behalf are not solely with a view of acquiring increased wealth. The mind is undoubtedly the controlling force of all bodily action, so that a contented mind will influence the physical efforts of the body under its control.

Specific Case

In this connection it might be well to emphasize the importance of mutual understanding when some phase of safety work is contemplated. Too fre-

General view of the blast furnaces at plant of Algoma Steel Corporation.

quently we see guards and other protective appliances placed on machinery and dangerous places without consulting the wishes or desires of the parties for whom the protection is installed. The writer has in mind the installation of a special guard on a sheet metal punch press. Several accidents had happened on this particular press and it was decided to place a guard on the machine. When the device was ready to instal the man was given another temporary job until the guard was fitted in place.

In this particular shop a lot of the press work was done on the piece work basis, so when the operator was brought back to run the machine he did not take kindly to the protecting guard owing to the fact that it seemingly hindered production. The mind of the man had his body under submission. He seemed determined that the guard would hold up production to a prohibitive extent and for a time he had the foreman of the same opinion, with the result that the guard was seldom or ever used during a period of non-accident. However, a minor injury to the workman on one of the other presses again brought the subject of protection to the fore. This time the foreman had a talk with several of the press hands regarding the advisability of using protective guards.

Considering Suggestions

To try and offset the arguments of the men the foreman asked if any of them had any suggestions for press protection. One of the operators came forward and stated that he thought a slight alteration in the design of guard would secure better results. Believing he saw where he could get co-operation the foreman had the suggested modifications made to the original guard and when again fitted to the press, the success of the device was immediately evident, as the operator demonstrated that the efficiency of the apparatus was more a matter of human adaptability than mechanical defect. The mere fact that he had been consulted and his suggestion taken into consideration was sufficient to gain the goodwill and open mind of the worker, and in a short time the rate of production not only attained the old figure but in some instances surpassed it, as in time the operator gained confidence in the protective qualities of the guard and came through with increased production.

Safety Work Publicity

At the Algoma plant the essence of success appears to be in the publicity that is given to the general safety movement in and around the plant. This publicity is carried on in every conceivable way. By publishing in the local papers, decreases in number of accidents or no accident reports in specific mills, with, if possible, the name of superintendent or foreman. By keeping safety first in the public eye and by issuing periodical statements of the work being done. The house organ of the Algoma Corp., is probably the most effective unit in the whole scheme of the safety educational movement. This plant magazine equals anything of its kind in Canada, as the executives believe that what is worth doing is worth doing well. The engravings used are of the very best and the paper is of high-grade, coated surface. The publication is edited in such a manner as to create a permanent interest on the part of all employees, the friendly and good humored feeling being one of the most beneficial results obtained from the expense and effort of the monthly organ.

Instructing New Men

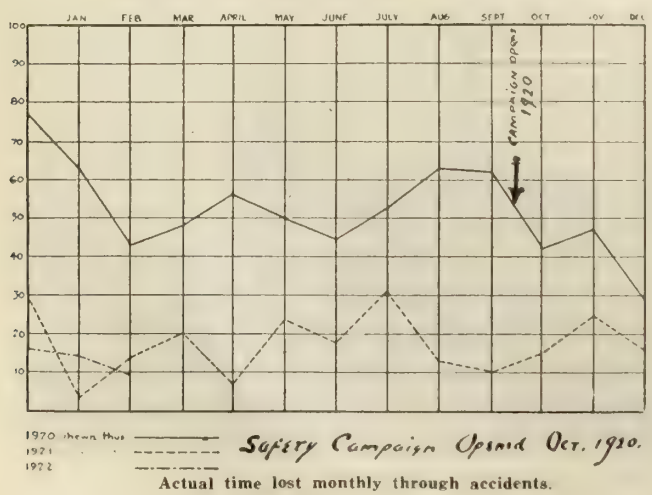
One of the principal features of the system and one that impresses the beginner with the thoroughness of the accident prevention move is the short course of safety instruction given to those starting into the service. A safety demonstration room, wherein all new men must pass at least half a day, getting instructions as to certain dangers in particular parts of the plant in which they will be called upon to work. The object of these instructions is to impress upon the workman the need for caution and to get him to realize that he is a unit in the scheme of better protection and that THERE IS DANGER in many sections of the plant provided he does not act cautiously and judiciously in the performance of his various duties.

The institution of an accident investigation system whereby every accident, no matter how slight the injury resulting therefrom, or even if no injury has resulted to an employee, has proved very effective in preventing subsequent mishaps from the same cause. The investigators are members of the safety department and it is their duty to make out a written report in every case—the essential facts covering who, what, how, when, where and why. In answering these questions the investigator is under instructions to interview all witnesses, getting each to recount what transpired at the time of the accident. If it is shown that carelessness has had a part in the accident the name of the responsible person is incorporated in the report. Several of these reports are made out and sent to the different departments interested for permanent record.

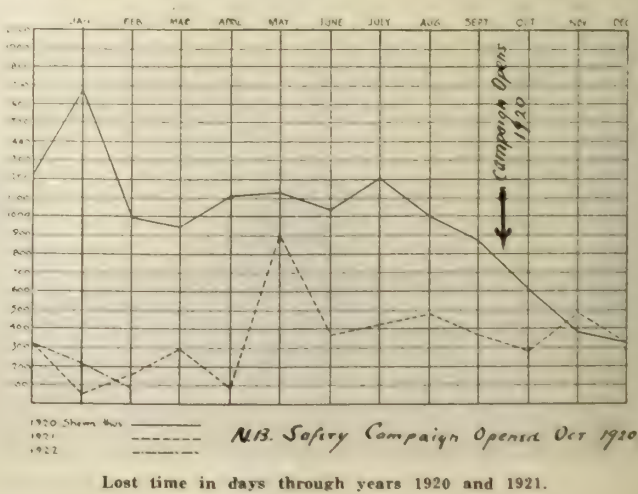
Immediately a man is injured he is given medical or surgical attention by the plant surgeons who are constantly on duty. It is the duty of these doctors to forward a report each day to the safety department, covering the details of their work for the previous day. To avoid any malingering of accident cases close tab is kept on every man injured and to the possible duration of off time, the number and time of periodical dressings, etc. The idea back of this was to eliminate a condition of affairs whereby men who had been injured, but who were able to return to work, were in the habit of staying away from the plant and drawing compensation at the expense of the company, though they had no right to such compensation.

Visiting the Home

In addition to the system as carried out at the plant the corporation has instituted a home-visiting plan whereby a member of the safety department visits the injured man in his own home and sizes the case up for himself. It has been found that many men who were able to return to work were putting it off in the hope that they would get a few days more with compensation. Every evidence points to the fact that the safety movement policy as adopted at the Algoma plant has been highly beneficial both from the standpoint of physical health and economy.



Actual time lost monthly through accidents.



Lost time in days through years 1920 and 1921.

Overcoming Some Faults in Babbitt Bearings

Proper Lubrication Very Necessary—Properties of Graphite—Causes That Produce Friction—Faulty Bearings Frequently Due to Carelessness—Keeping the Metal From Sticking to Mandrel

By W. S. STANDIFORD

AN IMPORTANT point in regard to lubrication is due to the weight of moving parts, these having a great influence in the proper lubricating of bearings, especially when the latter are made out of brass. It is well known among lubrication experts that the consistency of any grease or oil has to be suited to the weight and rapidity of motion of different machine parts; a lightly constructed machine such as a watch requiring a very thin oil to enable it to run properly. On the other hand, a thin oil proves to be decidedly unsatisfactory for heavy parts, as it is squeezed out by their weight before it can get in efficient work, thus allowing the bearing to heat up and "freeze" as it is technically termed, due to the heavy expansion of brass. Taken all in all, experience shows that babbitt-lined shells will give better results with the general run of lubricants on the market, as babbitt is, of itself, a more greasy-feeling metal than brass.

Safety Factor of Babbitt

It must not be construed from the above, that brass is unsuitable for making bearings; it being one of the best materials widely used and gives good results when rightly looked after. What the writer intends to convey is the fact that babbitt will withstand more abuse than brass before a bearing starts to cut from the stopping up of an oil-hole or carelessness upon the oiler's part; in forgetting to attend to bearings. There are some excellent oils on the market which contain graphite in suspension that give splendid service, conferring not only the lubricating properties of the oil to a bearing, but also the graphite. They are made in various degrees of viscosity. Greases are also combined with graphite; both oil and greases with the latter material added are well worth their money as a longer life is imparted to both brass and babbitt bearings.

Qualities of Graphite

To those who are not acquainted with the properties of graphite and the way that this substance prevents friction, a few pointers about its lubricating qualities will be of interest. Owing to its nature, graphite works on an entirely different principle from grease or oil and it is the best lubricant of all for heavy-moving or light parts. The theory and practice of all lubrication, regardless of the substance used for the purpose is, to keep two surfaces apart and prevent, as much as possible, their rubbing together as all metals are never smooth. Viewed under the most powerful microscope, the most highly polished pieces of any metal resemble a section of very coarse-grained sandpaper, there being many pin points sticking up, all pores in metal and also tool marks and other irregularities showing greatly enlarged, which taken altogether help to produce friction.

What Wear Means

When the oil on a bearing squeezes out, these irregularities and pin points interlock with the pin points getting broken off; this is termed wear. Tiny particles of the metal are then carried by the oil into the bearing parts and thus act as if an abrasive were added to the oil. The use of a grease or oil containing graphite entirely overcomes this state of affairs; the higher the percentage of graphite the substance contains, the better it acts. The graphite first fills up all pores and tool marks of the metal by being rubbed into them, after which a thin veneer of graphite is then placed over the entire wearing surfaces. When this veneer of graphite has been obtained, all friction will have been reduced to the lowest possible extent known to mechanical engineers. Another factor that helps to prevent undue wear on the bearings is, that the latter having become coated with graphite as is also the journal, the contact is now between graphite and graphite and not metal to metal.

To give an idea of the value of this material as a lubricant in reducing friction, the following test is instructive and interesting. Take two small pieces of uncalendered paper and lay one upon the other, then try to move the top one over the other by applying weight and force. It will be found to be difficult to move them as friction is holding both sections of paper together. Next take some flake graphite and rub some of it thoroughly into the pores on both sheets of paper; placing the two surfaces together and move them the same as was done before. You will now find that both pieces will move easily one upon the other, and also discover the fact that the more weight that you apply, or using other words, the more work that this graphite has to do, the easier both parts slide upon one another. Unlike oil, graphite cannot be squeezed out from between parts under any circumstances whatever. The above test illustrates one of nature's laws that, irrespective of weight, a graphite film cannot be squeezed out from between bearings, no matter how heavy pressure is applied to effect it, but remains at the point of contact; as a matter of fact the more weight that is applied, the firmer this material becomes embedded into all metal pores, the result being that all bearing surfaces are made extra smooth by its action.

An Ideal Mixture

As babbitt is by nature a more greasy substance when compared with brass, the use of a graphited grease or an oil containing it comes about to be as near an ideal mixture as can be expected, considering the rapid way all machines are worked so as to obtain increased output. In regard to the actual work of babbitting boxes, the machinist's or millwright's gang should take the greatest care so as to get best possible results, as any carelessness in handling it not only injures the babbitt's quality, but causes the poured bearings to wear out very rapidly and thus makes renewal necessary with its additional expense and loss of time that could be put to better advantage in doing other work by the maintenance forces of mills and factories, as it often occurs that these repair forces have two or more urgent jobs that need attention at the same time.

Where The Fault Lies

Another factor in babbitting work is due to the readiness in which the average run of workmen "lay the blame upon a metal's quality," it being said to "be inferior" when, as a matter of fact, the fault is entirely with the workers and their methods of handling. The finest quality of babbitt ever produced can be made to appear as if it were a cheaper grade and worthless. Mill foremen being as a general rule, very busy persons, have to depend to a large extent upon what their employees say about a babbitt's quality, they not knowing the conditions under which it was heated and poured, while others have a very hazy idea in regard to the fine qualities, or otherwise of this metal. For the information of this class of men as well as for their workmen who, in the vast majority of cases, are fair-minded and desire to do effective work and only put the blame upon a metal's quality because of sheer ignorance, this list of difficulties encountered and the proper remedies to overcome them are appended, which will, no doubt, also be of interest to all classes of factory men, as a better understanding of bearing materials will be of great advantage in regard to the long life of all bearings lined with babbitt and also to the keeping of machines in action so as to give the least amount of trouble.

(To be Continued)

Records Show Better Business in Machinery Hall

Interest in Wood-working Machinery and Good Sales Were Made —Prospects Encouraging—Sales Work Has Its Result After Year's Lapse—Complaint About Exorbitant Power Charges— New Engineering Building Badly Needed

ORDERS and enquiries received in Machinery Hall at Toronto Exhibition this year, show a marked improvement over last year's record, according to statements made by exhibitors. It would appear that many display their products, not because of any direct return, but because of the prospective customers which it develops. Others exhibit in anticipation of both sales and prospects and, as a rule, have demonstrations on hand and machines in operation. The variety of products represented this year was large and inclined to specialization. That is, there were no general displays of machinery or equipment. Every booth had an outstanding feature and it must be said that this added to t e general interest and helped promote actual business.

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Some exhibitors report sales from unexpected sources. Thus, when the representative of a firm making pneumatic tools went to considerable trouble last year to demonstrate a certain hammer to a prospect whom he had never seen before, he paid little heed to probable comeback. This year, the same man returned and declared that he had made up his mind to purchase such a hammer—which he did. Another firm reports a purchaser, last year, from Australia for a machine which he had demonstrated, and that a few years ago several sales were made to Australian buyers who had taken in the Fair. A manufacturer of transmission equipment states that a prospect with whom he discussed friction clutches last year dropped in this year and placed a rather respectable order.

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Considerable enthusiasm centered in the immediate prospect of a new Engineering building. Exhibitors are undoubtedly handicapped for space and demonstrating equipment. The task of placing and removing heavy machinery is a difficult and expensive one, and the inadequacies of display have further combined to discourage many large exhibitors who would otherwise be very much in evidence. Further, the cost of special electrical connection for motor-driven machinery strikes the exhibitor as a rather stiff item. Ten dollars per horse power for an exhibit where probably there would not be five-dollars-worth of juice used, is a big item, and one for which it is often hard to find an offset in the amount of business actually done. Line shafting does not always answer the purpose for such displays, and further, there is only a limited amount of this available in the old building. Each direct connection is a separate proposition and calls for an amount of expensive work by the electric companies. To make a block of power available for Machinery hall and to include individual costs in the booth rented, would appear to be advisable, but here again, the building hardly lends itself to complete electrification so as to suit the many changes in location and requirement. Some remedy may be worked out for 1923, but nothing short of a new building with all facilities for handling, shipping and demonstrating, will be completely satisfactory. The prospects looking to this most desirable objective in 1924 will undoubtedly meet with hearty support from manufacturers and engineering concerns.

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Woodworking machinery was a feature of the reported sales activity. It is evident that demand in this department has considerably more strength than in machine tools. The showing of the latter was by no means representative, and enquiries had particular reference to light equipment and accessories. In woodworking machinery, however, it was different. One exhibitor, three days before the close, had sold a variety saw, a band-saw and a 16 in. jointer, and had a number of sales in prospect before the close. Another manufacturer had disposed of a sander, a chisel mortiser and saw mortiser. A display of woodworking equipment adapted to the purposes of builders and contractors brought in several sales including planers, floor sanders, saw table and combination woodworkers. A dealer reported sales of two woodworkers, two adjustable saw tables, a small metal-working lathe, and other light equipment, besides many prospects that were very encouraging. There were a number of cylinder-grinding machines in demonstration and it is learned that in each case the demonstrator was sold. A light portable cylinder grinder was on display and satisfactory business was reported. Considerable interest centered in garage equipment. Included in a dealer's display was a universal tool, combining facilities for turning, boring, horizontal milling, vertical milling, drilling, tapping and reaming—a complete machine shop in itself, adapted for the small manufacturer, the garage, steamship or repair shop where space is at a premium.

Extensive displays of welding apparatus were featured and demonstrations were interesting. Quite a few sales were made not only of the larger, more expensive equipment, but more especially of the outfits designed to meet the more limited purpose or restricted requirements.

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Interviews with manufacturers of belting indicate this to be a department where, usually, sales run into very small items, where the large buyer does not put in an appearance because he feels that he will be well taken care of. Yet, some fairly good sales are recorded. There was a more representative display by belting firms this year. One large concern which had not found it possible to display during the past five years owing to shortage of stock, was on hand this year with some high-grade leather belting.

Transmission people state that, while Canadian belting has always represented high standards, some recognition is being accorded in this country to the new specifications for leather belting issued by the U. S. government. These represent concerted action by manufacturers and consumers of belting and have for their design a satisfactory and substantial quality on which competition could be fairly based. It is pointed out that a good many specifications in the past, created largely by the buyer without reference to the views of the maker, have been somewhat ridiculous, others impossible and the specifications now agreed upon remedy this and other evils. Large buyers, such as railroads having international interests, now base their requirements on these specifications.

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Any reference to the present year's record in Machinery hall would be incomplete without comparative statement, and in this connection Enoch Cronk, who has been exhibiting machinery for the A. R. Williams Co., for the past sixteen years, seems competent to speak from experience. Mr. Cronk declares this to be one of the best years on record in the matter of prospects and also in business closed. While the enquiry was chiefly for light equipment, so far as metal working machinery was concerned, the interest in woodworking machinery was most encouraging and is indicative of the activity in the building and allied fields. The list of prospects shows that saw tables and woodworkers capable of multiple operations had quite a decided call, and there were several calls for small lathes. The general tone was far better than that of last year, and there seemed to be a larger number of people actually interested in making purchases if not immediately, then in the near future. In Mr. Cronk's opinion, the Fair as a barometer, indicated better times ahead.

News From the Welding Field

Mechanical Control of Oxy-Acetylene Torch

Cutting Metal by This Process Approaches Very Closely the Maximum Theoretical Efficiency—Obtaining Any Desired Shape by Means of Templates—Application of the Radiograph

By FRED J. MAEURER

DRAWINGS are reproduced in cutting by the No. 1-A oxygraph one half size, ratio of movement of tracing wheel and the torch tip (measured from center to center), is as one-to-two. Inasmuch as the kerf cut out with the torch is of appreciable width from 1/16 to 3/16 inch or more, it is necessary to make allowance for the kerf when cutting.

Allowance for the kerf may be made by adjusting the pointers so that the distance between the points and the center of the tracing wheel is equal to the width of the kerf. The preferable method is to make the allowance on the drawing, however. Track lines are traced on the drawing inside and outside of the pattern at the required distance to allow for the kerf. The tracing wheel is run directly on the line and the pointer is ignored except when turning a corner. It is then used to indicate when the point is reached at which the swivel should turn. When the oxygraph is used for production cutting, pencil drawing may be replaced by metal templates that serve as guides to the feed disc, and thus make it possible to reproduce the required shape exactly and as many times as desired. The construction of these templates depends on the shape desired and the allowable cost. When many pieces of the same shape are to be cut the cost of the templates will be distributed over the whole lot and a construction may be advisable that would not be used where only a few pieces are to be cut.

The simplest form of template is a grooved track for straight line cutting. This guide may be made from a strip of cold rolled steel, say 2 inches wide, ½ inch thick in which a vee groove ⅛ inch deep and about 3/16 wide has been planed in the middle. Such a guide is indispensable for cutting off and other miscellaneous straight line cutting where a smooth effect is desired.

When the oxygraph is required to cut circles or circular arcs it may be set up with the radius attachments provided which make the tracer wheels follow the arc automatically. The center point on the radius rod may be adjusted to any length of radius within limits. The radius rod is inserted in the tracer wheel bearing in place of the regular short pivot and thus the wheel is held tangent to the curve.

The work table of the No. 1-A oxygraph is 36 inches square and the area covered by the torch, following the largest drawing spread on the table, is 18 inches square. The largest rectangular cuts are made on the diagonal from opposite corners. Thus, a shape 2⅛ inches wide, 23 inches long can be cut using a drawing outline 4¼ inches wide and 46 inches long to guide the tracer wheel.

The oxygraph has a wide application and many uses in tool shops, manufacturing plants, locomotive works, shipyards, drop forging concerns and wherever tools, dies, forgings and shapes are produced. The cutting action of the torch flame is smooth and rapid, and as any shape can be cut, it is comparable to a metal band saw of great power, following straight lines, curves, and angles acute or obtuse. Thin sections are cut more rapidly, of course.

Punches, dies, stripper plates and bolsters are cut in tool shops with the oxygraph with resultant large savings of time and cost. The usual practice in making a cutting or trimming a die is to plane the block on the top and bottom, bevel the sides, lay out and drill holes to the line, cut out the walls between the drilled holes with a broach or drift and finish with hammer, chisel and file, or by backing out with a shaper or slotter. Almost invariably a die made in this manner warps and twists in the process which requires either replaning on the bottom or shimming up in the bolster. The removal of the mass of steel in the center of the die relieves internal stress and lets the block warp out of shape. Not so when the rough die block is cut out on the oxygraph. All troubles of this sort are eliminated and the danger of cracking in hardening is reduced to a minimum.

When the opening has been cut, the die (still hot) is placed in an annealing box, covered and left to cool. When cold it is planed and finished in the usual manner with the assurance that internal stresses have been relieved. Finishing the die to precise dimensions and backing out for clearance is done in the usual manner. Not only is the oxygraph useful for blocking out dies but it may be used also to cut the stripper plates and bolsters.

In the cutting of die steel, we have found through long experience that with all dies with a carbon content of above .75, pre-heating before cutting is absolutely necessary to insure a smooth accurate cut. All die steels below this carbon content can be cut without preheating. This necessitates the taking of the die away from the jig after it is lined up, preheated to about 750 deg. F. or over and then it is put back in jig and cut. On Fig. 9 you will note that two 6 inch I beams are set on the frame of the machine, to support the die. Two 1½ angles are then clamped to the I-beams to hold die in place. The shape to be cut is scribed on die and a little off the line of cut a 3/16 inch hole is drilled for starting. Two straight lines are also scribed both ways, through the middle of die which enables the operator to set his drawing in the correct position. As this die is set up in jig when cold, then taken off and heated and placed back on jig to be cut, it is necessary to make provisions for the difference in size of die due to expansion caused by preheating. To overcome this a few strips of newspapers are placed between the angle irons and die when it is first set up, and the die is cold. When the piece to be cut is taken off the machine to be heated, the pieces of paper are removed from jig and hot die put back again to be cut. Experience quickly teaches us how much allowance it is necessary to make for various sizes and thicknesses of dies.

Fig. 10 shows the cutting of twelve pieces of ¼ inch steel plates, one piece being laid upon the other, at the same time, on the 1-A oxygraph. You will note the drawing is laid out on the tracing table and is twice the size as the pieces to be cut. Fig. 11 shows a line drawing of this cut and will give a much better idea of the irregular forms that can be cut on this type of machine. These pieces were used for wheelbarrow construction.

The No. 2 oxygraph, designed for heavy forge work and large plates has two pantagraphs connected by a hori-

This material was prepared by the author, who is engineer of Airco-Davis-Bournonville Co., for the American Welding Society. The first part appeared in June 29 issue and the second in July 13 issue.

zontal square tubular bar in front that holds the torch or torches, also the driving motor and feed gear.

Fig. 12 shows the cutting of quadruple punch machine plates that were previously cut with the radiagraph. These plates are 1½ inches thick and total amount of linear feet of cutting is 15, and were cut at the speed of 13 inches per minute. This also shows how the No. 2 oxygraph increases production without adding labor cost, as the two plates were being cut at the same time with one operator.

Make Foreman Responsible for Safety of Men Under His Charge

THAT periodic instruction should be given to foremen and mechanics by competent instructors was the suggestion made by a Toronto coroner's jury in their verdict on the death of a mechanic while at work on a snowplow in the railway yards. The evidence indicated that the only instructions received by car helpers in the mechanism and air systems on railway rolling stock were from those experienced men with whom they work. In this case an experienced workman was struck on the back of the neck, the blow of a lever breaking it. He had overhauled three snowplows previously, and had turned the petcock letting out the air from the reservoir which supplied the wing controls, and the air brakes, but had started to work before all the air had escaped, with the result that when he knocked out the pin from a chain that held the lever in place it flew forward, striking him and jamming his head against a pipe behind him.

Verdicts upon fatalities of this kind repeatedly suggest the question, Who should be responsible for the safety of employees under such conditions as described? A phase of this problem is being discussed this week at the Eleventh Annual Congress of the National Safety Council in Detroit. Adam Wilkinson, labor commissioner of the American Writing Paper Co., Holyoke, Mass., dealing with the subject, "The foreman and his responsibility for employees under his supervision," said:—

"Much has been said about the foreman's responsibility for the safety of employees under his supervision. The strategic position occupied by the foreman makes it possible for him to exercise a great deal of influence in the field of accident prevention.

"It is not too much to say, however, that the management generally in years gone by, has not expected the foreman to assume any great amount of responsibility for the safety of employees in his department. To maintain a uniform output of standard product has in most cases been the chief function of the foreman, and when this was secured his services were generally considered satisfactory.

"The safety movement is comparatively new, as is evidenced by the fact that this is the eleventh annual conference of the National Safety Council. Whatever great accomplishments have been made in this brief period of time have merely taken us from the field of propaganda into the field of practical accomplishments. In the paper-making industry it required a long term of service before men are promoted to the position of foreman, and it is safe to say that the majority of men occupying these positions to-day have done so for more than a decade past, and before the days when the term 'Safety first' had any real meaning.

Not Propaganda

"It is unfortunate, but nevertheless true, that many of our foremen to-day regard the safety movement as propaganda, and when men regard this work as such they naturally feel they have performed their full duty when a uniform output of standard product is maintained in their department.

"What I have said heretofore is largely a review of the conditions that have governed the foremen in the past, and to assume a critical attitude of the things that have been done or the things we fail to do will get us nowhere in our endeavors to prevent industrial accidents.

"With a full understanding of the foreman's duties as he has conceived them to be in the past we can approach the question of securing the wholehearted co-operation of the foreman in our effort to prevent accidents in the future. Many progressive concerns that have made a careful study of industrial accidents have concentrated their efforts for safety work through the medium of the foreman.

"Recognizing as we do the important part the foreman plays in accident prevention it becomes necessary for the person who directs safety work to maintain a close personal contact with the foreman. The interest displayed by the foreman will largely be reflected by the attitude of the employees under his supervision. To overlook the foreman in any plan for safety work will result in much wasted effort. The foreman is the leader in his department, and no movement will advance very far without leadership. To make the foreman a leader in the safety movement should be one of the chief aims of the safety director. To bring the foreman to a full realization of his responsibility for the safety of employees under his supervision he must realize that any effort made to prevent accidents is not a side line, but one of his chief duties. Our safety creed for the foreman should be:

"1. The foreman should see that every employee is properly instructed how to do his work in a safe manner.

"2. The foreman should maintain discipline in his department, and prevent 'horse-play' on the part of the employees.

"3. The foreman should advise the superintendent of any unsafe condition that exists in his department.

"4. The foreman should be as much interested in the safety of the employees as he is in the quality of the product of his department."

PROGRESS MADE FOR NEW MACHINERY HALL

The increasing need for a new machinery hall or engineering building on the grounds of the Canadian National Exhibition was additionally emphasized at a meeting held in the Administration building on Sept. 5. The gathering was well represented by machinery dealers and manufacturers and the plans and specifications were discussed at some length. The directors of the Exhibition and machinery men in general realize that the existing machinery hall has outlived its usefulness as an adequate place for mechanical exhibits. It was announced that already upwards of 16,000 sq. ft. had been disposed of to firms anxious to acquire space in the proposed new hall. It was stated, however, that about 35,000 sq. ft. would require to be sold on a ten-year basis before the proposal to erect a new building could be taken up with the city council. It was felt that the necessary space could easily be disposed of provided some satisfactory arrangement could be made in regard to power rates and other charges not included in the contract for space. The plans under discussion called for an outlay of approximately $350,000 and it was thought that this building would take care of the engineering needs for many years to come.

It was announced that quite a number of English firms would willingly take large space once they were assured of a suitable building to exhibit their various lines. While nothing definite was decided at the meeting the proposition was favorably received by those present and at the close of the exhibition a general meeting will be held to go more fully into the matter. It is anticipated that a thorough canvass of those interested will bring in sufficient space contracts to make the new building an assured fact for 1924 at the latest.

Lathe tools, drills and cutters made of high speed steel, that have been burned in grinding, or skin softened, generally can be redeemed by grinding off 1/64 in. to 1/32 in. of the burned section. On account of the skin softening effect it is necessary to use softer wheels for dry grinding than for wet grinding.

Recent Developments in Mechanical World

Casting Shells Centrifugally

A PHILADELPHIA consulting engineer, Mr. N. Lilienberg, maintains that the sleeves to be shrunk over the explosion chamber of a field or siege gun can be cast vertically by centrifugal force satisfactorily and more cheaply than by the present elaborate process. He states that projectiles can be made centrifugally, about as good as forged, and the cavity closely conforms to the required construction. All projectiles, whether cast or forged, have to be machined to exact finish. The great advantage is the forming of the cavity, thereby saving the tremendous labor of carving out the hollows cold from forged solid blanks by using a great number of machines. It would be interesting to fill a rotating mould so completely that no cavity can be formed, and to ascertain the effect of the centrifugal force by the microstructure. The most difficult metal is low carbon steel to be thus treated. The work with other metals is comparatively easier.

Inspection By Micro-Photograph

PICTURES which look like bird's-eye views of a dish of scrambled eggs turn out to be photographs of tiny metallic surfaces, magnified a hundred times. They are the best object lesson the welder can find, for they take him down to the heart of the weld and show him that things are going on which he cannot possibly see with the naked eye. Surfaces which appear to be closed turn out to be full of small cracks and metal which he thinks is clean is discovered to be fairly peppered with impurities. The microscope backs up the instruction book at every step, showing in a convincing manner the results of good and bad welding practice, the effects of heat treating and hammering, and the nature of the metal at any desired spot. It tells the welder more about his work, in fact, than he can learn with the same degree of certainty from any other source. It doesn't lie; it is more apt to reveal falsehoods.

Improved Testing of Welded Parts

TESTING welds by electrical and magnetic apparatus has recently been accomplished on a small scale, with a probability that such apparatus can be improved and further developed to the point where such tests can be made to supplant the present-day destruction tests. A device which would enable an inspector to test the entire length of a weld without injury to the parts would put welding on an entirely new footing. Attempts are being made, states the London Metal Bulletin, to perfect such a device, and such attempts deserve encouragement. The only real test available at present is the service test, because tests on specimens are not positive indication of what the total welded production is worth. X-ray Testing is another possibility of great promise which has not so far progressed beyond the laboratory stage. The latter method, by the way, seems to have received more attention abroad than in America.

French Import Duty on Zinc

THE FRENCH government proposes to impose an import duty on zinc, which would consist of a minimum tariff to be increased by co-efficients. The minimum scale suggested is 4 francs per 100 kilos for raw, and 8 francs for rolled metal. Belgian producers, says The London Metal Bulletin, have been getting somewhat apprehensive over the question, the impression in that country having been that the duty was to be 8 francs and 36 francs respectively; but in French quarters it is pointed out that Belgium will actually benefit when the new tariff is in force, for the reason that she alone will be granted the minimum, German zinc will have to pay four times the minimum, while America and Poland will probably be given an intermediate rate.

Cutting Micarta Gears and Pinions

MICARTA, a non-metallic material for gear and pinion application that can be advantageously substituted for untreated steel, cast iron, bronze, and all other materials used for gearing, has been developed by the Westinghouse Electric & Manufacturing Co. Micarta is self-sustaining and may be machined in the ordinary manner into gears and pinions of various standard and special types with standard tools and equipment. It is a laminated product of specially treated woven fabric. By means of the various processes through which it is passed, it acquires a homogeneous structure with physical properties that make it especially adapted to the manufacture of gears and pinions. This material was developed to meet the persistent demand for silent gear drives. In addition to silent operation, some of its distinctive features are that it is self-supporting; is not attacked by rodents and vermin; is not affected by water or oil, or by most acid and alkali solutions; can be kept in storage indefinitely without deterioration; is applicable to a great many special constructions where it is not possible to use other non-metallic material; and has a longer life than any other non-metallic material, often outlasting cast iron and brass.

Canadian Ore For Europe

IT IS SOMEWHAT interesting to know that twelve steamers are said to be engaged in exporting Wabana, Newfoundland, iron ore to Germany, and it is estimated that about three-quarters of a million tons will have been delivered by the end of the year. The source of information does not disclose the reasons for Germany's import of ore from such distance, subject to payment in English funds. The explanation may probably be found in difficult industrial conditions as they exist in Germany to-day, in restrictions placed upon her own resources by war settlements, or in the desire of certain smelters to secure quantities of high-grade hematite for specific purposes. The deposit at Wabana is said to be one of the richest yet discovered and one that might easily attract demand from world-wide sources.

Most countries where the steel industry has had marked development are importers of iron ore. British smelters are large dealers with Norway. Spanish ore has been shipped into United States and likewise to Britain. Ore from the Greek archipelago has found its way westward for the purposes of modern smelters.

When the history of ore and metal movements have been recorded, some strange reversals of trade conditions will be found to have developed since the pre-Roman days in Britain when Phoenician traders wandered overseas to acquire Cornish tin.

Practical Ideas From Practical Men

INCREASING RANGE OF DRILL PRESS STRAPS

By H. M.

From time to time the writer has taken notes of various drill press set ups whereby the usual straps and clamps have been made to serve in a rather unusual manner. Some of these methods are here collected and set down as examples showing how these common attachments can be used for many jobs which are ordinarily done in quite a different, but not always in such an efficient way. The different jobs shown are of a type commonly met with and therefore the simple methods used in each case will no doubt be interesting to many readers.

In Fig. 1 the double flat spring piece is to be drilled near the open end. Instead of using wood or other packing to take the thrust of the drill on the top ends of these pieces a strap A was held at the correct height by means of nuts on two bolts. This eliminated the necessity for knocking packing in or out of each piece as it was drilled and made a very solid fixture

Fig. 2 shows a coupling with the usual projecting flange required to be drilled with a circle of bolt holes. The thrust of the drill is taken by strap A fixed at the opposite side. This is not tightened on the work at all but merely adjusted, by means of the nuts, to hold the piece level. It will be seen that when the work is pushed against the bolts holding the strap A, this arrangement makes an efficient jig, as the work is revolved from hole to hole with the flange pressed against the bolts, so that there is no lost time lining up each punch mark with the drill.

Drilling a hole on an inclined surface is always an awkward job; almost impossible without supporting the drill in some way. The slides shown in Fig. 3 had to be drilled near the end for stop pins. The drill is here supported on the end of strap A, this having a V cut to receive the unsupported half of the drill. The strap A is adjusted and tightened in place by nuts on a stud, screwed into a tee nut a binding fit. The other end of the slide is clamped down in the usual manner.

The sprinkler pipe shown in Fig. 4 is generally considered a vee block job, but in this case the vee blocks were discarded and a couple of heel clamps A, used instead. They are bolted to the table with the heels upward and the pipe passed between as the row of sprinkler holes is drilled. To keep the holes upright a U clamp B is fastened at the end of the pipe with its ends touching the table. This work was performed quickly, the only stoppage being caused by the necessity for moving the U clamp back each time it reached the end of the table, but this required infinitely less time than the task of squinting along the pipe each time it is moved forward as is necessary when the pipe rests in loose V blocks.

A method of using straps at the edge of the table when long rods have to be drilled on the end is shown at Fig. 5. The heel clamp A is placed at the top and a straight strap B at the bottom. The end of the elongated slot in A is veed while the strap B has a hole spotted. Both clamps are adjusted to hold the rods vertical by keeping them close to the edge of the table by means of the heel clamp A and allowing the ends to rest in the spotted hole in B. In Fig. 6 is shown a heel clamp ground down to fit the table tee slot closely and furnished with a nut and screw in the elongated slot. This can be slipped into place in a moment and adjusted to the required thickness of material being drilled and forms a very effective guard for preventing this kind of stock flying round or riding up the drill as it breaks through.

HABIT OF SECRECY

By H. Hamilton

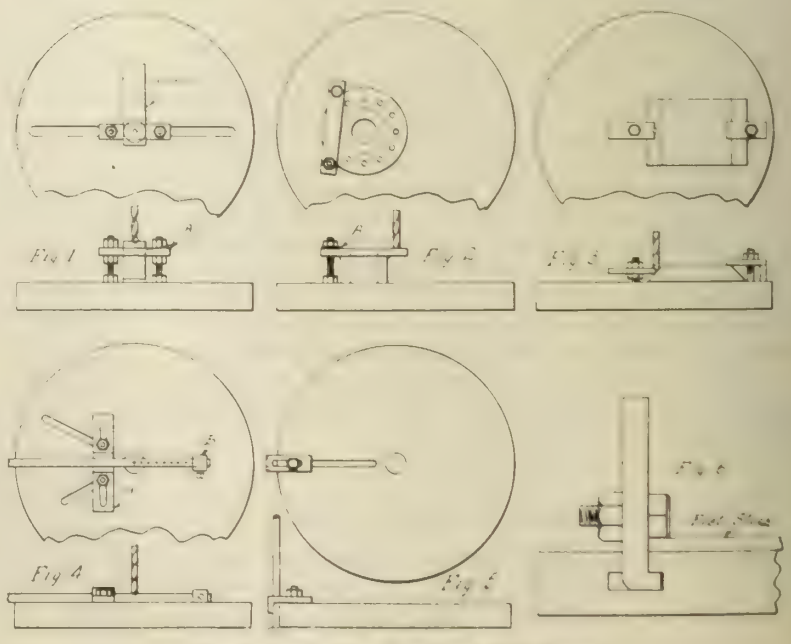
Nothing seems to be more prevalent with the human race than the habit of putting waste material in dark or secluded places, either for temporary or permanent abode. This is a condition far too common in the average industrial plant and one that requires considerable educational work in order to eliminate a source of danger that is seldom recognized as such by those participating in this practice. How often have we been walking along through the shop with a piece of useless paper, waste, wood, rag or other article and, when passing a box, bench, heating coil, or any convenient location, drop or throw the article out of sight. The next person may add his quota to the unseen pile, the accumulation making an ideal bed for the butt of a cigarette or the remains of an unburnt match. Of course, in the best regulated factories the non-smoking clause dispels the possibility of the cigarette or the match, but there is always a time when an exception to a rule proves disastrous. Aside from this the chance of spontaneous combustion is always present where rubbish is allowed to accumulate.

It is well to provide receptacles for placing waste and rubbish in, but if it is necessary to throw such material aside, cast it on the floor in the open where it can be swept up and removed. If you must expectorate while in the shop, do it in a cuspidor or on the floor in the open and not in a dark corner where it is hard to see and seldom cleaned. You owe it to your fellow worker, if not to yourself, to keep the place as sanitary and as free from the fire fiend as it is possible for you to do.

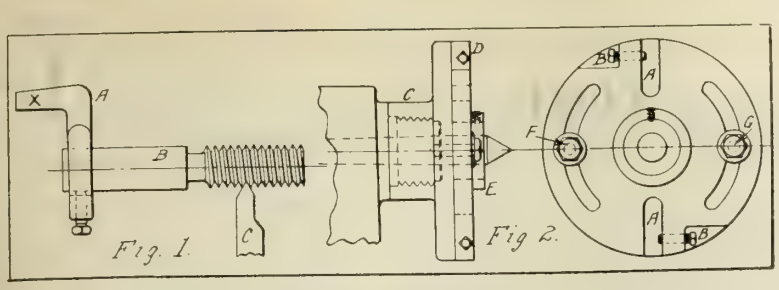
A LINE UP FACE PLATE

By F. Scriber

Oftentimes in metal working a rather difficult proposition presents itself where it is necessary to do some recutting on work previously machined. One such example is that of re-cutting oversized threads where the original thread must be accurately picked, that



Broader application of ordinary drill clamps.



A line-up face plate.

is to say, the tool must engage the thread in the same channel as previously cut when re-cutting.

This will be best understood by referring to Fig. 1 where A is a dog gripping a threaded stud B, C represents the threading tool. This piece of work B is placed in a lathe between centers in the usual manner for threading and the tool used and method of threading is the same as that usually employed except that a face plate such as is shown in Fig. 2 is employed to engage the tail X of the dog; this dog of course enters one of the slots A Fig. 2. The set screw B is set against the dog to hold it securely in place. This face plate is made in two sections C and D, C being screwed on the spindle nose of the lathe in the usual manner while D is revolvably mounted on C, being held thereto by a collar E and two set screws F and G. These screws go through an elongated slot in D into a tapped hole in C. The object of these elongated slots is to permit of swiveling the plate D relative to C which is permanently fixed on the spindle nose of the lathe.

In using this fixture the operator starts his lathe up in the usual manner, throws in his threading feed and advances his carriage sufficient to take the back-lash up. He then stops the lathe and with the cross feed runs the threading tool forward to see how it fits in the thread previously cut; as it is unlikely that the threading tool will match the previously cut thread he swivels plate until the tool will match the thread owing to the changing position of the helix of the thread caused by this revolving. When the thread and tool match the swivel plate, D is securely clamped in position and we are now ready to re-cut the thread. If it is desired to very accurately match a thread two or more trials are usually necessary to accomplish this and a piece of white paper placed beneath the threading tool may be used as a light reflector in matching the tool with the thread.

DRAWING THIN SHEET METAL

By H. James

In the construction of dies for the drawing of thin sheet metal difficulty is frequently experienced in obtaining a good draw without also securing a large percentage of split or spoiled work. This result is often traced to extra hard or brittle material and it is sometimes necessary to further anneal the stock before proceeding with the drawing operations. When the blank is large in relation to the diameter of the draw, it is usually advisable to relieve the outer portion slightly so that only 3/16 or ¼ in. around the die opening has a bearing on the blank holder. In addition to this the draw will be easier if the surface is stoned (radially) with a very fine stone or piece of fine abrasive cloth, carrying the process over the rounding edge of the hole. Better results are obtained when the corner has the shape of the broad side of an ellipse rather than a true quarter arc of a circle.

AN EMERGENCY FUEL

As an emergency fuel, a mixture of fuel oil with fine coal in as large proportions as the coal will absorb and hold is suggested by the United States Bureau of Mines to steam coal users and gas manufacturers to augment their fuel supply during the present shortage.

Slack coal that has a high percentage through an 8-mesh screen, or which may be crushed to sizes of one-eighth inch or less, will take up in oil from 30 to 40 per cent. of its own weight and make a fuel high in calorific value. Coarse, slack coal, however, as judged by a representative sample from the Pittsburgh market, will absorb oil to only 3 to 10 per cent. of its own weight, which would give a fuel having only about 4 to 15 per cent. increased heating value. The finer the size of the coal, therefore, the larger is the amount of oil which will be held. Tests made by the Bureau of Mines at its Pittsburgh experiment station indicate that the mixture can be made with either bituminous slack or anthracite culm.

This method bears a relationship to the Trent process of purifying coal by fine grinding and amalgamation with oil, now in operation at a plant at Alexandria, Va., which has demonstrated the success of a combination of oil and coal for steam-making, gas manufacturing and other fuel purposes. The present emergency proposal does not contemplate the cleaning process, but involves merely the simple mixing by shovel or concrete mixer. The Trent Corporation has volunteered to assist the government in advising in the use or application of oil-coal mixtures, and to waive during this emergency any claim of infringement of its process which may or may not be involved by the simple mixing of fuel oil and coal, without reference to cleaning.

An oil refinery at Baltimore, it is reported, mixed by shovel a ton of heavy Mexican fuel oil with two or three tons of western Maryland slack coal, and used it successfully in a switch engine. At the experiment station of the Bureau of Mines at Pittsburgh, it was found that mixtures containing one ton of Mexican fuel oil and four to five tons of Pittsburgh slack coal could be used in a hand-fired furnace.

In using oil-coal mixtures, the fire will smoke badly after firing, or while breaking up the coke bed from time to time. From such limited amount of testing as has been done by the Bureau of Mines, it was shown that careful firing is required to prevent continuous smoking. Experimenting must be done in each case to determine the best method of firing.

Chain grates and certain other automatic stokers are probably well adapted to handle the oil-fuel mixture if the bin and feeding devices are suitable. Oil-fuel mixtures will not fire spontaneously, but undoubtedly care should be exercised to ventilate bins where external heat may tend to drive off lighter gases, although the fuel oil which is on the market has had the lighter oils distilled from it.

Anthracite culm or dust which would sift through ordinary grate bars can be used successfully when mixed with the oil, as the oil causes it to adhere and the oil residue cokes as soon as heated. Oil and anthracite mixtures are not smokeless with hand-firing, the Bureau of Mines tests indicate.

This simple mixture of fuel oil and coal is proposed by the Bureau of Mines merely as a temporary measure. While under conditions of normal fuel supply such a mixture probably would not prove satisfactory unless it involved the cleaning feature embraced in the Trent process; in places where fuel oil is available it can be used to piece out a poor coal supply without the changes in equipment necessary to convert boilers to oil burning.

CANADIAN SHIPS TO CARRY COAL TO STATES

Victoria, B. C.—The Canadian Trading Company has chartered five steamships of the Canadian Government Merchant Marine to carry coal from Newcastle, N. S. W., to ports in the United States. The Canadian Trading Company has its head offices in Vancouver and this is the first time that a Canadian firm in British Columbia has chartered tonnage to carry coal to United States ports from another country. The steamships chartered are the Canadian Britisher, Canadian Highlander, Canadian Traveler, Canadian Transporter and Canadian Scottish, and they will carry lumber to Australia and return with coal for San Diego, San Francisco, Seattle and perhaps Honolulu.

New Things in Shop Equipment

UNIVERSAL GAUGING DEVICE

An attachment to be used in connection with a dial gauge, to provide accurate setting to any position or angle, has recently been developed. The device is particularly adapted to the testing of crankshafts, camshafts and valve stems; checking lifts of valves and valve cams; gauging thickness of piston rings, shims, bearing liners, piston diameters and recording the accuracy of flywheels and shafts. B. C. Ames Co., Waltham, Mass., are the manufacturers.

COMBINATION GRINDING ATTACHMENT

A grinding attachment that can be used in lathes as small as 10-in. swing has been placed on the market recently. The attachment is mounted on a special angle plate that is secured to the toolblock of the lathe, the motor and spindle being on opposite sides of the plate. The motor is pivoted to the angle plate, permitting movement for tightening the belt. There is a vertical adjustment to the spindle of 4 in., and the device can also be set at any angle in the horizontal plane and a reasonable angle vertically. Speed change is effected by transposing driving pulleys. Ball bearings are fitted to both wheel spindle and motor shaft. Spindle speeds range from 5,500 to 30,000 r.p.m. These tools are made by the United States Electrical Tool Co., Cincinnati, Ohio.

HAND PRESS AND PULLER

A combination hand press and puller especially intended for garage and jobbing shop service has recently been introduced to the trade. It is designed for the purpose of removing wheels, gears and bushings from shafts, and likewise for pressing similar parts in place. Three lag screws are provided for securing the base to the bench. The device can easily be converted into a serviceable arbor press for handling round pieces up to 18 in. in diameter. Three sizes of yokes provide for a wide range of service. The arms are reversible and may be used either side out and also at any spacing within the range of the tool. The parts are made of 40-point carbon steel and capable of withstanding a strain of 50,000 lbs. per sq. in. of sectional area. These tools are made by Geo. W. Dover, Providence, R.I.

HORIZONTAL HYDRAULIC PRESS

A hydraulic press capable of exerting a pressure of 25 tons at speeds ranging from ¼ to 6 in. per minute has been developed and placed on the market recently. The maximum speed of ram on outward stroke is 37 in. per minute, which speed is increased to 56 in. per minute on the return stroke. Ram speeds can be readily and instantly changed by a control lever located on top of pump. The pump is directly driven by a 2 h.p. motor and no accumulator or auxiliary pump is used. Relief valves are provided to prevent damage should ram be driven against stop at full speed. Initial pressure of 800 lbs. per sq. in. are used on a 9 in. piston. The ram has a stroke of 30 in. It is claimed that the press operates without shock or pulsations. These presses are built by the Oilgear Co., Milwaukee, Wis.

HAND AND BENCH VISE

A combined hand and bench vise, especially designed for toolmakers, patternmakers and others, required to work on small pieces that cannot conveniently be held in the hand, has been placed on the market. The tool is made of semi-steel and in two sections. The anvil clamp is secured to bench or other support and the vise portion is located in a tapered dovetail slot on the front of the clamp. No setscrews or other fastenings are required. The jaws of the vise are kept always parallel by means of a pantograph arrangement beneath the vise screw. This device permits the work to be lifted from position without removing from the vise. Either plain or serrated jaws are supplied with the vise. The Malleable Iron Fittings Co., Brantford, Conn., are the manufacturers.

GRINDING WHEEL DRESSER

A grinding-wheel dresser in which the tool-steel discs are carried on roller bearings has recently been offered to the trade. One of the advantages is the easy running and long life of the spindle. A ¾ in. stud carries a cage holding the rollers of the bearing, which in turn support a bushing on which the cutters are securely fastened. The bearing is practically dust-proof but ample means are provided for oiling. The cutters are made of corrugated steel with an outside diameter of 2⅜ in. The body is so designed that it can be held in a tool post or on a magnetic chuck. When used on the chuck the tool rests on an inclined face, so that the flat surface and the heel of the shank are both in contact with the face of chuck. These tools are made by the Desmond-Stephan Manufacturing Co., Urbana, Ohio.

INSPECTION GAGE AND STAND

An inspection gage and stand, especially intended for facilitating the calibration of accurate internal diameters in hardened and ground work, has been placed on the market recently. The gage is a modification of the internal micrometer and is adjusted by means of a micrometer screw and sliding wedge, the under surface of which is inclined at an angle of 15 deg. to the body of the tool. The amplification of movement provides very fine increments of diameter. The graduations permit of variations as small as .0001 in. It is stated that these measurements can be estimated as easily and as accurately as on the .001 divisions on the standard micrometer. The stand holds the tool firmly and allows the inspector to slide the work upon the measuring surface without fear of injuring the finish, a tapered hardened ring permitting of free entrance of the work. The operator handles the work in his left hand while making adjustments with his right. The gripping surfaces of the stand are faced with soft metal to protect the finished parts of the tool. These tools are made by John Bath & Co., Worcester, Mass.

SPECIAL MICROMETER

An interesting design of micrometer has just been placed on the market. The frame and barrel is in one piece, the U portion being of oval section. Provision is made for compensating the wear of the thread. The adjustment of diameter is made by the spring nut adjacent to the barrel. The thimble is pressed over the sleeve of the measuring spindle and it is also split and provided with a knurled ring nut for clamping it to the sleeve. The tool may be dis-assembled, adjusted and put together again in a few seconds. After completing the adjustment the spindle is moved into contact with the anvil, and the thimble adjusted to zero, after which the ring nut is tightened and the micrometer is ready for use. These tools have been brought out by the Central Tool Co., Auburn R. I.

POLISHING AND BUFFING LATHE

A new line of ball-bearing polishing and buffing machine has recently been introduced to the trade. The machine is of the duplex type, being equipped with two independent spindles, the wheels being carried at the outer ends. The spindles are operated separately and either spindle, together with the respective bearings, can be removed without disturbing the alignment. The bearing housings are of the ball and socket type. The spindles may be driven either by overhead or underneath shafts, facilities being provided for placing a motor in the base of the frame. Each spindle has a length of 32 in. The overall length of two spindles is 66 in. Spindles have a diameter of 2 in. Floor space required 26 x 42 in. The No. 5 machine has a net weight of 950 lbs. They are made by The Mitchell Engineering Co., Springfield, Ohio.

PORTABLE SAW BENCH

A small portable saw bench for the general use of pattern makers and in jobbing shops has recently been placed on the market. The machine is self-contained, the saw arbor being driven from a motor mounted on a bracket at the side of the pedestal, the belt running inside the column. The table has a working area of 16½ by 21½ in. and is fixed at a height of 38 in. from the floor. It is provided with a rip fence that may be set at any angle for bevel sawing, as well as a cut-off slide adjustable to mitre cutting up to 45 deg. The arbor runs at a speed of 2,400 r.p.m. and carries a 6-in. saw. The table may be tilted to any desired angle and may be swung clear when changing saws. The machine weighs 184 lbs. It is made by A. C. Sisson, of Pawtucket, R.I.

ANTI-EXPANSION CENTRES

A new type of centre for use in lathes and grinding machines has been developed and placed on the market recently. A series of helical grooves are milled in the shank proper which has a longitudinal movement within the outside tapered shell. This motion is opposed to a very stiff adjustable coil spring. The object of this construction is to take care of the expansion of the work, caused by the heat generated by the cutting of the metal, thus allowing the centre to recede and prevent binding. Lubrication of the interior is possible through a hole in the adjusting screw.

The same firm has produced anti-friction centre, the inner spindle of which revolves with the work, a forward radial and rear thrust bearing being mounted in the outside casing. The outside of shell is made with Morse tapers but other tapers may be secured when desired. When used for grinding machines the centre heads are reduced in size to permit the wheel to pass over end of work. These centres are made by the Snellex Manufacturing Co., Rochester, N. Y.

ELEVATING PLATFORM TRUCK

An electric elevating platform truck especially designed for the handling of large core racks into and out of core ovens, has been placed on the market recently. The battery compartment is provided with removable end plates and with rails for guiding and holding the storage battery trays. The motor is flexibly connected to the elevating mechanism by means of double worm reduction. Four crankshafts, two at each end, are connected to the worms by means of bevel gears. Hardened steel rollers on the crankshafts bear on hardened steel plates on the underside of platform. All four crankshafts operate simultaneously when platform is being raised or lowered. Limit switches are provided for platform travel. A contracting-type shoe brake is interlocked with the treadle, so arranged that the brake is applied when foot pressure is completely removed. Three operating speeds are provided for each direction. The maximum speed of truck is 700 ft. per min., on rubber tired wheels 27¾ in. dia. The load carrying wheels are 10¾ in. in dia. and are mounted on double-row ball bearings, with a ball thrust bearing fitted to facilitate steering. The platform is 7 ft. 2½ in. long and 30 in. wide, and 11½ in. from the floor in the low position. The truck can be turned completely in a 12-ft. radius. These trucks are made by the Atlas Car and Manufacturing Co., Cleveland, Ohio.

PROFILING AND MILLING MACHINE

A new design of profiling and milling machine has been developed and placed on the market. The work table has a working surface of 30 x 16 in., with a throat in the column that provides extra accommodation for wide work, the maximum distance from spindle to back of throat being 14 in. The table has a traverse of 12 in., and a cross movement of 7 in. The knee has an adjustment of 6 in. while the spindle has a vertical movement of 2¾ in., the latter being derived from rack and pinion. By means of helical gears the cross-feed of the table can be conveniently operated, owing to the fact that traverse and cross-feed handles are in the same plane. Provision is made for operating the cross-feed direct by means of a crank handle. The tool spindle is hollow and bored for No. 3 Morse taper. The spindle is supported in three bronze bearings, the drive operating through bevel gears from cone pulleys on the end of a horizontal shaft. The machine requires a floor space of 36 x 45 in. and is manufactured by the Robbins Machine Co., of Worcester, Mass.

DOUBLE-ENDED AUTOMATIC THREADING MACHINE

An automatic machine having two heads and especially adapted to high-speed threading has recently been placed on the market. The machine is capable of threading both ends of a forged or rolled stay bolt simultaneously, and both threads are in line and continuous lead. The condition of the intermediate portion of the bolt does not affect the accuracy of the thread alignment.

The machine is provided with a hopper that has a capacity for about 55 minutes of operation. A work-feeding mechanism with a pair of floating jaws holds the staybolt and presents it to the dies so that both ends are in exact alignment. The large lead screw is fitted with long bronze nuts, and suitable cams are provided for operating the various parts automatically. The spindles are connected to the main driving shaft by means of gears. The camshaft change gears regulate the speed of the camshaft to conform to the different length of threads to be cut. When the die heads are just clear of the work, the work-holding jaws open and move backwards, ejecting the finished staybolt. The mechanism then operates to place a rough bolt in position. To assure continuous lead the machine is accurately set by means of a master staybolt or long-thread gage, which is inserted in the dieheads. One die is closed on the thread and the second head is adjusted so that the die closes perfectly on the thread at the desired point. The machine is provided with a safety shearing pin which prevents damage should a rough blank be too much out of shape. The machine has a capacity to thread staybolts up to 1 15/16 in. dia. and from 7 to 18 in. long. Five machines can be operated by one man as it is only necessary to keep the magazines filled. These machines are manufactured by the Cleveland Automatic Machine Co., Cleveland, Ohio.

SCREW AND NUT SETTING TOOLS

A line of portable and stationary electric driven tools for the rapid setting of screws, studs and nuts, has recently been offered to the trade. The portable equipment represents in general outline an electric drill and may be operated from an ordinary light socket. The stationary design is intended to be operated from a power line. The motor of the stationary tool is universal under the same current conditions that govern the motor in the portable tool. The motors are of the high speed type, the spindles operating at a 10 to 1 reduction. The driving mechanism consists of a multiple-disc clutch, adjustable for any torque within the capacity of the motor, and driving a positive clutch through a splined shaft. When the disc clutch is fully released the automatic kick out permits the removal and replacement of tools while motor is running at full speed. It is stated that the slip clutch insures all screws and nuts being driven to the same tension and that prevents shocks to the motor. This tool cannot be overloaded. During the actual setting of screws the speed is reduced to 350 r.p.m. The possibility of crossed threads is eliminated as nuts are held with their axes in line with the operating spindle. The stationary tool handles nuts from ½ in. to 1 in. These tools are the product of the Elecdrive Manufacturing Co., of Syracuse, N.Y.

CATALOGUE

The Canadian Ingersoll-Rand Co., of Sherbrooke, Que., have just issued a new catalogue covering their complete lines of engineering equipment. The book is prepared in a very convenient and interesting style, being subdivided into fifteen sections, fourteen of which are devoted to some particular class of product and the last portion to a general collection of tables, formulae, etc., for the service and reference of engineers. The catalogue is compiled in loose-leaf card index form, permitting the removal or addition of certain pages or sections when necessary. The book contains 230 pages held together in an expansion cover by means of brass screws. Three hundred halftone cuts are used to illustrate the various lines.

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Coal for U. S. in Canadian Ships

SETTLEMENT of the coal strike seems to have added some intensity to the complacency with which the general fuel outlook is now regarded. What with supplies on hand and deliveries that should dribble through, the impression is that the country should be able to worry along until something like normal conditions return. It may be a tendency of the times, or of the holiday season at least, to discourage the development of a serious problem by assuming an attitude of indifference. At no time did the much-abused dealer seem to worry about it, and he did his share to reassure the public that everything would be all right and that consumers would be well looked after. Ottawa has had not only an eye but its hand on the situation but naturally not to the same extent as the man who had an empty coal bin, a family of several kids and prospect of a cold Canadian winter. Advice has been plentiful but apart from making it unanimous that there was a coal shortage and that consumers should acquire what substitutes they could, nothing of a practical character has developed.

Municipalities with foresight have made an attempt to buy Welsh coal and considerable tonnage is now on the way. This will help some. In the meantime, a correspondent in Victoria, B. C., advises us that a trading company there has chartered five steamers of the Canadian Government Merchant Marine to carry coal from Newcastle, N.S.W., to ports in the United States. This, it is said, is the first time a Canadian firm in British Columbia has chartered tonnage to carry coal to the United States from another country. This may be regarded either as neighborly or as good business, or both. It may mean that Canadian ships could not be profitably employed in carrying coal to Canada; it may mean that Canadians were needlessly alarmed over prospects of a coal shortage; it may mean, further, that a record, showing Canadian ships earning money on outside service, would look better at the end of the fiscal year than would Canadian ships employed in carrying coal for Canadian purposes. All of these things may look well, but they do not obscure the somewhat peculiar picture of Canadian ships employed in rushing return cargoes of coal to the United States, the base of this country's coal supplies, where scores of ships are standing idle that could be used in the coal business. Some person seems to be awake to the fact, on the other side, that even with coal strikes settled, there is going to be a shortage and that supplies will have to be supplemented from outside sources. Such enterprise is entitled to everything it can get.

Of course, on the other hand, it may be argued that these ships are restricted to Pacific service and that it would hardly be worth while to transfer them while there seems to be as many bottoms as necessary to meet the emergency. But on a cold winter day, Canadians may not easily reconcile themselves to the somewhat anomalous proposition.

Something Tangible at Last

EXHIBITORS in Machinery Hall at Toronto National Exhibition this year fully expect that the project of a new engineering building will be proceeded with at once. Plans have reached that stage where something tangible is at last emerging and committees now have something to work on. In another part of this paper will be found a report of a meeting at which manufacturers discussed the proposition. As compared with conditions in the old building, what is offered in the new structure on the price basis proposed, must appeal as being adequate and reasonable. Good display spaces, proper moving and shipping facilities, lighting that will show goods at their best, consideration of demonstrating requirements, including the all-important adjunct of electric power at minimum rates, are matters that will receive careful attention. There must be a representative display, and further, it must be a creditable one. The object of such a building should be to develop an annual event that will bring out the best in engineering enterprises. This result has been attained in other buildings in which industries have been segregated at the exhibition. Manufacturers of machinery are in a position to make a showing that should be the outstanding feature. The question of location is hardly as important as some would think. A building such as proposed is attractive because of the general impression created by its display.

Ready for Freight Congestion?

STEEL companies report remarkable activity among the American railroads in the building of new rolling equipment. Immense tonnages of steel are being consumed in this work, yet there exists considerable doubt as to whether there will be anything like adequate facilities to handle the quantities of coal, manufactured articles and food products accumulating for transportation. Canadian roads are doing very little in this matter of car construction, even with a bumper wheat crop in sight. It is pointed out that for all immediate purposes the rolling stock on hand is sufficient. The situation in the United States, however, will have its effect on Canadian deliveries and the coming winter may see another hopeless congestion at international points. Available supply of cars will be affected by the protracted railway shopmen's strike, yet against this is the declaration by road operators that they will be in good shape for the emergency, while the government, by issuing priority orders, is attempting something to prevent tie-up. Food for human consumption receives first consideration; then feed for livestock; then livestock, perishable products, coal, coke, fuel and last, all other commodities. The phase that will be followed with considerable interest is that which concerns industry in general and the necessity that it be well served under these circumstances. The situation will demand efficient handling.

Production Increases but Deliveries Difficult

Coal, Pig Iron and Steel Ingots Show Improvement—Now Up to the Railroads—Business in Steel Centres Handicapped—Canadian Furnaces Restricted to Light Output—Bars and Sheets Advance Though Demand Continues Good

LARGE IMPORT TONNAGE SHOWS BROAD ACTIVITY

DECLINING continuously in the past two months, the low point in pig iron and ingot production was reached at the end of August with respective records of forty-five and fifty per cent. of capacity. This is the latest Pittsburgh advice. There has been a subsequent increase in production, as several mills in Pittsburgh district, the valleys and about Chicago have resumed operations. Of these plants, practically all had by-product coke ovens. Coal shipments, generally, will be severely limited by railroad congestion, however, and nothing can be taken for granted as to increasing production in coal or iron and steel industries. Offerings of pig iron in Canadian markets are confined to restricted output as scarcity of coal has made operation on a large scale impossible. Production for August will show very low levels indeed, with no improvement in sight Algoma spot price is $39.30, while the Steel Company is out of the market for new business. Some Scotch pig iron has made its appearance, but not in such large quantities as to be a factor in relieving marked scarcity should such develop.

August has been a good month with the dealers in the iron and steel business, as a whole. In some quarters it is reported that while the volume was large, it was not due so much to the number of orders as to the size, while other dealers declare that orders showed unusual number. Structural material has been an outstanding factor, but large importing interests state that their bookings represent considerable variety. A $350,000 month by one concern, with an advance from $165 to $170 in the basic price, was considered a remarkably good showing for August. Still it is predicted the price peak has not been reached and even in the more conservative quarters advances are being seriously considered. For example, an advance of five cents in steel and iron bars represents unanimity in $3.40 as the maximum figure. Sheets continue to be a feature in the demand and prices show slight advances. Galvanized, No. 28, are quoted at $6.75; blue annealed, No. 10, at $4.50 and black, No. 28, at $5.50. The market continues fairly strong for finished products. An advance has been announced in wood screws, the new discounts being, for flat head, bright, 80-5% off; flat head, brass, 75-5% off; flat head bronze, 70-5% off; with ovals and rounds ranging from two to three per cent. below these figures.

Advances have taken effect in boiler tubes and then there appears to be some difference between the Montreal and Toronto quotations. In the former, on a three-inch lapweld, the latest figure is $28.50 per 100 feet, while Toronto quotes $27.50; on four-inch the Montreal price is $42, Toronto, $39. On standard butt and lapweld pipe, the price remains firm, raw materials are very slow in shipment and coupled with this is the gradual increase to about $8 per ton for skelp.

Demand is such that advances are being made an inevitable factor under present circumstances and there is little indication as yet that a conservative attitude is developing. The feeling is that with a shipping congestion in sight it would hardly be wise to curtail when the purpose has any urgency.

Montreal reports improvement in the scrap metal market, owing to continued scarcity of pig iron. Summerlee Scotch iron is the only kind available on that market at present and the stock is limited. Business generally is inclined to be spotty, some houses reporting improvement and others claim that the volume is not up to the mark. Quotations on steel are firm and supplies are increasingly difficult. Quotations are such as to restrict operations of Canadian mills. Demand for machine tools continues very light although supplies are keeping up.

Toronto

September 13, 1922

AUGUST has come through with a fairly good record so far as business booked by dealers is concerned. Advancing prices have not resulted in curtailment and this fact is taken as evidence that there is considerable urgent work in process. Import tonnages have been large, indicating wide industrial variety, and represent a slight improvement in transportation. This is the big problem at the present time, and some apprehension is felt with regard to the attitude of shopmen of the Canadian railroads. A tie-up of shipping would mean little short of industrial paralysis.

In pig iron markets there is little activity and is confined almost entirely to rush business on small lots. Algoma is operating on a limited scale quoting $39.30 spot. Foundries seem to be fairly well covered for the time being. It is a situation in which little if any help can be forthcoming from American furnaces. Report comes from Buffalo that imported iron, particularly in the East, has affected the demand for the domestic article. Summerlee Scotch pig has become quite a factor in Quebec, but has not yet made its appearance in Western Ontario, where it would be at an obvious disadvantage in competition.

Scrap metal markets remain somewhat inactive. There are quantities of heavy melting steel in sight but it is firmly held in anticipation of higher prices. Dealers' quotations of $11 per gross ton, Toronto, are in line with the $16.50 to $17.00 Buffalo figures. No. 1 machine cast iron is quoted at $18, Toronto; machine shop bearings at $6 and malleable scrap at $11. Local prices follow:

Copper, light, per 100 lbs.	9 00
Copper, crucible	11 50
Copper, heavy	11 25
Copper Wire	11 25
No. 1 compositon	9 00
New brass cuttings	6 00
Red brass turnings	6 50
Yellow brass turnings	5 25
Light brass	4 50
Medium brass	6 00
Scrap zinc	3 50
Heavy lead	4 50
Tea lead	3 00
Aluminum	11 00
Boiler plate, per gross ton.	9 00
Heavy melting steel	10 00
Axles (wrought iron)	20 00
Rails (scrap)	11 00
Malleable	10 00
No. 1 machine castiron	18 00
Pipe, wrought	7 00

Iron and steel bars, once more, appear slated for an advance to the maximum of $3.40 indicated in these columns for some time. Sheets also show the result of the upward swing in the American markets and the demand continues strong. Black sheets, No. 28, are quoted at $5.50, Toronto, and galvanized sheets at $6.75. Folowing is the local list as revised:

Iron bars	3 35	3 40
Steel bars	3 35	3 40
Reinforcing bars	3 35	3 40
Steel hoops		4 50
Tire Steel		3 50
Spring steel	7 00	14 00
Band steel, No. 10 gauge and 3-16 in base		3 90
Small shapes		3 40
Sheets, black, No. 28		5 50
Sheets, blue ann., No. 10		4 50
Canada plates, dull 52 sheets		5 75
Canada plates, all bright		6 75
Galvanized Sheets, No. 28		6 75

Non-ferrous markets have been practically featureless for the past week and no price movements of any importance are reported. The market for copper products continues to show strength. Manufacturers declare that deliveries are an increasingly difficult factor. Non-ferrous metals are quoted locally as follows:

Lake copper	17 75
Electrolytic copper	17 50
Castings, copper	17 00
Tin	37 00
Spelter	8 00
Lead	8 00
Antimony	8 50
Aluminum	21 00

Machine tool markets continue to show quite a fair demand for woodworking

equipment. From representatives at Toronto exhibition came the report that considerable interest was shown in small metal working lathes and machine tool accessories and supplies.

New discounts were issued recently by the Steel Company on wood screws. These are now as follows: Flat head bright, 80-5%; oval head bright, 77½-5%; round head bright, 77½-5%; flat head brass, 75-5%; oval head brass, 72½-5%; round head brass, 72½-5%; flat head bronze, 70-5%; oval head bronze, 67½-5%; round head bronze, 67½-5%, f. o. b. Hamilton, Toronto and Montreal with freight equalized thereon. Terms, 2% cash, 30 days.

Montreal

September 13

LOCAL jobbers are not of one opinion regarding the amount of business moving at present. Some houses appear to be handling an increase in business, and others claim the volume for the past week has dropped off. This condition is only to be expected, on account of the national disturbance in the iron, steel and coal industries, in addition to a partial tie-up of the transportation systems. Steel is becoming more difficult to procure each week, and the quotations are decidedly firm. Some mills have closed down entirely owing to the coal shortage and small bookings. Canadian pig iron is off the market temporarily, that is to say no new orders are being accepted, but business already booked is being taken care of. Machine tools are quiet. But little change has taken place in the non-ferrous metal market during the week. The scrap metal market has improved slightly.

Iron and Steel.—Mill quotations on steel are $2.60 base and $2.70 base, to the large consumer, and the jobber respectively. The tonnage moving continues to be about the same, but the jobbers are experiencing greater difficulty each week in maintaining warehouse stocks. The Algoma Steel Corporation have completed the 48,000 ton rail order for the C. P. R. and have practically closed their mills. Only a portion of the mills of the Steel Company are operating. The mills operating are producing small steel products largely, thus the tonnage produced is not large. Local jobbers are at present depending on local mills such as the Peck Rolling Mills and the Canadian Tube and Iron Co. for their supplies. These mills are kept reasonably busy supplying the local jobbers and consumers. Galvanized sheets, also blue annealed and black sheets are greatly in demand. Merchant bars, structural sections, and heavy material are very quiet. Boiler tubes are moving considerably better this week. Quotations on them have advanced during the week. Small steel products have continued to move satisfactorily. The local quotations are as follows:

Iron bars, base	3 15 to	3 25
Steel bars, base	3 15 to	3 25
Reinforcing bars, base	3 15 to	3 25
Steel hoops	4 25	
Tire steel	3 25 to	3 40
Spring steel	7 00	
Band steel, No. 10 gauge and 3-16" base	3 65	3 75
Small shapes	....	3 40
Sheets, black, No. 28	....	4 40
Sheets, blue ann., No. 10	....	4 05
Canada plates, dull, 52 sheets	....	5 50
Canada Plates, all bright	....	7 00
Galvanized Sheets, No. 28	....	6 50

Pig Iron.—Practically all Canadian iron is off the market temporarily, inso-far as new orders are concerned. The nominal quotation is $40.80, but no business is being done at this figure. Practically the only iron available at the moment is Summerlee, and this stock is limited. It is expected that Carron iron will be offered at an early date. The consumption of the foundries at this time is only nominal. Most firms bought heavily some weeks ago and the producers are protecting their customers who placed orders well in advance. Thus there is very little actual demand for iron, and the amount that does exist is being handled with the Scotch iron. The local quotations are as follows:

Algoma, No. 1, car lots on tracks, nominal quotation	40 80	....
Summerlee, 5-ton lots, warehouse	38 50	33 50
Summerlee, 30-ton lots, dock	33 50	....
Carron, 30 ton lots	33 50	....
Do., 5 ton lots, ex. warehouse	38 50	....

Machine Tools and Shop Supplies.—No improvement is shown in the machine tool line. The recent labor troubles have accentuated an already bad situation. Only a few sales of small tools have been reported. The supply business is holding its own. Machine shops are not taking on additional men and consequently the volume of business in this line shows only nominal improvement. Price levels are being maintained reasonably well. In a few instances an advance is quoted owing to the increasing costs of materials.

Non-Ferrous Metals.—For the past week the non-ferrous metal market has been unusually quiet. No price changes have been made, and the volume of business remains about the same. Orders continue to be for small lots but are well distributed throughout the province. The list of local quotations is as follows:

Lake Copper	17 75
Electrolytic Copper	17 50
Castings, Copper	17 25
Tin	35 50
Lead	7 00
Spelter	8 75
Antimony	6 25
Aluminum	22 00

Scrap Metals.—Owing to the continued scarcity of pig iron, the demand for all kinds of scrap, particularly for No. 1 heavy machine, has improved. The demand for non-ferrous scrap has also shown a little more activity. In a few lines quotations have advanced. Throughout the province the market appears to be awakening. Up to the present quite a reasonable amount of business in iron and steel scrap has been done. Local quotations are as follows:

Copper, light per 100 lbs.	9 00
Copper, crucible	11 50
Copper, heavy	11 25
Copper Wire	11 25
No. 1 composition	9 00
New brass cuttings	6 00
Red brass turnings	6 50
Yellow brass turnings	5 25
Light brass	4 50
Medium brass	6 00
Scrap zinc	3 50
Heavy lead	4 50
Tea lead	3 00
Aluminum	11 00
Boiler plate, per gross ton	9 00
Heavy melting steel	10 00
Axles (wrought iron)	20 00
Rails (scrap)	11 00
Malleable	10 00
No. 1 machine cast iron	20 00
Pipe, wrought	7 00
Car wheels	17 00
Steel Axles	15 00
Machine shop turnings	4 00
Stove plate	16 00
Cast boring	4 00

Pittsburg

September 13

THE LOW point in pig iron and steel production was reached just at the end of August, since when there has been an upward swing. At the low point, pig iron production was at the rate of about 20,000,000 tons a year or say 45 per cent. of capacity, and steel ingot production at about 26,000,000 tons a year, or say 50 per cent. of capacity. Production declined continuously during July and August. Average rates of production during August were about 21,500,000 tons a year in pig iron and 30,000,000 tons a year in steel ingots.

All told, about a dozen steel works blast furnaces have resumed operations since the end of August, in the Pittsburgh district, the valleys and the Chicago district. These resumptions were almost wholly at plants having by-product coke ovens, to which coal began to move rather promptly after the signing of wage scales with the United Mine Workers by various operators. There has been little if any resumption of blast furnaces tributary to the Connellsville coke region. The strike in the region did not end with the posting of the high wage scale by various operators on August 22 and 23, the men holding out for actual union recognition. Production of coal and coke in the region has increased slightly, by men drifting back to work and by men being brought into the region, just as was the case before the advance of between 40 and 50 per cent. in wages. Now, however, the strike, although apparently formidable, can hardly be considered a commercial factor, since careful study indicates that the limit of transportation from the region has been reached and if there were labor to produce more coal the additional tonnage could not be moved.

A fair guess probably is that while the production of steel was at about 50 per cent. of capacity at the end of August it is now, or will be within a few days, at 55 per cent. It would be quite unsafe, however, to conclude that a rate of improvement has been established. Coal production has been increasing rapidly, but on all hands it has been predicted that railroad congestion would develop and would severely limit coal shipments for months. Coal production, once it reaches a certain rate, may not stay there but may decline, the particular point being that there may have been many idle coal cars near mines and it is no trick to load them the first time

while it may be difficult to get them to destination and back again for a second loading. The trade's view, therefore, is that nothing should be taken for granted as to increasing coal production or, in turn, increasing pig iron and steel production. While no precise predictions are made, it is commonly considered quite unlikely that, at any time in the remainder of the year, the steel industry will operate at the best rate previously attained this year, between 70 and 75 per cent. of capacity, late in June.

Pig Iron Not Helped.—A feature of the increased pig iron production seen thus far is that it is practically confined to the steel interests, those that have by-product ovens. The great majority of merchant furnaces in the north depend either upon Connellsville coke or upon surplus coke offered from by-product ovens, and there is practically no improvement in coke supplies from these sources.

Offerings of pig iron are very limited indeed. They are of iron now in stock or certain soon to be made. There is no disposition to negotiate for pig iron to be made by furnaces now idle, when they may chance to resume. Small lots of Bessemer iron have sold at $34, valley, an advance of $2 in the week. Basic iron presents no market. Some in the trade call it "not under $30, valley." Some is said to be offered at $32 or $33. Steel works are not in the market and it is problematical what they would pay. Very likely none would be willing to pay as much as $30. The steel producers would take a loss using iron at such a price, on acount of prices at which they owe steel to customers. Some small lots of off basic are said to have sold at around $33, for malleable foundry use, but this is no criterion of the basic iron market, since purchases, if made, would represent substitution for standard malleable, which would cost more.

Foundry iron for Pittsburgh delivery is on a Buffalo basis, the nearest point of regular supply, the Buffalo market, being $34, furnace, making, with $3.28, $37.28 delivered Pittsburgh, equivalent to $35.51 at valley furnaces as the valley-Pittsburgh rate is $1.77. It is said that some small resale lots have gone at $35 to $36, valley basis.

Steel Market Strong.—On the whole, finished steel products have been distinctly inactive in the open market in the past week. No particular significance is attached to the fact that there was little incentive to trading. All mills appear reluctant to sell. Some are already sold far ahead and do not care to increase their obligations, while buyers would not be interested in such late deliveries. Mills that can make relatively early deliveries hope they can get higher prices later and are anxious to get as high prices as possible, not merely to make money, but to equalize on some sales on which they will have a loss. Steel sold a few months ago, at prices then going, means a loss to make now as costs are so much higher, with high coal costs and with wages up 20 per cent. all around.

The minimum on bars is 1.90c and on shapes and plates $2, but these prices seem to be made only by the Carnegie Steel Company, for delivery at mill convenience. Moderately early deliveries are held at 2.25c in case of all three products, and that is the real market. Plates for shipment in two or three weeks command about 2.50c.

Additional sheet mills have advanced asking prices, and there is a wide range. It is a question whether any independents will sell on the Steel Corporation's basis of 3.35c for common black, while asking prices range up to 3.75c, depending on delivery, etc. Buying at premiums has been light.

Rivets have been advanced $7 a ton, to 3.00c for button head structural rivets and 3.10c for cone head boiler rivets.

Sheet bars have sold in several instances at $40, and the $38 price that figured recently has disappeared. Slabs are regarded as nominally at the same level. Billets might possibly be picked up at $38. In the first three months of the year sheet bars were $29 and the present sheet bar market insures a continuance of sheet prices at about the present range while it suggests that tin plate may advance above $4.75, which has been the nominal market since late in the old year, but which has been shaded almost continuously by independents.

The Steel Corporation's unfilled obligations increase by 173,944 tons during August, to 5,950,105 tons, against an increase of 140,630 tons in July. The August increase represented 12 per cent. of the month's capacity, and as shipments were at about 67 per cent. of capacity the bookings were about 79 per cent., comparing with 86 per cent. in July and 103 per cent. in June.

The Flint Varnish and Color Works, Toronto, are in the market for the following machinery:

1 Hoefer 21in. drilling machine with wheel and lever and geared power feed, automatic stop and back gears. 1 Walcott 16in. high duty crank shaper cone drive, complete with 10in. swivel vise, counter shaft and wrenches. 1 McDougall 18in. x 30in. x 12ft. gap lathe with 3-step cone, double back gears and quick change gears and complete with compound rest, steady rest, follow rest, large and small face plates, necessary wrenches and two speed friction counter shaft. 1 12in. Cushman geared scroll chuck, 3 jaw fitted. 1 16in. Imperial 4-jaw independent chuck fitted. 1 Power hacksaw back geared on leg base backed geared. Lowest f. o. b. price, Toronto, is required.

In the malleable fitting list, there has been a revision of discounts. The discount to dealers of 70 and 5 off. has been superseded by a discount of 70 per cent. covering class A and of 60 per cent. on classes B and C.

KEEPING THE INDUSTRIAL PLANT FIT TO WORK IN

(Continued from Page 19)

is if he felt he had several grievances constantly. A clean, well lighted and well ventilated shop inspires a man to do better work. He will develop a pride in his accomplishments and will endeavor to conduct himself so as to be in harmony with his surroundings, with an idea of meriting promotion.

A shop that is kept in A-1 condition always suggests prosperity, and all men prefer to be identified with successful concerns, as they usually mean steady jobs with good rates of pay. Perhaps these suggestions may be described as being idealistic, but nevertheless, they are very concrete factors in our industrial world, and the sooner employers of labor realize the truth of this doctrine, the sooner will dawn the day when industrial controversies, strikes, lock-outs, etc., will be conspicuous by their absence. No great or permanent change was ever made in a day. Such changes must be made slowly. It should be the aim of employers to encourage labor to sink prejudices, and to freely discuss, through accredited representatives, any ideas that labor may have as to the improvement of their condition. Everyone grants that labor should have the right to earn a wage that permits of a good standard of living. Labor must come to believe that employers are sincere in their attitude toward them, and when this is accomplished, we will have gone a long way toward establishing a permanent industrial peace.

SUBSTITUTE FOR IRON PIPE

A cheap bituminous clay pipe, to be used in the place of cast iron pipe, has been devised by the Carnegie Institute of Technology, states the Industrial Digest. The new form of piping, it is expected, will be as satisfactory for drainage and sewerage purposes as the more expensive cast iron pipe which has been the only variety available up to the present.

The chief difficulty in the search for a substitute for cast iron has been to find a method of joining the ends of the substitute piping without leakage. Various bituminous cements were recommended for this purpose but early experiments showed that they were unable to overcome the difficulty. An entirely new joining technique in the use of these cements has now been devised. Four important points have been established: (1) the joining of the pipe can be effectively accomplished by the use of a proper bituminous compound; (2) the joints made in this manner will withstand any pressure that the pipe itself will stand; (3) a pipe line, joined in this manner, can be thrown out of alignment without causing leakage at the joints; (4) leaks due to poor workmanship can be repaired easily and quickly.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Toronto price:—	
Silicon, 2.25% to 2.75%	39 30
Algoma, No. 1, Montreal,	40 80
Summerlee, Scotch, Montreal dock,	33 50
Summerlee, Warehouse, 5-ton	38 50
Carron, Montreal docks	35 00
Grey forge Pittsburgh	34 76
Lake Superior, charcoal. Chicago	36 15
Standard low phos., Philadelphia	35 00
Bessemer, Pittsburgh	34 76
Basic, Valley furnace	30 00

METALS

	Montreal	Toronto
Lake Copper	$17 75	$17 75
Electroylic Copper	17 50	17 50
Castings, Copper	17 25	17 00
Tin	35 50	37 00
Spelter	8 75	8 50
Lead	7 00	8 00
Antimony	6 25	8 50
Aluminum	22 00	21 00

Prices per 100 lbs.

BILLETS

F. O. B. Pittsburgh

	Per gross ton
Bessemer billets, 4 in. x 4 in. and larger	38 00
Open hearth billets	38 00
O. H. sheet bars	40 00
Forging billets	45 00
Bessemer rods	45 00

IRON AND STEEL

Per 100 lbs. to large buyers

Iron bars, base, Toronto	$3 35	3 40
Steel bars, base, Toronto	3 35	3 40
Small shapes, base		3 40
Iron bars, base, Montreal	3 15	3 25
Steel bars, base, Montreal	3 15	3 25
Reinforcing bars, base	3 35	3 25
Steel hoops		4 50
Tire steel, base		3.50
Spring steel	7 00	14 00
Band steel No. 10 gauge and 3-16 in. base		3 90
Chequered floor plate ¼" and heavier		7 00
Bessemer rails, heavy, at mill		2 35
Steel bars, Pittsburgh mill prices		2 25
Tank plates, Pittsburgh mill prices		2 25
Structural shapes, Pittsburgh mill prices		2 25
Steel hoops, Pittsburg		2 75

F. O. B. Chicago Warehouse

Steel bars	2 80
Structural shapes	2 90
Plates	2 90
Small shapes under 3-in.	2 90

PLATES

Plates 3-16 in.	$3.85	$3 60
Plates, ¼ up	3 50	3 40

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$3 70	$5 50
Sheets, blue ann., No. 10	4 70	4 50
Canada plates, dull, 52 sheets	5 50	5 75
Can. plates, all bright	7 00	6 75
Galvanized sheets, No. 28	6 75	6 75
Queen's Head, 28 B.W.G.	7 25	
Fleur de Lis, 28 B.W.G.	7 00	
Gorbal's best, No. 28		
Colbornes Crown, No. 28		
Premier	6 85	6 35
Premier 10¾ oz.	6 85	6 75
Zinc sheets	9 25	11 00

FREIGHT RATES

Pittsburgh to Following Points	Per 100 lbs. C.L.	L.C.L.
Montreal	52	65½
St. John, N. B.	76	96
Halifax	77½	97
Toronto	34	48½
Guelph	34	48½
London	34	48½
Windsor	31½	45½
Kingston	48½	61

Current surcharge 1 per cent.

OLD MATERIAL

Dealers' Average Buying Prices

	Montreal Per Ton	Toronto Gross
Boiler plate	$ 9 00	$ 9 00
Heavy Melting Steel	10 00	11 00
Axles (wrought iron)	20 00	16 00
Rails (scrap)	11 00	11 00
Malleable scrap	10 00	11 00
No. 1 Machine cast iron	20 00	18 00
Pipe, wrought	7 00	6 00
Car wheel	17 00	16 00
Steel axles	15 00	15 00
Mach. shop turnings	4 00	6 00
Stove plate	16 00	14 00
Cast boring	4 00	6 00
Copper, light	9 00	8 50
Copper, crucible	11 50	11 00
Copper, heavy	11 25	11 00
Copper, wire	11 25	11 00
No. 1 machine composition	9 00	9 00
New brass cuttings	6 00	6 00
Red brass turnings	6 50	6 50
Yellow brass turnings	5 25	4 85
Light brass	4 50	3 50
Medium brass	6 00	4 50
Scrap zinc	3 50	4 00
Heavy lead	4 50	4 50
Tea lead	3 00	3 00
Aluminum	11 00	11 00

COLD ROLLED STEEL

(At Warehouse)

Rounds and squares	$4.50 base
Hexagon and flats	$5.50 base

COPPER PRODUCTS

Prices per lb.

	Montreal	Toronto
Copper Bars, ½ to 2 in.	.29	.28
Brass Tube		.28
Plain sheets, 16 oz. in. 30 x 72	.30	.29
Copper sheet, tinned, 16 oz.	.37	.36
Copper sheet, planished, 16 oz. base	.42	.41
Braziers', in sheets, 6 x 4 base	.30	.29
Copper tubing, seamless		.32

LEAD SHEETS

Roll Lot Prices

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$ 8 75	$ 11 50
Sheets, 3 1-2 lbs. sq. ft.	8 75	11 50
Sheets, 4 to 6 lbs. sq. ft.	8 25	10 00

Cut sheets, ¾c. per lb. extra

Cut sheets to size, 1c. per lb. extra

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	20
Brass sheets, 24 gauge and heavier base	23
Brass tubing, seamless	28

WROUGHT PIPE

Price List No. 56. August 23, 1922.

Standard Buttweld Pipe S/C

Size	Steel Blk.	Steel Galv.	Gen. Wrot. Iron Blk.	Gen. Wrot. Iron Galv.
⅛ in.	6 00	8 00	....	....
¼ in.	3 96	6 00	7 20	9 30
⅜ in.	3 96	6 00	7 20	9 30
½ in.	5 02	6 55	7 31	8 93
¾ in.	6 10	7 82	8 86	10 70
1 in.	8 50	14 22	12 58	15 30
1¼ in.	11 50	15 18	17 02	20 70
1½ in.	13 75	8 15	20 35	24 75
2 in.	18 50	24 42	27 38	33 30
2½ in.	29 25	38 61	....	....
3 in.	38 25	50 49	....	....
3½ in.	49 68	64 40	....	....
4 in.	58 86	76 30	....	....

Standard Lapweld Pipe S C

Per 100 feet.

Below dividing line—price per foot.

Size	Steel Blk.	Steel Galv.	Gen. Wrot. Iron Blk.	Gen. Wrot. Iron Galv.
2 in.	22 20	27 75	31 08	37 00
2½ in.	32 76	41 54	46 80	56 16
3 in.	42 84	54 32	61 20	73 44
3½ in.	50 60	66 24	72 68	89 24
4 in.	59 95	78 48	86 11	105 73
1½ in.	68 58	87 63	1 04	1 24
5 in.	79 92	102 10	1 21	1 45
6 in.	1 04	1 32	1 57	1 88
7 in.	1 38	1 79	2 02	2 45
8L in.	1 45	1 88	2 13	2 58
8 in.	1 67	2 16	2 45	2 97
9 in.	2 04	2 62	2 97	3 59
10L in.	1 89	2 43	2 75	3 33
10 in.	2 43	3 13	3 54	4 28

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4-in. and under 55 per cent.

4½-in. and larger, 45 per cent.

4-in. and under running thread, 35%.

Standard couplings 4-in. and under 25%.

Do., 4½-in. and larger 5 per cent.

MALLEABLE FITTING LIST

1 in. elbow	.32	.53
2 in. elbow	1.05	1.70
1 in. tee	.43	.70
2 in. tee	1.45	2.40
1 in. coupling	.33	.53
1 in. locknut	.15	.23

Discounts to dealers—Class A, 70 per cent, Class B. and C., 60 per cent.

BOILER TUBES

Size	Seamless Toronto	Lapweld Montreal
1 in.	19.00	
1¼ in.	21 00	
1½ in.	20 00	
1¾ in.	23 00	
2 in.	18 00	20 00 19 00
2¼ in.	20 00	23 00 21 00
2½ in.	21 50	26 00 22 50
3 in.	27 50	32 00 28 50
3½ in.	30 50	37 00 33 00
4 in.	39 00	47 00 42 00

Prices per 100 ft., Montreal and Toronto

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, 7-16 and up	30
Carriage bolts, ⅜ in. and smaller 6 in. and shorter	40
Coach and lag screws	45
Stove bolts	72½
Wrought Washers	60
Do., corru. head	60
Machine bolts, 7-16 and over	35
Machine bolts, ⅜-in. and less	35
Blank bolts	35
Bolt ends	35
Machine screws, fl. and rd. hd., steel cut thread	37½ & 10
Machine screws, o. and fil. hd., steel cut thread	30
Machine screws, o, and fil. hd., brass cut thread	15
Standard couplings, 4-in. and under, brass cut thread	30% 30
Nuts, square, blank off net list	$1.00
Nuts, square, tapped off net list	50c.
Nuts, hex., blank off net list	50c.
Nuts, hex., tapped net list	
Copper rivets and burrs, list less	32c.
Burrs only, list plus	10%
Iron rivets and burrs	47%
Boiler rivets, base ¾ in and larger	$5.75
Structural rivets, as above	5 65
Wood screws, O. & R., bright	80
Wood screws, flat, bright	82½
Wood screws, flat brass	77½
Wood screws, O. & R., brass	75
Wood screws, flat, bronze	72½
Wood screws, O. & R., bronze	70

NAILS AND SPIKES

Wire nails, base	$3 65
Cut nails, base	4 35
Miscellaneous wire nails	72½%

MILLED PRODUCTS

(Prices on unbroken packages)

Set screws	65
Square and hexagon head cap screws	60
Round head cap screws	20
Fillister head cap screws	35
Flat head screws	25
Button head cap screws	20
Studs	45
Semi-finished nuts up to and including 9/16 in.	70
Semi-finished nuts ⅝ to 1¼ in.	65
Semi-finished nuts 1⅜ to 2 in	35
Coupling bolts	35
Taper pins, No. 2 to No 5	65
Taper pin No. 6 and over	10
Planer bolts without fillet	10
Planer bolts with fillet	Net
Patch bolts	Plus 10%
Hollow set screws	20
Thumb screws	50
Thumb nuts	70

CARBON DRILLS AND REAMERS

	Discount.
S. S. drills, wire size	60
Can. carbon cutters	plus 10
Standard drills, all sizes	60
3-fluted drills, plus	10
Jobbers and letter sizes	60
Bit stock	50
Ratchet drills	25
S. S. drills for wood	10
Wood boring brace drills	50
Electricians' bits	30
Sockets	50
Sleeves	30
Taper pin reamers	25
Drills and countersinks	20
Bridge reamers, carbon	50
Centre reamers	Net
Taps, machine screw	50 to 60
Taps, hand, sizes up to 1"	30 to 60
Chucking reamers	20 off
Hand reamers	20
High speed drills, list	40
Can. high speed cutters	plus 10
American	plus 40

FILES AND RASPS

Globe	60/5
Vulcan	50
P. H. and Imperial	60/5
Nicholson	40
Black Diamond	40
Heller	40
Jowitts	net
J. Barton Smith, Eagle	55
McClelland, Globe	50
Delta Files	20
Disston	40
Disston	50
Great Western-American	50
Kearney & Foote, Arcade	60/5

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

PROOF COIL CHAIN

B. B. B. CHAIN

⅜ in., $16.45; 7-16 in., $14.00; ½ in., $12.95; 5-8 in., $13.15; ¾ in., $12.75; ⅞ in., $12.25; 1 in., $11.85; 1⅛ and 1¼ in., $10.55. Fire weld chain same sizes respectively are $14.00; $11.50; $10.40; $10.55; $10.15; $9.75; $9.35; and $8.25.

ELECTRIC WELD COIL CHAIN B.B.B.

⅛ in. $20.00; 3-16 in. $16.50; ¼ in. $15.50; 5-16 in. $12.70.

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	30%
Standard	30 and 10%
Cut leather lacing, No. 1	1.75
Leather in side, (Lacing)	1.50

RUBBER BELTING

Standard 36 ....28% Best grades 28%

TAPES

Chesterman Metallic, 50 ft.	$5 00
Lufkin Metallic, 603, 50 ft.	3 17
Admiral Steel Tape, 50 ft.	3 00
Admiral Steel Tape, 100 ft.	4 50
Major Jun. Steel Tape, 50 ft.	3 75
Rival Steel Tape, 50 ft.	4 00
Rival Steel Tape, 100 ft.	8 75
Reliable Jun. Steel Tape, 50 ft.	5 25

PLUMBING SUPPLIES

Plumbers' oakum, per cwt.	6 30
Solder, strictly	$0 22½
Solder, guaranteed	0 24
Soldering coppers, lb.	0 62½
White lead, pure, cwt	13 20
Red dry lead, 100-lb. kegs, per cwt.	10 75
Wood alcohol, per gal.	1 75
Whiting, plain, per 100 lbs.	3 00

ROPE AND PACKING

Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope ¾ and larger, base	0 21
British Manila rope	0 17
New Zealand hemp	0 19
Jute packing, fine	15c
Jute packing, coarse	11c

OILS AND COMPOUNDS

Castor Machine Oil, per lb.	34½
Royalite, per gal. bulk	20
Palacine	23
Machine oil, per gal.	39
Black oil, per gal. (Summer)	19
Cylinder oil, Capital	69½
Petroleum fuel oil bbls., net	10.80
Turp., single bbls., gal.	1.65
Linseed oil, raw, single bbls.	1.01
Premier galsoline	34

WASTE

XXX Extra	16 Atlas	18
Peerless	21 X Empire	13
XX Grand	15 Ideal	18
Superior	20 X Press	11½
X L C R	14	

Colored

Lion	12 Fancy	13½
Standard	10½ Popular	9
No. 1	13 Keen	7½

Wool Packing

Arrow	24 Anvil	16
Axle	20	

Washed Wipers

Select White	18 Dark colored.	13
Mixed Colored	14	

This list subject to trade discount

PLATING SUPPLIES

Polishing wheels, felt	$3 25
Polishing wheels, bull-neck	1 60
Emerey in kegs, Turkish	7½
Pumice, ground	04½
Emery glue	26
Tripoli composition	08
Crocus composition	12
Emery composition	11
Rouge, silver	60
Rouge, powder, nickel	35

Prices per lb.

ANODES

Nickel	40 to .45
Copper	.38 to 22
Zinc	.16 to .12½

PLATING CHEMICALS

Acid boracic	.20
Acid, hydrochloric	.03¾
Acid, nitric	.10¼
Acid, sulphuric	.03¾
Ammonia, aqua	.20
Ammonium, Carbonate	.15
Ammonium, chloride	.18
Ammonium, hydrosulphuret	.75
Ammonium, sulphate	.10
Arsenic, white	.18
Copper carbonate, anhy.	.26
Copper, sulphate	.08
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.14
Nickel carbonate	.32
Nickel sulphate	.14
Potassium sulphide (substitute)	.40
Silver chloride (per oz.)	.85
Silver nitrate (per oz.)	.65
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.32
Sodium hyposulphite	.08
Sodium phosphate	.10
Tin chloride	.50
Zinc chloride, C. P.	.30
Zinc sulphate	.06

Prices per lb. unless otherwise stated

News From the Industrial Field

Montreal.—Quebec has made an additional grant of $500,000 for the maintenance of roads.

British Train Traders Ltd., are sending an exhibition train carrying samples of British goods across Canada, leaving Montreal the end of October. The tour will take ten months. Two hundred and ten British manufacturers will exhibit their goods.

Henry Ford's decision to close his plants Sept. 16 may be rescinded if shipments of 250 tons a day from a coal corporation in the south is up to specification and requirements. It is stated that one of Ford's representatives had authorized shipment.

Montreal.—Authorized capital of $33,997,200 is reported by companies incorporated during the past week. Dominion incorporations totalled $31,165,000; Alberta, $126,000; British Columbia, $650,000; Ontario, $1,460,000; Prince Edward Island, $5,000; and Quebec, $577,200.

Ocean Falls, B. C.—Pulp was shipped during the week to Stockton, California, this being the first consignment of pulp to that destination, all previous shipments going to Astoria. A full cargo of paper was also sent to San Francisco in addition to which a cargo was loaded for Australia.

Sherbrooke, Que.—The latest concern to secure a site in Sherbrooke with a view to establishing a plant is the Canadian Brakeshoe Company, and it is predicted extensive developments will soon be under way. Industrially, Sherbrooke has experienced improved conditions this summer and immediate prospects are bright.

Mission, British Columbia.—It is reported that placer gold and platinum sands have been found on the Fraser River. Favorable assays have encouraged prospectors who intend to develop them on a large scale. The location of the deposits is not more than 125 miles from the coast.

Ottawa.—Every man in Canada who wants work can get it according to managers of labor bureaux who are advertising for men. There is plenty of work, it is claimed, and more jobs than there are applicants for them. The majority of vacant positions is for laborers, though the situation regarding skilled labor is stated to be brighter.

Haileybury, Ont.—Operations have commenced at the new mill of the Temiskaming Pulp and Paper Company, recently erected at a cost of approximately $1,000,000. The plant will have a daily production of forty tons of ground wood pulp, which will be shipped to Chicago, Kalamazoo, and points in the state of New York.

No one can purchase a ton of hard coal in New England without buying a ton of soft coal, according to a recent regulation in prospect of fuel shortage. There is reported to be a frantic demand for hard coal all along the Atlantic seaboard and there is very little anthracite on the market.

Solution of the unemployment problem, by importing all the farm labor that could be secured is advocated by Ontario Boards of Trade. Increased population in this way would also cause a brisker demand for manufactured goods and it is felt that an aggressive advertising campaign by the government is necessary. Steps will be further considered at a meeting of Associated Boards of Trade in Owen Sound, Sept. 21.

Recent changes on the operating staff of the C. P. R. include the promotion of W. B. Howard, district passenger agent at Toronto, to the position of assistant-general passenger agent at Montreal. W. Fulton succeeds Mr. Howard at Toronto, and W. Horner will assume the duties of assistant district passenger agent at Toronto.

Anyox, B. C.—The Granby Consolidated Mining and Smelting Company's plant is reported to have broken all records in production in July, producing more than three million pounds of copper matte during the month, the best previous record being approximately 2,800,000 pounds. The company has 1,400 tons of copper matte at Vancouver loading for the New Jersey refinery. It contains $408,000 worth of copper; $88,000 worth of silver; and $72,000 worth of gold.

Montreal.—It is reported that a large manufacturing plant, costing approximately $1,000,000, will be erected soon by the Dominion Glass Company in the vicinity of Montreal. The company now operates two plants in Montreal, but it is understood that the proposal is to erect one large plant which will not only look after the business now being handled by these two plants, but will also provide for any expansion of the company's business.

Official announcement indicates that the output at the Leaside plant of the Durant Motors of Canada will aggregate nearly 40,000 cars, 25,000 of these being the new Star model. The two large buildings now under construction will be completed by the close of the present year and production of cars and trucks will gradually increase to a rate exceeding 1,000 a month. It is expected that the electric units and axles for the cars and Mason trucks will be manufactured at Leaside by March of next year.

Montreal.—H. S. Campbell, travelling representative of the D. F. Jones Manufacturing Co., Ltd., states that business is improving in his line. On January first the factory warehouse at Gananoque had a stack of thirteen thousand dozen shovels. To-day the stock in the same factory warehouse is reduced to three thousand dozen, and the factory has been working 150 men full time for some time past. The company had a very fair year in 1921, but the figures for this year promise to be as great as those of any previous year in the history of the business, which was established in 1852.

At the annual session of the British Association recently held in Hull, Que., it was decided to hold the meeting for 1924 in Toronto. Next year's session will take place in Liverpool. During the 91 years that the Association has been in existence Canada has had but three meetings. Annual sessions are always held in some leading place throughout the Empire. The main branches of science dealt with by the association are mathematics and physics (with which are associated astronomy and meterology, chemistry, geology, geography, zoology, physiology, botany, economics and statistics, education, engineering, anthropology, psychology and agriculture).

The Ford-Smith Machine Co., Hamilton, Ont., have just completed a special hosiery press, which is the first of its kind made in Canada. This machine is of single bed construction 50 x 40 ins., and hosiery forms are placed between the bed, and pressed by steam at about 30 lbs. pressure. They are making other presses of similar design, also larger styles of 3-bed construction. The smallest size being made weighs approximately 3,100 lbs., while the three-bed press being made is of two sizes, 50 x 40 in., and 78 x 42 in., weighing approximately 4,500 and 7,000 lbs. respectively. The Ford-Smith Co., have been going in for special machinery to a large extent lately, having made attachments for hosiery machinery, special millers etc., etc.

Montreal.—In the proposed new city hall, on which construction will begin this autumn, there will be no tower, but an additional storey, and it is planned to have a flat roof. The Quebec legislature has granted the city authority to spend $1,500,000 in this connection.

Montreal.—Vernon G. Hardy has been appointed manager of the new Mount Royal Hotel in this city. This hotel is stated to be the largest hotel in the British Empire and one of the largest in the world. Mr. Hardy is a Canadian, being a native of Galt, Ontario.

Montreal.—Judgment was handed down on Sept. 6th by the Dominion wreck commissioners in the case of the collision between the French steamer "Indochine" and the Danish steamer "Sarmatia," which occurred on August 11th last. Thiok weather on account of fog and the nuisance from fumes and smoke in the vicinity of Three Rivers were largely blamed. The inquiry set these conditions aside and placed the responsibility with the officers and pilot of the 'Indochine."

Montreal. — The Canadian Pacific Steamships Ltd steamer "Monteagle," withdrawn from the service to the Orient recently when the larger Empresses were placed on that route, has been chartered to carry a cargo of two and a half million feet of lumber from Vancouver to Montreal for the harbor commissioners. This is the first shipment of lumber to leave Vancouver this month. The voyage, it is estimated, will last thirty-two days.

A Pittsburgh correspondent suggests that, in meeting the pending coal shortage, consumers should pass up anthracite entirely and use a combination of bituminous and coke. He points out that there is little anthracite used now in the big centres of Pennsylvania, and that for years there has been a growing tendency in the Central West to use coke as a substitute for anthracite or as an improvement on bituminous. In Central Ontario last year, anthracite sold at $15.50. This winter it is predicted the price will range from $10 to $20. Belleville dealers are offered coal at $25 a ton.

Montreal.—Two local munition plants belonging to the United States Government were placed on sale recently. The Lachine plant went at $32,700. This property was assessed at $118,755. The purchaser was S. W. Narizzano, managing director of the Saxonia Fruit Preserving Co. It was announced after the sale by the purchasers, that they would extend their operations so as to make use of the newly acquired property.

The other property was located in Longue Pointe. The bidding for this reached the figure of $292,500, and no higher bids could be obtained. This bid was rejected, and the plant is still for sale. The cost of the plant was in excess of $1 500,000.

Quebec.—Steel and concrete construction on the extension of the Chateau Frontenac is being pushed by the Dominion Bridge Co. Twelve stories of steel and concrete have been erected on the tower and eight more, including a roof space are to come. There are 475 engaged. The addition means 400 more rooms for the Chateau.

Canadian purchasing agents will hold their annual convention in Montreal, Oct. 7th. Among other features of the program, there will be a discussion on transportation, on the relationship between the purchasing agent and production department, and an hour to receive salesmen. It is proposed to have one or two members from each of the associations represented, introduce these subjects. The National executive will hold their fall meeting in Montreal at this time.

Montreal.—Work is again to be started on the new French-Canadian hospital at the corner of Sherbrooke St. East and Maisonneuve St., after it has been dormant for fifteen years. New plans are being prepared and it is estimated that the new hospital will cost $800,000. The corner stone will be laid on September 8th. Dr. L. de L. Harwood is president of the hospital, and Dr. O. F. Mercier is general superintendent, while Tancrede Bienvenu is treasurer.

Fort William, Ont.—Every effort possible is being made to have the N. M. Paterson Company one million bushel addition to its elevator ready for the handling of a good portion of the 1922 crop. Over 1,600 piles have been driven, some of them to a great depth, but all of them down to hard pan. Forty three new bins will be erected, each ninety feet, of varying capacity. When completed the total capacity of thi elevator will be 1,750,000 bushels.

Sydney, N. S.—Officials of the British Steel Corporation have announced that wage increases running from ten to fifteen per cent., and affecting all classes of workers at the steel plant, will become effective shortly. Approximately 2,800 men are affected by the new order. The new schedule will include a general levelling-up of rates in different departments. The minimum rate, that paid for common labor, is increased from 24½ and 26 cents to 28 and 30 cents an hour. A detailed statement of all rates has not yet been worked out.

An active campaign has been started by the Grimsby Chamber of Commerce to stimulate the industrial interests of the smaller towns in Ontario. The initial move was made last week when about 200 representative citizens from all parts of Ontario gathered at the King Edward Hotel at Toronto to discuss plans and organize the various districts. It has been decided that a representative of the Grimsby body will tour the province and address other Chambers of Commerce on the course of action that is to be pursued.

Dodds Canadian Iron Works, Welland, has been incorporated with capital stock of $250,000 to engage in the iron and steel business as converters also as coke producers and manufacturers of milling equipment.

Sudbury, Ont.—After a suspension of eighteen months the statement that the International Nickel plant at Coppercliff has again resumed active operations with a staff of 650 men, will be good news to the district. As capacity production has not yet been considered, preference has been given to pre-war employees and the majority of these are now engaged on an eight-hour shift. Regular shipments of the matte will be made to the refinery at Port Colborne, where all of the refining will be done hereafter, the refinery at Bayonne, N. J., having been scrapped. The refined nickel will be shipped to the new $2,000,000 rolling mills at Huntington, Va., where it will be rolled into malleable metal and marketed mostly in the United States.

Contracts for the rebuilding of a number of locomotives have been received by the Canadian Locomotive Company, Kingston. At a meeting of directors recently it was pointed out that prospects for business were very much improved and that, if conditions continued favorable, further contracts should soon be obtained. The works will probably open in a month's time with 100 hands, to be increased as activities develop. The company has declared a regular dividend of 7 per cent. on the preferred and one per cent. on common as against 2 per cent. formerly. Last year the company received no orders for locomotives and only a few orders for repairs. It was therefore necessary to meet current and interest charges, etc., out of income from investments which was insufficient. The net loss for the year was $191,351, but interest on investments and adjustment of valuation of investments reduced the deficit to $76 299.

Professional engineers of British Columbia protest that they have poor recognition in big undertakings. Recently a Prof. J. G. Kerry, Toronto and McGill, was chosen by the city to report on a hydro project. Local engineers were not notified, and naturally felt that, being on the ground, they were more conversant than an outsider. The city took the stand that any eligible engineer in the province might have personal interests. This was an inference and the engineers protested further. They pointed out that the city did not have to go outside to get a magistrate. At a recent meeting engineer after engineer arose and reported he had been brought to the province to undertake some big engineering works. He had completed it satisfactorily, and had been so pleased with British Columbia that he had stayed. Since then he had received no big jobs. It was decided to appoint a committee to appear before the mayor and council and request that the association of Professional Engineers in the province be considered in future.

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LABOR LOST 700 YEARS

There were 22 strikes in progress during July involving more lost time than in June, 1922, or July of last year. Some 15,736 workmen were involved and the estimated time loss was 261,240 working days, equivalent to more than seven hundred years, as compared with 25 strikes, involving 10,155 workpeople and 251,134 working days in June, 1922; and 41 strikes, 9,413 workpeople and 92,891 working days in July, 1921. On July 1, there were on record 19 strikes, affecting 5,045 workpeople. Three strikes were reported as having commenced during July as compared with six during June. Two of the strikes commencing prior to July and one of those commencing during July terminated during the month, leaving 19 strikes involving about 9,726 workpeople on record at the beginning of August.

The general movement in prices noted by the Department of Labor, was slight, both the index number of wholesale prices and the retail prices of foods showing little change from June levels, though with an upward tendency.

The index number of wholesale prices stood at 225.3 in July as compared with 224.3 in June; 238.6 in July last year; 346.8 in July, 1920; 294.0 in July, 1919; 248.7 in July, 1917; and 134.6 in July, 1914. The general decline in farm products and foods noted in June was continued in a lesser degree in July. Grains and livestock and meats again fell, but dairy products, fish, and miscellaneous foods showed an upward tendency. Most of the other groups were slightly higher. The chief increases for the month were in butter, sugar, raw wool, raw silk, jute, coke, linseed oil and turpentine with smaller increases in metals, gasoline, and coal oil. The chief declines were in grains, cattle and beef, sheep and dressed lamb, boots, some chemicals, glassware and crockery.

In retail prices the average cost of a weekly family budget of 29 staple foods in some 60 cities was $10.27 at the beginning of July; $10.18 for June; $10.97 for July, 1921; $16.84 for July, 1920; $11.62 for July, 1917; and $7.42 for July, 1914. The total for food, fuel, and rent averaged $20.67 for July, as compared with $20.58 for June; $21.53 for July, 1921; $26.92 for July, 1920; $18.41 for July, 1917, and $14.17 for July, 1914. In food no violent changes occurred; dairy products were practically unchanged, while mutton, flour, and potatoes were slightly lower. Nearly all the other items showed small increases, the chief of which were in beef, pork, and sugar. Fuel and rent were unchanged.

Following the posting of a notice in St. Thomas shops that a cut of seven cents an hour would go into effect at once and be retroactive to the time when the company first gave notice of a reduction, the men of the federated shop crafts employed by the Michigan Central left their benches for a conference. A board of conciliation to arbitrate such a dispute is necessary in Canada before a strike can be called and it is the report of this board in favor of reduction that is evidently behind the action of the railroad officials. The men are not bound by the report and are at liberty to strike. They voted, originally, 90 per cent. in favor of strike. About 400 men are affected in St. Thomas. The reductions amount to $8,500 a month. It is reported that the M. C. R. do not intend to enforce the retroactive measure against Canadian shopmen.

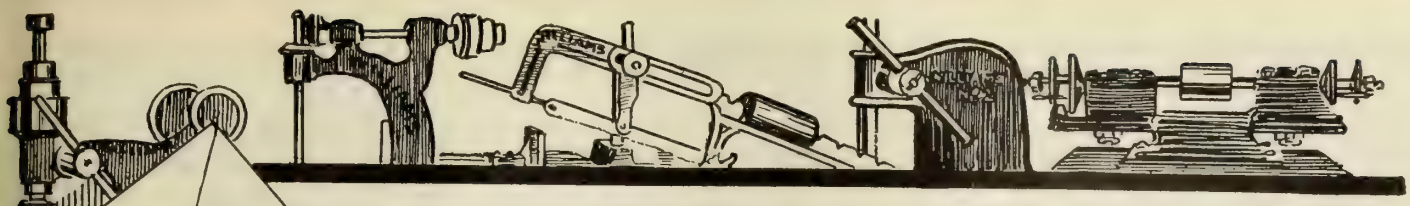
COMPLETING LARGE CONTRACTS

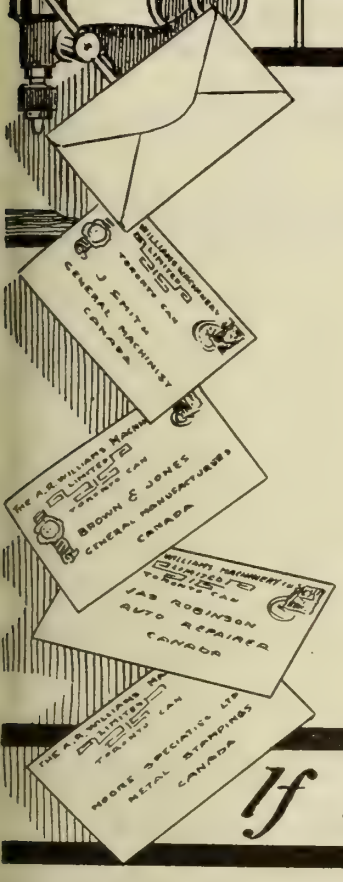
Industrial construction started this year in Fort William is fast nearing completion and several big jobs will be finished shortly. The Barnett and McQueen Construction Company have completed the two million bushel annex to the Northwestern elevator in the west end of the city, and in twenty days' time machinery will be installed and the new house turned over to its owners ready to commence handling its portion of the 1922 western grain crop.

A start has been made by the Fegles Construction Company in pouring the concrete for the tanks of the new annex to the N. M. Paterson Elevator Co., West Fort William, and it is expected that by September 20 they will be completed. The new addition will have a capacity of one million bushels and consists of a single unit of twenty-two concrete storage tanks. The Fegles Company expect to turn the house over to the Paterson Company, fully completed ready for the handling of grain, on October 15.

Another week will see the completion of the half-million-dollar steel conveyor bridge which has been under construction at the Island number one coal dock of the Canadian Pacific Railway since April 25 by the McMyler Interstate Construction Company, Cleveland, Ohio. The bridge is a huge affair built entirely of steel and equipped with electric motors which not only operate hoists contained thereon but serve to move the entire bridge from place to place at the will of the operator.

Rapid progress is being made with the erection of the paper mill adjoining the pulp manufacturing plant of the Fort William Paper Co., at the Mission. The new plant will consist of four main buildings and progress is exceptionally well advanced on each. One has already been roofed and it is expected that the roofs will be built over the other three by the end of the present month. It is the intention of the paper company's engineers, under whose supervision the plant is being built, to have all buildings completed by the time cold weather starts so that the installation of machinery can be carried on during the winter.





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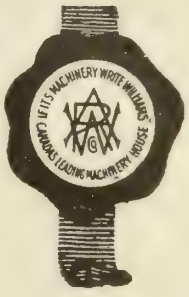

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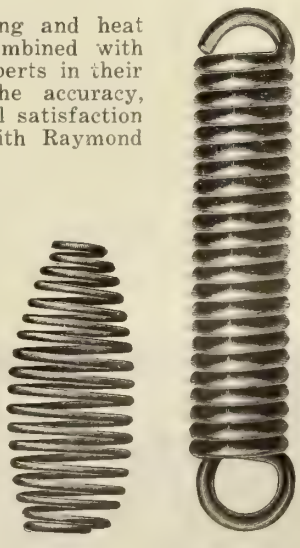

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STEEL SASH COMPANY DOING BIG BUSINESS

WITH repeat orders coming in from Vancouver to Montreal for steel sash, J. E. Dennis, manager of Steel Sash Ltd., London, Ont., says there is every reason to believe that business in general is in a healthy condition. Mr. Dennis has practically closed a $3,000 order to supply steel sash for a large Toronto building and he expects to close one for $2,400 within the next few days. Large shipments have just been made to Vancouver and Montreal. The factory is working full time.

Chief among the large buildings which were supplied with steel sash by this London factory recently are the following: Public Utilities Building, Galt, Toronto Transportation Commission car barns, Hydro Electric buildings, Chippawa, Montreal Waterworks power house, Fletcher building, Victoria, B. C., the new Arcade, Vancouver, B. C., Eugene Phillips plant, Brockville, Ont.

BRITISH AND AMERICAN COAL OUTPUT

A comparison of American and British figures for coal production shows that the average mine worker in the United States produced more than 700 tons yearly while output in the United Kingdom is at present reported to be only about 223 tons per worker, states the Commerce Monthly for September.

A substantial increase in the productivity of British miners has been effected since the British coal strike of 1921. In 1913 the average annual output per worker employed was 258 gross tons; and in 1915 it was increased to 265 tons. Following that year, however, the average output dropped steadily until for the year 1920 it amounted to no more than 182 tons, but the current output of coal is reported to be at an annual rate of about 223 tons per worker. While this is still below the prewar rate, it represents a considerable increase over previous postwar years.

The average output per man in the United States is in striking contrast to that in the United Kingdom. The 1913 average, for the United States, was no less than 681 tons and it was steadily increased to 768 tons for the year 1918, declining to 743 tons in 1920, the latest available year.

This striking difference is due largely to the greater use of machine mining in the United States. Prior to the war less than 9 per cent. of British output was machine mined, against 43 per cent. for the United States. Since then there has been some increase in the use of machines in the United Kingdom, particularly in the Scottish fields, where about one-quarter of the output is now mined by machine. In the Welsh fields, however, only 2 per cent. of the output is machine mined.

The relatively limited use of machine methods in the United Kingdom is in part ascribed to hostility of the workers who fear displacement but in good measure it is said to be due to the physical characteristics of many British mines, which render the adoption of machine mining impractical or difficult.

FOR GREATER SAFETY

At the eleventh annual congress of the National Safety Council held recently in Detroit, the following resolution endorsing a safety platform for next year was adopted:

Whereas, the 80,000 accidental deaths and millions of injuries occurring each year on our streets, in our industries, in homes and elsewhere are a blot on American civilization and the cause of untold suffering and sorrow, and

Whereas, the direct economic cost of industrial accidents alone exceeds one billion dollars annually, and

Whereas, experience has demonstrated that at least 75 per cent. of industrial accidents are preventable and that approximately an equal reduction is possible as regards public accidents, therefore be it

Resolved: That the National Safety Council in its eleventh annual congress in Detroit assembled advocates:

1. The safeguarding of all dangerous machinery and places according to standard methods of proved value;

2. The development of industrial equipment and processes along lines of inherent safety for the double purpose of eliminating accident hazards and increasing production efficiency;

3. The education of all workmen and their supervisors in safe methods and habits of work;

4. The training in safety of all school children, as well as students in colleges and universities, both for their own protection and as an object lesson in good citizenship;

5. The adoption and strict enforcement of uniform, practicable laws and ordinances for the safeguarding of vehicular traffic and the protection of the multitude of law-abiding drivers and pedestrians against the thoughtlessness and recklessness of the few, and;

6. The mobilization of all community forces through state and city safety councils for securing those ends through the overwhelming force of enlightened public opinion.

Machinery to the value of over one million pounds sterling, of which more than one-half classed as "mining and accessory," was imported by Trinidad from United States and was probably all in connection with oil fields. In sugar machinery, the business has always been in the hands of manufacturers in the United Kingdom. Some attempt is being made to form a Canadian engineering alliance in Barbadoes in order to promote Canadian business. It is believed that a large field is being exploited there by American firms for certain kinds of machinery that could be equally supplied by Canada.

Ottawa.—There has been very little unemployment among machinists here, as the majority of local shops were able to keep their forces going on the following wages: Machinists, 50 hours per week, 56 cents per hour; moulders, 50 hours per week, 60 to 65 cents per hour; laborers, 50 hours per week, 40 cents per hour. The large majority of these trades in contract shops are non-union and preferred reduction in wages to shorter hours or lay-off. One concern recently secured a contract for about 200 tons of large castings and with one exception prices were so close that an increase of less than 5 per cent. in wages would have sent the work elsewhere. The city buys street castings, etc., at $2.95 per hundred pounds delivered as required.

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The Air-Cooled, Multi-Purpose
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5 Engines in 1
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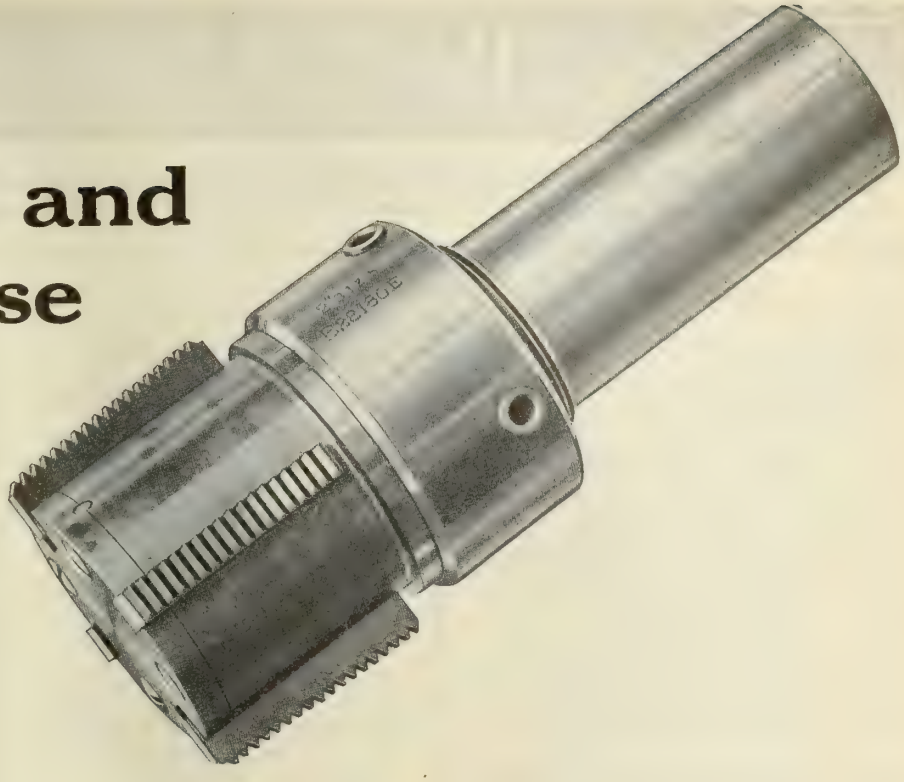

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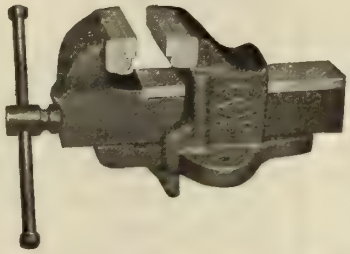

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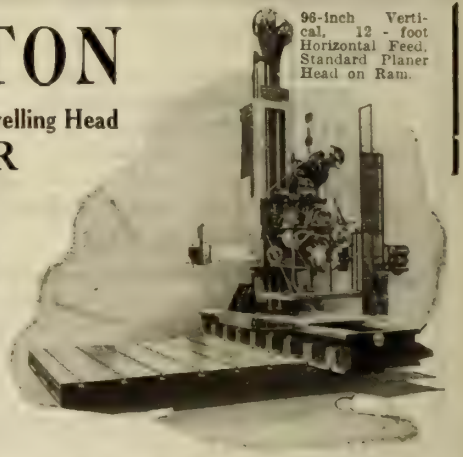

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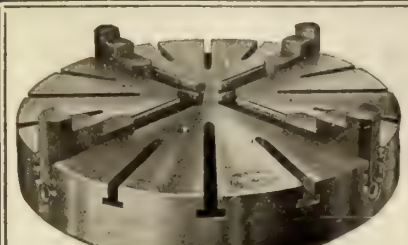

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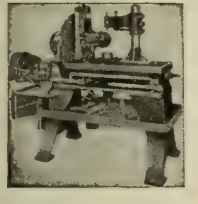

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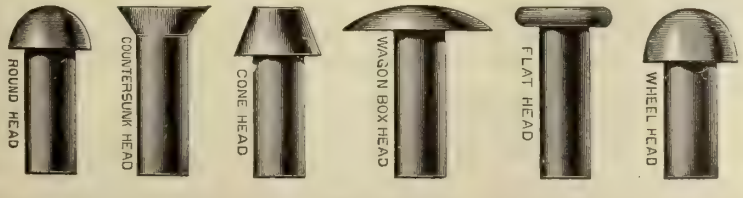

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British Empire Steel Corporation, Montreal, Que.

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McLaren Belting Co., J. C., Montreal, Que.
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See "Where to buy your castings" Section. Page number may be found by turning to Advertisers' Index.

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Can. Link-Belt Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont
Jones & Glassco, Montreal, Que.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

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Landis Machine Co., Inc., Waynesboro, A.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

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Brown & Sharpe Mfg. Co., Providence, R. I.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

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Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
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Cushman Chuck Co., Hartford, Conn.
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Gisholt Machine Co., Madison, Wis.
Ker & Goodwin Machine Co., Brantford, Ont.
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Skinner Chuck Co., New Britain, Conn
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Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

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Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cushman Chuck Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn
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William L. Procunier, Chicago, Ill

CHUCKS, VERTICAL BORING MILL
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Gisholt Machine Co., Madison, Wis
Skinner Chuck Co., New Britain, Conn
Union Mfg. Co., New Britain, Conn.

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Starrett Co., L. S., Athol, Mass.

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Hardinge Bros., Limited, Toronto, Ont.

CLOCKS, TIME
Gisholt Machine Co., Madison, Wis.

CLOCKS, WATCHMEN'S
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Hardinge Bros., Limited, Toronto, Ont.

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Bertrams Ltd., Edinburgh, Scotland.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

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Steel Co., of Can. Ltd., Hamilton, Ont.

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Rockwell Co., W. D., New York City.

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Wright Mfg. Co., Lisbon, Ohio.

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Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

BLOCKS, DIE
Canada Foundries & Forgings Co., Welland, Ont.

BLOCKS, PILLOW
Can. Link-Belt Co., Toronto, Ont.

BLOWERS
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

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Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Montreal, Que.

BOLT AND NUT MACHINERY, Automatic
National Acme Co., Cleveland, Ohio.

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Can. Link-Belt Co., Toronto, Ont.

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Pryibil Machine Co., New York, N.Y.

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Blount Co., J. G., Everett, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Pryibil Machine Co., New York, N.Y.
U. S. Electrical Tool Co., Cincinnati, O.

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Starrett Co., L. S., Athol, Mass.

CAMS
Canada Foundries & Forgings Co., Welland, Ont.

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Brown, Boggs & Co., Ltd., Hamilton, Ont.
Bliss Co., E. W., Brooklyn, N. Y.
Smooth Mfg. Co., Jersey City, N. J.

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Garlock Machinery, Ltd., Toronto, Ont.

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Wright Mfg. Co., Lisbon, Ohio.

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Johnson Machine Co., Carlyle, Manchester, Conn.

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Can.-Link Belt Co., Toronto, Ont.
Roelofson Elevator Works, Galt, Ont.

COAL-STORAGE SYSTEMS
Can. Link-Belt Co., Toronto, Ont.

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Canada Foundries & Forgings Co., Welland, Ont.
Can. Link-Belt Co., Toronto, Ont.

COLLETS
Butterfield & Co., Inc., Rock Island, Que.
Geometric Tool Co., New Haven, Conn.
Hardinge Bros., Inc., Chicago, Ill.
Hendley Machine Co., Torrington Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

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Oakley Chemical Co., New York, N.Y.

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Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Oakley Chemical Co., New York, N.Y.

COMPRESSORS, AIR AND GAS
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.

CONES, FRICTION
Norton Co., of Can. Ltd., Hamilton, Ont.

CONNECTING RODS AND STRAPS
Canada Foundries & Forgings Co., Welland, Ont.

CONTRACT WORK
Victoria Foundry Co., Ltd., Ottawa, Ont.

CONVEYORS AND ELEVATORS (SEE ELEVATORS)
Jones & Glassco, Montreal, Que.

COTTERS
Steel Co. of Canada, Ltd., Hamilton, Ont.

COUNTERBORES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

COUNTERS, REVOLUTION
Starrett Co., L. S., Athol, Mass.

COUNTERSHAFTS
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Johnson Machine Co., Carlyle, Man-
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

COUNTERSINKS
Butterfield & Co., Inc., Rock Island. Que.
Pratt &Whitney Co., of Canada, Ltd., Dundas, Ont.

COUPLERS, CAR AND LOCOMOTIVE
Can. Steel Foundries, Montreal, Que.

COUPLINGS
Steel Co. of Canada, Ltd., Hamilton, Ont.

COUPLINGS, PIPE
Fittings, Limited, Oshawa, Ont.

COUPLINGS, SHAFT
Can. Link-Belt Co., Toronto, Ont.

CRANES, ELECTRIC
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can.-Link-Belt Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Northern Crane Works, Walkerville, Ont.

CRANES, LOCOMOTIVE
Can. Link-Belt Co., Toronto, Ont.

Bertram & Son Co., td., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Northern Crane Works, Walkerville, Ont.

CRANK PIN TURNING MACHINE
Underwood Corp., H.B., Philadelphia, Pa.

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Brown & Sharpe Mfg. Co., Providence. R. I.
Butterfield & Co., Inc., Rock Island, Q. Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

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Atkins & Co., Inc., E. C., Indianapolis.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CUTTERS, MILLING
Brown & Sharpe Mfg. Co., Providence, R. I.
Butterfield & Co., Inc., Rock Island. Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.

CUTTERS, STAY BOLT
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.

CUTTING-OFF MACHINE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

CUTTING OFF MACHINES, PIPE (SEE PIPE-CUTTING AND THREADING MACHINES)
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.

CUTTING-OFF TOOLS
Armstrong Bros. Tool Co., Chicago, Ill.

CUTTING OIL FILTERS (SEE OIL FILTERING SYSTEMS
Bowser, S. F. & Co., Ltd., Toronto.

CUTTING, OXY-HYDROGEN
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Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

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International Malleable Iron Co., Guelph, Ont.

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Wheel Trueing Tool Co., Windsor, Ont.

DIAMOND TOOLS
Can. Desmond-Stephan Co., Hamilton,
Wheel Trueing Tool Co., Windsor, Ont.

DIAMOND CROSSINGS
Can. Steel Foundries, Montreal, Que.

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Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Co., Windsor, Ont.

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Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.

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DIES, FORGING
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

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Geometric Tool Co., New Haven, Conn.
Landis Machine Co., Inc., Waynesboro,
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

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Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas. Ont.

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Burke Machine Tool Co., Conneaut, Ohio.
Hendey Machine Co., Torrington, Conn.
Kearney & Treacker Co., Milwaukee, Wis.
Petrie, Ltd., H. W. Toronto, Ont.

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Armstrong Bros. Tool Co., Chicago, Ill.

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American Lead Pencil Co., New York City, N.Y.

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Canadian Desmond-Stephan Mfg. Co., Hamilton, Ont.
Norton Co., of Can., Ltd., Hamilton.
Wheel Trueing Co., Windsor, Ont.

DRESSING TOOLS
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Co., Windsor, Ont.

DRILL HOLDERS
Armstrong Bros. Tool Co., Chicago, Ill

DRILLING MACHINES, BENCH
Burke Machine Tool Co., Conneaut,, Ohio.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Hardinge Bros., Inc., Chicago, Ill.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
U. S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, ELECTRIC AND HAND
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, GANG
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

DRILLING MACHINES, HEAVY DUTY
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
Rockford Drilling Machine Co., Rockford, Ill.

BORING, DRILLING AND MILLING MACHINES, (HORIZONTAL.)
Gisholt Machine Co., Madison, Wis.

DRILLING MACHINES, Multiple Spindle
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
National Acme Co., Cleveland, Ohio.

DRILLING MACHINES, Pneumatic
Cleveland Pneumatic Tool Co., Toronto. Ont.

DRILLING MACHINES, PORTABLE
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, RADIAL
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Wiliams Machinery Co., A. R., Toronto,

DRILLING MACHINES, SENSITIVE
Burke Machine Tool Co., Conneaut, O.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Williams Machinery Co., A. R., Toronto
Wisconsin Electric Co., Racine, Wis

DRILLING MACHINES, TURRET
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wisconsin.
Williams Machinery Co., A. R., Toronto.

DRILLING MACHINES, VERTICAL
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

DRILLS, CENTRE
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DRILLS, HIGH SPEED TWIST
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Cleveland Twist Drill Co., Cleveland, O.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DRILLS, RATCHET
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont
Morse Twist Drill & Machine Co., New Bedford, Mass.

DRILLS, TWIST AND FLAT
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.

DROP FORGINGS
Steel Co of Canada, Ltd., Hamilton.

DUMB WAITERS
Roelofson Elevator Works, Galt, Ont.

DUST HANDLING EQUIPMENT
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

ELECTRICAL INSTRUMENTS
Bristol Co., Waterbury, Conn.

ELECTRICAL SUPPLIES
Atkins & Co., Inc., E. C., Indianapolis
Diamond State Fibre Co., Toronto, Ont.
U.S. Electrical Tool Co., Cincinnati, O.

ELEVATORS AND CONVEYORS
Can. Link-Belt C., Toronto, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q

ELEVATORS, FREIGHT AND PASSENGER
Roelofson Elevator Works, Galt, Ont.

EQUIPMENT, ELEVATOR SAFETY
Jones & Glassco, Montreal, Que.

EMERY WHEELS (See Grinding Wheels)
Lion Grinding Wheels, Limited, Montreal, Que.
Atkins & Co., E. C., Indianapolis, I.
Norton Co., of Canada., Ltd., Hamilton.

ENGINES, CAPSTAN
Kennedy & Sons, Wm., Owen Sound, Ont.

ENGINE LATHE MANUFACTURERS
Oliver Machinery Co., Grand Rapids, Michigan.

ENGINEERS, MECHANICAL
Dominion Engineering Works, Limited. Montreal, Que.
Gisholt Machine Co., Madison, Wis.
Hamilton Gear & Machine Co., Toronto.

EXPANDERS, TUBE
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

FANS, ELECTRIC
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

FANS, EXHAUST
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Petrie Ltd., H. W., Toronto, Ont.

FANS, VENTILATING
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

FIBRE
Diamond State Fibre Co., of Can. Ltd., Toronto, Ont.

FILES AND RASPS
Nicholson File Co., Port Hope, Ont.
Simmons Canada Saw Co., Montreal, Que.

FILLER, IRON (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J.

FIRE ESCAPES
Roelofson Elevator Co., Galt, Ont.

FITTINGS, PIPE
International Malleable Iron Co., Guelph
Fittings, Limited, Oshawa, Ont.

FLEXIBLE SHAFTS
Strand & Co., N. A., Chicago, Ill

FLUXES, WELDING
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd, Toronto
Liquide Air Company, Toronto, Ont.

FORGING MACHINERY
Acme Machinery Co., Cleveland, Ohio
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown Boggs & Co., Ltd., Montreal.
National Machinery Co., Tiffin, Ohio.
Steel Co of Canada, Ltd., Hamilton

BUYERS' DIRECTORY

FORGINGS, DROP
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Ltd., Toronto, Ont.

FORGINGS, HAMMER
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Hepburn Ltd., John T., Toronto, Ont.

FOUNDRY EQUIPMENT
Rice Lewis & Son, Ltd., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

FOUNDRY SUPPLIES
Rice Lewis & Son, Ltd., Toronto, Ont.

FROGS, SPRING OR RIGID
Can. Steel Foundries, Montreal, Que.

FURNACES, ELECTRIC
Rockwell Co., W. S. New York City.
Hiram Walker & Sons Metal Products. Ltd., Walkerville, Ont.

FURNACES, HEAT TREATING COAL
Rockwell Co., W. S., New York City.

FURNACES, HEAT TREATING OIL AND GAS
Bellevue Industrial Furnace Co., Detroit, Michigan.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Rockwell Co., W. D., New York City.

FURNACES TEMPERING AND ANNEALING
Bellevue Industrial Furnace Co., Detriot, Mich.
Brown & Sharpe Mfg., Co., Providence R. I.
Rockwell Co., W. S., New York City.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

FURNACES AND OVENS, ELECTRIC
Petrie, Ltd., H. W., Toronto, Ont.
Rockwell & Co., W. S., New York city.
Starrett Co., L. S., Athol, Mass.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

GAGES, MEASURING (See Tool Work)
Brown & Sharpe Mfg. Co., Providence, R. I.
Greenfield Tap & Die Corp, Galt, Ont.
Lufkin Rule Co., Windsor, Ont.
Starrett Co., L. S., Athol, Mass.

GAGES, RECORDING
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GAGES, SPECIAL MEASURING
(See Tool Work)
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GAGES, THREAD
Brown & Sharpe Mfg. Co., Providence R. I.
Starrett Co., L. S., Athol, Mass.

GALVANIZING
Fittings, Limited, Oshawa, Ont.

GAS, COAL COMPRESSED
L'Air Liquid Society, Toronto, Ont.

GAS, COMPRESSED
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

GASKETS
Diamond State Fibre Co. of Ca., Ltd., Toronto, Ont.
Smooth Mfg. Co., Jersey City, N. J.

GAUGES VACUUM AND PRESSURE
Taylor Instrument Co. Toronto, Ont.

GEAR BLANKS
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can, Ltd., Toronto, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.
Dominion Engineering Works, Limited, Montreal, Que.

GEAR COUNTERS
Hart Mfg. Co., R. A., Battle Creek, Michigan.

GEAR CUTTING MACHINES
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Fellows Gear Shaper Co., Springfield, Vt.
Petrie, Ltd., H. W., Toronto, Ont.
Whiton Machine Co., D. E., New London, Conn.

GEAR TESTING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.

GEARS, CAST
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Hull Iron & Steel Foundries, Hull, Que.
Dominion Engineering Works, Limited, Montreal, Que.

GEARS, CUT
Brown & Sharpe Mfg. Co., Providence, R. I.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Gardner & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto, Ont.
Hepburn Ltd., John T. Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

GEARS, DRESSED
Kennedy & Sons, Wm., Owen Sound, Ontario.

GEARS, FORGED
Canada Foundries & Forgings Co., Welland, Ont.

GEARS, HERRINGBONE
Hamilton Gear & Machine Co., Toronto, Ont.

GEARS, RAWHIDE (See Gears, Cut)
Hamilton Gear & Machine Co., Toronto

GEAR, SILENT CHAIN
Gardner & Son, Robt., Montreal, Que.
Can. Link-Belt Co., Ltd., Toronto, Can.
Hans Renold of Canada, Ltd., Montreal, Quebec.

GEARS, WORM
Hamilton Gear & Machine Co., Toronto

GENERATORS, ACETYLENE
L'Air Liquide Society, Toronto, Ont

GOGGLES, SAFETY
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto
Liquide Air Company, Toronto

GRAB BUCKETS
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Cleveland Twist Drill Co, Cleveland, O

GREASE CUPS, PRESSED STEEL AND BRASS
Can. Winkley Co., Ltd., Windsor, Ont.

GREASES, LUBRICATING
Canadian SKF Co., Toronto, Ont.

GRINDING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Norton Co., of Canada, Ltd., Hamilton.

GRINDING MACHINES, ABRASIVE BELT
Norton Co. of Can. Ltd., Hamilton, Ont.

GRINDING MACHINES, AUTOMATIC
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, BENCH
Blount Co., J. G, Everett, Mass.
Geometric Tool Co., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co. of Canada, Ltd., Hamilton, Ont.
Petrie, Ltd, H W. Toronto, Ont.
Pratt & Whitney C of Canada, Ltd, Dundas, Ont.

GRINDING MACHINES, CENTER
U. S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES, CUTTER AND REAMER
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Petrie Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, CYLINDRICAL
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.
Norton Co., of Canada, Ltd., Hamilton.

GRINDING MACHINES, DIE
Geometric Tool Co., New Haven, Conn.
National Acme Co., Cleveland, O.
National Machinery Co., Tiffin, Ohio.

GRINDING MACHINES, DRILL
Bellevue Industrial Furnace Co., Detroit, Mich.
Bertram & Son Co., Ltd., The John, Dundas, Ont.

GRINDING MACHINES, ELECTRIC
Strand & Co., N. A., Chicago, Ill.

GRINDING MACHINES, FLOOR AND TOOL
Blount Co., J. G., Everett, Mass.
National Acme Co., Cleveland, Ohio.
Norton Co. of Canada, Ltd., Hamilton, Ontario.
Petrie, Ltd., H. W., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.

GRINDING MACHINES, INTERNAL
Garlock Machinery Ltd., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Cleveland Pneumatic Tool Co., Toronto Ont.
Wisconsin Electric Co, Racine, Wis.

GRINDING MACHINES PORTABLE
Strand & Co., N. A., Chicago, Ill.

GRINDING MACHINES, SNAGGING
Blount Co., J. G., Everett, Mass.
Norton Co., of Can. Ltd., Hamilton, Ont.

GRINDING MACHINES, SURFACE
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Petrie, Ltd,. H. W., Toronto, Ont.
Pratt & Whitney Co, of Canada, Ltd, Dundas, Ont.

GRINDING MACHINES, THREAD
Pratt & Whitney Co., of Canada, Ltd.,

GRINDING MACHINERY, TOOL POST
Gisholt Machine Co, Madison, Wis.
Grenfield Tap & Die Corp, Galt, Ont.
Wisconsin Electric Co, Racine, Wis.

GRINDING MACHINES, UNIVERSAL
Brown & Sharpe Mfg Co, Providence, Rhode Island.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Landis Tool Co, Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co, of Canada, Ltd., Hamilton Ontario.
Petrie, Ltd, H. W., Toronto, Ont

GRINDING WHEELS
Lion Grinding Wheels, Limited, Montreal, Que
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Can Fairbanks-Morse Co., Ltd., Montreal.
Norton Co. of Can., Ltd., Hamilton, Ont.

GUN-BARREL MACHINERY
Steinle Turret Machine Co, Madison, Wisconsin

HACK SAWS, POWER
Atkins & Co., Inc., E C., Indianapolis, Indiana.
Petrie, Ltd, H W., Toronto, Ont.
Simonds Canada Saw Co, Montreal, Que.
Starrett Co, L. S., Athol, Mass.

HAMMERS, CHIPPING
Cleveland Pneumatic Tool Co., Toronto, Ont.
High Speed Hammer Co, Rochester.

HAMMERS, DROP
Bertram & Son Co, Ltd., The John Dundas, Ont.
Pliss Co, E W., Brooklyn, N.Y.
Brown Boggs & Co, Ltd, Hamilton, Ont.
Canada Foundries & Forgings Co, Welland, Ont

HAMMERS, ELECTRIC
Brown, Boggs & Co., Ltd., Hamilton, Ont.

HAMMERS, PNEUMATIC
Can. Steel Foundries, Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto Ont.

HANGERS, SHAFTING
Canadian SKF Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Hamilton Gear & Machine Co., Toronto,

HOBBING MACHINES
Shore Instrument Co., Jamaica, N.Y.

HARDENING, CASE-HARDENING AND TEMPERING
Barnes Company, Wallace, Hamilton.
Petrie, Ltd., H. W., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Cleveland Pneumatic Tool Co, Toronto Ont.

HAMMERS, POWER
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

HOBS
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Tap & Die Corp., Galt, Ont
Pratt & Whitney Co., of Canada, Ltd, Dundas, Ont.

HOISTS, ELECTRIC
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

HOISTS, ELECTRIC
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

HOISTS, HAND
Morris Crane & Hoist Co, Ltd, Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio

HOISTS, PNEUMATIC
Morris Crane & Hoist Co., Ltd, Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont

HOLDERS-ON, PNEUMATIC
Cleveland Pneumatic Tool Co., Toronto Ont.

HYDRAULIC MACHINERY
Bertram & Son Co., Ltd, The John, Dundas, Ont.
Dominion Engineering Works, Limited Montreal, Que.

IGNITERS, GAS ENGINE
Canada Foundries & Forgings Co, Welland, Ont.
Burke Machine Tool Co, Conneaut, O

INDICATORS, SPEED AND TEST
Brown & Sharpe Mfg Co, Providence, R.I.

INSULATION
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.

IRON BARS
Steel Co. of Canada, Ltd., Hamilton, Ont.

JACKS, HYDRAULIC
Norton, A. O, Boston, Mass.

JACKS, PLANER
Armstrong Bros Tool Co, Chicago, Ill
Starrett Co., L. S., Athol, Mass

JAPANNING AND VARNISHING OVENS
Brantford Oven & Rack Co., Brantford, Ont.

JIGS AND FIXTURES (SEE TOOL WORK)
Fisher Motor Co, Ltd, Orillia, Ont
Gisholt Machine Co, Madison, Wis

KEYSEATING MACHINES
Morton Mfg Co, Muskegon, Mich

BUYERS' DIRECTORY

Petrie, Ltd., H. W., Toronto, Ont
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

KEYS, MACHINE
Can. Drawn Steel Co., Hamilton, Ont.
Morton Mfg. Co., Muskegon, Mich.

KNIVES, MACHINE
Atkins & Co., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

KNURL HOLDERS
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

LATHE ATTACHMENTS
Hendey Machine Co., Torrington, Conn.
Petrie, Ltd., H. W., Toronto, Ont.

LATHE TOOLS
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

LATHES, AUTOMATIC AND SEMI-AUTOMATIC
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, BENCH
Hardinge Bros., Inc., Chicago, Ill.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

LATHES, BORING
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, CHUCKING (SEE LATHES, HORIZONTAL TURRET, AND LATHES, VERTICAL TURRET)
Acme Machine Tool Co., Cincinnati, O.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, ENGINE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hendey Machine Co., Torrington, Conn.
Petrie, Ltd. H. W., Toronto, Ont
Rockford Lathe & Drill Co., Rockford, Illinois.

LATHES, EXTENSION AND GAP
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison Wis.
National Acme Co., Cleveland, O.
Petrie, Ltd., H. W., Toronto, Ont.
Steinle Turret Machine Co., Madison, Wis.

LATHES, PRECISION
Hardinge Bros., Chicago.

LATHES, RELIEVING
Hendey Machine Co., Torrington, Conn.

LATHE, UNIVERSAL HAND
Brown & Sharpe Mfg. Co., Providence, Rhode Island.

LATHE, SPEED AND HAND
Blount Co., J. G., Everett, Mass.

LATHES, SPINNING
Pryibil Machine Co., Torrington, Conn.

LATHES, VERTICAL TURRET
Bertram & Son, Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

LATHES, WOOD TURNING
Blount, Co., J. G., Everett, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.

LEAD PIPE
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

LEATHER FILLET
D. K. McLaren, Limited, Montreal.

LINOLEUM MILL MACHINERY
Bertrams, Ltd., Edinburgh, Scotland.

LIQUID AIR PLANTS
L'Air Liquide Society, Toronto, Ont.

LOCKERS, CLOTHES
Dennis Wire and Iron Works, London Ont.

LUBRICANTS
Oakley Chemical Co., New York, N.Y.

LUBRICATING SYSTEMS
Bowser, S. F., & Co., Ltd., Toronto, Canada.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Ltd., Welland, Ont.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R. Toronto Ont.

MANGANESE STEEL
Can. Steel Foundries, Montreal, Que.

MANDRELS, EXPANDING
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MANDRELS, SOLID
Greenfield Tap & Die Corp., Galt, Ont.
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Pratt & Whitney Co., of Canada. Ltd., Dundas, Ont.

MEASURING MACHINES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MECHANICS' FINE TOOLS
Lufkin Rule Co., Windsor, Ont.

METALS, ALLOY
Canada Metal Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.

METAL WORKERS
Parker Co., Charles, Meriden, Conn.

MICROMETER CALIPERS
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Rice Lewis & Son, Ltd., Toronto, Ont

MILLING ATTACHMENTS
Burke Machine Tool Co., Conneaut, O.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

MILLING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Burke Machine Tool Co., Conneaut, O

MILLING MACHINES, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence, R. I.
Hardinge Bros., Inc., Chicago, Ill.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

MILLING MACHINES, BENCH
Burke Machine Tool Co., Conneaut, O.
Hardinge Bros., Inc., Chicago, Ill.

MILLING MACHINES, HAND
Brown & Sharpe Mfg. Co., Providence
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MILLING MACHINES, HORIZONTAL PLANER TYPE.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Kearney & Trecker Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto.

MILLING MACHINES, PLAIN
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, O.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

MILLING MACHINES, THREAD
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MILLING MACHINES, UNIVERSAL
Brown & Sharpe Mfg. Co., Providence,
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

MILLING MACHINES, VERTICAL
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, O.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto.

MILLING TOOLS, ADJUSTABLE HOLLOW
Geometric Tool Co., New Haven, Conn.

MOTORS, ELECTRIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Roelofson Elevator Co., Galt, Ont.
Williams Machinery Co., A. R., Toronto.
Wisconsin Electric Co., Racine Wis.

NAILS AND STAPLES
Canada Metal Co., Ltd., Toronto, Ont.

NIPPLES
Canada Metal Co., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton.

NITROGEN
Carter Welding Co. Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

NUT TAPPERS
(See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
National Acme Co., Cleveland, Ohio.

NUTS, FINISHED and SEMI-FINISHED
Galt Macine Screw Co., Galt, Ont.
National Acme Co., Montreal, ue.

NUTS (Up to 4-in.)
Steel Co. of Canada, Ltd., Hamilton.

NUTS, S.A.E., PLAIN AND CASTELLATED
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

OIL FILTERING AND STORAGE SYSTEMS
Bowser, S. F., & Co., Ltd., Toronto,

OIL STORAGE ENGINEERS
Bowser, S. F., & Co., Ltd., Toronto,

OIL HOLE COVERS
Can. Whitney Co., Ltd., Windsor, Ont.

OILS, SOLUABLE
Brantford Oven & Rack Co., Brantford, Ontario.

ORNAMENTAL IRON AND WIRE WORKS
Roelofson Elevator Works, Galt, Ont.

OXYGEN
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

OXY-ACETYLENE APPARATUS
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Atlas Press Co., Kalamazoo, Mich.

PAPER MILL CONVEYORS
Bertram Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd., Montreal, Que.

PATTERNS, WOOD AND METAL
Fittings, Limited, Oshawa, Ont.
Victoria Foundry Co., Ltd., Ottawa.

PHOSPHOR TIN
Canada Metal Co., Ltd., Toronto, Ont.

PHOTOGRAPHIC DUPLICATING MACHINES
Photostat Corp., Providence, R. I.

PIPE BENDING MACHINES
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Underwood Corp., H. R., Philadelphia, Pa.
Williams Machinery Co., A. R., Toronto.

PIPE CUTTING AND THREADING MACHINES
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Petrie, Ltd., H. W., Toronto, Ont.

PIPE
Canada Metal Co., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.

PIPE FITTINGS
Canada Metal Co., Toronto, Ont.
Fittings, Limited, Oshawa, Ont.
International Malleable Iron Co., Guelph Ont.

PIPE AND NIPPLE THREADING MACHINES
Landis Machine Co., Inc., Waynesboro, Pa.

PIPE FITTERS' TOOLS
Rice Lewis & Son, Ltd., Toronto, Ont.

PIPE THREADING DIE HEADS
Landis Machine Co., Inc., Waynesboro, Pa.

PISTON-RING MACHINES
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

PLANING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Williams Machinery Co., A. R., Toronto

PLANING MACHINES, ROTARY
Bertram & Son Co., Ltd., The John, Dundas, Ont.

PLATE ROLLS
Bertram & Son Co., Ltd., The John, Dundas, Ont.

PNEUMATIC TOOLS
Cleveland Pneumatic Tool Co., Toronto

POLISHING AND BUFFING MACHINES
Lion Grinding Wheels, Limited, Montreal, Que.
Blount Co., J. G. Everett, Mass.
Brown & Sharpe Mfg. Co., Providence.
Pryibil Machine Co., New York, N.Y.

PRESSED STEEL PARTS
American Pulley Co., Philadelphia, Pa.
Fisher Motor Co., Ltd., Orillia, Ont.

PRESSES, ARBOR
Atlas Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

PRESSES, DROP AND FORGING
Brown, Boggs & Co., Ltd., Hamilton.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

PRESSES, FOOT AND HAND
Brown, Boggs & Co., Ltd., Hamilton.

PRESSES, HYDRAULIC
Bertram & Son Co., Ltd., The John Dunidas, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Perrin Ltd., W. R., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

PRESSES, POWER
Bliss Co., E. W., Prooklyn, N. Y.
Brown, Boggs, & Co., Ltd., Hamilton.
Hepburn Ltd., John T., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Stoll Co., Inc., D. H., Buffalo, N.Y.

PRESSES, SCREW
Brown, Boggs & Co., Ltd., Hamilton.
Petrie, Ltd., H. W., Toronto, Ont.

PROFILING MACHINES
Prit & Whitney Co., of Canada, Ltd., Dundas, Ont.

PROTRACTORS
Brown & Sharpe Mfg. Co., Providence.
Lufkin Rule Co., Windsor, Ont.

PROPELLERS
Kennedy & Sons, Wm., Owen Sound, Ontario.

PULLEYS, CORK INSERT
American Pulley Co., Philadelphia, Pa.

PULLEYS, METAL AND FIBRE
American Pulley Co., Philadelphia, Pa.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.
D. K. McLaren Co., Limited Montreal, Que.

PULP AND PAPER MILL EQUIPMENT
Dominion Engineering Works, Ltd., Montreal, Que.

PUMPS, HYDRAULIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Dominion Engineering Works, Ltd Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont

BUYERS' DIRECTORY

PUMPS, LUBRICANT AND OIL
Bowser, S. F., & Co., Ltd., Toronto.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Hepburn Ltd., John T., Toronto, Ont.

PUMPS, POWER
Bowser, S. F., & Co., Ltd., Toronto.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hepburn Ltd., John T., Toronto, Ont.

PUNCHES, CENTER
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

PUNCHES, HAND
Brown Boggs & Co., Ltd., Hamilton.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Jardine & Co., A. B., Hespeler, Ont.

PUNCHES, POWER
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

PUNCHING MACHINES, HORIZONTAL
Bertram Ltd., Edinburgh, Scotland.

PYROMETERS, ELECTRIC
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Hiram Walker & Sons Metal Products Co., Walkerville, Ont.

RACKS, CUT
Hamilton Gear & Machine Co., Toronto.

RACKS, STORAGE
(See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ontario.

REAMER HOLDERS
Simonds Canada Saw Co., Montreal, Q.

REAMERS, EXPANDING
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

REAMERS, SOLID
Butterfield & Co., Inc., Rock Island, Q.
Morse Twist Drill & Machine Co., New Bedford, Mass.

REAMERS, TAPER
Brown & Sharpe Mfg. Co., Providence, R. I.
Butterfield & Co., Inc., Rock Island, Q.
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canad, Ltd., Dundas, Ont.

RECORDERS, TEMPERATURE
Taylor Instrument Co., Rochester, N. Y.

RECORDERS, TIME
Gisholt Machine Co., Rochester, N. Y.
Taylor Instrument Co., Toronto, Ont.

REGULATORS, TEMPERATURE
Taylor Instrument Co., Toronto, Ont.

RIVETS AND BURRS
Parmenter & Bulloch Co., Gananoque, Ont.
Steel Co., of Canada, Ltd., Hamilton.

RIVETS, CHAIN
Pittings, Limited, Oshawa, Ont.

RIVET-MAKING MACHINERY
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

RIVETING MACHINES
Can. Fairbanks-Morse Ltd., Montreal Q.
High Speed Hammer Co., Rochester, N.Y.
Parmenter & Bulloch Co., Gananoque Ont.
Petrie, Ltd., H. W., Toronto, Ont.

RUDDER FRAMES, STEEL
Can. Steel Foundries, Montreal, Que.

RUBBER MILL MACHINERY
Bertram Ltd., Edinburgh, Scotland.

RULES, STEEL AND WOOD
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Windsor, Ont.

RUST PREVENTATIVES
Oakley Chemical Co., New York, N. Y.

SAND EQUIPMENT
Can. Link-Belt Co., Toronto, Ont.

SAND RAMMERS, PNEUMATIC
Cleveland Pneumatic Tool Co., Toronto.

SAW FRAMES AND BLADES, HACK
Atkins & Co., Inc., E. C., Indianapolis.
Diamond Saw & Stamping Works, Buffalo, N. Y.
Rice Lewis & Sons, Ltd., Tornto, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWING MACHINES, POWER HACK
Atkins & Co., Inc., E. C., Indianapolis.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

SAW SHARPENING MACHINES
Atkins & Co., Inc., E. C., Indianapolis.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

SAW SHARPENING MACHINES
Atkins & Co., Inc., E. C., Indianapolis.

SAW TABLES, UNIVERSAL
Petrie, Ltd., H. W., Toronto, Ont.

SAWS, CIRCULAR METAL
Atkins & Co., Inc., E. C., Indianapolis.
Pryibil Machine Co., New York, N. Y.
Gisholt Machine Co., Madison, Wis.

SAWS, HAND
Atkins & Co., Inc., E. C., Indianapolis
Simonds Canada Saw Co., Montreal, Q.

SAWS, HOT AND COLD
Atkins & Co., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Q.

SAWS, HIGH SPEED STEEL
Atkins & Co., Inc., E.C., Indianapolis, I.
Butterfield & Co. Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWS, METAL BAND
Atkins & Co., E. C., Indianapolis, I.

SAWS, METAL CUTTING
Brown & Sharpe Mfg. Co., Providence.
Butterfield & Co., Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.
Starrett Co., L. S., Athol, Mass.

SAWS, SCREW SLOTTING
Atkins & Co., Inc., E., C., Indianapolis.
Butterfield & Co., Inc., Rock Island, Q.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canda, Ltd., Dundas, Ont.

SAWS, SCREW SLOTTING
Atkins & Co., Inc., E. C., Indianapolis.
Butterfield & Co., Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWS, WOOD
E. C. Atkins & Co., Indianapolis, Ind.

SCALES
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Lufkin Rule Co., Windsor, Ont.

SCREENS
Dominion Engineering Works, Ltd., Montreal, Que.

SCREW DRIVERS, OPTICAL, JEWELRY AND NOVELTY
Strand & Co., N. A., Chicago, Ill.

SCREW MACHINE WORK
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Montreal, Que.

SCREW MACHINERY, WOOD AND LAG
Cook Co., Asa S., Hartford, Conn.

SCREW MACHINES
Brown & Sharpe Mfg. Co., Providence, Rhode Island.

SCREW MACHINES, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.

SCREW MACHINE PRODUCTS
National Acme Co., Montreal, Que.

SCREW PLATES
Butterfield & Co., Inc., Rock Island. Que.
Jardine & Co., A. B., Hespeler, Ont.

SCREWS, CAP AND SET
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

SCREWS, SAFETY, SET
Galt Machine Screw Co., Galt, Ont.

SECOND-HAND MACHINERY
See last page of directory.
Petrie, Ltd., H. W., Toronto, Ont.

SEPARATORS, MOISTURE AND OIL
Bowser, S. F., & Co., Ltd., Toronto, Canada.

SEPARATORS, OIL AND WASTE
Bowser, S. F., & Co., Ltd., Toronto.

SHAFTS, FLEXIBLE
Strand & Co., N. A., Chicago, Ill.

SHAFTING
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
Williams Machinery Co., A. R., Toronto.

SHAPES, COLD-DRAWN SPECIAL STEEL
Union Drawn Steel Co., Hamilton, Ont.

SHAPING MACHINES
Hendey Machine Co., Torrington, Conn.
Morton Mfg. Co., Muskegon, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Williams Machinery Co., A. R. Toronto.

SHEARS HAND
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

SHEARS, POWER
Bliss Co., E. W., Brooklyn, N. Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Stoll Co., Inc., D. H., Buffalo, N. Y.
Williams Machinery Co., A. R., Toronto, Ont.

SHEARING MACHINES, ANGLE, IRON BAR AND GATE
Bertrams Ltd., Edinburgh, Scotland.

SHEET LEAD
Canada Metal Co., Ltd., Toronto, Ont.

SHEET METAL WORKING MACHINERY
Bliss Co., E. W., Brooklyn, N. Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Stoll Co., Inc., D. H, Buffalo, N.Y.

SHEETS, NICKEL, MONEL AND FIBRE
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.

SHEETS, O.P.C.R. & B. A. AND BLUE ANNEALED
Steel Co., of Canada, Ltd., Hamilton, Ont.

SIDE FRAMES, LOCOMOTIVE
Can. Steel Foundries, Montreal, Que.

SLOTTING ATTACHMENTS
Brown & Sharpe Mfg. Co., Providence, R.I.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

SLOTTING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.

SOLDERS
Canada Metal Co., Ltd., Toronto, Ont.

SPECIAL MACHINERY AND TOOLS
Brown Engineering Corp., Ltd., Toronto.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Cleveland, O.

SPIKES, RAILWAY AND PRESSED
Steel Co of Canada, Ltd., Hamilton, Ont.

SPINNING LATHES
Prybil Machine Co., P., New York City.

SPRING, MILLED
Barnes & Co., Wallace, Hamilton, Ont.

SPRINGS, SMALL SPIRAL HELICAL, COMPRESSION, EXTENSION, TORSION AND SPECIAL
Barnes Company, Wallace, Hamilton.

SPRINGS
Barnes Company, Wallace, Hamilton.
Cleveland Wire Spring Co., Cleveland, O.
Steele Ltd., James, Guelph, Ont.

SPRINGS, FLAT STEEL, BRUSH HOLDER, CLOCK, SMALL FLAT SPRINGS
Barnes Company, Wallace, Hamilton.

SPROCKETS AND CHAINS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Renold Hanson of Canada, Ltd., Montreal, Que.

SQUARES
Brown & Sharpe Mfg. Co., Providence, R.I.
Lufkin Rule Co., Windsor, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

STAMPING, METAL
American Pulley Co., Philadelphia, Pa.
Barnes Company, Wallace, Hamilton.
Diamond Saw & Stamping Works, Buffalo, N. Y.
Parmenter & Bulloch Co., Gananoque, Ont.

STAMPS, STEEL
Diamond Saw & Stamping Works, Buffalo, N. Y.

STEEL CONCRETE REINFORCEMENT
Steel Co. of Canada, Ltd., Hamilton.

STEEL PLATE
British Empire Steel Co., Montreal, Que.

STEEL AND IRON BARS
Steel Co. of Canada, Ltd., Hamilton.

STEELS TOOL
British Empire Steel Co. Montreal Q.

STEEL, COLD-ROLLED STRIP
British Empire Steel Co., Montreal, Q.
Barnes Company, Wallace, Hamilton.

STEEL, CRUCIBLE, SPRING
Barnes, Company, Wallace, Hamilton.
British Empire Steel Co., Montreal, Q.

SHEETS, OPEN HEARTH STEEL
Steel Co., of Canada, Ltd., Hamilton.

STEEL, SHAFTING AND FREE CUTTING SCREW
Union Drawn Steel Co., Hamilton, Ont.

STEEL, SHEET
British Empire Steel Co., Montreal, Q.
Rice Lewis & Son, Ltd., Toronto, Ont.

STEEL, STAINLESS
Steel Co., of Can. Ltd., Hamilton, Ont.

STEEL STAIRS
Rodolson Elevator Works, Galt, Ont.

STEELS, ALLOY AND CARBON
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Can. Steel Foundries, Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton, Ont.

STEELS, HIGH-SPEED
Armstrong Bros. Tool Co., Chicago, Ill.
Atkins & Co., Ltd., Wm., Sheffield, England.
British Empire Steel Co., Montreal, Q.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton.

STEEL TUBING, CLOSE JOINT AND WELDED
Standard Tube & Fence Co., Ltd., Woodstock, Ont.

STERN FRAMES, CAST STEEL
Can. Steel Foundries, Montreal, Que.

STRAIGHTENING MACHINERY
Bertram Ltd., Edinburgh, Scotland.
Williams & Co. Limited, Brooklyn, N.Y.

STUDS
Geometric Tool Co., New Haven, Conn.
Galt Machine Screw Co., Galt, Ont.

BUYERS' DIRECTORY

SWAGING MACHINES
Atkins & Co., Inc., E. C., Indianapolis, Indiana.

SWITCHES, RAILWAY
Can. Steel Foundries, Montreal, Que.

TACHOMETERS
Bristol Co., Waterbury, Conn.

TANKS AND PUMPS, OIL
Bowser, S. F., & Co., Ltd., Toronto.

TAP HOLDERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
William L. Procunier, Chicago, Ill.

TAPER PINS
Galt Machine Screw Co., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

TAPES, MEASURING
Starrett Co., L. S., Athol, Mass.
Lufkin, Rule Co., Windsor, Ont.

TAPPING MACHINES AND ATTACHMENTS
Burke Machine Tool Co., Conneaut, O.
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Wm. L. Procunier, Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

TAPS AND DIES
Butterfield & Co., Inc., Rock Island, Q.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

TAPS, COLLAPSING
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.

TEETH, DREDGE BUCKET
Kennedy & Sons, W., Owen Sound, Ont.

THERMOMETERS
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Greenfield Tap and Die Corp., Galt, Ontario.

THREAD-CUTTING TOOLS
Butterfield & Co., Inc., Rock Island, Q.
Greenfield Tap and Die Corp., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

THREAD CUTTING MACHINES
Landis Machine Co., Inc., Waynesboro, Pa.

THREADING MACHINES
Acme Machinery Co., Cleveland, Ohio.
Geometric Tool Co., New Haven, Conn.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Williams Tool Corp., of Can. Ltd., Brantford, Ont.

THREAD LEAD TESTING MACHINES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

THREAD-ROLLING MACHINES
Bliss Co., E. W., Brooklyn, N. Y.

TIE PLATES
Steel Co. of Canada, Ltd., Hamilton.

TIME RECORDERS
International Business Machine Co., Ltd., Toronto, Ont.

TONGS
Hepburn Ltd., John T., Toronto, Ont.

TOOL CASES
Rice Lewis & Son, Ltd., Toronto, Ont.

TOOL HOLDERS
Armstrong Bros., Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Bertrams Ltd., Edinburgh, Scotland.

TOOL POSTS, LATHE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Williams & Co., Limited, Brooklyn, N.Y.

TOOLS, SMALL
(See Machinists' Small Tools)
Armstrong Bros. Tool Co., Chicago, Ill.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Lufkin Rule Co., Windsor, Ont.
National Machine Tool Co., Racine, Wis.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S. Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A.R., Toronto,

TOOL WORK
Brown Engineering Corp., Ltd., Toronto, Ontario.

TORCHES, BLOW
Rice Lewis & Son, Ltd., Toronto, Ont.

TRACKWORK, RAILWAY
Can. Steel Foundries, Montreal, Que.

TRACKWORK, MANGANESE STEEL
Can. Steel Foundries, Montreal, Que.

TRANSMISSION MACHINERY
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound.
Petrie, Ltd., H. W., Toronto, Ont.
Renold, (Hans) of Canada, Ltd., Montreal, Que.

TROLLEYS AND TRAMWAYS
Can. Link-Belt Co., Toronto, Ont.
Northern Crane Works, Walkerville, Ont.
Wright Mfg. Co., Lisbon, Ohio.

TROLLEY WHEELS
Langley & Austin, Galt, Ont.

TROWELS, PLASTERING
E. C. Atkins & Co., Indianapolis, Ind.

WRENCHES, MACHINISTS'
Armstrong Bros. Tool Co., Chicago, Ill.

TRUCKS
Can. Fairbanks-Morse Ltd., Montreal, Q.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.

TUBING, SEAMLESS STEEL, BRASS AND COPPER AND FIBRE
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

TURRET HEADS
Bertram & Son Co., Ltd., The John Dundas, Ont.

TURRET MACHINES
(See Lathes, Horizontal Turret)
Acme Machine Tool Co., Cincinnati, O.
Cook Co., Asa S., Hartford, Conn.
Gisholt Machine Co. Madison Wis.
National Acme Co. Cleveland O.
Pratt & Whitney Co. of Canada Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

TURRETS, TOOL POST
Gisholt Machine Co. Madison, Wis.

UNIONS, PIPE
Fittings, Limited, Oshawa, Ont.

VALVES
Canada Metal Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Mon-
Dominion Engineering Works, Limited, Montreal, Que.

VISES, DRILLING MACHINE
Burke Machine Tool Co., Conneaut, Ohio.
Charles Parker Co., Meriden, Conn.
Cleveland Pneumatic Tool Co., Toronto, Ontario.
Kempsmith Mfg Co., Milwaukee, Wis.

VISES, PIPE
Charles Parker Co., Meriden, Conn.

VISES, PLANER AND SHAPER
Bertram & Son Co., Ltd., The John Dundas, Ont.
Philip Gies Foundry, Kitchener, Ont.
Hendley Machine Co., Torrington, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.

VISES, WOOD WORKERS'
Charles Parker Co., Meriden, Conn.
Parmenter & Bulloch Co., Gananoque, Ontario.

VOLTMETERS
Bristol Co., Waterbury, Conn.

WAGON LEADERS
Can. Link-Belt Co., Toronto, Ont.

WASHERS, LOCK, SPLIT AND SPRING
Barnes Company, Wallace, Hamilton.

WELDING APPARATUS, OXY-ACETYLENE
L'Air Liquide Society, Toronto, Ont.
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto, Ont.

WELDING APPARATUS
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.

WELDING, ELECTRIC, ARC, SPOT AND BUTT
International Malleable Iron Co., Guelph, Ont.

WELDING MACHINES, OXY-ACETYLENE
Carter Welding Co., Ltd., Toronto, Ont
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.

WELDING, ELECTRIC
McLaren Belting Co., J. C., Montreal Que.
Steel Co. of Canada, Ltd., Hamilton.

WELDING ROD, TOBIN, MANGANESE, BRONZE AND ALUMINUM
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto, Ont.

WELDING SUPPLIES
Carter Welding Co., Ltd., Toronto, Ont
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.

WHEELS, INDUSTRIAL
American Pulley Co., Philadelphia, Pa.
Hull Iron & Steel Foundries, Hull, Que.
Kennedy & Sons, Wm., Owen Sound, Ontario.

WINCHES, HEADGATE
Kennedy & Sons, Wm. Owen Sound, Ontario.

WINCHES, STOPLOG
Kennedy & Sons, Wm., Owen Sound. Ontario.

WIRE
Barnes Company, Wallace, Hamilton.
Canada Metal Co., Ltd., Toronto, Ont
Dennis Wire & Iron Works, London, Ontario.
Greening Wire Co., B., Hamilton, Ont.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

WIRE, BLACK TEMPERED, MUSIC PHOSPHOR BRONZE AND PREMIER
Barnes Company, Wallace, Hamilton.

WIRE, COPPER AND BRASS, FINE AND HEAVY
Steel Co., of Canada, Ltd., Hamilton, Ontario.

WIRE STRAIGHTENING AND CUTTING MACHINERY
Brown, Boggs & Co., Ltd., Hamilton, Ontario.

WIRE, WELDING
L'Air Liquide Society, Toronto, Ont.
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.

WIRES, SPECIAL
Dennis Wire & Iron Works, London, Ontario.
Greening Wire Co., B., Hamilton, Ont.

WOODWORKING MACHINERY
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Williams Machinery Co., A. R., Toronto, Ontario.

WRENCHES, DROP FORGED
Armstrong Bros. Tool Co., Chicago, Ill.
Canada Foundries & Forgings Co., Welland, Ont.

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MALLEABLES
OF QUALITY SINCE 1878.
SMITH'S FALLS MALLEABLE CASTINGS LTD
SMITH'S FALLS, ONTARIO.

DIRECTORY OF DEALERS

THE Buyers' Directory of CANADIAN MACHINERY was originally intended to contain information regarding lines actually manufactured by our advertisers. We now carry the advertising of leading machinery dealers, some of whom represent scores of manufacturers in addition to being manufacturers themselves in some cases. We recommend, therefore, if our subscribers cannot find what they want in our Directory that they communicate with the dealers whose names appear herewith.

MACHINE TOOLS, ETC.

Bertram & Sons, Ltd., John, Dundas, Ont.
The Canadian Fairbanks-Morse Co., Montreal, Que.
Garlock Machinery Ltd., Toronto.
Herbert Ltd., Alfred, Toronto, Ont.
H. W. Petrie, Ltd., Toronto, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
Yeates Machinery Co., London, Ont.

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Garlock Machinery Ltd., Toronto.
Herbert Ltd., Alfred, Toronto, Ont.
H. W. Petrie Ltd., Toronto, Ont.
A. R. Williams Machinery Co, Toronto, Ont.
Yeates Machinery Co, London, Ont.

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If what you need is not advertised, consult our Buyers' Directory and write advertisers, listed under proper heading.

BLACK & DECKER

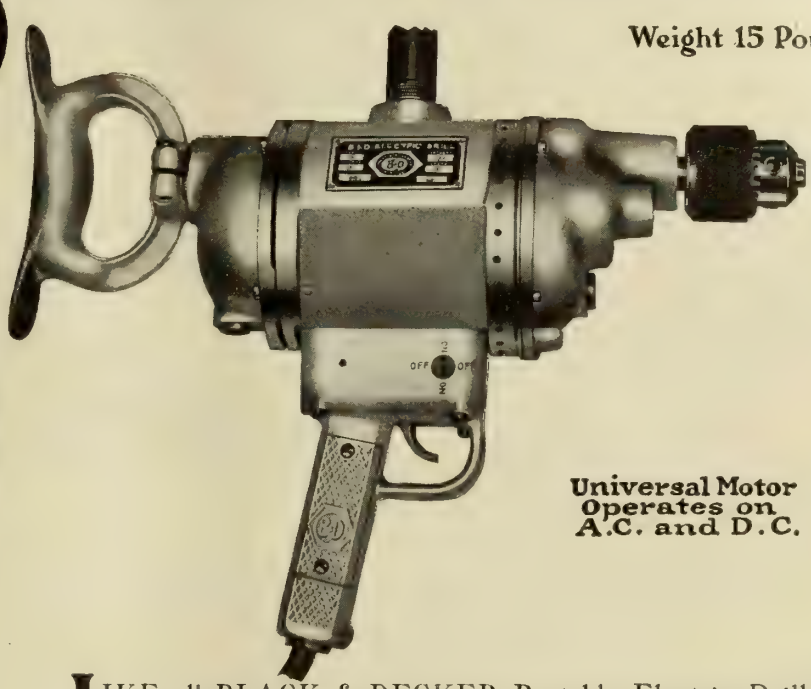
SPECIAL HALF-INCH DRILL

"With the Pistol Grip and Trigger Switch"

$106.00

1922 Model
1922 Price

Weight 15 Pounds



Universal Motor Operates on A.C. and D.C.

By removing two screws cover plate of switch handle may be lifted off, exposing terminal block to which electric cable and motor leads are attached by means of SCREW TERMINALS. Cable may be renewed quickly and easily without soldering.

A little thing which means a lot to the busy mechanic.

LIKE all BLACK & DECKER Portable Electric Drills this SPECIAL HALF-INCH DRILL is powerful, durable, comfortable to handle and perfectly controlled.

"The Pistol Grip and Trigger Switch" not only provides a large comfortable grip and instant control of the switch, but reduces the breakage of expensive drill bits, because the switch may be operated at critical times, such as when bit is breaking through the work, without disturbing the position of your hands. *"The Pistol Grip and Trigger Switch"* control is instinctive—practically automatic.

THE BLACK & DECKER SPECIAL HALF-INCH DRILL fits the BLACK & DECKER BENCH DRILL STAND, or POST DRILL STAND, and can be secured from your regular jobber.

SPECIFICATIONS

HOUSING—Aluminum Alloy.
MOTOR—Universal. Operates on Direct or Alternating Current.
AIR COOLED—Die Cast Aluminum Alloy fan keyed to armature shaft.
GEARS—Double Reduction, stub tooth, chrome nickel steel heat treated. Run in grease like an automobile transmission. (No brass gears are used on any Black & Decker tools).
CONTROL—*"With the Pistol Grip and Trigger Switch."* Improved switch handle with removable plate and screw terminals.
CHUCK—Three-jaw geared nut chuck for straight shank drills up to ½ inch.
NO LOAD SPEED—475 R. P. M.
NET WEIGHT—15 pounds.
EQUIPMENT—Drill is complete with 15 feet duplex electric cable, attachment plug, combination spade handle and breast plate, detachable side handle.

The fact that Canadian Industrials insist upon the finest tools and equipment obtainable makes BLACK & DECKER a natural choice.

MADE IN CANADA

A very substantial reduction in prices has been made possible by the establishment of our Canadian factory.

CREDIT

BLACK & DECKER National Credit Service enables any reliable person in Canada to purchase Black & Decker equipment from his jobber on terms that permit the equipment to pay for itself.

THE BLACK & DECKER MFG. CO.
LIMITED
344 St. James Street
Montreal, P. Q.
A. J. HOPKINS, Manager

Miniature catalogue will be supplied on request.

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V., U.S.S. & S.A.E. Cap Screws
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V. & S.A.E. Plain and Castellated Nuts
V. & U.S.S. Semi-Finished Nuts

SPECIAL

Screw Machine Product up to 2 1-4 in. diam., including Hardened and Ground work —to specifications.

Quotations on request

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MONTREAL, P.Q.

CANADIAN MACHINERY
AND MANUFACTURING NEWS

Vol. XXVIII. No. 12 | Published Weekly by the MacLean Publishing Company, Limited, Toronto, Ont. | Sept. 21, 1922 | $4.00 a Year Subscription Price

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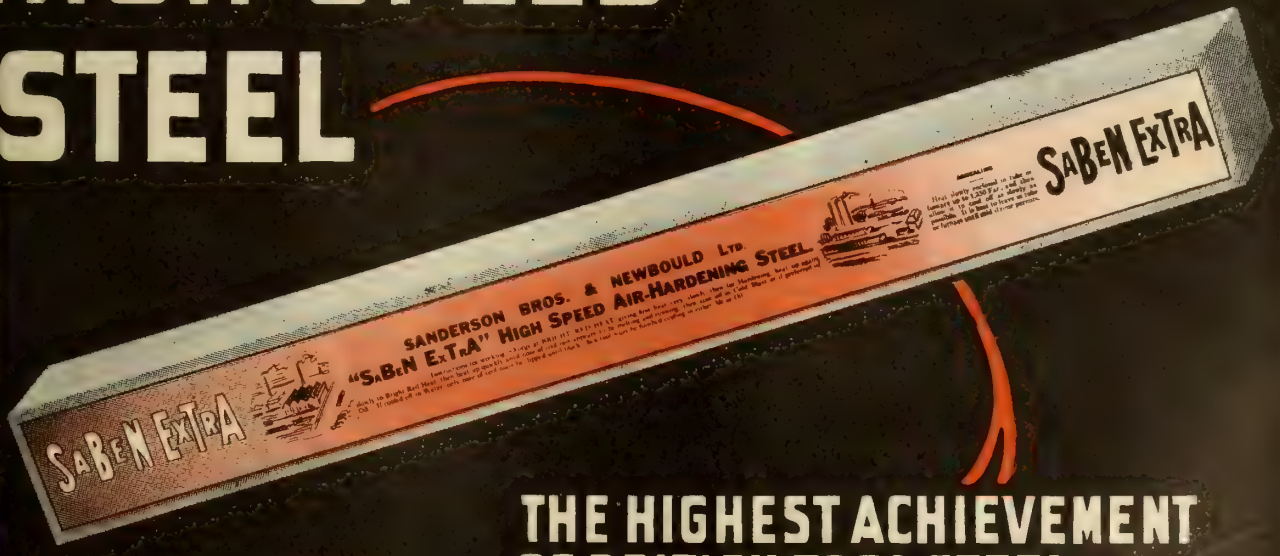
SABEN EXTRA

HIGH SPEED STEEL



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THE PRODUCT OF SANDERSON BROS. AND NEWBOULD LTD SHEFFIELD, ENG.

H. A. DRURY CO. LIMITED

MONTREAL TORONTO VANCOUVER

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LIQUID AIR Co
CANADA

The Reason for .000,005" Accuracy

Every gage you use, whether it's a master, inspection or a working gage, is based on some standard of measurement. If this basis of measurement is a set of gage blocks, built-up to form various dimensions, the nearer those blocks individually are to absolute accuracy, the smaller the errors in the built-up stacks.

That's why Hoke gages are made and **guaranteed** accurate to within five-millionth of an inch. They give you a basis to work from that practically eliminates error at the start and ensures closest possible accuracy in your gages and in all the measuring you do with them.

Even though shop tolerances are usually to thousandths, gages set to Hoke block "millionth of an inch" accuracy are bound to be more accurate — and keep your work more accurate — than when set to other standards.

And remember this, Hoke Gages cost no more than other high-class gage blocks of less guaranteed accuracy. They are so reasonable in price that any shop can well afford a set. They're sold singly, too, or in sets of 5, 10, 34 and 81 blocks.

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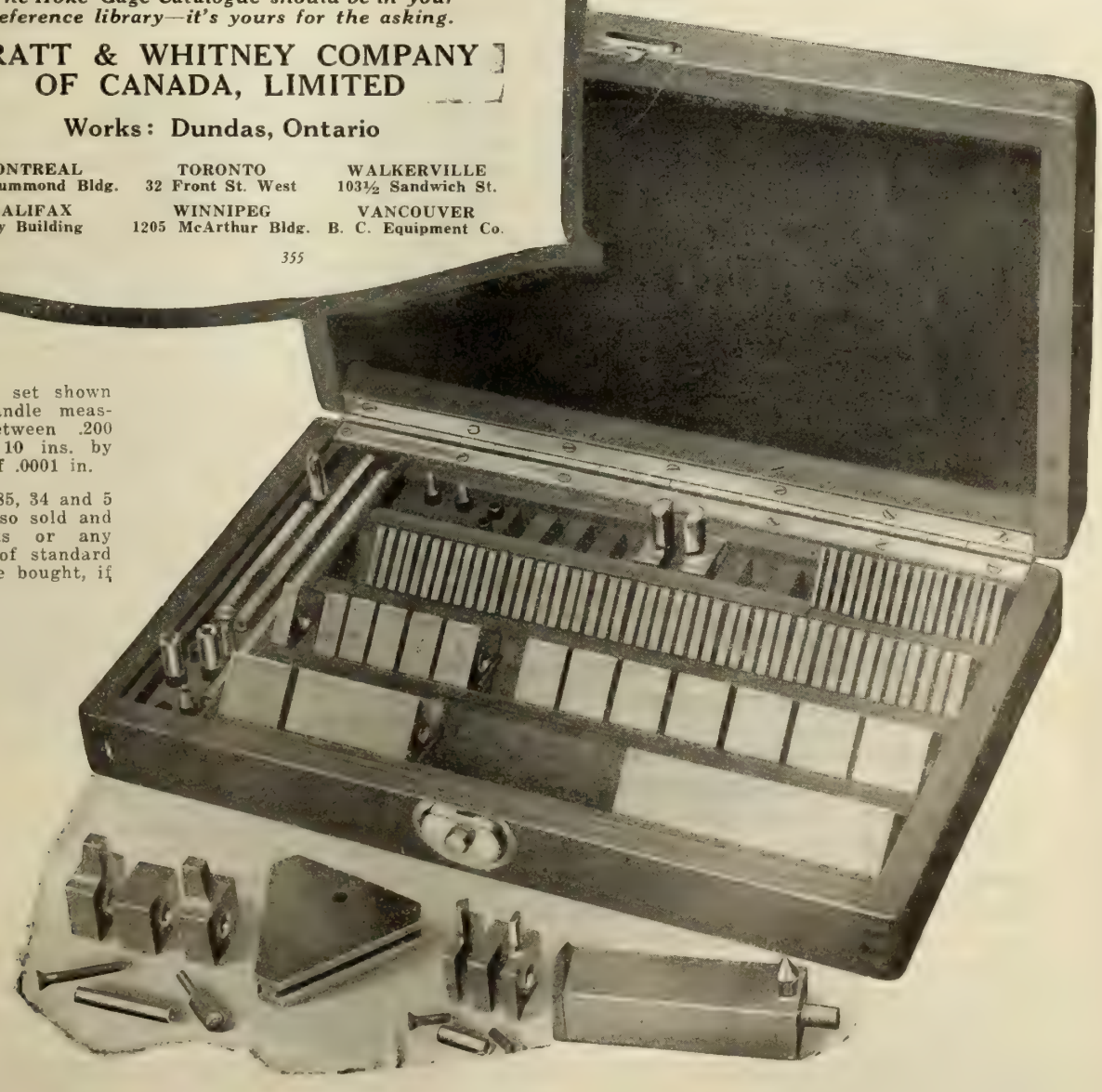
HOKE

PRATT & WHITNEY
PRECISION GAGES
Laboratory Accuracy at a Toolroom Price



The 81-block set shown here will handle measurements between .200 in. to over 10 ins. by increments of .0001 in.

Sets of 103, 85, 34 and 5 blocks are also sold and single blocks or any combination of standard blocks can be bought, if desired.

To Holders of Five-Year 5½ per cent. Canada's Victory Bonds

Issued in 1917 and Maturing 1st December, 1922

CONVERSION PROPOSALS

THE MINISTER OF FINANCE offers to holders of these bonds who desire to continue their investment in Dominion of Canada securities the privilege of exchanging the maturing bonds for new bonds bearing 5½ per cent. interest, payable half yearly, of either of the following classes:—

(a) Five year bonds, dated 1st November, 1922, to mature 1st November, 1927.

(b) Ten year bonds, dated 1st November, 1922, to mature 1st November, 1932.

While the maturing bonds will carry interest to 1st December, 1922, the new bonds will commence to earn interest from 1st November, 1922, GIVING A BONUS OF A FULL MONTH'S INTEREST TO THOSE AVAILING THEMSELVES OF THE CONVERSION PRIVILEGE.

This offer is made to holders of the maturing bonds and is not open to other investors. The bonds to be issued under this proposal will be substantially of the same character as those which are maturing, except that the exemption from taxation does not apply to the new issue.

Dated at Ottawa, 8th August, 1922.

Holders of the maturing bonds who wish to avail themselves of this conversion privilege should take their bonds AS EARLY AS POSSIBLE, BUT NOT LATER THAN SEPTEMBER 30th, to a Branch of any Chartered Bank in Canada and receive in exchange an official receipt for the bonds surrendered, containing an undertaking to deliver the corresponding bonds of the new issue.

Holders of maturing fully registered bonds, interest payable by cheque from Ottawa, will receive their December 1 interest cheque as usual. Holders of coupon bonds will detach and retain the last unmatured coupon before surrendering the bond itself for conversion purposes.

The surrendered bonds will be forwarded by banks to the Minister of Finance at Ottawa, where they will be exchanged for bonds of the new issue, in fully registered, or coupon registered or coupon bearer form carrying interest payable 1st May and 1st November of each year of the duration of the loan, the first interest payment accruing and payable 1st May, 1923. Bonds of the new issue will be sent to the banks for delivery immediately after the receipt of the surrendered bonds.

The bonds of the maturing issue which are not converted under this proposal will be paid off in cash on the 1st December, 1922.

W. S. FIELDING.
Minister of Finance.

If interested tear out this page and place with letters to be answered.

HENRY BERRY & Company Limited.

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LEEDS, England

Codes: A.I., A.B.C. (5th Edition) Engineering, Everybody's Pocket Code, Marconi International.

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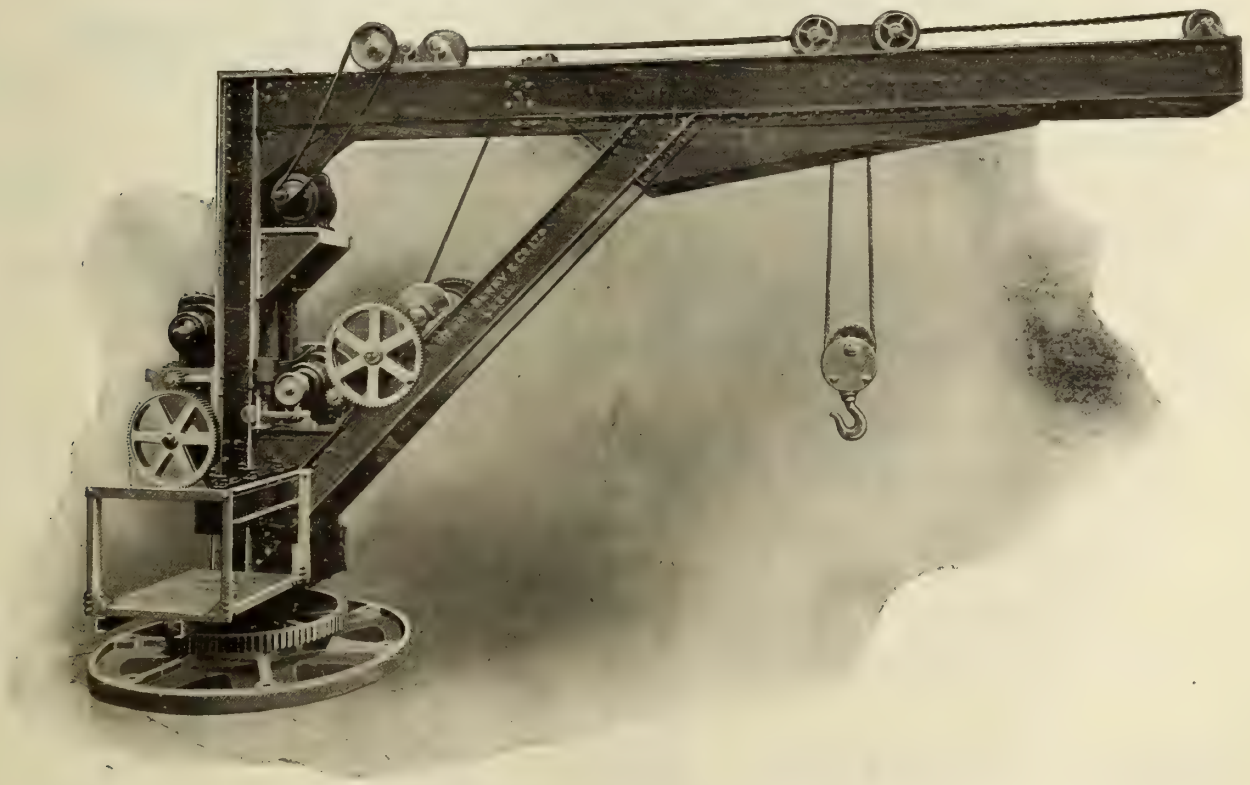

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OF

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Tested Processes in File Making

In the course of fifty years' specialization in file making we have developed processes that ensure uniform quality in our files.

When you order one of the following brands, you get the result of fifty years' experience and perfected processes.

Kearney & Foot
Great Western
American
Arcade
Globe

Nicholson File Company

Port Hope Ontario

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WIRE
BARNES CANADIAN SPRINGS
STEEL
HAMILTON, ONTARIO
CANADA

Precision

Springs

Best Grade Flat Tempered and Annealed Spring Steel;

Phosphor Bronze, Music, Brass and Tempered Spring Wire

The Hammer With The Human Stroke

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Heads 'em tight or loose, flush, countersunk, or finishes heads any shape desired, and at the rate of:
A rivet a second, sizes up to 3/16".
A rivet in two seconds, size ¼" to ⅜".
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And on special order we build machines to handle rivets up to 1½" with proportionate rapidity.
Built in eight sizes.
Besides riveting, the High Speed Riveting Hammer does all kinds of peining, swaging, upsetting, etc.
Send us sample assembly parts with rivets or sketch of your work,

and

Let us shoulder your riveting problems.
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THE HIGH SPEED HAMMER COMPANY, INC.

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The latest type of cylinders, safe, light in weight and strong.
A liberal policy of cylinder loans.
A desire to meet your requirements.
Oxygen and dissolved acetylene of a higher standard of purity than is usual for commercial use.

We will appreciate an opportunity of placing our proposition before you and quoting prices, whether for small or large quantities, before you make arrangements for the year's supply.

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They are adjustable to any angle of discharge instantly—have universal type of wheel and carefully constructed, self-aligning oil-ring bearings.

Catalog 410-77—gives technical data and prices. Write for a copy.

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It's the most reliable, speediest, safest and easiest operated, one-man hoist that you can get.

All steel construction with large overload c. pacity. Built in sizes from 1 to 10 tons. Investigate and be convinced.

We have the proof. Shall we send it?

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CONFIDENCE—

born of thirty-five years of
BABBITT SERVICE
Warrants us Giving You
IMPERIAL GENUINE

AND

HARRIS HEAVY PRESSURE
BEARING METALS

IT IS

a great and glorious feeling to serve you, knowing that your troubles will disappear with the touch of our knowledge of bearing problems.

Give us a chance to help you. WHAT ARE YOUR PROBLEMS?

THE CANADA METAL CO. LIMITED
MONTREAL WINNIPEG TORONTO VANCOUVER HAMILTON

Boosting Production

BLISS

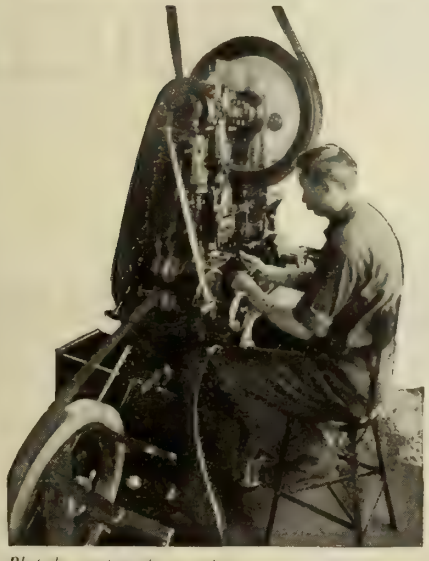

Photo by courtesy of our customer

BOOSTING PRODUCTION is an ideal way to reduce costs. In production from presses this may often be done by the use of feeds. The picture shows a BLISS No. 19 Inclinable Press specially equipped with a roll feed. It blanks, pierces and forms at one operation—production 55,000 to 60,000 in ten hours—material cold rolled strip stock .020 thick.

BLISS Inclinable Power Presses are rigid, convenient and adaptable. Built in a great number of sizes, they may be equipped with simple practical attachments which give them a wide range. There is a BLISS Press to meet every sheet metal working requirement.

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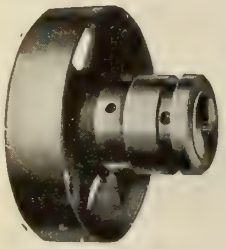
No. 317

THE JOHNSON FRICTION CLUTCH



Clutch with Pulley Mounted on Hub

as used on

"The Linderman Automatic Dovetail Glue Jointer"

as made by Canadian Linderman Co., Woodstock, Ont., Can. is an instance of how this small compact clutch is used by Builders of Wood-Working Machinery in Canada as a part of some of the best high-grade machines built.

Courtesy: Muskegon Machine Co., Muskegon, Michigan.

One No. 8 Single Johnson Friction Clutch on each machine on the large pulley gives complete and easy control over the machine at all times.

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LIMITED

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Up to
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Machine Finished

Send Blue Prints for Prices
Prompt Delivery

Canada Foundries & Forgings Ltd.
Welland, Ont.

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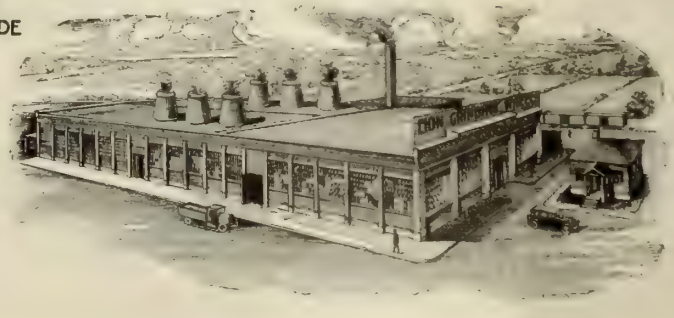
LION GRINDING WHEELS LIMITED — LION — CANADA — TRADE MARK

MANUFACTURERS OF HIGH GRADE GRINDING WHEELS

ALU-LION

For Grinding High Tensile Material



CARBO-LION

For Grinding Low Tensile Material

The Wheels You Will Eventually Buy. Why Not Now?

LION GRINDING WHEELS Ltd.

BROCKVILLE, ONT.

Agents for Prov. Quebec
J. R. Baxter & Co., Ltd.
Montreal

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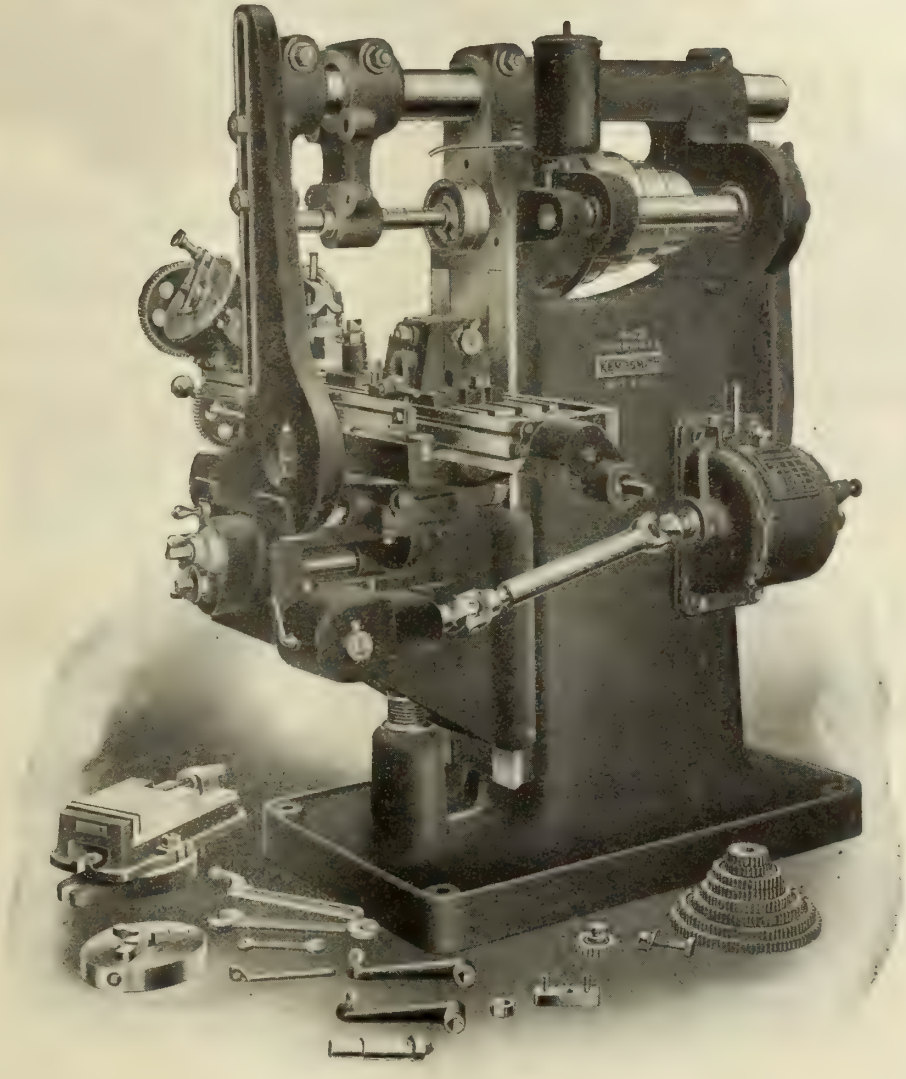
KEMPSMITH



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Thirty-two years ago the Kempsmith Company began its career in a small one-storey frame building. To-day there are four main buildings, aggregating 106,000 square feet of floor area, besides various storage sheds, etc. Every building of the plant is a model of its kind.

It has always been, and will continue to be, the purpose of the Kempsmith Company to produce machines of the highest quality only, suited to the most advanced practice.

Every machine, whatever size or type, is put to test under cuts and conditions purposely more severe than it will encounter in even the most progressive shops and when it leaves our factory it has our positive and definite guarantee back of it.

Literature will be gladly sent upon request

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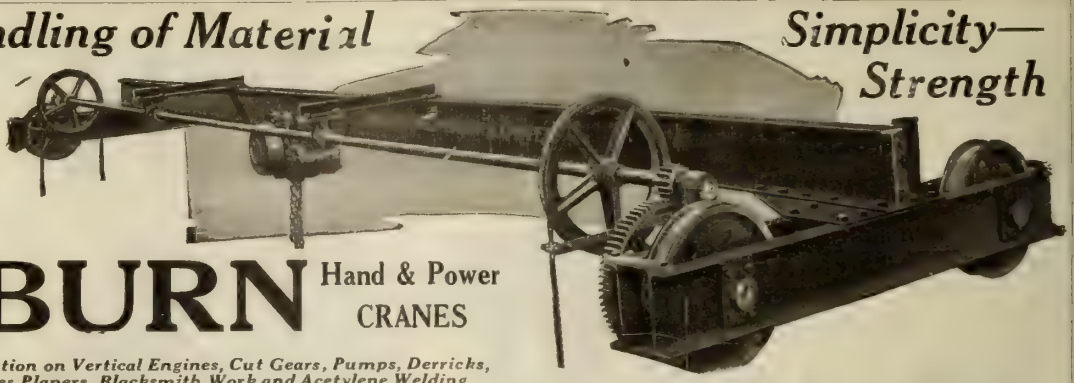

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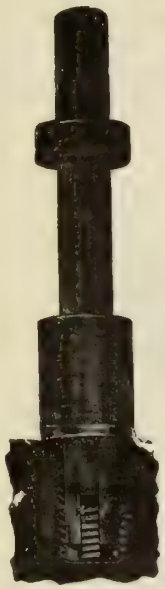

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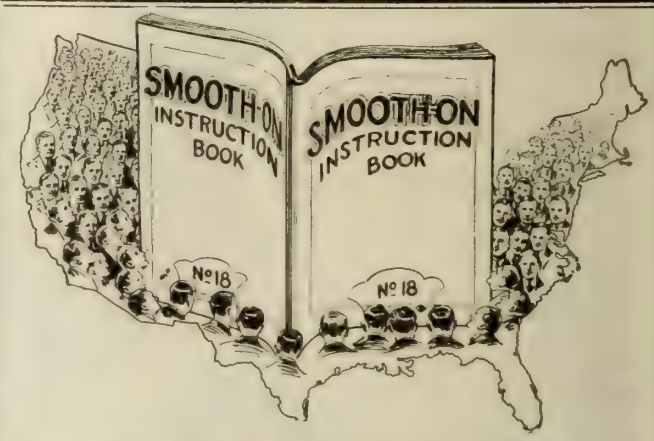

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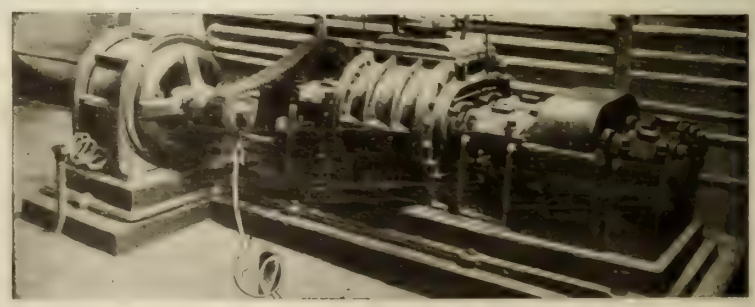

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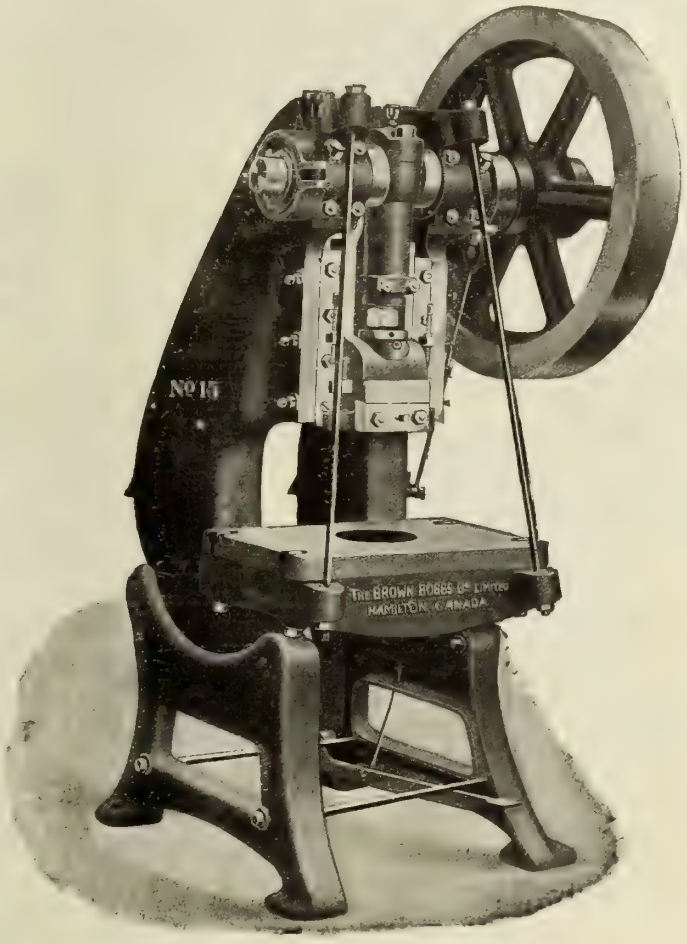

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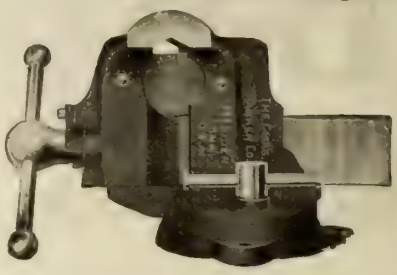

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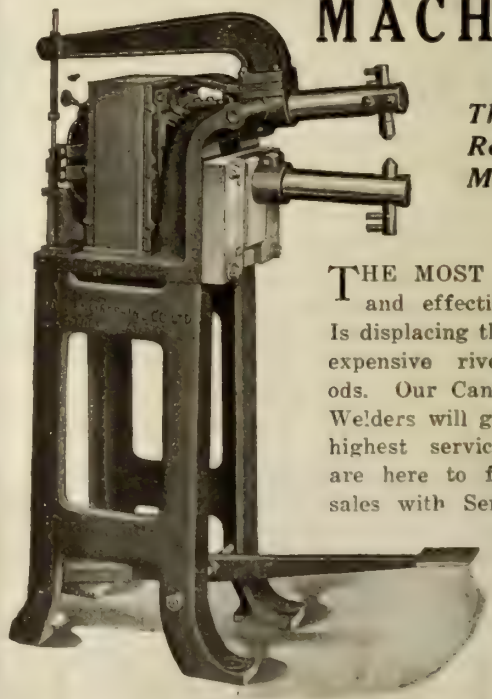

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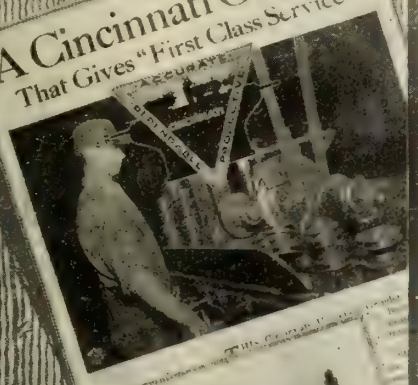

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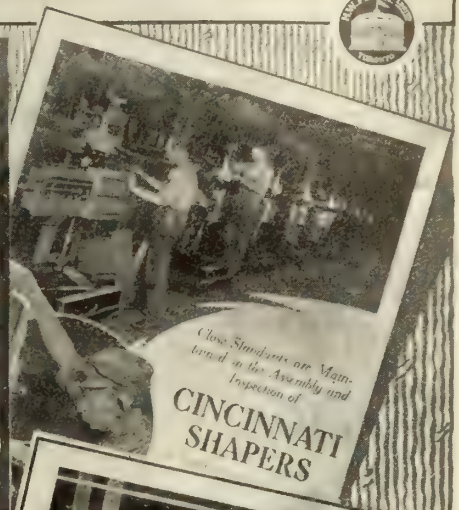

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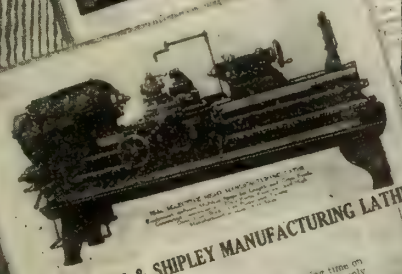

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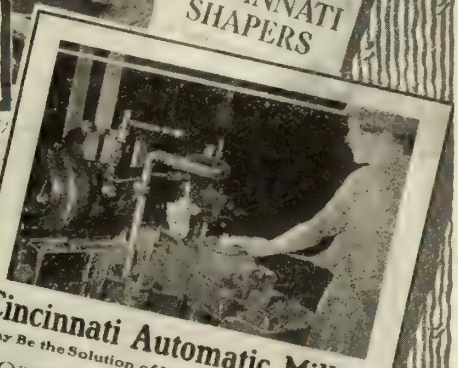

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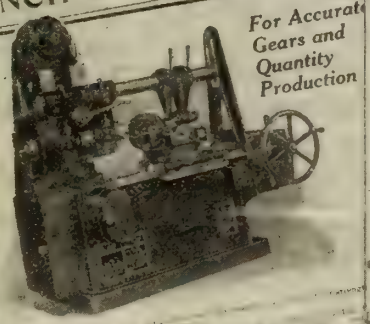

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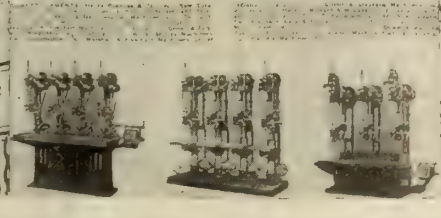

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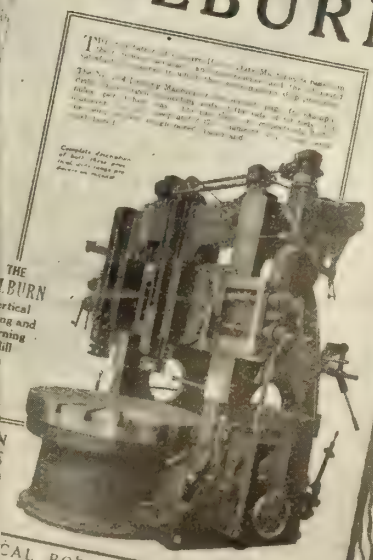

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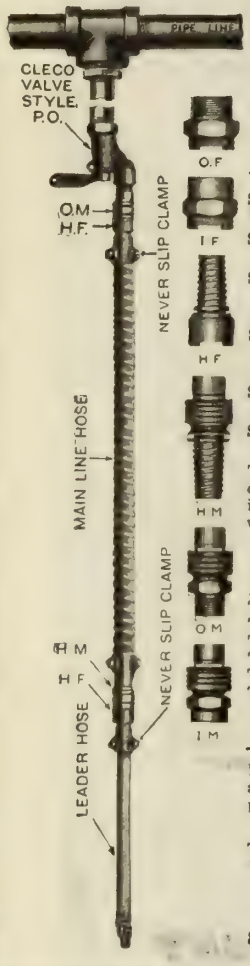

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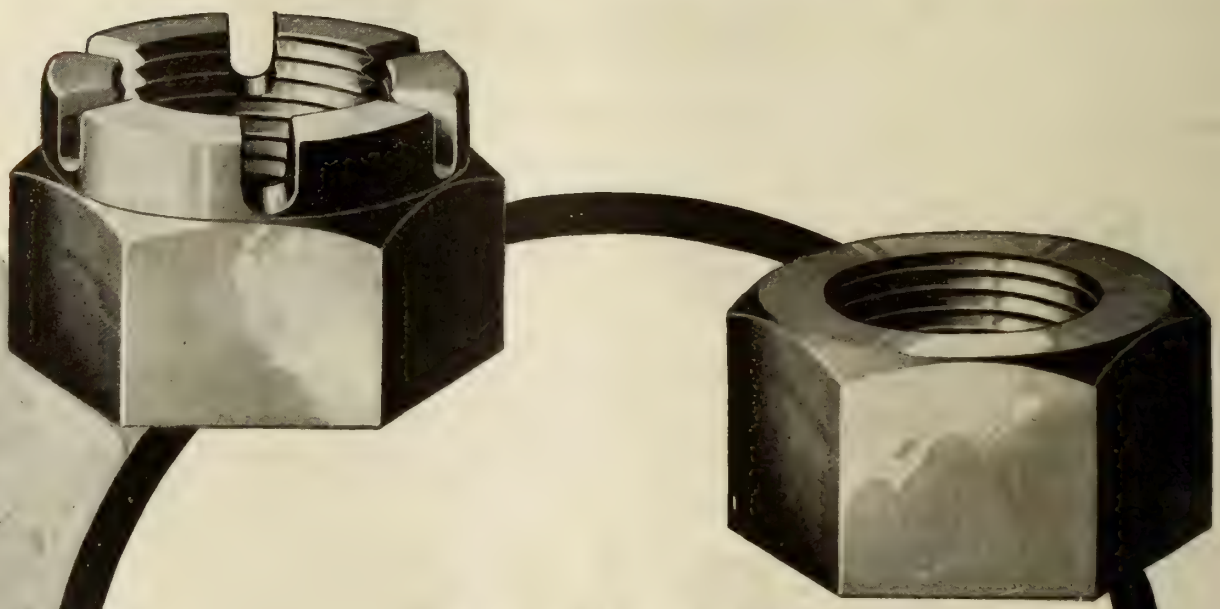

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CANADIAN MACHINERY
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VOL. XXVIII, No. 12 SEPTEMBER 21, 1922

Jigs and Fixtures Used in Producing Car Axles

Milling Trunnions on Steering Arms—Machining Front Axle—Locating Forging in Jig—Brake Drum of Unusual Design—Grooves for Dispelling Heat—Eccentric Work on Pivot Pins

By ROBERT MAWSON

MANUFACTURING automobile car axles involves interesting operations and the methods adopted in the large plant are here described and illustrated. Fig. 1 shows the jigs and tools used when hollow milling the steering arms. The forging, which has been previously drilled and reamed, is located by this machined hole on the pin A. The arms of the forging are located by means of the clamp B which force the piece back into circular grooves in the vertical wall of the fixture when the nut is tightened onto the clamp. The hollow mill C is then fed down by means of the revolving drilling machine spindle and the two ends of the steering arm machined to 11/16 in. dia., the mill being then moved over to the other position for the second prong.

Another style of steering arm is shown at D, also the style of hollow mill used for the operation; this second steering arm is also milled in this fixture. The arm is threaded 11/16 in.—16 threads per inch in a subsequent operation. It will be noticed that the fixture is provided with a second boss F which has been designed on the tool so that if at any time it is desired to machine a steering arm of the opposite hand the tool will take care of the work by fitting a locating pin in this boss on the casting.

Machining Front Axle End

The front axle end used on the Dusenberg automobile requires some interesting methods during its manufacturing in the shop. The part is made from a forging and the first operation is boring the large center hole and one of these elements after this work has been performed on it is shown in Fig. 2 at A. The piece is then placed into the jig B and located with the center plug C that fits into the bored hole. The clamp D is next dropped down and fastened with the pin as shown. A screw plug shown in the center of this clamp is then tightened down onto the forging and pressing against the spring pad E squares the piece in the jig. The swinging strap F is next dropped and this is held with a cam shaped screw. The following holes are then drilled, one 15/16 inch for the axle pin, one 7/16 inch for the lock pin, two holes for 11/16 inch 20 threads, one 9/16 inch in the spring pad and one ¼ inch. It will be observed that this jig is turned over into different positions for several drilling operations, legs or machined faces being provided in order to bring the guide bushings in line with the drills used.

Both clamps are fitted with guide bushings through which holes are drilled into the forging and in service this tool is giving the best of satisfaction both as regards quality and quantity of production. One of the finished drilled forgings is shown in front of the tool and will give the reader some idea of the work performed on it when it is compared with the piece at A, which is the rough element before drilling.

The next illustration Fig. 3, shows the fixture used for the first milling operation on the front axle end. The forging is again located with a plug that fits into the large center bored hole and the outer end rests on two height pins A. A plug is then placed in the holes B and the height pins which are screwed into the fixture are adjusted until this plug sets in a perfectly horizontal position. The clamp C is then tightened onto the forging, by means of the nut shown, to hold it securely for the milling operation. A gang set-up of cutters are then fed across the bosses shown at the forward end with the fixture located and held to the milling machine table in the usual manner and the sides of the four bosses machined to the correct width as shown.

The same fixture is employed for the second milling operation but set-up as shown in Fig. 4. The forging is again located wth the large plug that fits in the center hole, and the pin A fitting in the 15/16 inch hole machined in the forging with the jig, and this locating also fits in the fixture. Two supporting pins B are next screwed against the under side of the spring pad to hold it rigidly for the machining stresses, and the strap C being fastened down holds the forging securely during the milling operation. When the element is in the position as shown the spring pad surface D is machined using an end mill in a vertical milling machine for the operation.

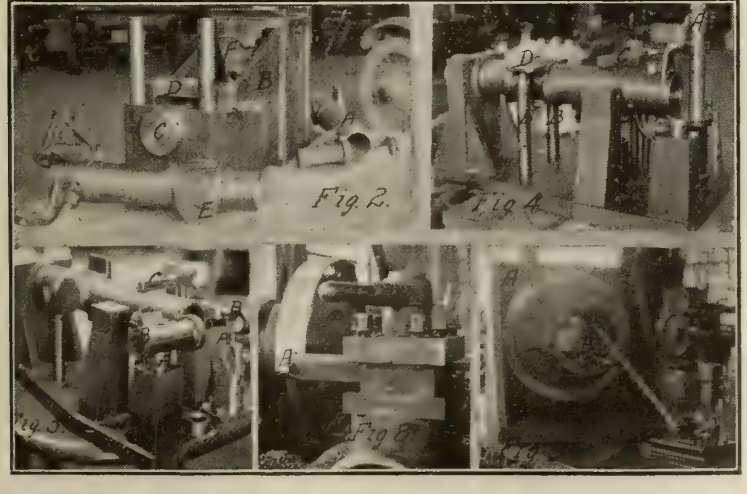


Fig. 2.—Drilling front axle end. Fig. 3.—First milling operation on axle end. Fig 4.—Second milling operation. Fig. 8.—Turning brake shoes. Fig. 9.—Testing axle pinion housing.

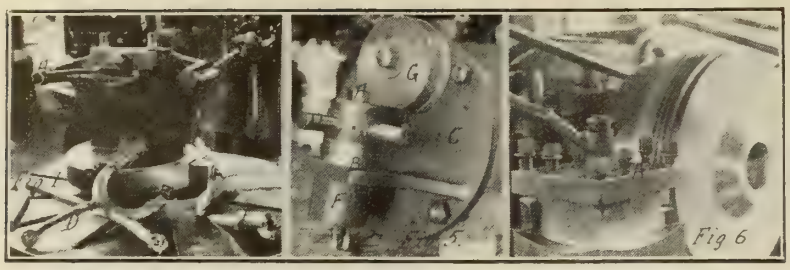


Fig. 1.—Hollow milling steering arm. Fig. 5.—Grinding differential spider arms. Fig. 6.—Turning grooves in brake drum.

The last operation on the differential spider is grinding the arms; these have been previously turned on centers in a lathe, but in order to get them absolutely smooth, to size and at right angles to each other, they are ground with the fixture illustrated in Fig. 5. The forging is located by means of a key on the plug A, a nut and washer holding the element to the face B. The face plate is fastened to the grinding machine with the bolts shown, being located by means of a register fitting a tongue in the grinding machine head. The arm D is then ground to size, the index pin E is then pulled out of the indexing bushing in the casting F and the spider moved around until the plug that located it fits the next position determined with the pin E which will drop into another bushing. The second arm is then in line for grinding and so on until all the four arms have been ground to size. A balance weight G is provided on the fixture so that the fixture will revolve smoothly during the grinding operation.

The brake drum is of rather unusual design being made with grooves in order that the heat generated during the braking action can be dispelled by having more surface in contact with the air, these grooves providing this additional surface. This drum is first bored and turned all over and then held in the chuck shown in Fig. 6. The six grooves which are 5/16 inch wide and ⅜ inch deep are then machined using the multiple tool set up held in the tool post A. The machining of the grooves was tried first to form all six at once, but it was found that better time could be made by turning three and then setting over the tool post and machining the other three in separate setting, a guide being provided in the multiple tool to drop into one of the grooves so that the operator will know when he is in the proper location for the second forming of the grooves.

The steering knuckle pivot pins used with the hydraulic brake cylinders are manufactured in rather an interesting manner. The hole is made eccentric with the shank so that as the shank is rotated by the automobile operator through the brake rods the cylinder will allow the fluid used to bring the braking action into effect and slow down or stop the car as desired. The pin is first machined in a lathe to the shape shown at A in Fig. 7. This is a somewhat ordinary machine shop operation and is done by turning the shank B with one pair of centers and then using a throw dog center at the shank end equal to the amount of eccentricity, in this case 11/32 of an inch, and using a new center at the head end equal to this throw. The turned pin is then placed in the fixture C with the head end protruding as shown, four screws placed in the knurled section D are then tightened down as these are fitted with copper shoes the surface of the pin is not injured.

It will be observed that the fixture face plate is attached to the lathe in an offset position, in other words not on the true center line of the machine, the amount of this offset being equal to the eccentricity desired, namely 11/32 of an inch. The following operations are then performed on the head end of the element bore, and ream 1½ inch diameter 1½ inch deep, counterbore 1 9/16 inch 1/8 inch deep, turn outside diameter to 1¾ inch and for a distance of 1⅝ inches. The tools used for the work are operated in the turret head of the machine and the set-up used when reaming and turning the outside may be seen at F and one of the finished pins is shown at G.

Turning Brake Shoes

Turning the face of brake shoes is considered one of the difficult problems in many automobile manufacturing plants; these elements are made of rather thin section and have a wide face to be machined which must be true, otherwise the brake would not operate smoothly. This problem has been solved in a simple and positive manner at this plant and is shown in Fig. 8. The brake pin holes are first drilled and reamed in the bosses, the casting being located in the jig from the outside rough surface of the piece. Two of these brake shoe elements are then placed on the face plate fixture shown in the illustration, being located and held with pins that fit accurately the reamed brake pin holes. The braking surface is then turned with the tool A, and as the castings are located correctly, held firmly and the tool used as may be seen is also of rigid construction, the surface machined in all that can be desired.

The fixture used for testing the rear axle pinion housing is shown in Fig. 9. This operation is performed after the element has been completely machined. The housing is located in the fixture by means of a turned register which fits into an accurately bored hole in the vertical wall A of the fixture. The three clamps shown are then tightened up slightly not to hold the part securely but merely to prevent it falling out. The dial B of the indicator is then set to zero and the housing revolved in the register hole of the fixture, the tester taking the reading from the indicator dial to see what variation if any is present in the large machined hole in relation to the locating register. On this element a tolerance of two thousands of an inch is permitted and any housing not meeting these requirements is rejected as not being within the accuracy demanded on this part.

This will convey to the reader some idea of the carefulness of the machining operations demanded at this plant and such requirements could only be complied with by the use of accurate jigs and fixtures and yet meet production; without such special tools the problem would resolve itself into a tool room proposition.

1922 VICTORY BONDS

Returns received to date by the Department of Finance indicate a very general acceptance of the proposals for the conversion of 1922 Victory Bonds into new bonds bearing 5½ per cent. interest and running for a further period of five or ten years as desired. Many holders would like to take up considerably more of the new bonds than they have of the maturing issue, but this is not permitted as cash subscriptions are not being invited at this time. It is open, of course, for such persons to add to their holdings of 1922 bonds by purchasing them in the market or from holders who require the cash and then to surrender them for new bonds. It is known that this is being done.

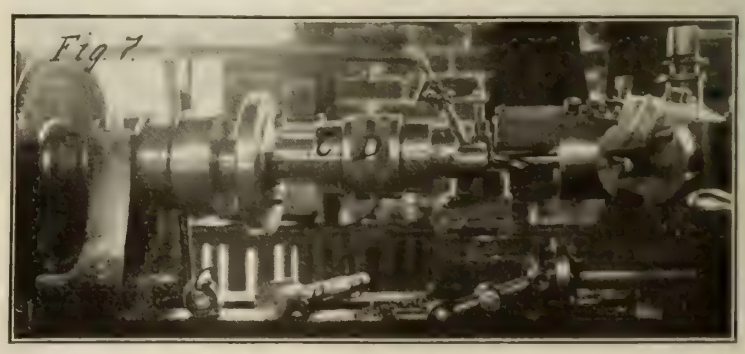


Fig. 7.—Machining steering knuckle pin.

Training of Apprentices Has Its Speed Limits

Theory That There Are Short Cuts to Destiny Too Much in Evidence—Hamilton Manufacturer's View—Responsibility of Home and Parent—Present-Day Ease and Old-Time Fire—Boys Still Indentured by Bertram's

THAT manufacturers of machinery are not depending altogether on the prospect of a supply of apprentices from the technical schools is evident from the encouragement they are holding out to boys whose ambitions urge them toward the engineering field. Not that there is any serious fault found with the idea of technical training in the schools—anything that educates tends to higher standards—but the apprentice will always be an adjunct of industry and there are different methods by which the same end may be achieved. It cannot be imagined that a manufacturer should disapprove of technical education for there are those at the head of Canadian industries who owe much of their success to well-disciplined, early association with technical training and the most practical kind of application in actual machine shop practice.

But there is a feeling to-day that the youth from the technical school cannot always content himself with the position available to him when he emerges from the shell of instruction to make his first scratch upon an industrial pay-roll. There is a great difference in boys; to some the first rung of the ladder and a clear vision ahead is all that is required, while others have given the impression that they have arrived before they are there. They demand positions for which they have not been equipped through experience.

Fifteen the Preferred Age

"Eighty per cent. of the apprentices we have entered in our shop have carried on until they were through," said P. F. Ford-Smith of Hamilton, while discussing the apprenticeship question with Canadian Machinery. In this shop, the boy is introduced to his chosen calling under modern practice and conditions—careful supervision, well-balanced arrangement of tools, and reasonable encouragement.

"We prefer to have a boy at the age of fifteen or sixteen," continued Mr. Ford-Smith. "The boy's parents are first consulted, they are advised fully as to the conditions under which he enters our employ, while on our part, we must convince ourselves that he is adapted to the work, and that he is the kind who should make good. In our experience, however, we find that the boy coming from a well-to-do home, who has everything he desires and has little to worry about is not the most satisfactory. Very often his parents interfere with his application to work, desire that he should have protracted holidays and are anxious that he be preserved untested and unsoiled. The word apprentice doesn't appeal to this class of people.

"In my opinion there is nothing like the fire of experience and wisely directed discipline. The old-timers passed through it and on looking back declare it to have been very good. But we are living in a speedy, pleasure loving age. If there isn't a royal road to destiny, a boy of eighteen is prepared to map out one. He knows, and he must be moving on. Speed, I am afraid, is the hand-maiden of superficiality. At least it is in the machinery business, for I've been over the road myself. Many an old-timer from the Old Country will tell you about having to jump out of bed at five o'clock in the morning, as a boy, take his day's meals with him to the shop and consider his turn at technical schools as part of the day's work without inconvenience to his duties as an apprentice and without reward. Why, training was such that at thirteen a boy knew as much about hydrostatics, mathematics and all the rest of it, as some of to-day's youths graduating from the universities. Remember, I am not advocating these strenuous courses for to-day. But I want to point out that it was a system that produced mighty thorough engineers.

Encouraging the Boy

"When a boy enters our employ as an apprentice, we pay him 14 cents an hour. I will admit that he has a little more to do than the boy who has the job of delivering the early morning or the evening paper, and is paid $5 per week for heaving the news of a palpitating world in the general direction of the patient subscriber. In time the boy may learn to strike the house, but one can't very well call that a life mission. The boy in the shop is supposed to be working toward a destination. He begins work on a lathe and in time becomes acquainted with gears and mechanisms and blue prints. His training includes a period in the designing room. Our system is to keep quite as close a record of that boy's conduct and development as does the school. We have merits and demerits and at the end of a certain period, say six months, we present the boy with a micrometer, or a square or some other necessary part of a kit, by way of reward for good work. Some boys, of course, are quicker than others, but we have tried to impress the importance of thoroughness and of serious application. These are the things that count in the end. I recall one boy we had with us who was somewhat exceptional. Smart as a steel trap, he seemed to outstrip everything, and the development of importance in his vicinity was something to give one pause. He was a good speaker and had ideas about organizing his fellows for various purposes. He is now a minister or evangelist somewhere in the States where he has scope for a rich imagination without restricting it to the hundredth part of an inch.

"As manufacturers, there appear to be

Developing pattern makers at the woodworking department of a large technical school.

quite a number of us who think the adolescent act is a little too hard on the parents who cannot afford to keep grown children at school for the period required. That extra two-year period might have come easier had it been made a matter of five and ten years. Manufacturers nowadays want to do the right thing by young people. They are the ones who must carry on, but it is first essential that the home be right. That is where the tendencies that we sometimes deplore in present day rush must be safeguarded against. We parents must have confidence in each other. Given the right outlook, there can be no doubt about the result.

"Apprentices of to-day are reaping the advantage of yesterday's application. In the early days the period of training was seven years. Now it is four years, but the development of machinery has been such and the progress made in the application of electricity, pneumatics, automatics, that one might almost say that the intelligence of a machine goes a long way in the elimination of that extra three years. Operations that were once considered quite a delicate matter have been reduced to absolute simplicity. Still there is wonderful scope for brains in the engineering field.

Technical System Not Perfect

"Let me repeat that I have no complaint to make with regard to technical education. It increases a boy's fund of knowledge and improves his usefulness. We cannot all agree that the system is perfect, as for example, requiring a boy to break away from his work in the shop during the middle of the afternoon in order to attend class, but there is nothing that cannot be remedied in time. You may count on me as a friend of the boy and of anything that makes him a better citizen. If a crisis comes, we will undoubtedly have our apprentice requirements met. It developed that way during the war, although not all of those who went out as machinists and toolmakers afterwards could properly be called such. Some remarkably good men may be numbered among those who began their apprenticeship after the age of twenty. Such men have an idea of responsibility not always found among the youngsters and turn out to be most dependable. One sometimes wonders where our supply of apprentices for all industries will come from, but I guess the law of supply and demand will take care of that question, as it does of most others."

Gentlemen Apprentices

Mr. Ford-Smith recalled earlier days when scions of prominent families identified themselves with industry as gentlemen apprentices. Some of these boys made good, but the majority did not and were terribly bored. Such apprentices however, netted a firm £200 each and it is known that receipts from this source sometimes paid the salaries of the executives in the business. The amount had to be high, however, because breakage and spoilage were sometimes considerable items.

Apprentices Bound Here

John Bertram & Sons Co. still employ the indenture system. This is a matter between the firm and the parent or guardian. A fee of $100 is required, and if this is not paid at the time the boy is bound as an apprentice, the sum of $2 is retained from his weekly salary. This amount is placed in a bank in the boy's name and at the conclusion of four years, when his training is complete, he is handed back his $100 with accrued interest. It is quite a nice little nest egg.

"We prefer that a boy should have two years in the collegiate before we take him on," said Chas. E. Dickson, secretary-treasurer, "and we consider that the best age is about fifteen years. A great deal depends on the boy, of course. Among the best apprentices we ever turned out were three young men about twenty-one years of age. They completed their training and are now doing well. It is not a difficult matter securing machine shop apprentices in Dundas where a trade is pretty much a matter of heredity as in the Old Country. There is a real apprenticeship problem in connection with the foundry industry, but more castings are being made to-day than ever before. Machinery is helping in the solution in such a way that any intelligent man can very shortly become a producer. Improvement in conditions associated with the industry will probably attract more men to it."

MONTH'S EMPLOYMENT RECORD IMPROVES

THE volume of employment in the iron and steel group increased considerably during July, states the Employment Service bulletin, mainly on account of the resumption of operations in several of the railway car shops, which had been temporarily closed down at the end of June. In addition, noteworthy improvement was recorded in the crude, rolled and forged division, supplemented by increases in employment on a smaller scale in boiler, engine and hardware factories and in the production of structural iron and steel. On the other hand, steel shipyards were decidedly less fully employed. All provinces except British Columbia shared in the upward movement, but the expansion in Ontario was more pronounced than elsewhere. The 730 concerns making returns reported 110,130 persons on their payrolls as compared with 102 105 on June 30. There was, therefore, an increase of 8 025 persons or almost 8 per cent. Increased activity on a much smaller scale had been indicated in this group during July of last year but the index numbers for the two periods were approximately the same.

Employment in electrical apparatus has fluctuated considerably since the beginning of the year, but the general trend has been favorable. The largest increase of the year was reported during the period under review, when 239 persons were added to the staffs of the 83 concerns making returns, whose payrolls covered 6,126 persons, an increase of approximately 4 per cent. over their June staffs. Establishments in Ontario absorbed the majority of these workers.

Continued activity in summer operations was indicated in railway construction and maintenance. Statements tabulated from 31 concerns and divisional superintendents indicated a total payroll of 49,259 persons as compared with 45,626 on June 30. The bulk of this 8 per cent. gain was reported in Ontario and the Prairie Provinces, although expansion was also registered in the other districts. The advances made during the same month of last year had been only slightly smaller than for July, although the index number at that time stood considerably lower than for the period being reviewed.

The volume of employment afforded by building construction showed a further increase during July, mainly in Quebec and Ontario. The 328 firms reporting, whose pay-rolls included 19,278 employees, indicated that they had enlarged their working forces by 1,026 or 5.6 per cent since the end of June. Expansion on a much smaller scale had been evidenced in July of last year and employment in the group was on a higher level for the period under review than at that time.

Another large increase in activity occurred in railways during July, 1,794 persons having been added to the staffs of the 125 concerns and divisional superintendents reporting. As the total payroll included 74 361 persons, this indicated a gain of 2.5 per cent. All provinces shared in the upward movement to some extent, but the gains in Ontario and the Prairie Provinces together formed 85 per cent. of the entire increase. The seasonal expansion reported during July of last year also had been somewhat more extensive but the index number at that time was slightly lower than for the month under review.

Shipping and stevedoring.—Varying conditions were recorded in shipping and stevedoring, resulting in a net increase of 396 persons or nearly 3 per cent. Sixty-three concerns reported an aggregate working force of 14 361 employees as compared with 13.965 on June 30. Quebec harbors were very much busier, while at the New Brunswick and Pacific ports reduced activity was registered. The level of employment in this group was very much higher than during July of last year.

It is always advisable to use light pressure when starting to grind on a cold wheel, gradually increasing the force as the wheel gets warm. This prevents the wheel from expanding rapidly and eliminates breakage. This applies particularly to starting work in the morning in cold weather where temperature of room is low during the night, or when wheels are stored in a cold place.

Making Steel Forgings With Header Machine

Intricate Parts Formerly Made on a Power Hammer Now Pressed Into Shape on an Upsetting Machine—Pole Piece is Forged in One Operation and a Ring Gear in Three

By H. E. DILLER

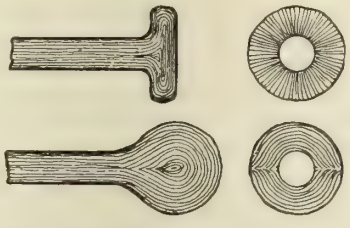
RIGHT forgings usually are made by hammering the metal stock into the desired shape, either on a board, or true drop hammer, or on a steam hammer. Large hydraulic presses have been employed for a number of years in forging shafting and similar shapes which are simple in design. The header machine, which also operates on the pressing or squeezing principle, has been used for forming simple shapes on the ends of rods but only recently has this principle of pressure in distinction to blows from a hammer been used in making forgings of more intricate design. For this reason the operations in the forging plant of the Dayton Engineering Laboratories Co., Dayton, O., a subsidiary of the General Motors Corp. manufacturing starting sets, is of great interest. Here under the direction of Edward Hughes, supervisor, tool division, some intricate forgings are being made on a header or upsetting machine, and experimental development work is being carried on continually to broaden the scope of the machine for this class of work.

The principal advantage of making forgings on the header machine is the direction it gives to the grain of the metal in forging, states the author in Iron Trade Review. The die presses out the metal parallel with the radii of the bar stack, while in a drop hammer forging, the metal is hammered down in the direction of rolling. This causes the grain of the metal to run irregularly in the forging instead of radiating from the center as in the forgings from the header machine. This is more clearly illustrated in Fig. 1 which is a line drawing showing at the top what takes place when a forging is made on a header machine, and at the bottom the direction of the grain of the metal when the forging is made on a drop hammer.

Lower Upkeep Costs

Other advantages claimed for the header machine are higher production and lower upkeep cost. Against these advantages must be weighed the higher first cost of the header machine. Installed, such a machine costs about four times as much as a steam hammer or about eight times as much as a true drop hammer driven on a line shaft. However, the die costs by the different methods are approximately the same, although dies are more apt to be broken when used in the hammer on account of the shocks received at each blow.

The dies are all built in sections and sectional parts are standardized as much as possible to make them interchangeable and to facilitate replacements and repairs. Then when a piece is broken or worn out it can be replaced without the expense of making a complete new die. Time as well as expense is saved by this precaution. The dies and inserted pieces usually are made of a high carbon, chrome-nickel steel heat treated to give toughness rather than hardness. After heat treatment the die is tested and must show a scleroscope hardness of between 65 and 70 to be accepted by the inspection department. The standard metal for dies and inserted parts contains between 0.80 and 0.90 per cent. carbon; approximately 3.0 per cent. chromium, and between 1.75 and 2.00 per cent. nickel. Sulphur and phosphorus are kept low, usually under 0.02 per cent. while silicon averages around 0.2 per cent. and manganese between 0.35 and 0.40 per cent. Occasionally a steel with 3.50 to 4.00 per cent. chromium is used, and a tungsten containing approximately 12.00 per cent. tungsten, 3.25 per cent. chromium and 0.65 to 0.70 per cent. carbon is being experimented with. Die blocks are made from a lower carbon chrome-nickel steel with approximately 0.60 per cent. carbon, 1.00 to 1.50 per cent. nickel and 3.00 per cent. chromium.



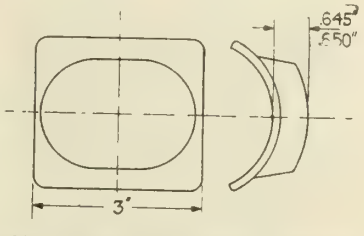


Fig. 1.—(Above) Distortion of grain by a header machine; (below) distortion by a hammer. Fig. 3.—Right, pole piece made in a header machine.

Dies frequently too heavy to be handled by hand are brought to the header machine on an overhead I-beam trolley to which is attached a chain fall. The dies are equipped with eyes screwed in holes in the top and the chain is hooked to these.

To secure the enormous force necessary to press the steel into shape, the 20 h.p. motor is connected to the operating mechanism by means of reducing gears and pinions. In operation the machine operator places a bar of stock against a stop guide and then with his foot presses the control lever. This meshes the driving gears, raising the stop guide, bringing the gripping dies together and pressing forward the shaping die. Space is sufficient for placing the dies three high so that three operations can be made on the same piece of stock to form the forging.

Furnace Burns Gas or Oil

Although at present burning producer gas the furnace can be operated with oil. As originally installed the furnace was heated by eight burners at the back and two at each end. However, it was found advantageous to dispense with the burners in the back of the furnace and to lower the burners at the ends. Now the

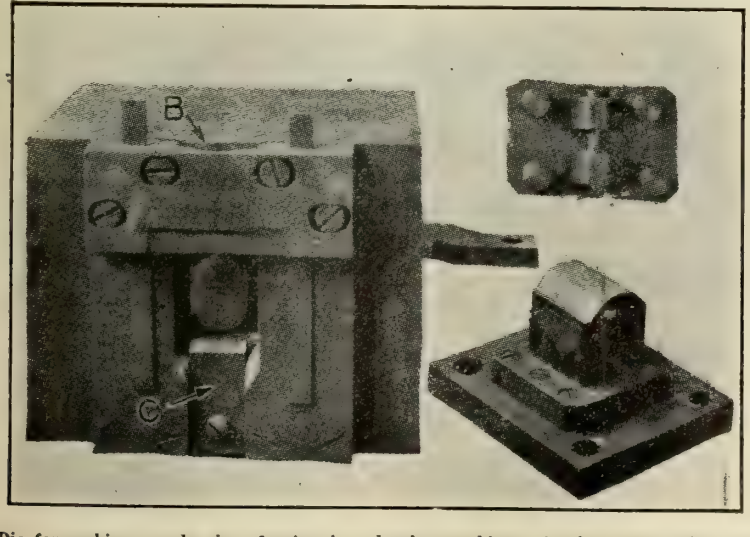


Fig. 2.—Die for making a pole piece forging in a header machine. At the lower right is the plunger die and at upper right is the lug to which the taper wedge controlling the ejector is attached.

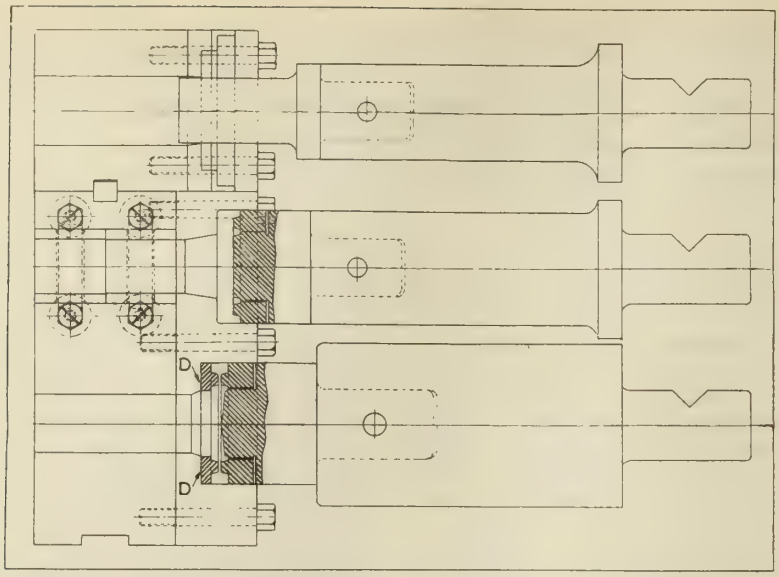


Fig. 4.—Ring gears are made in three operations. The first forms one side of the forging; the next completes it, and the third pushes it from the bar of stock.

end burners are the only ones used and the flame enters at both ends of the furnace about one foot below the level of the bar stock. It then passes up through openings in the roof and, in escaping, heats the two 4-inch gas pipes and the 12-inch air pipe on top of the furnace.

Method of Operation

Ordinarily the stock for the forging is fed into the machine from the front but to make this forging it was necessary to feed the metal from the top. Fig. 2 shows the die, and the hole through which the stock is introduced is indicated at B. Accurately rolled bars, 1½ inches in diameter, are used. The hot bar is set in the die until it rests on the stop C. Then by tripping the machine the movable die shown at the left, Fig. 2, is moved forward by the plunger to which it is bolted. This cuts off the metal exactly the same length at every stroke forcing it into the forming die and making the pole piece, therefore the necessity of having the stock of regular dimensions. Of course, if a lot of bars which do not measure exactly 1½ inches in diameter is received, the bars can be used if they are of a uniform size. This is accomplished by adjusting the stop, C, Fig. 2, so that the length of the piece sheared off will be correct. Adjustment is made by the set screw shown near the base of the stop.

After the pole piece is formed the punch moves out and an ejector arm forces the pole piece from the die, allowing it to drop on the floor.

Helper Controls Machine

At present some difficulty is encountered in the operation of making this forging as the machine operator standing on the machine to feed in the stock is unable to trip the machine as he does when standing in his regular place before the machine. After the helper hands the operator a heated bar he waits for a signal from the operator and then trips the machine. However, arrangements will be made so the operator can trip the machine from his position on top. This incident is interesting as showing the developmental stage of the process and the resourcefulness of the engineers.

Scale is blown from the die with a jet of compressed air after each operation. The die is also swabbed with a light mineral oil to assist in keeping it cool, as no water is used for this purpose.

A somewhat more intricate forging made with three strokes instead of one is the ring gear, Fig. 5, used on the starting clutch and forming the connection between the starting motor and the gasoline motor on an automobile. The 2 3-8 inch round bar stock for this forging is fed into the machine in the regular way. Fig. 4 shows in detail the three dies and the stock. The die in the center performs the first operation. When the stock is put in the machine until it touches the die at the back, the machine is tripped. The side grippers, shown at the left, come in and grip the stock firmly; the ram, attached to the die block at the extreme right, moves forward heading up the bar and putting a shoulder on it. The dies then move apart allowing the stock to be withdrawn.

After the first stroke a ring, which had been placed on the bar by the helper before the first operation, is slid up against the back face of the forging blank. The blank and the ring are then placed in the die in the lower, or second position. The ring may be noted at D D, Fig. 4. As the heading tool comes up it enlarges the outside diameter and thins the blank to the required dimensions, the ring forming a circular channel on the back of the forging and the punch bringing to dimensions the channel formed in the front of the blank by the first operation. The stock with the blank is then taken from the die and placed in the upper die. This pushes the bar out of the blank leaving the finished forging. Then as the die opens the ring falls on the floor and after being reheated the head of stock is ready for another ring. No waste of stock is necessary in making these rings as when the bar becomes too short to handle it is electrically welded to a new bar. Small gear rings without the H section are made in two strokes, it being unnecessary to use the ring which is essential in the second operation when forming the rings with an H section.

The magnet core made in a solid piece 2⅛ x 3 x 3 inches with a ¾-inch radius at the edges offers a somewhat different problem from the forgings described. This is made in two operations from 1¾-inch round stock. The first stroke gathers the stock into a section 2⅛ inch in diameter and necks it on two sides. The second stroke, as the die closes, shears off the gathered piece at point at which it is necked and carries this piece over to the impression in the die. Then as the heading tool comes up it forms the piece to its final shape. The heading tool comes up as the die closes and as the ram recedes the die opens and the formed piece drops out. A special advantage of forging this piece on the header machine is that it can be secured close enough from the header to eliminate the milling operation for length. When made on a drop hammer it always was milled, then finished by grinding. These forgings made on the header are only ground.

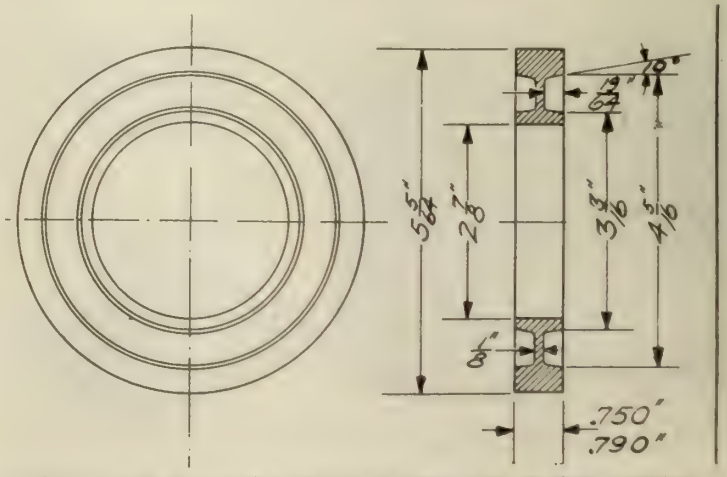


Fig. 5.—Ring gear forging with an H section made in three operations.

Speeding Up Industrial Painting Operations

Easy Manipulation of the Spraying Apparatus—Evenly Coated Surface—Greater Output With Less Labor—Proper Ventilation of Painting Chamber Necessary—Heating the Mixture

FROM the very commencement decorative art manufacturers and artists have used hair brushes and hand methods in finishing coated surfaces. The higher costs and keen competition of modern civilization, however, paved the way for improved methods of applying materials to surfaces to be coated with liquid paints or varnishes o any description.

Where a number of colors or variety of finishes are required on a large surface, or a reasonably large quantity of articles, the spray method of application is to be preferred over the hand brushing process. Not only does it effect a great saving in labor but the speed and uniformity of the work places this process in the front ranks of the attack on the problems of economic industrial management.

The paint gun, or air brush, as it is frequently termed, eliminates the tedious method of slowly and incessantly wielding a hand brush where the hands become covered with paint and the surface being coated is occasionally marred with a stray bristle extracted from the brush. The utilization of compressed air has increased the efficiency of the painter in many ways and the application of liquid coatings at the present time is practically unlimited. From the painting of ship hulls to the finest finishing of commercial articles the spray method has a wide and varied field. Not only in the coating of a surface does the spray gun prove its superiority, but in the hands of a skilled operator, or the workman endowed with ordinary intelligence, the blending of colors becomes a comparatively simple accomplishment.

With a spray gun there is practically no waste of material. The coating may be applied in any reasonable degree of thickness, as the equivalent of two brushed coats may be obtained at one application, if desired. It makes it possible to effectively coat surfaces that would be virtually inaccessible or difficult to cover with a brush, and rough and irregular places are easily and uniformly coated with the spray. One important feature of the spray process is the fact that there is no appreciable wear on spraying apparatus and rough surfaces are coated as readily as smooth. Brush work on brick, concrete and like substances is very destructive to the bristles, and replacements are costly.

One of the difficult problems to contend with in connection with spray painting, however, is the satisfactory solution of proper ventilation and removal of the dangerous fumes. Experiments have been made with small fans and heavy blowers or motor-driven ventilating outfits. Few of these have entirely satisfied the needs for continuous performance.

When paint spraying of small objects is carried on to any great extent it is advisable to install or erect a suitable cabinet or compartment scientifically designed to draw off all the fumes generated by the spraying apparatus. The exhaust fan must be so constructed that the air and fumes which are being exhausted from the painting cabinet do not pass through or come in contact with the motor mechanism. This is a very important factor as the paint or varnish spray is detrimental to the proper working of the motor.

Another condition that should be observed in regard to efficient spraying of paints is that of keeping the material at the proper temperature for maximum effective flow from the container through the connecting hose to the spray nozzles. Moisture, no matter of what nature, is dangerous to high grade work and will often ruin the finished surface. Heating the spray has numerous advantages over spraying with raw, cold or damp air, and liquids below the proper degree of temperature. Special electric heaters are provided for this purpose which are so constructed that the compressed air is thoroughly heated by passing through a red hot copper coil, whereby the air is purified, dried and heated, to facilitate the proper spreading of all paint, varnish, enamel, shellac, and other liquid materials.

Owing to the character of the work the handling of painted articles requires special facilities in transferring them from the painting cabinet to the drying rooms. When the parts are handled in small quantities the drying may be carried on in the same room, but where large production is required it is advisable that drying take place in a separate department. After the coating has been applied the article should be delivered to the drying room with the least amount of handling. The use of conveyors is an ideal method of delivery where the parts can be easily handled by hand, and where the nature of the work will permit the conveyor could be made to pass directly through the painting chamber, the work entering from one side and delivered from the other. Under such conditions the painting operator could control the movement of the conveyor, stopping it long enough to paint the work and allowing it to advance for the next article.

The installation of a revolving table in the painting chamber is also an advantage as it permits the operator to reach all surfaces without touching the article. If a conveyor is used in conjunction with the cabinet it is well to have it on the level of the table so that finished articles can be transferred with the least effort and handling.

PAINTED MACHINE TOOLS

As an indication of the dollar and cents sales value of a suitable finish properly applied to machine tools the following statement was made recently by a Canadian manufacturer:—"At an exhibition in which were shown English, American and German tools a great difference was noted on the finishing. The German and American tools were very much alike and although the machine work on them was vastly inferior to that of the English machines, the application of a dull finish brought out in strong relief every favorable point of their machines so that they seemed to be much better than they actually were. On the other hand the English machines were finished in brilliant enamel glossy finishes which brought out every imperfection in them without giving any distinction to the good points, so that even though the latter were visible to the eye the effect of them was lost on the observer owing to the prominence given the imperfections by the high finish. That did nothing to emphasize the costly brass work and careful attention to detail. The consequence was that the inferior machines (mechanically) had an advantage over those of higher grade.

"I have seen so many instances of a similar nature that I haven't the slightest hesitation in saying that there is a big field in Canada as in England for the development of this side of machinery marketing and a great deal needs to be done to educate our manufacturers to the value of the intelligent use of paint for show room and other sales purposes. It is not enough just to use paint. It must be the right kind of paint in the right place and that is something that should be entrusted in a large way at least only to a man who has made a study of the problem and of the effects of different combinations of colors on the objects to which they are applied."

Safety hoods when installed on grinding wheels should always conform as near as possible to the periphery of the wheel, and should be so designed as to leave exposed the least portion of the wheel compatible with the work. It is advisable that the hoods be adjustable so that the opening in the hood can be reduced as the wheel wears, so as to afford the maximum protection at all times.

Industry Reveals Many Interesting Sidelights

Long Service Records Held by Men of John Bertram & Sons—Machine Tool Maker in Fruit Business—Companies Merge for Cheaper Operation—U.S. Buys Canadian Machines

WHERE grandfathers and fathers and sons and sons-in-law are actively engaged in the same industry, one natually expects to hear of Old Country industrial heredity, or of family specialization for generations in various departments of one particular calling. But although the setting might well be England, and eloquent of scenes that are peculiarly of the Old Land, it is not actually so. It is Dundas, Ont., and the plant that of John Bertram & Sons Co., Ltd. Here are men who have been "on the strength" for 25, 30, 40, 50 years. In fact, there are men who, like George Turnbull, were on the payroll when the present Gen. Sir Alex. Bertram was also at work there at a dollar a day, and there is still that mutual friendliness which quite as whole-heartedly and acceptably greets him with "Hello, Alex.," when he visits the plant, as in those youthful days of 60 years ago. Loking about him he still sees sons and sires and grandsires and great-grandsires who have grown up in the industry. It is one place where a man's record is no flitting thing of a year or two and where loyalty and co-operation have surely counted as appreciable factors.

It was somewhat amusing recently facturer a great length of time to distensive plant, a visitor was introduced to one of the young men at work on a machine. It was here that the conductor, with a twinkle in his eye observed, "Of course, Bill is hardly one of us yet; he has only been here eighteen years."

* * * *

It has not taken a machinery manufacturer a great length of time to discover that there is a far greater spread as between the point of production and that of consumption in the fruit business than there ever existed between the production and sale of a miller, a lathe or any other machine tool. Having recently disposed of a farm in the Niagara district he retained the privilege of harvesting and marketing this year's crop. Peaches were very plentiful and on going over his record he cites a price of nineteen cents from the marketers for eleven quart baskets of fruit at a time when the price of the same in Toronto was around seventy-five cents. From the nineteen cents had to be taken the cost of baskets and picking, to say nothing of other items, leaving very little for the boy. "If machines sold on that basis," he observed, "we might be able to afford an occasional period of depression."

* * * *

Discussing salesmanship in machine tools recently, a manufacturer was asked which, in his opinion, had given the more satisfactory results, the man with a practical, working knowledge of machine tools, or one with no training whatever. He replied that a happy combination of the two naturally appealed to him, but that it was difficult to obtain such a one. "The man with practical training is too much given to discussion or argument with the prospect on matters that draw him no nearer to the sale and very often antagonize," he replied. "On the other hand, the untrained man loses out because he is not as familiar with his line as he might be. In either case, however, where there is tact, a knowledge of human nature, honesty and familiarity with the line, sales will result. Personally I ilke to do business with a practical man, but I also know of cases where the unskilled salesman gets it across. But he is a better man if he has had practical knowledge, and has developed that happy faculty of knowing what to say at the right time, and ability as a good listener. Honesty is an essential, for in the last analysis, a machine tool speaks for itself and therein is the salesman judged."

* * * *

Marked progress has recently been made in the development of machinery used in cutting, polishing, grinding and otherwise working heavy stone used for building or monumental purposes. The Pollard Manufacturing Company at Niagara Falls, Ont., have specialized in this, and while the Canadian market has its limitations, considerable business is being done with American buyers. There is here a drawback of duty on raw material which makes competition quite feasible. It is interesting, that from a grinder designed for certain operations in shell-making during the war, there has been developed a machine employed in the production of stone balusters or columns such as used in large public structures. Activity in the building industry has caused improved demand for this class of machinery and much manual work has been eliminated or simplified.

* * * *

Once again, a merger has been announced having for one object, at least, the development of economy in operation. This time the Ramapo Iron Works with a plant at Niagara Falls, Ont., and N. Y., is merged with the Ajax Forge Company with plants at Chicago and Superior, Wis. The merged companies will form a subsidiary of the American Brakeshoe and Foundry which has a plant in St. Thomas, Ont. Thos. E. Akers, vice-president of the Niagara Falls Ramapo plant, will be vice-president and general manager of the Ramapo-Ajax coropration. He is reported as stating that many economies are anticipated by merging under one manag ment. Both companies have specialized in safety devices for railroad operation such as frogs, crossings, switches, switch boards, guard rails, clamps and industrial cars and car equipment. Proposed plans call for sale of $2,250,000 first mortgage 20 year bonds which have already been underwritten.

Canadian Machinery learns that the Canadian plant of the Ramapo Iron Works has been fairly well employed up to the present time on railway work, but not to capacity. No extensions are in immediate prospect, athough the evidence of any considerable amount of railroad or other activity requiring such equipment might lead to a development of that kind. At the present time a foundry at Niagara Falls is kept busy on work for this concern.

* * * *

It is predicted that motor truck production this year will reach $250,000,000 and that sales of tires, gasoline and equipment and accessories will bring the amount up to one billion dollars. These figures are indicative of the extent to which motor trucks are being employed, not only for commercial and agricultural purposes but also for passenger service. In United States serious consideration is being given to a proposal to link all large cities by trunk lines of motor buses. With improvement of roads in Canada, the use of trucks in interurban service of all kinds is bound to increase. There are in fact rumors that a gigantic truck corporation is proposed to compete with the network of trolley lines which Sir Adam Beck has in view as a development of hydro-electric service. Statistics available from districts where trucking has been most extensively employed, indicate the extent of competition offered to steam and electric lines. Less than three per cent. of the milk that is brought into Cincinnati is transported by railroads even under normal conditions and milk and produce dealers in the vicinity of Cleveland are reported to be using trucks altogether. Milk coming into Philadelphia by trucks now amounts to 64,169 quarts daily, and it is estimated that trucks operating out of Louisville, Kentucky, will soon be handling 500 tons of supplies both on the outbound and inbound trips. Under normal conditions the trucks and interurbans handle 75% of all perishable foodstuffs in Kentucky and Southern Indiana. The meat packing industry has also adopted motor transportation. Fifteen motor express lines for handling livestock shipments within a radius of 45 miles of Kansas City have been established.

Practical Ideas From Practical Men

COLORING STEEL BLUE

By C. Howard

Polished steel articles may be given a blue finish by placing them in heated charcoal. The pieces of steel to be colored must be smooth and clean. The charcoal is powdered and placed in a box made of steel or iron plate. The steel being blued must be taken out from time to time and dusted with finely powdered whiting. The piece should be watched and when the desired shade of blue is reached it is removed and allowed to cool, then cleaned and oiled.

It is often desired to color a piece of steel and still avoid using heat to keep it from warping. This can be accomplished by first cleaning the piece thoroughly and then covering it with a solution containing ten parts of water to one part of nitric acid. After it has turned a bluish shade wash it thoroughly with warm water, using a soft cloth; then wipe it dry. Finally rub it well with linseed oil.

TOOL LAYOUT FOR PRESSED STEEL TRUCK WHEEL HUB

By Geo. Barrett

Many designs of automobile wheel hubs are now made for the various types of cars and in order to attain and maintain rapid and economic production it is necessary to provide adequate yet simplified tooling to assure duplication and interchangeability in the parts manufactured.

The accompanying sketches herewith illustrate the method used in producing a motor truck hub on a Libby turret lathe. The part is made of electric steel casting, finished in two chuck sittings at an average rate of 35 minutes each. Fig. 1 represents the sectional view of the hub with the various finish marks and dimensions; the latter indicate the close limits to which surfaces have to be machined.

Fig. 2 shows the general arrangement of tools for the first setting, the tools A, C, D and E being located in every other hole on an octagon turret. The hub is gripped on the outer end, using a self-centering chuck. The bore is first roughed out with boring bar A and roughing tool B on cross slide. The turret is indexed to next position and boring tool C increases the hole to reaming size, the reamer D removing the final .010 in. of metal. This completes the boring of inner ball cup seat, the length being taken care of by the special facing tool E, which is set to the required distance and has a revolving washer at the end to prevent scoring of ball cup seat. The forming tool F on cross slide is used to bring the diameter and width of wheel centre to within about .030 in. of the finish dimension, after which the facing tool G completes the operation.

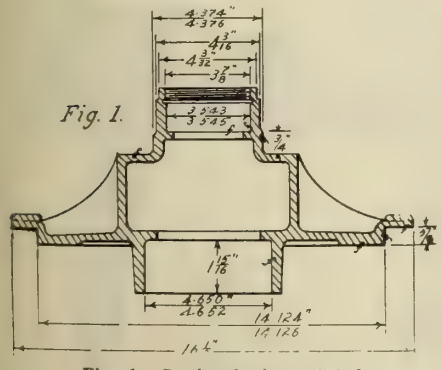


Fig. 1.—Sectional view of hub.

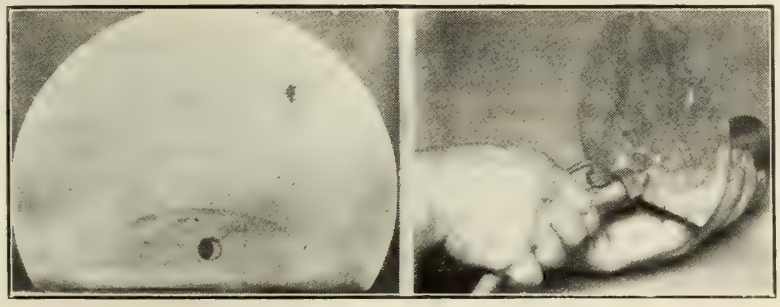
The hub is then reversed and held in chuck as shown in Fig. 3. The outside is finished by roughing tool A and forming tool B on cross slide, the threading being performed by the self-opening die on turret C. It will be noted that the shank of this die is made to slide into the holder set in turret head, and is prevented from turning by the feather key D. This construction has given good satisfaction in producing both inside and outside threads, as when the chasers are once started to cut, the irregularity of the feed is taken care of by the coil spring inside of die holder.

The boring is similar to inner side, only using an eccentric tool E for forming diameter for thread and undercutting for clearance. The boring bars and reamers are all of the adjustable type, and are ground between centres, to centralize cutters and pilot with the steel bushing inserted in lathe spindle, thus relieving the operator from grinding and setting the tools.

AIR HOSE SHIELD

By H. Moore

Air hoses are used frequently for cleaning purposes; cleaning out holes, slots, etc., or blowing away cuttings from machines, and for this reason the handy device here illustrated was devised. A large percentage of eye accidents may be traced to chips and dust rebounding under the strong pressure of air, yet it is seldom that one sees a guard of any kind attached to an air nozzle. This may be from the fact that it is difficult to hold anything securely on the tapering surface of the average nozzle. Improvised shields are often made out of a piece of stiff cardboard, but it is advisable to have the guard made of metal stock. The one here shown is made of thin sheet steel of circular shape bent over as indicated. Two holes are drilled, their location in each section being slightly out of alignment; this is done for two reasons, first to give an inclined surface to deflect the chips and also to increase the grip on the noz



Showing application of air hose shield.

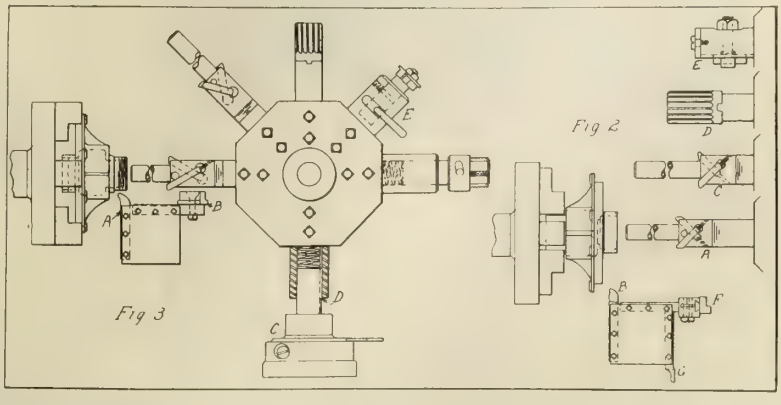


Fig. 2.—General arrangement of turret tools for first setting. Fig. 3.—Tool set-up for second operation.

New Things in Shop Equipment

SPECIAL MILLING MACHINE

As a general rule when a new type of machine is designed the chief point aimed for is high productive qualities, but the small milling machine illustrated was made for accuracy rather than production. It is specially designed for cutting racks and pinions used on computing scales and as extreme accuracy is essential on work of this nature, each portion of the new machine received the closest attention.

Several attempts have been made previously by other concerns to adapt the regular type of miller to this class of work, but this move has been found impracticable, because, while close limits are obtained, they are not accurate enough for computing scale work. Therefore, in starting the machine shown, the Ford-Smith Machine Co., Hamilton, Ont., who designed and made this special miller, decided to step out of the beaten path and make something entirely different.

Up to the present time, others who have tried to mill these racks depended upon the screw in the knee to secure the proper location of table for each tooth cut, but even when the screw was exceptionally well made inaccuracies soon developed, making it useless as a proper locating medium. In the new design no attempt to use the screw as the locater has been made, but a series of teeth, properly spaced, and made of high grade tool steel, has been designed and placed at A. These teeth are each separate blocks of tool steel and are carefully ground until the pitch required is absolutely correct. This entails considerable work and skill, but once completed the teeth placed alongside of each other form a permanent templet from which the table can be located to cut the rack accurately. To further ensure accuracy the pointer B is used. Here is how the table is located before each tooth is cut.

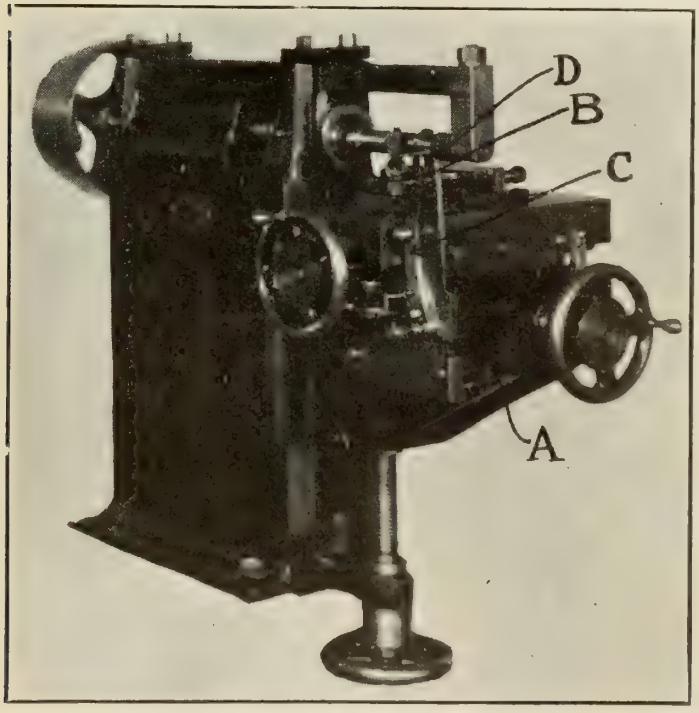
The operator places a similar pointed tooth on the end of the lever C into the first tooth of the series A. He next operates the handle of table until the pointer B corresponds with a mark at D. Once these line up, the table is in correct location for the cutting of the first tooth in the rack.

As soon as the cutter passes through the tooth being cut the table is tipped, also the lever C, which automatically brings the pointed tooth at end of C out of mesh with the first tooth in series of teeth A. This is a fool-proof arrangement so that the operator cannot damage the complete templet A.

To cut the next tooth the table is moved until the pointer at end of lever C can be placed in mesh with the second tooth in series A; the table is further adjusted until point B lines up with mark D once more, when the second tooth of rack is cut. This is kept up until all the teeth have been completed.

This machine, although only slightly larger than bench size, is very rigidly built, as the illustration will show, it being very necessary that vibration be eliminated. Even the spindle is specially designed, extra long bearings with adjustable features being provided. A single pulley on end of spindle is sufficient for driving purposes.

When cutting pinions on this machine a special dividing head is mounted on the table, this having a large diameter dividing disc, in order to avoid inaccuracies. To further guard against error this disc is notched on the outside diameter and holes are not depended upon. Furthermore, one side of these notches is straight and the other taper, this allowing the grinding of the straight side, if necessary, and guaranteeing that the locating plug goes in the same depth each time as stated previously. The chief point which has been kept in mind has been accuracy, for every mesh produced must pass government inspection. This is an exceptional machine to be made in a shop usually working on standard machine tools, but it goes to show what can be done by co-operation between the management, designing staff and shop.

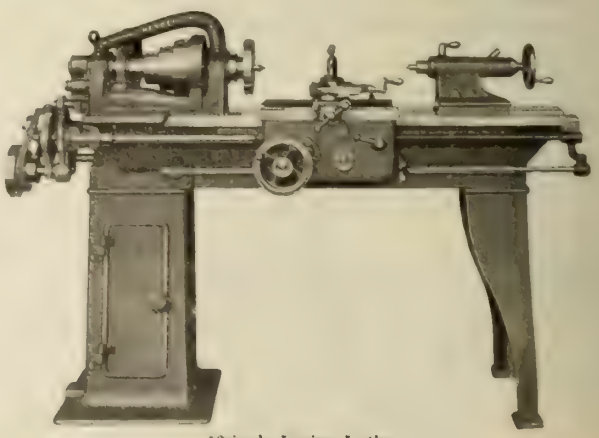


Special Milling Machine.

12-INCH JUNIOR LATHE

A plain-geared engine lathe, especially designed for accurate work in connection with light manufacturing, has recently been placed on the market. The headstock is of improved tie-bar pattern with housings fitted with annular bearings of special metal, having taper bearings for spindle journals. Forward and rear journal bearings are independently adjusted to allow for contraction and expansion of the spindle. Bearings are self-oiled, with oiling rings running in large reservoirs of oil, with provision for catching and returning oil to the reservoirs. The screw cutting is effected through ordinary change gears. Power cross feed and carriage feed are driven by a feed belt over two three-step cones. By the use of change gears the feed belt speed may be modified through a wide range.

This lathe has the regular carriage reverse mechanism for the starting, stopping and reversing of feeds, operated by lever located at the right side of apron.



12-inch Junior Lathe.

allowing both speeds of countershaft to run and drive lathe spindle in one direction, giving a total of sixteen working speeds for spindle. The tailstock spindle is graduated in thirty-seconds. Aprons have double plate construction with safety interlock, preventing simultaneous operations of longitudinal feed and screw cutting. All studs have outboard bearings, and rack pinion is supported either side of its engagement with rack. The inner wall, which carries the outboard bearings, is bolted to front plate and forms an oil pocket for gearing. The beds are made in lengths of 4, 5 and 6 feet, the weight of the five-foot machine being about 1,375 lbs. These lathes are manufactured by the Hendey Machine Co., Torrington, Conn.

CENTERING DEVICE

A special device for center-marking round stock has been placed on the market recently. The hub of the device has a reamed hole through the axis in which is fitted a ground center punch. Sliding jaws are fitted to three equi-distant radial posts that extend out from the hub. A spider with corresponding bosses fits over the hub and is so arranged as to prevent end movement. Connecting rods join the radial bosses to the jaws upon the hub, so that when the bushing is rotated relative to the hub the toggle action of the rods causes the jaws to move simultaneously inward or outward, according to the direction of rotation. After gripping the work in the jaws a light blow with a hammer on the punch puts an indent in the center of the bar. The tool is marketed by the J. A. Finley Co., of Allston, Mass., under the name of the "Duwell" centering device.

1-INCH MICROMETER

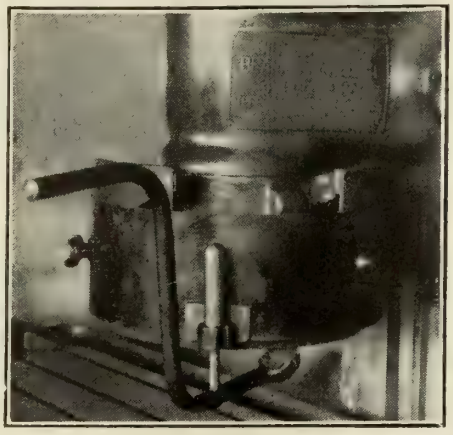
A new one-inch micrometer has been placed on the market by the L. S. Starrett Co. The frame is drop forged and is ribbed to provide added rigidity, and is finished in black enamel. It is claimed to have a longer life due to the fact that the contact points are .270 in. dia. with a screw of .312 in. dia. Decimal equivalents are marked on the thimble. The micrometer can be obtained either with or without a rachet stop.

SELF-GUIDING SCRIBER

A special scriber, particularly adapted to the use of toolmakers has been introduced to the trade. The feature of the tool is the double point, by means of which it is possible to lay out an outline at the bottom of a small, irregular-shaped hole, as in the transferring of shapes of dies to punches and blankholders. One point is sharp while the other is rounded and slightly shorter than the scriber point. In operation the tool is placed in the small hole and then twirled by the thumb and finger, the spring points causing the scriber to follow the outline of the hole. For large holes the regular scriber point is used. The tool is made by the J. A. Finley Co., Allston, Mass.

SAFETY WHEEL DRESSER

A great many operators claim satisfactory results cannot be obtained except by hand method of wheel dressing, but this is unsafe and never advocated. The new style dresser brought out by the Pratt & Whitney Co. for use on their vertical surface grinders gives all the advantages of hand dressing without



Safety wheel dresser.

danger of injury to the operator. It consists of a bracket bolted or riveted to the wheel guard which supports the stem of the dresser. The dressing wheels are held in one end of the device, the bar being bent to fit under the wheel. The other end forms a handle so that the attachment can be easily moved into position. No change in the work and wheel relation is necessary and the device is quick acting and thoroughly efficient. It may be readily applied to grinders now in use and is furnished as regular equipment on new machines.

PIN DRIVE FOR SMALL TOOLS

A line of small tools provided with special holders has recently been offered to the trade. The cutters are made of high-speed steel while alloy steel is used for the holders. The cutters may be provided for a wide range of work, including milling, reaming, drilling, countersinking, etc. The cutter is prevented from turning on the holder by a small pin running lengthwise in a groove. The design provides a positive drive and enables tool to be run accurately, also permitting the use of a small shank. These tools are particularly well adapted to turret operations. They are made by the Hanson Tool and Die Co. of Detroit, Mich.

METAL-PARTS WASHING MACHINE

For the washing of large quantities of metal parts a special machine has been developed. This particular apparatus is capable of taking care of the washing and rinsing, and also the drying if the latter is necessary. The machine is built on the unit principle, the sections being added as required. Formerly the washing and rinsing were performed as two distinct operations. The machine is especially serviceable where a large volume of water is required. The machine will take care of parts 24 x 40 in. in any length up to 16 ft. The work level is 34 in. above the floor. The shell is made of 10-gage steel plate supported by 6-in. channels. The initial chamber is provided with two-arm upper and lower revolving washing units for spraying water on the work, the sprays operating in opposite directions; 1,200 gals. of water per min. is supplied to the nozzles by means of a centrifugal pump operated by a 15 h.p. motor. A 3 h.p. motor is used to drive the pump that distributes 400 gals. of fresh rinse water per hour. When washing small objects, such as stamping and screw machine products, the parts are placed in racks made of wire mesh laid over pressed steel frames. Two 18 x 24 in. racks can be fed into the machine, side by side. They are carried through the machine on a continuous conveyor, so as to pass under both the washing and rinsing sprays. Larger parts can be conveniently handled in the machine. These washers are built and marketed by the Crescent Washing Machine Co., New Rochelle, N. Y.

GEARED-HEAD ENGINE LATHE

A recently developed 24-in. all-geared-head engine lathe equipped with a motor drive, has been placed on the market. With the exception of the main spindle all shafts are fitted with ball bearings, and all headstock gears run in oil. The head is of the selective type and the drive may either be from an overhead shaft or direct from a motor mounted on the top of the headstock. Twelve speeds are possible, using fourteen gears. A friction clutch is incorporated in the main drive pulley, and may be operated from the right hand side of the apron or from a push rod overhead. Provision is made for stopping the spindle quickly. The lead screw half-nuts are provided with a locking device, to prevent their engagement when the feeds are being employed. Accessory attachments may be interchanged with the compound rest. This lathe is manufactured by the Springfield Machine Tool Co., Springfield, Ohio.

PYROMETER FOR MOLTEN METALS

For the purpose of instantly determining the temperature of molten metals, a special pyrometer outfit has recently been placed on the market. The appliance consists of a standard type PA portable meter and a specially constructed thermo-couple, the ends of which are easily removable. When new they are 16 in. in length and may be used until they are reduced to a few inches. They are inserted bare into the molten metal, such as aluminum, babbitt, brass, bronze, copper, etc., and the temperature can be read directly from the meter. The safe limit of temperature is about 2,200 deg. F. The scale is graduated in degrees from 32 to 2,500. The case is made of cast aluminum with a black enamel finish. Twenty feet of flexible cord connects the couple and the meter. These outfits are made by the Hoskins Mfg. Co., Detroit, Mich.

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Railways Need Shop Equipment

INDUSTRIES doing business with the railroads seem agreed that there should be a better buying inclination evident in that direction. That they need much new equipment for their shops, even the railroads themselves will admit. In fact, it is declared that requisitions for shop machinery have been made out for some time, but seem to await sanction from some place higher up. A prominent manufacturer who investigated the situation for himself declares that much equipment is needed, and that as soon as conditions are right the order to go ahead will be given. The situation is better than it was one year ago as regards railroad buying. American roads have been heavy purchasers of equipment. Canadian rolling stock was in better shape and proper upkeep was imperative in view of bumper crops. The outlook of the Canadian Locomotive Works at Kingston indicates marked improvement and the impression is gaining ground that with the reorganization completed in connection with the National System, with a clear industrial horizon and the greatly improved general tone, this business will come along.

Coal Men Merge for Economy

MERGER OF bituminous coal interests in Pittsburgh district is announced, involving a score of big operators with normal annual production of eight million tons and assets of $35,000,000. The reasons given for the merger are said to be the elimination of costly duplication in sales, supervision, laboratory, traffic direction and purchase department overhead expense. The new company will be a formidable competitor to the Pittsburgh Coal Company, probably the largest company mining soft coal in the world.

To the consumer of coal it would naturally appear that such mergers should bring about a solution of some of the evils surrounding coal production whereby costs tend upward rather than back toward former levels. During the recent coal strike some facts found prominence with reference to mine operation which did not seem to be generally known and appreciated by the buyer and consumer of coal. One deep-seated problem relates to the fact that there are so many mines and miners in operation that normal requirements may be easily overtaken. Mining does not seem to be conducted on a full-time basis, and hence wages have to be sufficient to carry over the idle workmen and this eventually means peak prices to the consumer. If time and processes will evolve a system whereby the coal industry may become amenable to laws of supply and demand as other industries are, rather than to uneconomic manipulation, then the long-suffering public may be able to regard its fuel bill with less apprehension. The consumer has his part to play in purchasing well in advance of the rush period, and he has now something to steer by in the fact that agreements with the miners run until April 1st next. It remains to be seen whether production will be equal to the enormous demand that must develop during the next seven months.

Select Industries Carefully

MUNICIPALITIES are displaying a wise degree of caution with regard to industries that present themselves for location and probable operation. It is not long ago that a statement appeared in this paper from an industrial commissioner who declared that he had many prospective industries on paper, but that the majority of these were looking for much and offered very little. He pointed out that there were a great many smooth promoters in the field who, if brought to a showdown, had as their ultimate object, some favor that eventually worked back to the pockets of the ratepayers. It seems unfortunate that not a few of these questionable industrial schemes have as their focus the motor car and truck industry, but it will always be the case that wherever prosperity flourishes there will also be found the greatest number of speculative propositions. It is a problem sometimes to sift the good from the bad, but nowadays it must be a clever scheme that gets by the industrial commissioner, the chamber of commerce, the board of trade and the industrial committee of the city council, all of whom are supposed to be keen business men. If fakes are more numerous, the public interest is also more carefully safeguarded, or should be.

Will Industry Stand the Gaff

FOLLOWING the wage advance of twenty cents an hour by the United States Steel Corporation, similar action has been taken by many of the independent companies, and the movement will likely become general in the steel industry.

While it is claimed that independent companies as a rule pay less than the Steel Corporation, the fact is that, during the very strong market that has developed since February last, some independents have been bidding for men, thus tending to disorganize staffs of larger mills. Some independents also attempted premature advances in steel prices, but the attitude of the Corporation reflected a determination to develop a degree of stability and to keep prices on a level that would be free from criticism.

Various motives are said to be behind the advance. It may mean nothing more than an attempt to hold existing staffs. On the other hand it is described as a blow at unionism and the closed shop. Another view delares it to be nothing more than a policy of least resistance against unreasonable and uncombatable labor conditions on one hand, and a desire to make the most of the wave of prosperity on the other. Whether these two will mix remains to be seen.

Machine Tool Demand Shows Railway Buying

List of Equipment Approved for Shop at St. Malo, Quebec—C.P.R. Buys Big Tonnage of British Plate—Wrought Iron Pipe Advances $11 Per Ton—Unwelcome War Prospect—Opinion That Serious Development Would Cause Decided Stiffening in Markets

PRODUCTION IMPROVES BUT DELIVERIES SLOW

STEEL prices still appear to be in the advancing mood, as the changes in wrought iron pipe, plain wire, bars, shapes, plates and sheets, as announced this week from Pittsburgh, would indicate. Wrought iron pipe has advanced $11 per ton, and Canadian mills may shortly make an announcement in kind. Wire mills have advanced their prices $3 a ton, while some of those mills that went out of the market on bars, shapes and plates on account of the coal strike have re-entered at $2.25. This is higher by 25 cents than the steel corporation, but the latter's prices are for shipment at mill convenience, which probably means some months hence. It is evident, however, that the turnover in finished steel is not large. Very little interest is being taken in December or first quarter business. Buyers display lack of interest in late deliveries, but if the feeling developed that prices were advancing, the interest might develop strength. One factor making for higher prices is said to be that mills have many orders still to fill that will bring little, if any, profit, owing to sales having been made when material was low. They feel, therefore, that there is an opportunity at present to make an improved showing.

There has been a sharp increase in ingot production since the end of August as the result of coal mine operation, but car shortage still proves to be a limiting factor. Canadian importers say there has been very little improvement in shipments and that with accumulated business pressing for cars the situation does not seem promising.

An Unwelcome Prospect

There is no doubt that the prospect of war has had an influence on Canadian steel and iron business for the past few days. It is an unwelcome prospect, commanding pause while mental attitude adjusts itself. Should the country's resources in men, material and equipment again have to be mustered, the feeling among business men is that experience has been such as to make splendid mechanical and engineering service available at short notice.

That the railways are adopting a more liberal attitude in their requirements of machine tools is evident from purchases that are being made from time to time. Canadian National Railways recently approved a list of machine tools for their shops at St. Malo, Que. The expenditure, comparatively, was not large, but was one of the most worth-while items coming from this direction in some time. Among machine tool dealers it is said that any serious move toward war will have a stiffening effect on the market.

In iron and steel, prices are firm and the demand shows strength. One dealer declares that if there is as good business until the end of the year as during August, there should be no cause for complaint.

Montreal reports that the pig iron situation grows acute. While indications were that large tonnages of Scotch iron had come into the market, customs records show the tonnage to have been only 2 814. Some foundries are running short and soon will have to consider supplies. Demand for iron and steel is increasing, and stocks are difficult to obtain. British mills are quoting a price that would approximate $1.75 base Pittsburgh, and guarantee shipment two weeks after receipt of order. Large tonnages, however, would be necessary. An order for one hundred tons of British plates was placed by the C.P.R. through a Montreal jobber and no doubt much more business will go in that direction should other more convenient sources fail. The seasonal demand for structural steel is falling off.

Toronto

September 20.

ANY REPORT that would correctly describe the situation in the Toronto market this week cannot overlook the fact that prospect of war in the near East had an effect that was more or less disquieting. The fact that Great Britain had invited her colonies to send contingents, at once established the significance of the situation. Development of bear tendencies in the stock markets indicated an early appreciation of the effect of the war-cloud upon public feeling. It was not a sense of depression, but more of doubt or suspense. Canadians are proudly alert to their place in the Empire and it is not surprising that there was pause while duty developed the direction as to employment of resources at the disposal of the country, should emergency call. Threatening events therefore had an overshadowing effect.

Machine tool dealers were of opinion that should the situation become so pressingly serious as to claim priority of materials and equipment, as in the last war, there could not fail to be a stiffening of the market. There were those who considered such a contingency as most remote, however, and who vigorously discouraged suggestion of this kind, although agreeing that Canadian engineering and mechanical skill was in a splendid condition to serve, after its experience in connection with the world war.

Iron and Steel—Generally speaking the Toronto market was without important feature. Prices are firm but unchanged. Although some advances were announced last week on steel bars, it has developed that the price of $3.40 is not representative. Dealers there are who claim that the psychological moment for a raise has not yet developed. They adhere to the $3.25 quotation, and declare that they prefer to reflect an independent attitude. August, they say, was half as good as it should have been, but twice as good as it used to be, and suggest further that conditions render stability in price more or less preferable. It is a fact, however, that the $3.40 price obtains in certain quarters, as when the hardware trade and small lots feature the demand. The Pittsburgh price is $1.90 to $2.00, while Hamilton is quoting $2.70, a spread at the least of 70 cents, which is quite legitimate.

Sheet markets remain active on the advanced prices as announced one week ago. It is felt that fair-sized stocks have been accumulating throughout the country, and that existing figures represent peak. There are dealers, however, who think otherwise. The fact that the Baldwins have closed their Toronto plant does not seem to indicate any radical development in the market. Competition had developed to such an extent and coal and materials so difficult to obtain that it is felt temporary suspension was the wise course. No credence is placed in the rumor that the company is withdrawing from Canada altogether. In fact, enquiry at the plant brought a denial of this report, but there was some corroboration of the statement that they had expected some assistance by way of the tariff from the government. The plant has been producing black sheets and tin plate. Local quotations:—

Iron bars	3 25	3 40
Steel bars	3 25	3 40
Reinforcing bars	3 25	3 40
Steel hoops		4 50
Tire Steel		3 50
Spring steel	7 00	14 00
Band steel, No. 10 gauge and 3-16 in base		3 90
Small shapes		3 50
Sheets, black, No. 28		5 50
Sheets, blue ann., No. 10		4 50
Canada plates, dull, 52 sheets		5 75
Canada plates, all bright		6 75
Galvanized Sheets, No. 28		6 75

Old Material—"So far as values of old materials are concerned," said the representative of a large house, "it is likely that values will remain just where they are." It is considered that the Canadian

pig iron situation is now likely to improve and that conditions in supplies of old material may become a little easier. However, the market has shown little of the spectacular.

There has been quite a development of strength in the American markets. Heavy melting steel is quoted at $18 to $19, Buffalo, while Pittsburgh prices range from $19.50 to $20. Youngstown quotes $21. Local prices are:—

Copper, light, per 100 lbs.	9 00
Copper, crucible	11 50
Copper, heavy	11 25
Copper Wire	11 25
No. 1 compositon	9 00
New brass cuttings	6 00
Red brass turnings	6 50
Yellow brass turnings	5 25
Light brass	4 50
Medium brass	6 00
Scrap zinc	3 50
Heavy lead	4 50
Tea lead	3 00
Aluminum	11 00
Boiler plate, per gross ton.	9 00
Heavy melting steel	10 00
Axles (wrought iron)	20 00
Rails (scrap)	11 00
Malleable	10 00
No. 1 machine castiron	18 00
Pipe, wrought	7 00

Pig Iron—There is a feeling in the market that the pig iron situation should develop an easier tone now that strikes have been settled and coal more easily available.

But it is pointed out that accumulated orders must necessarily be disposed of before new business can be considered. Although the Toronto office of M. A. Hanna & Co. could give no information on the matter, it is reported that furnaces at Port Colborne are to be blown in shortly. Meanwhile Hamilton furnaces are out and the Algoma plant is on limited production. Improvement in the coal situation, it is feared, is likely to be slow under present priority and embargo systems affecting transportation. Supplies of pig are running low and no relief may be looked for from Scotch furnaces.

Non-Ferrous Metals—This market has developed a firmness recently and although no price advances are reported it is the feeling that any complication threatening war would have a decidedly strengthening effect. New York reports that foreign demand is the sustaining feature of the market. Shipments of four million pounds, during the past week, are recorded, most of this amount going to English and French buyers. Tin is reported as active and a trifle firmer. Zinc stocks are reported to be decreasing and New York reports price advances. Local prices:—

Lake copper	17 75
Electrolytic copper	17 50
Castings, copper	17 00
Tin	37 00
Spelter	8 00
Lead	8 00
Antimony	8 50
Aluminum	21 00

Machine Tools—Some activity is reported in this department as the result, it is said, of the Toronto Exhibition. Sales of equipment for garage purposes, such as cylinder grinders, have been made, and a fairly good general list was O.K.'d for the Canadian National Railways, who are improving the equipment in their shops at St. Malo, Que. This business was distributed to a large extent among Toronto dealers. It is stated that this purchase is the forerunner of a less conservative buying policy on the part of the railways.

Buffalo Forge Co., Kitchener, manufacturers of drying and ventilating equipment, report that although the industrial demand has not been what it should be, there has been a fair amount of municipal buying for schools and other public institutions. Pulp and paper mills have also been active buyers in the present season.

American markets report an increase of $11 per ton on genuine wrought iron pipe, which is used largely in construction work where resistance to corrosion is necessary. Basing discounts have been reduced from 39½ to 34%, a difference of 5½ points, each point meaning $2. Advances in the Canadian market may follow.

Discounts on stove bolts have been reduced by the Steel Company from 70 to 65 and 5.

Montreal

September 20)

ALTHOUGH there is only an average volume of business moving in the iron and steel lines, the local situation is bristling with possibilities. The influences of the coal and iron strike have made themselves very much in evidence. Jobbers are managing to obtain steel in sufficient quantities to take care of the business offering. Prices are firm but remain unchanged. The pig iron situation is acute. Only a small tonnage of Scotch iron is available for sale purposes and prices are advanced. The machine tool market is quiet. Supplies are moving somewhat better than they have been for the past few weeks. The demand for non-ferrous metals during the last ten days has shown a satisfactory increase, quotations remaining stationary. The scrap metal market conditions are improving, especially in some of the ferrous metals.

Iron and Steel.—In spite of the unusual conditions which prevail in the basic steel industries, the local demand has not only been maintained but is increasing. Jobbers have been successful in obtaining the necessary stocks from local or U. S. mills to take care of the demand. Pittsburgh prices for preferred delivery, (three to six weeks' shipment), hover around $2.25 base at mill, while the local mills' more or less nominal quotations are $2.70 base to jobber. All quotations are firm. British mills quote figures that would approximate a quotation of $1.75 base Pittsburgh, and guarantee shipment two weeks after receipt of order. That would mean a local delivery of about six weeks after the mailing of the order. Of course, it is considered undesirable to place orders with British mills unless they are for at least sixty or seventy tons.

During the week the C. P. R. placed an order through a local jobber for approximately one hundred tons of British plates. No doubt an increasing number of requisitions will find their way to British mills if the conditions surrounding the industry on this continent are not soon adjusted. Sheets are in good demand locally, particularly galvanized and blue annealed. Practically all sheets handled locally are of British manufacture. The demand continues to be very good indeed, and quotations are firm. There is always a seasonable autumn demand locally, caused by the fact that consumers always plan to cover their winter requirements before the close of navigation. After the close of navigation the rail haul from St. John, N. B., adds more than seven dollars a ton to the cost at Montreal. Thus the present demand is bound to improve right up until the end of December. It is a certainty that the present firm quotations will be maintained if not increased.

The demand for structural steel is falling off somewhat, as is expected at this season. Merchant bars are moving steadily. Small steel products are moving very well indeed. There have been no price changes during the week. Local jobbers feel that deliveries from U. S. mills will continue to improve gradually, unless the demand that has been throttled for some time past is large enough to cause a big increase in the tonnage required, in which case the mills will be a long time in overtaking the situation. Present quotations are as follows:—

Iron bars, base	3 15 to 3 25
Steel bars, base	3 15 to 3 25
Reinforcing bars, base	3 15 to 3 25
Steel hoops	4 25
Tire steel	3 25 to 3 40
Spring steel	7 00
Band steel, No. 10 gauge and 3-16" base	3 65 3 75
Small shapes	3 40
Sheets, black, No. 28	4 40
Sheets, blue ann., No. 10	4 05
Canada plates, dull, 52 sheets	5 50
Canada Plates, all bright	7 00
Galvanized Sheets, No. 28	6 50

Pig Iron.—Except for a few tons of Scotch pig in stock locally there is not a pound available for sale. Local representatives of Canadian producers state that it is largely speculative as to the length of time the furnaces will remain out-of-blast. The coal supply controls the situation. No new orders can be accepted, although most producers right along are making shipments on old orders. Thus quotations on Canadian pig are only nominal.

Such large tonnages of Scotch iron have been shipped to the United States that, during the week, local agents of the Scotch furnaces were notified that the furnaces were completely booked up to October 15th. No new business could be accepted for shipment before that date. In many cases quotations have been advanced. Official customs records of the port of Montreal show that only 2,814 tons of Scotch pig iron have been imported this season up to September 10th. Some foundries are already running short of iron and are ready to come into the market. Others have their requirements covered for only a short time. Everything points to a very acute situation in the near future. Consumption has

been on the increase and it is only reasonable to suppose that it will continue to increase. Local quotations are as follows:—

Algoma, No. 1, car lots on tracks, nominal quotation	40	80	....
Summerlee, 5-ton lots, warehouse	40	50	....
Summerlee, 30-ton lots, dock	35	00	....
Carron, 30 ton lots	35	00	....
Do., 5 ton lots, ex. warehouse	40	50	....

Machine Tools and Shop Supplies.—Very little change is shown in the machine tool market, which has been extremely quiet for some time past. Only a very few small sales have been made and these are for small machines. Movement in the wood working tools appears to be a little better than that of the iron working tools.

The supply business has been on the up-grade for the last week. The demand for small tools is very fair. Few price changes have been made. All lines seem to be moving very nicely. There slight improvement in the machine shops, which will no doubt be reflected in the sale of supplies showing a further improvement soon.

Non-Ferrous Metals. — During the week there has been a slightly better demand for non-ferrous metals. Inquiries and business are widely distributed over the province. There has been no change in prices during the week. Local quotations are as follows:—

Lake Copper	17	75
Electrolytic Copper	17	50
Castings, Copper	17	25
Tin	35	50
Lead	7	00
Spelter	8	75
Antimony	6	25
Aluminum	22	00

Scrap Metals.—The scarcity of pig iron has created a much better demand for heavy cast scrap. Foundries are conserving their supply of pig and are thus mixing more and more scrap. The demand locally is much better than it has been for some months past. Other forms of scrap have increased in value, in sympathy with the present situation. Sales have increased somewhat and the whole situation is a great deal more encouraging to the dealers. The following are local quotations.

Copper, light, per 100 lbs.	9 00
Copper, crucible	11 50
Copper, heavy	11 25
Copper Wire	11 25
No. 1 composition	9 00
New brass cuttings	6 00
Red brass turnings	6 50
Yellow brass turnings	5 25
Light brass	4 50
Medium brass	6 00
Scrap zinc	3 50
Heavy lead	4 50
Tea lead	3 00
Aluminum	11 00
Boiler plate, per gross ton	9 00
Heavy melting steel	10 00
Axles (wrought iron)	20 00
Rails (scrap)	11 00
Malleable	10 00
No. 1 machine cast iron	20 00
Pipe, wrought	7 00
Car wheels	17 00
Steel Axles	15 00
Machine shop turnings	4 00
Stove plate	16 00
Cast boring	4 00

Pittsburg

September 20.

LEADING Iron Company issued a new list on wrought iron pipe, dated September 12, advancing prices 5½ points or about $11 a net ton, the basing discount changing from 39½ to 34 per cent., and all other makers are expected to follow. Steel pipe remains at a basing discount of 68 per cent., and advanced about a month ago.

One independent wire mill advanced its prices $3 a ton about ten days ago and all other independents have since followed, making prices uniform among independents at 2.50c for plain wire and $2.75 for nails. The American Steel & Wire Company continues at 2.35c and $2.60, prices to which it advanced late in August. Such independents as are able to make early shipment find no difficulty at all in making all the sales they wish, at the advance. Probably the majority cannot make very early shipment. One interest cleaned up all its old orders and then closed its wire department on account of shortage of steel in the coal strike. Resuming a couple of weeks ago it is able to make very prompt shipment, say in a fortnight.

Most of the mills that were out of the market on bars, shapes and plates on account of the coal strike, have re-entered. The usual price is 2.25c on all three products. One large independent is quoting shapes, to regular customers, asking 2.15c on bars, but not on plates or shapes, to regular customers, asking 2.25c from chance buyers. The Carnegie prices are understood to remain at 1.90c for bars and 2.00c for shapes and plates. Three or four weeks ago many small orders for prompt plates were going at 2.50c, but there seems to be little business at that price now, and fairly early deliveries could probably be secured at 2.25c. The Carnegie prices are for "shipment at mill convenience," which would probably mean many months hence.

In sheets, the two conservative independent mills that were adhering to the steel corporation's prices, based on 3.35c for common black, have advanced to 3.50c. Other independents are asking from 3.50c to 3.75c. Claims are made that there are many sales on the 3.75c basis, but from the fact that some mills quoting on the 3.50c basis can make shipment in about 30 days the probability is that sales at 3.75c do not roll up much of a tonnage, and are perhaps chiefly in less than carload lots.

The National Association of Sheet and Tin Plate Manufacturers reports August figures as follows, in net tons: Sales, 175,495 tons; production, 228,398 tons; shipments, 218,200 tons; unfilled tonnage, 379,249 tons; finished stock, sold but not shipped, 95,058 tons; in stock, unsold, 19,184 tons. The mills thus reporting comprise about two-thirds of the total in the country, and seem to have had a rated capacity for August of 262,000 tons. Sales, production and shipments all increased from July, while unfilled tonnage decreased 30,000 tons during August, while unshipped tonnage increased 14,000 tons.

Price Trends

The general talk in the trade is that steel prices are in an advancing state, and the items given above support this view, in general, but at the same time the actual concrete advances do not make altogether the showing that would be expected if the market is really a sharply advancing one. The total turnover in the finished steel markets is not large, probably on the whole considerably less than the production, even though production is not much over half of capacity. Jobbers and manufacturing consumers show a strong disposition to buy for early deliveries, say for spot, October or November shipment, while they display very little interest in December or first quarter.

This is the condition. What it means is not so clear. Remarks that forward business is light because mills do not want to sell are not convincing. It may be that buyers' lack of interest in late deliveries is due to their being too busy with present day problems to consider the more distant future, but if they were certain steel prices were going to advance further they would presumably find the time to consider late deliveries. Very likely they feel that prices are too high now, and many mills admit frankly that such is the case. Costs are up by a very considerable margin, but cost increases alone would not warrant 2.25c for plates, shapes and bars when these commodities sold at 1.35c or thereabouts early in the year, or 3.75c for sheets when last year the market dropped for a time to 2.75c.

Increase in Production

One reason why mills are anxious to get as high prices as possible is that they have orders still to fill that will bring little if any profit and in some cases may involve a loss, the material having been sold long ago at much lower prices, while it must now be made when costs are much higher. The mills may feel that they should obtain all they can while steel is scarce even though the prices are too high to justify a long buying movement being based on them.

Steel ingot production at the end of August was down to about 50 per cent. of capacity or about 26,000,000 tons a year, having been at between 70 and 75 per cent. in June. Since the end of August there has been a sharp increase in production, perhaps to a 60 per cent. rate. On account of the particular circumstances existing, it does not follow that further increases, at the same rate, are to occur. The increase thus far has been due chiefly to steel interests getting their union coal mines in operation, the U.M.W. wage scale being signed, and promptly establishing a movement to their by-product coke plants. Further increases would have to come chiefly from there being more coal and coke from the Connellsville region, where transportation has already become the limiting factor, and by purchases of coal in the open market, when the distribution of purchased coal is almost completely controlled by priorities, in which the steel industry has no standing.

Connellsville coke is quoted at $11 to $11.50 for furnace and $12.50 to $13 for foundry. Offerings of furnace coke have not been sufficient to justify a furnace trying to gather together enough for an operation. In the past week car shortage has prevented full shipments being made

on contract and offerings are likely to be less in the next few days.

Pig iron remains quotable at $34 for Bessemer, $30 for basic and $35.50 for foundry, valley basis. These figures are not well supported, transactions being very light. It is held that most consumers could not afford to pay these prices, unless they get further advances in their finished products. Recent predictions that pig iron would advance to $40 or $50 have become unpopular.

The Steel Corporation has announced that it will book rail orders, for shipment to July 1, 1923, at the old price of $40 a gross ton, up to October 1, when the price will go to $43. It is a question how much tonnage this move will bring into the market.

FOR MERITORIOUS SERVICE

In C. P. R. educational bulletin No. 216, the following employees are mentioned for meritorious service:

E. T. Gauthier, agent, Cartier, 10 merit marks, for interest taken in arranging diversion of car, at request of shippers, when car had already passed his station, thus saving shippers much inconvenience and possible loss.

J. E. O'Neil, ticket clerk, North Bay, 10 merit marks for detecting that commercial traveler's certificate was being used by other person than owner and arranging to have same lifted.

A. O. Lake, conductor, Schreiber, 5 merit marks, for removing tree which had fallen on telegraph wires during storm.

G. Porter, engineer, Sudbury, 5 merit marks, for attending to hot journal on dead engine traveling on his train, enabling engine to be taken through to terminal.

J. F. Downey, operator, Pays Plat, 5 merit marks, for repairing telegraph wire when not on duty.

S. N. Retty, trainman, Chapleau, 5 merit marks, for firing engine over part of sub-division when fireman was unable to do so on account of sickness.

O. G. McDonald, trainman, MacTier, 5 merit marks, Paul Snob, trainman, Schrieber, 5 merit marks.

C. A. Parfit, trainman, North Bay, 5 merit marks for detecting broken arch bar on car when train was in motion, avoiding possible accident.

The present car shortage makes imperative the elimination of all delays to cars in transit and while being unloaded at destination.

Victoria, B. C.—A conference of Imperial Government officials, British steel manufacturers, Canadian government and the British Columbia cabinet ministers, will be held in London next month in connection with the proposed construction of a $12,000,000 steel plant on the British Columbia coast, according to an announcement made here. The project, it is claimed, is being backed by the three Governments.

C.N.R. BUYS MACHINERY FOR SHOPS IN EAST

Toronto.—By making extensive purchases for shops at St. Malo, Quebec, and Moncton, N. B., the Canadian National Railways have started a buying movement which is regarded in machine tool circles as long overdue. The St. Malo list follows:

One No. 2 Brown-Sharpe surface grinder, one No. 2A Brown-Sharpe universal milling machine, one electric drill, one funnel former, three chain blocks, one pneumatic molding sand rammer, one slip-roll forming machine, one No. 224 combined shear and punch, one No. 2 magnetic chuck, one No. 2 spindle pattern centering machine, one high-speed power hack saw, one portable boring bar with motor, one portable oil rivet forge, four one-ton jib cranes, two half-ton jib cranes, a one-ton air hoist, three geared drills with motor drive, small turner with stand complete, one LeBlond heavy duty production, one hairpin loop armature coil winder and spreader, one coil-winding lathe head, one model C turbine air planer, one pneumatic punch, one emery-wheel dresser, one Davis expansion boring tool, four pneumatic chipping hammers, four pneumatic drills, two pneumatic grinders, one single bar shearing machine, one Bertram special crank pin turning and quartering machine, two C. M. C. quick-change gear engine lathes.

For the Moncton, N. B., shop the list included two No. 13 crucible furnaces (Stewart); one combined shearing and hot punching machine; one 100-ton hydraulic banding press; one 100-ton spring stripping press.

ACUTE CAR SHORTAGE MAY SOON DEVELOP

Montreal.—Throughout the local shops that depend more or less upon the railways for their business, there exists a feeling that the Canadian railways have for sometime past been neglecting their equipment to such an extent that unless they do considerable buying an acute car shortage will develop. This is also more or less true of the motive power departments. Some state that the movement of the Western crop will tax the capacity of the railroads to the utmost and feel that a crisis will develop before the season of navigation on the lakes is closed.

Among the companies depending more or less on the railroads for their business is the Canadian Car & Foundry Co. This company is at present doing practically nothing, having faced the dullest period since the inception of the company, according to one of its executive officers. The sum total of the business on the company's books at present is represented by the order for the Toronto Transportation Company for 150 cars which was mentioned in these columns some weeks ago. The company has continued to quote on more or less work but very little business has materialized from these quotations. The last large order handled by the company was that for the Russian government which was taken care of about one year ago. It is believed by this firm that they can successfully market their products in various parts of the Empire and from time to time as these countries come into the market for equipment they intend to bid on the business. They feel that there is a particularly fertile field in India and the only fear entertained by the local firm is that they would have difficulty in competing with English builders. Car shops, generally speaking, in the United States have experienced quite a revival of business in the last few months and being familiar with the conditions on Canadian roads it is only reasonable for the firm to suppose that they will be receiving orders in the very near future. At present they feel that Canadian National Railway will not do much until the new president, general manager and board of directors are definitely decided upon. However there promises to be an early settlement in this connection and business will no doubt be forthcoming in the near future. In considering the C. P. R., the firm is of the opinion that the C. P. R. have never been in the habit of letting their equipment run down very badly, but they do state, that during the past few years, which have been exceptional, it would not be surprising to learn that they too could do with considerable new equipment.

It is believed that the situation will be brought to a crisis during the next few months when the movement of the large Western grain crop is in progress and the shortage of cars that exists at that time will be the means of bringing the railroads into the market. It is known that in anticipation of the movement of grain a large number of cars have been moved west of the Great Lakes and in a great many quarters it is felt that for this reason a shortage in the East may result.

OIL COMPANY BUYING MACHINERY

In connection with their equipment plans for their machine shop at the proposed Calgary plant, the Imperial Oil Co., Toronto, are calling for tenders on a list of tools, including lathes, planers, grinders and other items necessary in making oil refinery repairs.

The munitions plant of the U. S. Government at Lachine, Que., was early this month sold at auction by Charles Gerth, New York auctioneer. The figure realized was $32,700, the purchaser being Silvio W. Marizzano, managing director of the Saxonia Fruit Preserving Co. of Montreal. Mr. Gerth and his assistants made an effort to dispose of the U. S. plant in Montreal, occupied by the Peter Lyall Construction Co. during the later part of the war, but the highest bid of $292,500 was not accepted. The estimated value of the property is above $1,500,000. The plant is still for sale.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Toronto price:—

Silicon, 2.25% to 2.75%	39 30
Algoma, No. 1, Montreal,	40 80
Summerlee, Scotch, Montreal dock	35 00
Summerlee, Warehouse, 5-ton	40 50
Carron, Montreal docks	35 00
Grey forge Pittsburgh	36 77
Lake Superior, charcoal. Chicago	36 15
Standard low phos., Philadelphia	38 00
Bessemer, Pittsburgh	34 77
Basic, Valley furnace	32 50

METALS

	Montreal	Toronto
Lake Copper	$17 75	$17 75
Electroylic Copper	17 50	17 50
Castings, Copper	17 25	17 00
Tin	35 50	37 00
Spelter	8 75	8 50
Lead	7 00	8 00
Antimony	6 25	8 50
Aluminum	22 00	21 00

Prices per 100 lbs.

BILLETS

F. O. B. Pittsburgh

	Per gross ton
Bessemer billets, 4 in. x 4 in. and larger	40 00
Open hearth billets	40 00
O. H. sheet bars	40 00
Forging billets	45 00
Bessemer rods	47 50

IRON AND STEEL

Per 100 lbs. to large buyers

Iron bars, base, Toronto	$3 25	3 40
Steel bars, base, Toronto	3 25	3 40
Small shapes, base		3 50
Iron bars, base, Montreal	3 15	3 25
Steel bars, base, Montreal	3 15	3 25
Reinforcing bars, base	3 35	3 40
Steel hoops		4 50
Tire steel, base		3 50
Spring steel	7 00	14 00
Band steel No. 10 gauge and 3-16 in. base		3 90
Chequered floor plate ¼" and heavier		7 00
Bessemer rails, heavy, at mill		2 35
Steel bars, Pittsburgh mill prices		2 25
Tank plates, Pittsburgh mill prices		2 25
Structural shapes, Pittsburgh mill prices		2 25
Steel hoops, Pittsburg		2 75

F. O. B. Chicago Warehouse

Steel bars	2 80
Structural shapes	2 90
Plates	2 90
Small shapes under 3-in.	2 90

PLATES

Plates 3-16 in.	$3.85	$3 60
Plates, ¼ up	3 50	3 40

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$3 70	$5 50
Sheets, blue ann., No. 10	4 70	4 50
Canada plates, dull, 52 sheets	5 50	5 75
Can. plates, all bright	7 00	6 75
Galvanized sheets, No. 28	6 75	6 75
Queen's Head, 28 B.W.G.	7 25	
Fleur de Lis, 28 B.W.G.	7 00	
Gorbal's best, No. 28		
Colborne's Grown, No. 28		
Premier	6 85	6 35
Premier 10¾ oz.	6 85	6 75
Zinc sheets	9 25	11 00

FREIGHT RATES

Pittsburgh to Following Points	Per 100 lbs. C.L.	L.C.L.
Montreal	52	65½
St. John, N. B.	76	96
Halifax	77½	97
Toronto	34	48½
Guelph	34	48½
London	34	48½
Windsor	31½	45½
Kingston	48½	61

Current surcharge 1 per cent.

OLD MATERIAL

Dealers' Average Buying Prices

	Montreal Per Ton	Toronto Gross
Boiler plate	$ 9 00	$ 9 00
Heavy Melting Steel	10 00	11 00
Axles (wrought iron)	20 00	16 00
Rails (scrap)	11 00	11 00
Malleable scrap	10 00	11 00
No. 1 Machine cast iron	20 00	18 00
Pipe, wrought	7 00	6 00
Car wheel	17 00	16 00
Steel axles	15 00	15 00
Mach. shop turnings	4 00	6 00
Stove plate	16 00	14 00
Cast boring	4 00	6 00
Copper, light	9 00	8 50
Copper, crucible	11 50	11 00
Copper, heavy	11 25	11 00
Copper, wire	11 25	11 00
No. 1 machine composition	9 00	9 00
New brass cuttings	6 00	6 00
Red brass turnings	6 50	6 50
Yellow brass turnings	5 25	4 85
Light brass	4 50	3 50
Medium brass	6 00	4 50
Scrap zinc	3 50	4 00
Heavy lead	4 50	4 50
Tea lead	3 00	3 00
Aluminum	11 00	11 00

COLD ROLLED STEEL

(At Warehouse)

Rounds and squares	$4.50 base
Hexagon and flats	$5.50 base

COPPER PRODUCTS

Prices per lb.

	Montreal	Toronto
Copper Bars, ½ to 2 in.	.29	.28
Brass Tube		.28
Plain sheets, 16 oz. in. 30 x 72	.30	.29
Copper sheet, tinned, 16 oz.	.37	.36
Copper sheet, planished, 16 oz. base	.42	.41
Braziers', in sheets, 6 x 4 base	.30	.29
Copper tubing, seamless		.32

LEAD SHEETS

Roll Lot Prices

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$ 8 75	$ 11 50
Sheets, 3 1-2 lbs. sq. ft.	8 75	11 50
Sheets, 4 to 6 lbs. sq. ft.	8 25	10 00

Cut sheets, ¾c. per lb. extra

Cut sheets to size, 1c. per lb. extra

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	20
Brass sheets, 24 gauge and heavier base	23
Brass tubing, seamless	28

WROUGHT PIPE

Price List No. 56. August 23, 1922.

Standard Buttweld Pipe S/C

Size	Steel Blk.	Steel Galv.	Gen. Wrot. Iron Blk.	Gen. Wrot. Iron Galv.
⅛ in.	6 00	8 00	....	....
¼ in.	3 96	6 00	7 20	9 30
⅜ in.	3 96	6 00	7 20	9 30
½ in.	5 02	6 55	7 31	8 93
¾ in.	6 10	7 82	8 86	10 70
1 in.	8 50	14 22	12 58	15 30
1¼ in.	11 50	15 18	17 02	20 70
1½ in.	13 75	8 15	20 35	24 75
2 in.	18 50	24 42	27 38	33 30
2½ in.	29 25	38 61	....	....
3 in.	38 25	50 49	....	....
3½ in.	49 68	64 40	....	....
4 in.	58 86	76 30	....	....

Standard Lapweld Pipe S/C

Per 100 feet.

Below dividing line—price per foot.

Size	Steel Blk.	Steel Galv.	Gen. Wrot. Iron Blk.	Gen. Wrot. Iron Galv.
2 in.	22 20	27 75	31 08	37 00
2½ in.	32 76	41 54	46 80	56 16
3 in.	42 84	54 32	61 20	73 44
3½ in.	50 60	66 24	72 68	89 24
4 in.	59 95	78 48	86 11	105 73
4½ in.	68 58	87 63	1 04	1 24
5 in.	79 92	102 10	1 21	1 45
6 in.	1 04	1 32	1 57	1 88
7 in.	1 38	1 79	2 02	2 45
8L in.	1 45	1 88	2 13	2 58
8 in.	1 67	2 16	2 45	2 97
9 in.	2 04	2 62	2 97	3 59
10L in.	1 89	2 43	2 75	3 33
10 in.	2 43	3 13	3 54	4 28

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4-in. and under 55 per cent.

4½-in. and larger, 45 per cent.

4-in. and under running thread, 35%.

Standard couplings 4-in. and under 25%.

Do., 4½-in. and larger 5 per cent.

MALLEABLE FITTING LIST

1 in. elbow	.32	.53
2 in. elbow	1.05	1.70
1 in. tee	.43	.70
2 in. tee	1.45	2.40
1 in. coupling	.33	.53
1 in. locknut	.15	.23

Discounts to dealers—Class A, 70 per cent, Class B. and C., 60 per cent.

BOILER TUBES

Size	Lapweld Toronto	Seamless Toronto	Lapweld Montreal
1 in.	19 00		
1¼ in.	21 00		
1½ in.	20 00		
1¾ in.	23 00		
2 in.	18 00	20 00	19 00
2¼ in.	20 00	23 00	21 00
2½ in.	21 50	26 00	22 50
3 in.	27 50	32 00	28 50
3½ in.	30 50	37 00	33 00
4 in.	39 00	47 00	42 00

Prices per 100 ft., Montreal and Toronto

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, 7-16 and up	30
Carriage bolts, ⅜ in. and smaller 6 in. and shorter	40
Coach and lag screws	45
Stove bolts	72½
Wrought Washers	60
Do., corru. head	60
Machine bolts, 7-16 and over	35
Machine bolts, ⅜-in. and less	35
Blank bolts	35
Bolt ends	35
Machine screws, fl. and rd. hd., steel cut thread	37½ & 10
Machine screws, o. and fil. hd., steel cut thread	30
Machine screws, o, and fil. hd., brass cut thread	15
Standard couplings, 4-in. and under, brass cut thread	30% 30
Nuts, square, blank off net list	$1.00
Nuts, square, tapped off net list	50c.
Nuts, hex., blank off net list	50c.
Nuts, hex., tapped net list	
Copper rivets and burrs, list less	32c.
Burrs only, list plus	10%
Iron rivets and burrs	47%
Boiler rivets, base ¾ in and larger	$5.75
Structural rivets, as above	5 65
Wood screws, O. & R., bright	80
Wood screws, flat, bright	82½
Wood screws, flat brass	77½
Wood screws, O. & R., brass	75
Wood screws, flat, bronze	72½
Wood screws, O. & R., bronze	70

NAILS AND SPIKES

Wire nails, base	$3 65
Cut nails, base	4 35
Miscellaneous wire nails	72½%

MILLED PRODUCTS

(Prices on unbroken packages)

Set screws	65
Square and hexagon head cap screws	60
Round head cap screws	20
Fillister head cap screws	35
Flat head screws	25
Button head cap screws	20
Studs	45
Semi-finished nuts up to and including 9/16 in.	70
Semi-finished nuts ⅝ to 1¼ in.	65
Semi-finished nuts 1⅜ to 2 in	35
Coupling bolts	35
Taper pins, No. 2 to No 5	65
Taper pin No. 6 and over	10
Planer bolts without fillet	10
Planer bolts with fillet	Net
Patch bolts	Plus 10%
Hollow set screws	20
Thumb screws	50
Thumb nuts	70

CARBON DRILLS AND REAMERS

	Discount.
S. S. drills, wire size	60
Can. carbon cutters	plus 10
Standard drills, all sizes	60
3-fluted drills, plus	10
Jobbers and letter sizes	60
Bit stock	50
Ratchet drills	25
S. S. drills for wood	10
Wood boring brace drills	50
Electricians' bits	30
Sockets	50
Sleeves	30
Taper pin reamers	25
Drills and countersinks	20
Bridge reamers, carbon	50
Centre reamers	Net
Taps, machine screw	50 to 60
Taps, hand, sizes up to 1"	30 to 60
Chucking reamers	20 off
Hand reamers	20
High speed drills, list	40
Can. high speed cutters	plus 10
American	plus 40

FILES AND RASPS

Globe	60/5
Vulcan	50
P. H. and Imperial	60/5
Nicholson	40
Black Diamond	40
Heller	40
Jowitts	net
J. Barton Smith, Eagle	55
McClelland, Globe	50
Delta Files	20
Disston	40
Disston	50
Great Western-American	50
Kearney & Foote, Arcade	60/5

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

PROOF COIL CHAIN

B. B. B. CHAIN

⅜ in., $16.45; 7-16 in., $14.00; ½ in., $12.95; 5-8 in., $13.15; ¾ in., $12.75; ⅞ in., $12.25; 1 in., $11.85; 1⅛ and 1¼ in., $10.55. Fire weld chain same sizes respectively are $14.00; $11.50; $10.40; $10.55; $10.15; $9.75; $9.35; and $8.25.

ELECTRIC WELD COIL CHAIN B.B.B.

⅛ in. $20.00; 3-16 in. $16.50; ¼ in. $15.50; 5-16 in. $12.70.

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	30%
Standard	30 and 10%
Cut leather lacing, No. 1	1.75
Leather in side, (Lacing)	1.50

RUBBER BELTING

Standard 36 ....28% Best grades 28%

TAPES

Chesterman Metallic, 50 ft.	$5 00
Lufkin Metallic, 603, 50 ft.	3 17
Admiral Steel Tape, 50 ft.	3 00
Admiral Steel Tape, 100 ft.	4 50
Major Jun. Steel Tape, 50 ft.	3 75
Rival Steel Tape, 50 ft.	4 00
Rival Steel Tape, 100 ft.	8 75
Reliable Jun. Steel Tape, 50 ft.	5 25

PLUMBING SUPPLIES

Plumbers' oakum, per cwt.	6 30
Solder, strictly	$0 22½
Solder, guaranteed	0 24
Soldering coppers, lb.	0 62½
White lead, pure, cwt	13 20
Red dry lead, 100-lb. kegs, per cwt.	10 75
Wood alcohol, per gal.	1 75
Whiting, plain, per 100 lbs.	3 00

ROPE AND PACKING

Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope ¾ and larger, base	0 21
British Manila rope	0 17
New Zealand hemp	0 19
Jute packing, fine	15c
Jute packing, coarse	11c

OILS AND COMPOUNDS

Castor Machine Oil, per lb.	34½
Royalite, per gal. bulk	20
Palacine	23
Machine oil, per gal.	39
Black oil, per gal. (Summer)	19
Cylinder oil, Capital	69½
Petroleum fuel oil bbls., net	10.80
Turp., single bbls., gal.	1.65
Linseed oil, raw, single bbls.	1.01
Premier galsoline	34

WASTE

XXX Extra	16
Atlas	18
Peerless	21
X Empire	13
XX Grand	15
Ideal	18
Superior	20
X Press	11½
X L C R	14

Colored

Lion	12
Fancy	13½
Standard	10½
Popular	9
No. 1	13
Keen	7½

Wool Packing

Arrow	24
Anvil	16
Axle	20

Washed Wipers

Select White	18
Dark colored.	13
Mixed Colored	14

This list subject to trade discount

PLATING SUPPLIES

Polishing wheels, felt	$3 25
Polishing wheels, bull-neck	1 60
Emerey in kegs, Turkish	7½
Pumice, ground	04½
Emery glue	26
Tripoli composition	08
Crocus composition	12
Emery composition	11
Rouge, silver	60
Rouge, powder, nickel	35

Prices per lb.

ANODES

Nickel	40 to .45
Copper	.38 to 22
Zinc	.16 to .12½

PLATING CHEMICALS

Acid boracic	.20
Acid, hydrochloric	.03¾
Acid, nitric	.10¼
Acid, sulphuric	.03¾
Ammonia, aqua	.20
Ammonium, Carbonate	.15
Ammonium, chloride	.18
Ammonium, hydrosulphuret	.75
Ammonium, sulphate	.10
Arsenic, white	.18
Copper carbonate, anhy.	.26
Copper, sulphate	.08
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.14
Nickel carbonate	.32
Nickel sulphate	.14
Potassium sulphide (substitute)	.40
Silver chloride (per oz.)	.85
Silver nitrate (per oz.)	.65
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.32
Sodium hyposulphite	.08
Sodium phosphate	.10
Tin chloride	.50
Zinc chloride, C. P.	.30
Zinc sulphate	.06

Prices per lb. unless otherwise stated

News From the Industrial Field

Stratford city assessor reports an increase of 600 in population. The official return shows 18,244.

Calgary is to have a $2,500,000 oil refinery. The city has encouraged the Imperial Oil Company in the matter by granting a fixed assessment of $250,000 for 20 years.

Makers of dies used in the manufacture of motor car bodies report demand for requirements on car designs for next year. Some radical changes are predicted in certain models.

Employment service figures show that during July the index figure rose from 91.1 at the end of June to 93.1 and that 754,533 people were actually at work July 31, out of an aggregate pay roll of 769,306. The number of concerns reporting was 6,305.

Employment agencies report a very strong demand for men for the lumbering camps. Preparations for a large cut this winter are being made. Wages range from $30 to $35 monthly, and board.

Re-opening early in July of railway car shops, temporarily closed in June, caused an improvement in the labor situation, but an increase was also evident in transportation, railway and building construction as well as in sawmills and other branches of the manufacturing industries.

Tillsonburg may have an industry engaged in manufacture of fire engines and tractors. Efforts are being made to sell $25,000 worth of preferred stock in the town. Another concern wants the town to supply a building 100 x 50 in which to manufacture a staple article.

Two new compressors are being installed at the Strange st. pumping station, Kitchener. The new equipment costs $21,000 and delivery was delayed a month because of the fact that the steamer "Manchester" on which they were shipped collided with an iceberg. The compressors are eight feet high and seven feet wide.

Engineering & Machine Works, of Canada, St. Catharines, report that conditions show steady improvement. The factory at present is well employed on work that indicates a better feeling generally. Among other jobs in process is the building of two boilers, one 14 feet dia. and the other 10 feet dia., for Great Lakes Transportation Co., the Playfair interests, who are rebuilding two of their ships. One hundred and twenty-five hands are employed at present and the coal situation is not such as to cause anxiety.

The steel contract for the new $500,000 building for the Knights of Columbus in Montreal has been awarded to the Phoenix Bridge and Iron Works of Montreal.

Fraser S. Keith, general secretary of the Engineering Institute of Canada, was in Port Arthur recently for the purpose of organizing a branch of the society at the head of the lakes.

Sherbrooke, Que.—Operations have commenced at the plant of the Manganese and Steel Foundry, and the mill is now turning out castings. The furnace is capable of handling one ton at a heat and three heats can be run in a day. This capacity is expected to be reached within the course of the next few weeks, as the company has a number of excellent orders booked up, and prospects are stated to be bright.

John G. Abraham, general sales manager of the Beldam Asbestos Co., has just returned from an extensive trip through the West. Mr. Abraham reports splendid outlook for his products, and likewise announced that he had made arrangements for his firm to act as general distributors for the John Crane Metallic Packing Co., and certain other specialties. The John Crane Metallic packing will be manufactured in Toronto as soon as satisfactory arrangements can be made.

Winnipeg, Man.—After a careful survey of the reports received from agents throughout the West, it is estimated that this year's western crop will approximate 317,000,000 bushels of wheat, according to the weekly crop report of the Agricultural Department of the Canadian Pacific Railway. Cutting is general in the Prairie Provinces. Reports indicate that the Western crop generally is turning out well. Even in areas where poor yields were looked for the conditions have proved better than anticipated.

Montreal.—The Brockville factory of Eugene Phillips Electrical Works, will be completed about October 15th. This factory will roll copper rods entirely, and will be the only copper rod rolling mill in Canada. The firm have installed over three hundred and fifty thousand dollars worth of equipment. This includes not only the mill machinery but their own transformer station, pumping house, etc. The factory is situated in the western section of the town, on the river bank. It is expected that about forty men will be employed from the start. The prospects, as far as they can be foretold at the moment, are that the mill will operate full time from the start.

Atlas Construction Co., of Montreal, has been awarded the contract for extensions to the Alexandra Pier in the Harbor of Montreal. The cost will approximate $400,000.

Winnipeg, Man.—Some idea of the high grade of this year's wheat crop can be gained from the fact that out of 246 cars received here in one day 159 graded No. 1 Northern, 13 No. 2 Northern and 8 No. 3 Northern.

McDougall and McNeill of Vancouver, B. C., have secured the general contract for the erection of a pulp and paper mill for the Wigwam Pulp and Paper Co., of Elko, B. C. The approximate cost will be $3,000,000.

Calgary, Alberta.—A $2,500,000 oil refinery plant will be located here by the Imperial Oil Co., on a site comprising 108 acres now waste land in the eastern part of the city. The agreement between the city and the Company has been approved, and it is said that the construction of the new plant will employ from 300 to 500 men continuously from six to eight months.

McKinnon Industries, St. Catharines, report that they are fairly busy in all departments. Activity in production of gears for motor cars has reflected the improvement in the motor industry. The foundry is also engaged in auto work and railway castings, while in hardware lines improving demand is noted from the West where stock levels are low. It is not anticipated that steel at present prices will have much effect upon buying, but abnormal tendencies might cause a return to higher auto prices.

Brandon, Man.—There is absolutely no unemployment in this city at the present time. In fact there has been an insistent call for farm labor and there is no excuse for any person being out of work here this month. It is estimated that the farmers in the Brandon district are carrying out their harvest operations about 400 men short of the actual need. Farmers and employment agents could not interest eastern harvesters to stop over here, the harvesters preferring to go as far west as their ticket will take them, although this district was paying equally as good wages as points farther west. All local industries are well employed, and activities in all lines are much better and brighter than a year ago. Crop prospects are excellent here for a bumper yield, and consequently there is a feeling of optimism that is booming business along. There has been a decided improvement in business during the last two or three months, which speaks for prosperity this fall.

Campbellton, N. B.—The shipping season from this port has established a record for recent years and a similar activity is evidenced as far as Bathurst and the Miramichi Valley. Most of the steamers at the port have been engaged in clearing lumber held during the war period, but further opportunities for the lumber industry are confidently expected to follow.

Vancouver, B. C.—Vancouver is beginning to realize that more grain elevators are needed, if the port is to hold the grain export trade secured last year. Between September 1st, 1921, and the present 7,552,044 bushels have been shipped from the port, compared with 460,000 bushels the previous twelve months. To carry away this amount of grain 80 ships, each taking 3,000 tons, must be employed. The elevator at Vancouver will hold 1,250,000 bushels, 37,500 tons, or roughly 12½ shiploads.

Elko, B. C.—Financed by American and Canadian capital, with Canadians in the majority on the directorate, a $13,000,000 newsprint plant is shortly to be erected at Elko, near Nelson. The edifice will be built in three units, one a year, and the project will employ 1,000 men in construction and when completed 3,000 in operation. The output per unit will be 100 tons of newsprint per day or 300 tons from the three units. It is estimated that the limits which have been secured will supply raw material sufficient for thirty years' production.

Ottawa.—Large property holdings in Low township, along the shores of the Gatineau River, including the Riparian rights to the Parigan Falls, have been acquired by the Hull Electric Company, which intends establishing next year a hydro-electric power plant with an ultimate capacity of 150,000 horse-power. The cost of construction, it is said, would approximate $10,000,000. It is estimated that it would take about two years to complete the plant, including a large viaduct and dam and that employment would be found for about one thousand residents of this district.

Montreal.—Messrs. Jones & Glassco, Montreal and Toronto, have recently accepted the Canadian agency for the Unchokeable Pump, Limited, of London, England. This pump is a specially designed unit of the centrifugal type and it is guaranteed to pump with its patent impeller the following materials, when they are mixed with a nominal quantity of water—fibre, grit, tailings, flushings, ashes, sand, tan, sewage, grain, mud and pulp. The design of the pump is such that it depends on nothing but the impeller to deal with the solids and the pump will swallow anything capable of passing through the suction opening. The pumps are standardized and absolutely interchangeable. It is stated that the pump has successfully demonstrated its ability to handle solids of a coarse and bulky nature in a manner that has never been done before by a pump.

Toronto.—Extension work to cost more than $2,000,000 has been planned by the Bell Telephone Co. in Toronto alone during the coming year, and it is expected that an average of $2,500,000 will be spent during the next five years to keep up with the demand. This city now has a total of 110,000 subscribers, roughly 30 per cent. of the company's list, and there are at the present time nearly 10,000 waiting for connections.

The closing down of the Ford plants, supposedly as an industrial strike against the excessive coal prices, has become effective, and in consequence approximately 73,000 men in the Detroit district are out of work. The situation is still further aggravated by the fact that something like 30,000 employees of other concerns are affected by this move, these latter being engaged in the production of parts used in the construction of Ford cars.

Montreal.—A new grain elevator is to be built at Tarte Pier, costing $2,347,000, with an initial capacity of 2,000,000 bushels, to be ultimately increased to 8,000,000 bushels, according to the announcement of the Minister of Marine and Fisheries. Other improvements to the harbor include extension of piers and railways, improvement of channel and construction of a new bridge, are to cost in excess of four and a half million dollars.

Niagara Falls, Ont., Chamber of Commerce reports a number of new industries in immediate prospect. The Dominion Insulator Company, manufacturers of insulators and other electrical accessories are completing their factory; the Glen Motor Car Co., an assembly proposition, will locate there and negotiations are concluding with a motor car accessory and machine company. The Robert Manufacturing Co., Lockport, N. Y., makers of knives for paper cutting in paper mills, are building a new steel and concrete factory.

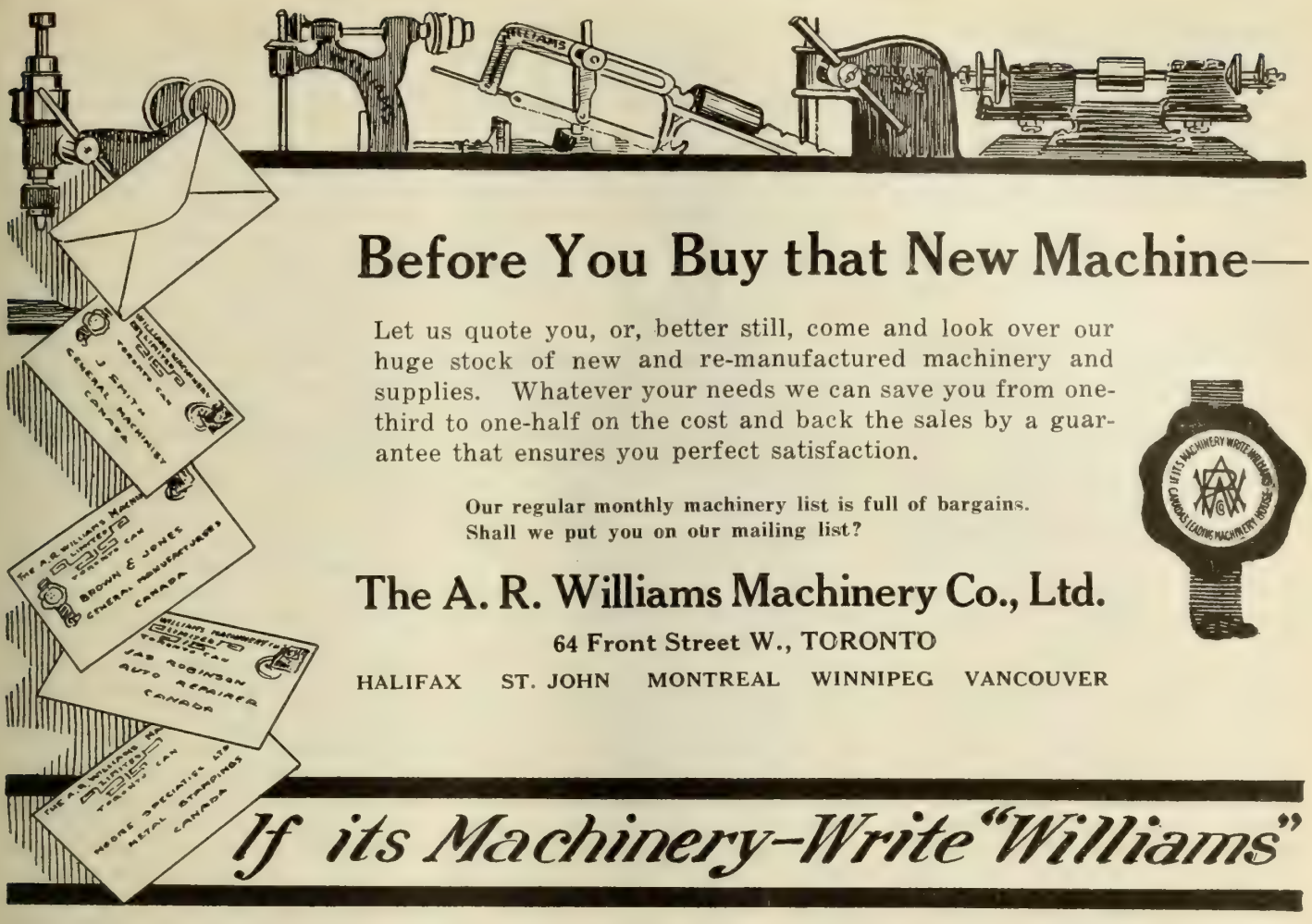
Following the action of the United States in putting shingles on the free list there is a possibility of the McMasters Shingle Co., one of the largest shingle manufacturers of Washington and Oregon, establishing extensive plants in British Columbia. "The situation is very serious," stated John McMasters, "as the output in our American plants last year was approximately seven billion shingles, and that of British Columbia about two billion. But the recent inimical action of the conference committee on tariff will undoubtedly reverse these outputs."

Montreal.—Private advices received on September 12th by several prominent coal dealers here, indicate that this city and New York will be the first to receive considerable consignments of anthracite coal from Pennsylvania district. September 18th is stated to be the day on which Montreal will receive its first cargo which is coming down by water from Oswego, N. Y. It is understood that a great deal of Montreal's supply of anthracite coal, which will be received in the next few months, will be water borne from lake ports. The car borne coal will start a little later but at this season there will be a big demand on the various water routes which lead to the Lachine Canal. It is stated that Montreal occupies a very important place in the Pennsylvania market as about 25 per cent. of the anthracite coal from these mines, purchased in Canada, comes to Montreal. F. L. Wanklyn, the Quebec fuel commissioner, produced recently before the Coal Dealers' Association letters and cables each containing offers of coal ranging as high as 30,000 tons a month during the navigation season. Thus should the coal strike have continued for any greater length of time it is shown without doubt that emergency supplies of coal could have been obtained.

COPPER AGAIN USED IN CARS

Copper, brass and bronze are returning to service in automobile construction. During war years substitutes had to be used, for these materials were not available for non-essential industries. This year according to a statement issued by the Copper and Brass Research Association, something like fifty thousand tons of copper will be used in the motor car industry, which is something like fifteen thousand tons more than last year. During the buyers' strike in 1920 the demand for cars dwindled, and in an effort to revive sales, manufacturer vied with manufacturer in successive price cuts. Under insistent pressure to lower costs, automobile manufacturers turned their attention first to the more expensive metal, copper, and carried still further the principle of substitution, first generally established during the war years. Substitution took many forms, among them being sheet-iron water tanks in place of brass or copper; malleable or cast-iron water line fittings in place of brass; cast-iron carburetor bowls in place of brass; die-cast babbitt main bearings and crank pin bearings in place of bronze-backed babbitt. Other substitutions were cast iron bushings in place of bronze in camshaft bearings, rocker arm bearings, spring eyes, shackle bolts, brake equalizers, etc. (in many cases, there are no bushings at all); cut-steel or aluminum alloy small gears, for pump drive, timer shaft, etc.; cast iron water-pump casing and impeller in place of bronze or brass; aluminum or pressed steel hub caps in place of nickeled brass; aluminum, enameled iron, or sherardized steel windshield trim, body trim, hardware and hood trim; steel latches in place of brass; steel screws, nuts and bolts in place of brass; malleable or cast iron special fittings such as caps, covers, plugs, glands, control links, in place of cast brass.

Grinding wheel spindles should be of sufficient length to permit of the nut being drawn up flush with spindle end.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DIFFICULT YEAR FOR STEEL INDUSTRY

By the report of the Lake Superior Corporation's operations for the year ending June 30, 1922, it is shown that the net earnings were $330,00.80, to which should be added $734,814.26 brought forward as a balance for last year. When provision had been made for interest on bonds and for bank advances, amounting to $1,410,478.88, the sum of $87,703.81 had been set aside for depreciation, and $445.40 had been provided for income tax, there was a deficit of $763,813.83 carried forward by all companies. The net earnings of all the subsidiary companies in the preceding year amounted to $1,541,293.32, a decrease of $1,211,292.42.

The past year was a very difficult one in the iron and steel industry in Canada, as elsewhere, and the Algoma Steel Company felt to the full the effects of the continued depression. Steel plant operations were seriously curtailed, and decreases shown in both output and earnings. Rail orders received were not sufficient to keep the rail mill operating full time. The mill was operating fifty per cent. of capacity for 194 days, and was closed down 67 days. For the balance of the year the mill was in full operation.

During the first quarter of the fiscal year under review it became necessary to make a further reduction in prices of steel products, and in order to meet this, economies had to be effected in various directions. There was very little buying in rails and other products by the Canadian railways, but a fair proportion was received of the business offered. Rail production for the year was 155,764 tons, as compared with 201,312 tons in 1921. The pig iron shipments were 64,189 tons, as compared with 105,619 tons in 1921. Orders on hand at June 30th were sufficient to keep the rail mill in full operation until September 5th, and the merchant mill until August 31st. It is expected that further rail orders will be received in the fall for winter rolling. The possibility of the coal and railroad strikes in the United States affecting the company's importations of coal and ore for the coming winter, however, is causing considerable concern at the present time.

The tonnage of the Algoma Steel Corporation, as compared with the preceding year, was as follows:—

	1920-21	1921-22
Coal imported	841,983	468,534
Ore imported	420,830	298,740
Limestone produced	235,399	164,218
Coke produced	429,041	273,007
Pig iron produced	362,805	246,779
Steel ingots produced	327,906	230,237
Steel products	255,209	173,012

The complete cessation of operations of the International Nickel Company and other industrial concerns upon which the Algoma Eastern Railway Company is dependent for its principal traffic, was reflected in the earnings of the company. The reduction in the tonnage of mining and other products hauled, as compared with the previous year, was approximately 1,000,000 tons. As a result the company was not in a position to pay the half year's interest on its first mortgage bonds, which was due March 1st, 1922. It is understood that the mining, smelting and refining operations of the International Nickel will be resumed about Sept. 1st, 1922, on a basis which will furnish ore traffic to the railway of approximately 50,000 tons per month. Coal, coke, quartz and other mining supplies will be shipped in proportion.

More than 26,000 strikes have disturbed industrial America during the past decade, it is estimated. More than 60% of the strikes for the past ten years have taken place in the States that lie north of the Ohio and east of the Mississippi; about 10% of them in territory to the south of the Ohio and east of the Mississippi; and the rest in the West.

CANADA'S CHANCE IN SOUTH AFRICAN TRADE

A trade commission report on South Africa's import trade last year, reveals some interesting figures as to Canadian and American exports in that direction. Dealing with machinery and engineering equipment the report states:

Cranes.—In 1921 total imports were valued at £89,978, of which Canada is credited with £19,885, and the United States with £15,250.

Machine tools.—Of the total import valued at £22,088 during 1921, machine tools to the value of £614 were supplied by Canada, while the share of the United States was £9,821.

Machinery, mining.—Total imports during 1921 were £940,535 as compared with £765,986 in 1913. During 1913 Canada supplied mining machinery to the value of £166, whereas in 1921 her share was £2,986. Imports from the United States were valued at £161,191 in 1913 and £347,001 in 1921.

Machinery, printing and bookbinding.—Total value of imports had risen in 1921 to a value of £165,856 when compared with imports of 1913 valued at £45,866. Of these totals, Canada is credited with £11 in 1921 and £91 in 1913, and the United States with £81,779 in 1921 and £6,457 in 1913.

Pumps.—Total value of imports in 1921 was £150,230, of which Canada is credited with £31 and the United States with £37,819. Canada's share was nil in 1913, when the United States supplied pumps to a value of £30,888 in a total import of £115,861 from all countries.

Windmills.—The total value of imports in 1921 was £117,529, and in 1913, £79,771. Canada took no share in such imports in 1913, but is credited with £1,023 in 1921. The United States supplied windmills to the value of £96,110 in 1921 and £60,899 in 1913.

Canadian engineering plants which have already interested themselves in South African trade, and prospective exporters, will be interested in knowing that in the few instances of increased imports into South Africa last year, machinery leads. These are mining, printing, water-boring, and manufacturing machinery. Both manufacturing and mining machinery show value of import of over £2,000,000.

In addition to such imports as are indicated above, there are supplies for the South African Government Stores such as air compressors, £3,103; boilers, £69,164; cranes £111,578; elevators and lifts, £8,619; engines, tractors and steam rollers, £5,982; machine tools, £17,986; manufacturing machinery £88,691; printing and bookbinding machinery, £11,148; pumps, £10,645; sawing machinery, £5,681; water-boring machinery, £85,343; machinery, all other, £142,305. The ability of Canadian engineering firms for competition in overseas fields is best known to themselves but if it is only the possibilities that are required to induce them to make an effort, surely the figures indicated showing general and government imports will warrant an endeavor by representation on the spot.

Electrical material-batteries, primary.—Total value of imports in 1921 was £29,823, of which Canada supplied £218 as against £11,047 from the United States.

Cables and wires.—Total value of imports was £394,470 in 1921 as compared with £250,669 in 1913. Canada supplied cable and wires to the value of £33 in 1921 and £64 in 1913, while the United States is credited with £14,319 and £29,518 in 1913 and in 1921 respectively.

Quite a number of entries under the heading of electrical machinery and material show increase of imports over 1920. All through the past year the writer has heard of the wonderful purchases made from Germany of electrical material, but it is only in "incandescent lamps" and "material n.o.d." that she figures to any extent (incandescent lamps, £3,133; "material n.o.d.," £14,010). However, some contracts placed for delivery this year if completed will bring them well back to their 1914 supply.

Now that two of the leading municipalities are in a position to sell power freely there should be a much larger sale for electrical household utensils. The position in regard to fixtures is a little better than it has been in the past, but the selling of any but drop-lights is still very small comparatively.

Railway material, n.o.d.—Total imports under this heading were valued at £40,373 in 1921 as against £35,912 in 1913. Canada's share was nil in 1913, but in 1921 she is credited with shipments to the value of £186. Imports from the United States totalled £4,638 in 1921 and £304 in 1913.

Tramway material, rolling stock.—Total imports in 1921 were valued at £55,063 as against £28,403 in 1913 (Canada, 1913, nil; 1921, £46. United States, 1913, £11,794; 1921, £41,006).

Tramway material, all other except sleepers.—Total imports were valued at £37,425 in 1921 and £16,841 in 1913 (Canada, 1913, nil; 1921, £3. United States 1913, £5,141; 1921, £12,586).

There is no record of imports from Canada of light rails and accessories for industrial purposes, rails, locomotives, rolling stock, or tramway rails, but the United States is credited with large shipments under all these headings.

Rejecting a bid of $292,500 for the Peter Lyall munitions plant, at Longue Pointe, Montreal, recently, the auctioneer declared it to be ridiculous and added, "If I went back to Washington with $292,500 for this property, they would put me and my children and my grandchildren in the penitentiary for life."

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Air Pressure Tanks, Air Receivers, Steel Plate Tanks, Pneumatic Tanks, Tote Boxes, Shop Barrels, Steel Factory Equipment, Smoke Stacks, Gasoline Tanks.
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—the name of a service for supplying pig iron to the merchant iron trade from eight separate localities strategically placed for advantageous shipping.

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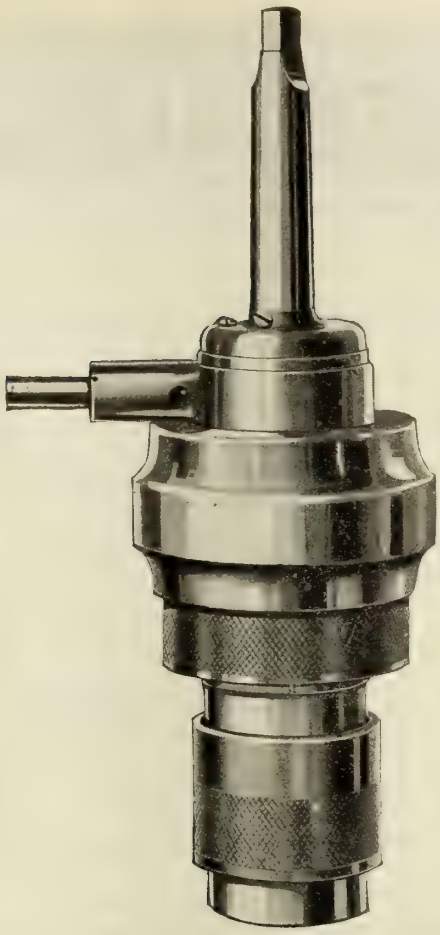
Make a Time Study of Stopping and Starting Your Drilling Machine to Change Tools.



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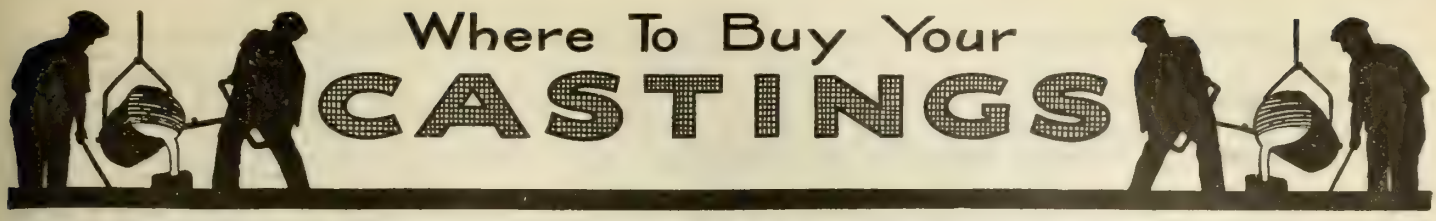

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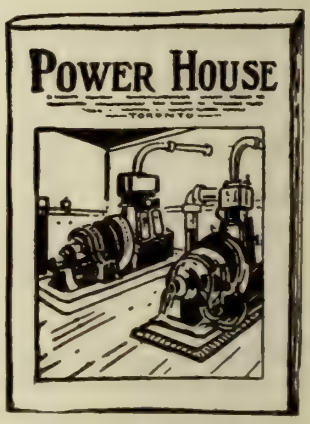

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Labor (3 days)	13.50	Labor (4 days)	18.00
Burden (3 days)	19.25	Burden (4 days)	27.00
Total	$44.65	Total	$56.90
for 2,000 pieces.		for 2,300 pieces.	
Or $.022 per piece.		Or $.025 per piece.	

Wheel No. 2 costs the same as No. 1.
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But
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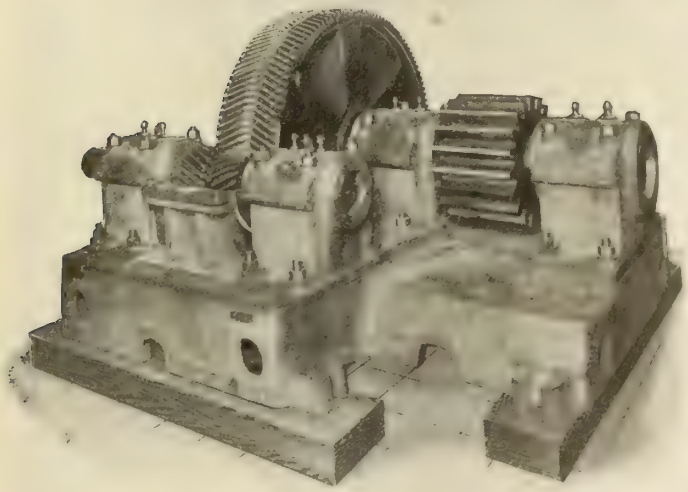

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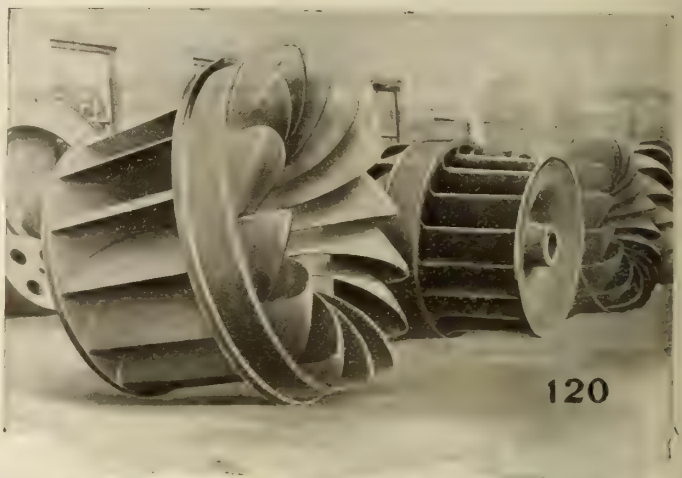

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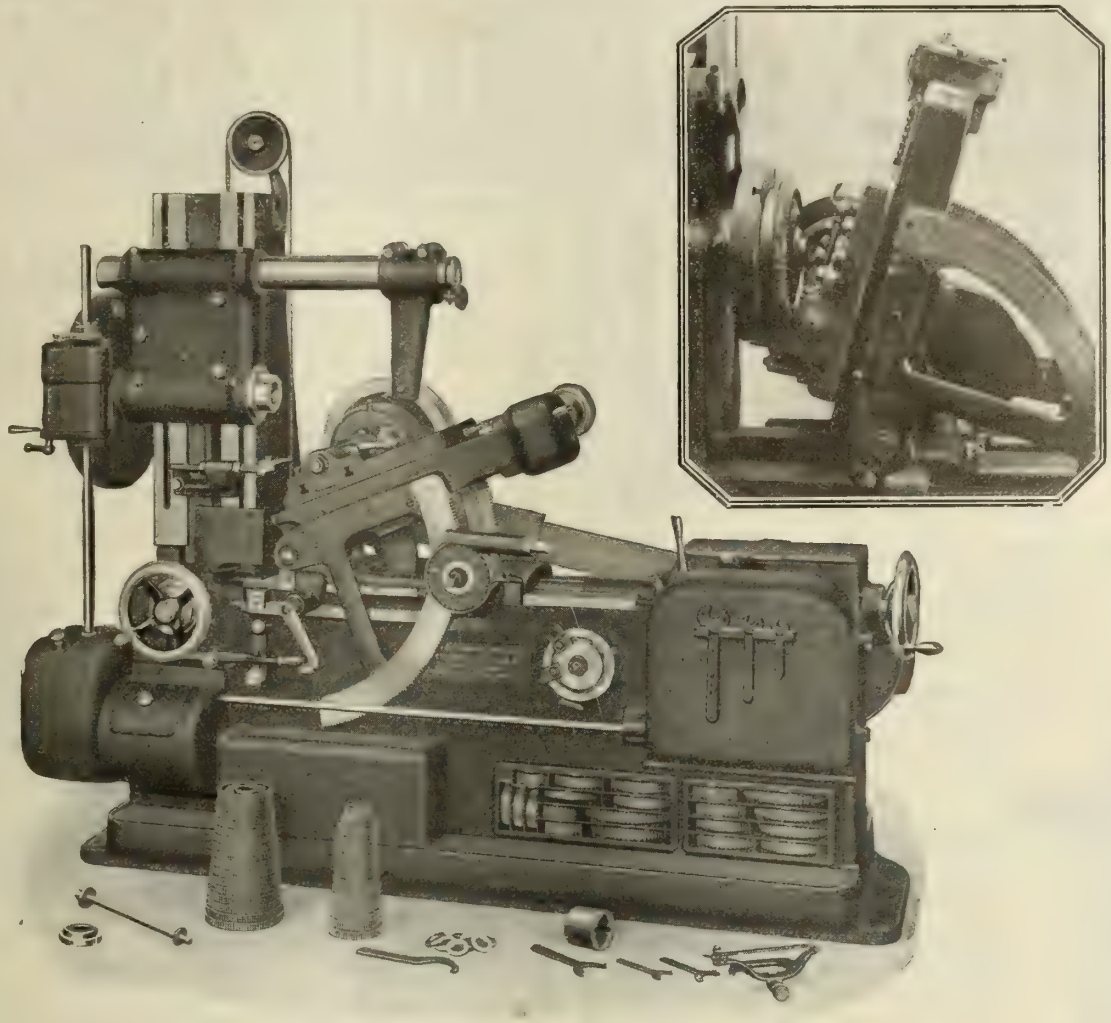

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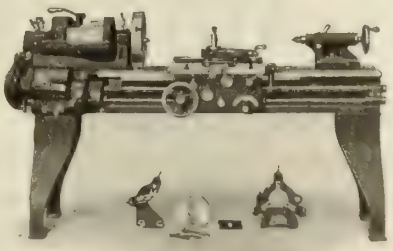

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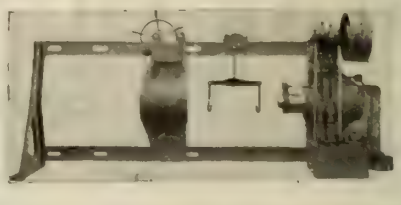

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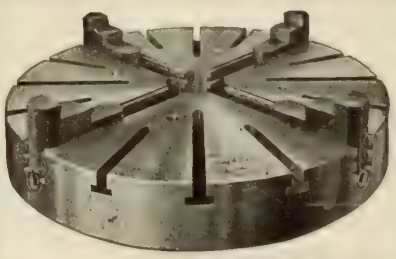

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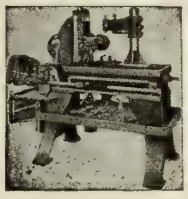

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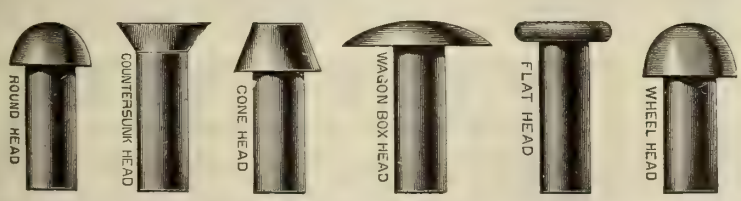

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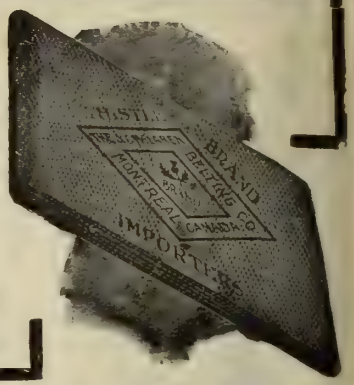

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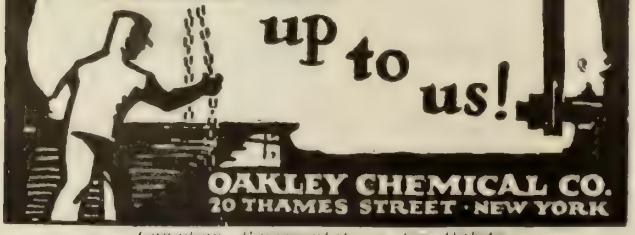

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2544—Bertram 36 in. Sliding Head Drill, used.

GRINDERS

2504 — Lafayette Universal Motor - Driven Grinder, new.
2510—Perfect No. 4 Bench Grinder, used.
2534—Perfect No. 6 Double End Emery Grinder, used.
2537—Perfect No. 8 Double End Emery Grinder, used.
2543—Landis Plain Grinder, 12 in. x 42 in., used.

HACK SAWS

2514—Perfect Power Hack Saw, No. 3, capacity 6 in. x 6 in., new.
2515—Racine Power Hack Saw, No. 10, capacity 8 in. x 8 in., new.

LATHES

2505—Cataract Bench Lathe, 32 in. bed, 7 in. swing, fitted with chasing attachment, rebuilt.
2506—Cataract Bench Lathe, 32 in. bed, 7 in. swing with compound rest, new.
2545—Putnam Engine Lathe, 36 in. x 18 in., used.
2546—McGregor Gourlay Engine Lathe, 18 in., x 8 in., used.
2553-4-5—Davis Turret Lathe, 24 in. capacity, used.

RE-BUILT MACHINERY

Stock No.
2570—Bardons & Oliver, 16 in. Turret Lathe, used.
2556—Turning Lathe, 14 in. x 5 in., used.

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2516—Gooley and Edlund Plain Milling Machine, 22 in. traverse, type A, new.

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2518—Greenerd Arbor Press on Pedestal, No. 3 1-2, new.
2557—Styles-Parker Punch Press, No. 172, used.

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2503—Hand Punch, 1-2 in. bench type.
2507—Hand Punch, and Shear, 3-8 in. capacity, 2 in. knife, bench type, used.

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4—Size 1 1-16 in., new.
22—Size, 1 3-16 in., new.
22—Size 1 1-4 in., new.

RIVETERS

2512—Townsend, No. 1, Single Head, used.
2513—Townsend, No. 1 Double Head, used.

USED MACHINERY

TAPPING MACHINES

Stock No
2508—Burke Bench Tapper, 1-4 in. capacity, used.
2574—Burke Horizontal Tapping Machine, on pedestal, 3-4 in. capacity, used.

MISCELLANEOUS

2529—Castellating Attachment for Garvin Miller, No. 3, new.
2538—Jardine Canadian Giant No. 50 Power Hammer, used.
2559—Perrin Hydraulic Pump, 2 Plunger, 2 1-2 in. diameter, 6 in. stroke, 1 1-4 in. inlet and discharge, used.
2561—Gas Furnace, 12 in. x 15 in. x 8 in. 2 burners, lift door, pedestal type, opening 10 in. x 8 in., used.
2584—Garvin Slotter screw, No. 1, used. 1 1-2 in. discharge, used.
2366—Northey Duplex Pump, capacity 8 in. x 4 in., x 7 in., used.
2579—Roots No. 1 Pressure Blower, used.
2581—Allis-Chaliners, 5 H.P. Electric Motor, 3-phase 60-cycle, 550 volts, 1200 r.p.m., used.
2584—Garvin Slotter screw No. 1, used.
2588—Racine 10 in. Hack Saw Blades.
2590—Smart-Turner Duplex Pump, 4 1-2 in. x 2 3-4 in., x 6 in., used.
2591—Thor Universal Electric Drill, 5-16 in. capacity, used.

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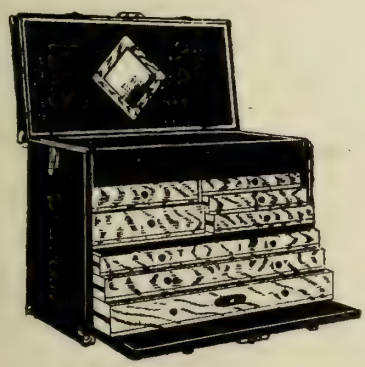

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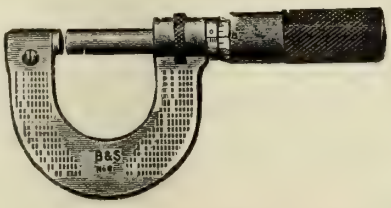

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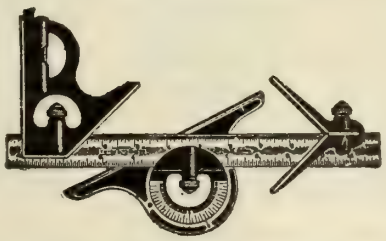

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Gisholt Machine Co., Madison, Wis.
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Greenfield Tap & Die Corp., Galt, Ont
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Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

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Landis Machine Co., Inc., Waynesboro, a.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

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Acme Machine Tool Co., Cincinnati, O
Brown & Sharpe Mfg. Co., Providence, R. I.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
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Roelofson Elevator Works, Galt, Ont.

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Johnson Machine Co., Carlyle, Man-
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

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Pratt &Whitney Co., of Canada, Ltd., Dundas, Ont.

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COUPLINGS
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COUPLINGS, PIPE
Fittings, Limited, Oshawa, Ont.

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Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

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Can.-Link-Belt Co., Toronto, Ont.
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Butterfield & Co., Inc., Rock Island, Que.
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Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.

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Landis Machine Co., Inc., Waynesboro, Pa.

CUTTING-OFF MACHINE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

CUTTING OFF MACHINES, PIPE (SEE PIPE-CUTTING AND THREADING MACHINES)
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.

CUTTING-OFF TOOLS
Armstrong Bros. Tool Co., Chicago, Ill.

CUTTING OIL FILTERS (SEE OIL FILTERING SYSTEMS
Bowser, S. F. & Co., Ltd., Toronto.

CUTTING, OXY-HYDROGEN
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

DETACHABLE CHAIN
International Malleable Iron Co., Guelph, Ont.

DIAMONDS, BLACK AND ROUGH
Can. Desmond-Stephan Mfg Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

DIAMOND TOOLS
Can. Desmend-Stephan Co., Hamilton,
Wheel Trueing Tool Co., Windsor, Ont.

DIAMOND CROSSINGS
Can. Steel Foundries, Montreal, Que.

DIAMONDS, IMPORTERS
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Co., Windsor, Ont.

DIES, SCREW AND THREAD CUTTING
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.

DIES, SHEET-METAL AND SUB-PRESS (See Tool Work)
Brown, Boggs & Co., Ltd., Hamilton, Ont.

DIES, FORGING
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

DIES, SELF-OPENING, ADJUSTABLE
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Landis Machine Co., Inc., Waynesboro,
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DIES, THREADING-OPENING
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

DIVIDING HEADS
Burke Machine Tool Co., Conneaut, Ohio.
Hendey Machine Co., Torrington, Conn.
Kearney & Treacker Co., Milwaukee, Wis.
Petrie, Ltd., H. W. Toronto, Ont.

DOGS, LATHE AND MILLING MACHINE
Armstrong Bros. Tool Co., Chicago, Ill.

DRAFTING MATERIALS
American Lead Pencil Co., New York City, N.Y.

DRESSERS, GRINDING WHEEL
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ont.
Norton Co., of Can., Ltd., Hamilton.
Wheel Trueing Co., Windsor, Ont.

DRESSING TOOLS
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Co., Windsor, Ont.

DRILL HOLDERS
Armstrong Bros. Tool Co., Chicago, Ill.

DRILLING MACHINES, BENCH
Burke Machine Tool Co., Conneaut, Ohio.
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Hardinge Bros., Inc., Chicago, Ill.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
U. S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, ELECTRIC AND HAND
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, GANG
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

DRILLING MACHINES, HEAVY DUTY
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
Rockford Drilling Machine Co., Rockford, Ill.

BORING, DRILLING AND MILLING MACHINES, (HORIZONTAL.)
Gisholt Machine Co., Madison, Wis.

DRILLING MACHINES, Multiple Spindle
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
National Acme Co., Cleveland, Ohio.

DRILLING MACHINES, Pneumatic
Cleveland Pneumatic Tool Co., Toronto. Ont.

DRILLING MACHINES, PORTABLE
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, RADIAL
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Wiliams Machinery Co., A. R., Toronto,

DRILLING MACHINES, SENSITIVE
Burke Machine Tool Co., Conneaut, O.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Williams Machinery Co., A. R., Toronto.
Wisconsin Electric Co., Racine, Wis

DRILLING MACHINES, TURRET
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wisconsin.
Williams Machinery Co., A. R., Toronto.

DRILLING MACHINES, VERTICAL
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

DRILLS, CENTRE
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DRILLS, HIGH SPEED TWIST
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Cleveland Twist Drill Co., Cleveland, O.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DRILLS, RATCHET
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

DRILLS, TWIST AND FLAT
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.

DROP FORGINGS
Steel Co. of Canada, Ltd., Hamilton.

DUMB WAITERS
Roelofson Elevator Works, Galt, Ont.

DUST HANDLING EQUIPMENT
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

ELECTRICAL INSTRUMENTS
Bristol Co., Waterbury, Conn.

ELECTRICAL SUPPLIES
Atkins & Co., Inc., E. C., Indianapolis.
Diamond State Fibre Co., Toronto, Ont.
U.S. Electrical Tool Co., Cincinnati, O.

ELEVATORS AND CONVEYORS
Can. Link-Belt C., Toronto, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q

ELEVATORS, FREIGHT AND PASSENGER
Roelofson Elevator Works, Galt, Ont.

EQUIPMENT, ELEVATOR SAFETY
Jones & Glassco, Montreal, Que.

EMERY WHEELS (See Grinding Wheels)
Lion Grinding Wheels, Limited, Montreal, Que.
Atkins & Co., E. C., Indianapolis, I.
Norton Co., of Canada., Ltd., Hamilton.

ENGINES, CAPSTAN
Kennedy & Sons, Wm., Owen Sound, Ont.

ENGINE LATHE MANUFACTURERS
Oliver Machinery Co., Grand Rapids, Michigan.

ENGINEERS, MECHANICAL
Dominion Engineering Works, Limited, Montreal, Que.
Gisholt Machine Co., Madison, Wis.
Hamilton Gear & Machine Co., Toronto,

EXPANDERS, TUBE
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

FANS, ELECTRIC
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

FANS, EXHAUST
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Petrie Ltd., H. W., Toronto, Ont.

FANS, VENTILATING
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

FIBRE
Diamond State Fibre Co., of Can. Ltd., Toronto, Ont.

FILES AND RASPS
Nicholson File Co., Port Hope, Ont.
Simmons Canada Saw Co., Montreal, Que.

FILLER, IRON (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J.

FIRE ESCAPES
Roelofson Elevator Co., Galt, Ont.

FITTINGS, PIPE
International Malleable Iron Co., Guelph
Fittings, Limited, Oshawa, Ont.

FLEXIBLE SHAFTS
Strand & Co., N. A., Chicago, Ill

FLUXES, WELDING
Carter Welding Co., Ltd, Toronto, Ont.
Dominion Oxygen Co., Ltd. Toronto
Liquide Air Company, Toronto, Ont.

FORGING MACHINERY
Acme Machinery Co., Cleveland, Ohio
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown Boggs & Co., Ltd., Montreal
National Machinery Co., Tiffin, Ohio.
Steel Co. of Canada, Ltd., Hamilton

BUYERS' DIRECTORY

FORGINGS, DROP
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Ltd., Toronto, Ont.

FORGINGS, HAMMER
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Hepburn Ltd., John T., Toronto, Ont.

FOUNDRY EQUIPMENT
Rice Lewis & Son, Ltd., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

FOUNDRY SUPPLIES
Rice Lewis & Son, Ltd., Toronto, Ont.

FROGS, SPRING OR RIGID
Can. Steel Foundries, Montreal, Que.

FURNACES, ELECTRIC
Rockwell Co., W. S. New York City.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

FURNACES, HEAT TREATING COAL
Rockwell Co., W. S., New York City.

FURNACES, HEAT TREATING OIL AND GAS
Bellevue Industrial Furnace Co., Detroit, Michigan.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Rockwell Co., W. D., New York City.

FURNACES TEMPERING AND ANNEALING
Bellevue Industrial Furnace Co., Detriet, Mich.
Brown & Sharpe Mfg., Co., Providence R. I.
Rockwell Co., W. S., New York City.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

FURNACES AND OVENS, ELECTRIC
Petrie, Ltd., H. W., Toronto, Ont.
Rockwell & Co., W. S., New York city.
Starrett Co., L. S., Athol, Mass.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

GAGES, MEASURING (See Tool Work)
Brown & Sharpe Mfg. Co., Providence, R. I.
Greenfield Tap & Die Corp., Galt, Ont.
Lufkin Rule Co., Windsor, Ont.
Starrett Co., L. S., Athol, Mass.

GAGES, RECORDING
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GAGES, SPECIAL MEASURING (See Tool Work)
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GAGES, THREAD
Brown & Sharpe Mfg. Co., Providence R. I.
Starrett Co., L. S., Athol, Mass.

GALVANIZING
Fittings, Limited, Oshawa, Ont.

GAS, COAL COMPRESSED
L'Air Liquid Society, Toronto, Ont.

GAS, COMPRESSED
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

GASKETS
Diamond State Fibre Co. of Ca., Ltd., Toronto, Ont.
Smooth Mfg. Co., Jersey City, N. J.

GAUGES VACUUM AND PRESSURE
Taylor Instrument Co. Toronto, Ont.

GEAR BLANKS
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.
Dominion Engineering Works, Limited, Montreal, Que.

GEAR COUNTERS
Hart Mfg. Co., R. A., Battle Creek, Michigan.

GEAR CUTTING MACHINES
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Fellows Gear Shaper Co., Springfield, Vt.
Petrie, Ltd., H. W., Toronto, Ont.
Whiton Machine Co., D. E., New London, Conn.

GEAR TESTING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.

GEARS, CAST
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Hull Iron & Steel Foundries, Hull, Que.
Dominion Engineering Works, Limited, Montreal, Que.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

GEARS, CUT
Brown & Sharpe Mfg. Co., Providence, R. I.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Gardner & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto, Ont.
Hepburn Ltd., John T. Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

GEARS, DRESSED
Kennedy & Sons, Wm., Owen Sound, Ontario.

GEARS, FORGED
Canada Foundries & Forgings Co., Welland, Ont.

GEARS, HERRINGBONE
Hamilton Gear & Machine Co., Toronto, Ont.

GEARS, RAWHIDE (See Gears, Cut)
Hamilton Gear & Machine Co., Toronto.

GEAR, SILENT CHAIN
Gardner & Son, Robt., Montreal, Que.
Can. Link-Belt Co., Ltd., Toronto, Can.
Hans Renold of Canada, Ltd., Montreal, Quebec.

GEARS, WORM
Hamilton Gear & Machine Co., Toronto.

GENERATORS, ACETYLENE
L'Air Liquide Society, Toronto, Ont.

GOGGLES, SAFETY
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

GRAB BUCKETS
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Cleveland Twist Drill Co., Cleveland, O.

GREASE CUPS, PRESSED STEEL AND BRASS
Can. Winkley Co., Ltd., Windsor, Ont.

GREASES, LUBRICATING
Canadian SKF Co., Toronto, Ont.

GRINDING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Norton Co., of Canada, Ltd., Hamilton.

GRINDING MACHINES, ABRASIVE BELT
Norton Co. of Can. Ltd., Hamilton, Ont.

GRINDING MACHINES, AUTOMATIC
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, BENCH
Blount Co., J. G., Everett, Mass.
Geometric Tool Co., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co. of Canada, Ltd., Hamilton, Ont.
Petrie, Ltd., H. W. Toronto, Ont.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, CENTER
U. S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES, CUTTER AND REAMER
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Petrie Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, CYLINDRICAL
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.
Norton Co., of Canada, Ltd., Hamilton.

GRINDING MACHINES, DIE
Geometric Tool Co., New Haven, Conn.
National Acme Co., Cleveland, O.
National Machinery Co., Tiffin, Ohio.

GRINDING MACHINES, DRILL
Bellevue Industrial Furnace Co., Detroit, Mich.
Bertram & Son Co., Ltd., The John, Dundas, Ont.

GRINDING MACHINES, ELECTRIC
Strand & Co., N. A., Chicago, Ill.

GRINDING MACHINES, FLOOR AND TOOL
Blount Co., J. G., Everett, Mass.
National Acme Co., Cleveland, Ohio.
Norton Co. of Canada, Ltd., Hamilton, Ontario.
Petrie, Ltd., H. W., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.

GRINDING MACHINES, INTERNAL
Garlock Machinery Ltd., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES PORTABLE
Strand & Co., N. A., Chicago, Ill.

GRINDING MACHINES, SNAGGING
Blount Co., J. G., Everett, Mass.
Norton Co., of Can. Ltd., Hamilton, Ont.

GRINDING MACHINES, SURFACE
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, THREAD
Pratt & Whitney Co., of Canada, Ltd.,

GRINDING MACHINERY, TOOL POST
Gisholt Machine Co., Madison, Wis.
Grenfield Tap & Die Corp., Galt, Ont.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES, UNIVERSAL
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co., of Canada, Ltd., Hamilton Ontario.
Petrie, Ltd., H. W., Toronto, Ont.

GRINDING WHEELS
Lion Grinding Wheels, Limited, Montreal, Que.
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Norton Co. of Can., Ltd., Hamilton, Ont.

GUN-BARREL MACHINERY
Steinle Turret Machine Co., Madison, Wisconsin.

HACK SAWS, POWER
Atkins & Co., Inc., E.C., Indianapolis, Indiana.
Petrie, Ltd., H. W., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.

HAMMERS, CHIPPING
Cleveland Pneumatic Tool Co., Toronto, Ont.
High Speed Hammer Co., Rochester.

HAMMERS, DROP
Bertram & Son Co., Ltd., The John Dundas, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

HAMMERS, ELECTRIC
Brown, Boggs & Co., Ltd., Hamilton, Ont.

HAMMERS, PNEUMATIC
Can. Steel Foundries, Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto Ont.

HANGERS, SHAFTING
Canadian SKF Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Hamilton Gear & Machine Co., Toronto.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

HOBBING MACHINES
Shore Instrument Co., Jamaica, N Y

HARDENING, CASE-HARDENING AND TEMPERING
Barnes Company, Wallace, Hamilton.
Petrie, Ltd., H. W., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Cleveland Pneumatic Tool Co., Toronto Ont.

HAMMERS, POWER
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Jardine & Co., A. B., Hespeler, Ont
Petrie, Ltd., H. W., Toronto, Ont.

HOBS
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

HOISTS, ELECTRIC
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

HOISTS, ELECTRIC
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

HOISTS, HAND
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

HOISTS, PNEUMATIC
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

HOLDERS-ON, PNEUMATIC
Cleveland Pneumatic Tool Co., Toronto Ont.

HYDRAULIC MACHINERY
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Dominion Engineering Works, Limited Montreal, Que.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

IGNITERS, GAS ENGINE
Canada Foundries & Forgings Co., Welland, Ont.
Burke Machine Tool Co., Conneaut, O

INDICATORS, SPEED AND TEST
Brown & Sharpe Mfg. Co., Providence, R.I.

INSULATION
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.

IRON BARS
Steel Co. of Canada, Ltd., Hamilton, Ont.

JACKS, HYDRAULIC
Norton, A. O., Boston, Mass.

JACKS, PLANER
Armstrong Bros. Tool Co., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

JAPANNING AND VARNISHING OVENS
Brantford Oven & Rack Co., Brantford, Ont.

JIGS AND FIXTURES (SEE TOOL WORK)
Fisher Motor Co., Ltd., Orillia, Ont.
Gisholt Machine Co., Madison, Wis.

KEYSEATING MACHINES
Morton Mfg Co., Muskegon, Mich.

BUYERS' DIRECTORY

Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

KEYS, MACHINE
Can. Drauw Steel Co., Hamilton, Ont.
Morton Mfg. Co., Muskegon, Mich.

KNIVES, MACHINE
Atkins & Co., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

KNURL HOLDERS
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

LATHE ATTACHMENTS
Hendey Machine Co., Torrington, Conn.
Petrie, Ltd., H. W., Toronto, Ont.

LATHE TOOLS
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

LATHES, AUTOMATIC AND SEMI-AUTOMATIC
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, BENCH
Hardinge Bros., Inc., Chicago, Ill.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

LATHES, BORING
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, CHUCKING (SEE LATHES, HORIZONTAL TURRET, AND LATHES, VERTICAL TURRET)
Acme Machine Tool Co., Cincinnati, O.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, ENGINE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hendey Machine Co., Torrington, Conn.
Petrie, Ltd, H. W., Toronto, Ont
Rockford Lathe & Drill Co., Rockford, Illinois.

LATHES, EXTENSION AND GAP
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison Wis.
National Acme Co., Cleveland, O.
Petrie, Ltd., H. W., Toronto, Ont.
Steinle Turret Machine Co., Madison, Wis.

LATHES, PRECISION
Hardinge Bros., Chicago.

LATHES, RELIEVING
Hendey Machine Co., Torrington, Conn.

LATHE, UNIVERSAL HAND
Brown & Sharpe Mfg. Co., Providence, Rhode Island.

LATHE, SPEED AND HAND
Blount Co., J. G., Everett, Mass.

LATHES, SPINNING
Pryibil Machine Co., Torrington, Conn.

LATHES, VERTICAL TURRET
Bertram & Son, Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

LATHES, WOOD TURNING
Blount, Co., J. G., Everett, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.

LEAD PIPE
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

LEATHER FILLET
D. K. McLaren, Limited, Montreal.

LINOLEUM MILL MACHINERY
Bertrams, Ltd., Edinburgh, Scotland.

LIQUID AIR PLANTS
L'Air Liquide Society, Toronto, Ont.

LOCKERS, CLOTHES
Dennis Wire and Iron Works, London, Ont.

LUBRICANTS
Oakley Chemical Co., New York, N.Y.

LUBRICATING SYSTEMS
Bowser, S. F., & Co., Ltd., Toronto, Canada.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Ltd., Welland, Ont.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R. Toronto Ont.

MANGANESE STEEL
Can. Steel Foundries, Montreal, Que.

MANDRELS, EXPANDING
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MANDRELS, SOLID
Greenfield Tap & Die Corp., Galt, Ont.
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Pratt & Whitney Co., of Canada. Ltd., Dundas, Ont.

MEASURING MACHINES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MECHANICS' FINE TOOLS
Lufkin Rule Co., Windsor, Ont.

METALS, ALLOY
Canada Metal Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.

METAL WORKERS
Parker Co., Charles, Meriden, Conn.

MICROMETER CALIPERS
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Rice Lewis & Son, Ltd., Toronto, Ont.

MILLING ATTACHMENTS
Burke Machine Tool Co., Conneaut, O.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

MILLING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Burke Machine Tool Co., Conneaut, O

MILLING MACHINES, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence, R. I.
Hardinge Bros., Inc., Chicago, Ill.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

MILLING MACHINES, BENCH
Burke Machine Tool Co., Conneaut. O.
Hardinge Bros., Inc., Chicago, Ill.

MILLING MACHINES, HAND
Brown & Sharpe Mfg. Co., Providence
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MILLING MACHINES, HORIZONTAL PLANER TYPE.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Kearney & Trecker Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto.

MILLING MACHINES, PLAIN
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, O.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

MILLING MACHINES, THREAD
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MILLING MACHINES, UNIVERSAL
Brown & Sharpe Mfg. Co., Providence,
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

MILLING MACHINES, VERTICAL
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, O.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto.

MILLING TOOLS, ADJUSTABLE HOLLOW
Geometric Tool Co., New Haven, Conn.

MOTORS, ELECTRIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Roelofson Elevator Co., Galt, Ont.
Williams Machinery Co., A. R., Toronto,
Wisconsin Electric Co., Racine Wis.

NAILS AND STAPLES
Canada Metal Co., Ltd., Toronto, Ont.

NIPPLES
Canada Metal Co., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton,

NITROGEN
Carter Welding Co. Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

NUT TAPPERS
(See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
National Acme Co., Cleveland, Ohio.

NUTS, FINISHED and SEMI-FINISHED
Galt Macine Screw Co., Galt, Ont.
National Acme Co., Montreal, ue.

NUTS (Up to 4-in.)
Steel Co. of Canada, Ltd., Hamilton.

NUTS, S.A.E., PLAIN AND CASTELLATED
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

OIL FILTERING AND STORAGE SYSTEMS
Bowser, S. F., & Co., Ltd., Toronto,

OIL STORAGE ENGINEERS
Bowser, S. F., & Co., Ltd., Toronto,

OIL HOLE COVERS
Can. Whitney Co., Ltd., Windsor, Ont.

OILS, SOLUABLE
Brantford Oven & Rack Co., Brantford, Ontario.

ORNAMENTAL IRON AND WIRE WORKS
Roelofson Elevator Works, Galt, Ont.

OXYGEN
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

OXY-ACETYLENE APPARATUS
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Atlas Press Co., Kalamazoo, Mich.

PAPER MILL CONVEYORS
Bertram Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd., Montreal, Que.

PATTERNS, WOOD AND METAL
Fittings, Limited, Oshawa, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.
Victoria Foundry Co., Ltd., Ottawa.

PHOSPHOR TIN
Canada Metal Co., Ltd., Toronto, Ont.

PHOTOGRAPHIC DUPLICATING MACHINES
Photostat Corp., Providence, R. I.

PIPE BENDING MACHINES
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Underwood Corp., H. R., Philadelphia, Pa.
Williams Machinery Co., A. R., Toronto.

PIPE CUTTING AND THREADING MACHINES
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Petrie, Ltd., H. W., Toronto, Ont.

PIPE
Canada Metal Co., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.

PIPE FITTINGS
Canada Metal Co., Toronto, Ont.
Fittings, Limited, Oshawa, Ont.
International Malleable Iron Co., Guelph Ont.

PIPE AND NIPPLE THREADING MACHINES
Landis Machine Co., Inc., Waynesboro, Pa.

PIPE FITTERS' TOOLS
Rice Lewis & Son, Ltd., Toronto. Ont.

PIPE THREADING DIE HEADS
Landis Machine Co., Inc., Waynesboro, Pa.

PISTON-RING MACHINES
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

PLANING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Williams Machinery Co., A. R., Toronto.

PLANING MACHINES, ROTARY
Bertram & Son Co., Ltd., The John, Dundas, Ont.

PLATE ROLLS
Bertram & Son Co., Ltd., The John, Dundas, Ont.

PNEUMATIC TOOLS
Cleveland Pneumatic Tool Co., Toronto.

POLISHING AND BUFFING MACHINES
Lion Grinding Wheels, Limited, Montreal, Que.
Blount Co., J. G. Everett, Mass.
Brown & Sharpe Mfg. Co., Providence.
Pryibil Machine Co., New York, N.Y.

PRESSED STEEL PARTS
American Pulley Co., Philadelphia, Pa.
Fisher Motor Co., Ltd., Orillia, Ont.

PRESSES, ARBOR
Atlas Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

PRESSES, DROP AND FORGING
Brown, Boggs & Co., Ltd., Hamilton.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

PRESSES, FOOT AND HAND
Brown, Boggs & Co., Ltd., Hamilton.

PRESSES, HYDRAULIC
Bertram & Son Co., Ltd., The John, Dunldas, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Perrin Ltd., W. R., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

PRESSES, POWER
Bliss Co., E. W., Prooklyn, N. Y.
Brown, Boggs, & Co., Ltd., Hamilton.
Hepburn Ltd., John T., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Stoll Co., Inc., D. H., Buffalo, N.Y.

PRESSES, SCREW
Brown, Boggs & Co., Ltd., Hamilton.
Petrie, Ltd., H. W., Toronto, Ont.

PROFILING MACHINES
Prtt & Whitney Co., of Canada, Ltd., Dundas, Ont.

PROTRACTORS
Brown & Sharpe Mfg. Co., Providence
Lufkin Rule Co., Windsor, Ont.

PROPELLERS
Kennedy & Sons, Wm., Owen Sound Ontario.

PULLEYS, CORK INSERT
American Pulley Co., Philadelphia, Pa.

PULLEYS, METAL AND FIBRE
American Pulley Co., Philadelphia, Pa.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.
D. K. McLaren Co., Limited Montreal, Que.

PULP AND PAPER MILL EQUIPMENT
Dominion Engineering Works, Ltd., Montreal, Que.

PUMPS, HYDRAULIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Dominion Engineering Works, Ltd. Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont

BUYERS' DIRECTORY

PUMPS, LUBRICANT AND OIL
Bowser, S. F., & Co., Ltd., Toronto.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Hepburn Ltd., John T., Toronto, Ont.

PUMPS, POWER
Bowser, S. F., & Co., Ltd., Toronto.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hepburn Ltd., John T., Toronto, Ont.

PUNCHES, CENTER
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

PUNCHES, HAND
Brown Boggs & Co., Ltd., Hamilton.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Jardine & Co., A. B., Hespeler, Ont.

PUNCHES, POWER
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

PUNCHING MACHINES, HORIZONTAL
Bertrams Ltd., Edinburgh, Scotland.

PYROMETERS, ELECTRIC
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Hiram Walker & Sons Metal Products Co., Walkerville, Ont.

RACKS, CUT
Hamilton Gear & Machine Co., Toronto.

RACKS, STORAGE
(See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ontario.

REAMER HOLDERS
Simonds Canada Saw Co., Montreal, Q.

REAMERS, EXPANDING
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

REAMERS, SOLID
Butterfield & Co., Inc., Rock Island, Q.
Morse Twist Drill & Machine Co., New Bedford, Mass.

REAMERS, TAPER
Brown & Sharpe Mfg. Co., Providence, R. I.
Butterfield & Co., Inc., Rock Island, Q.
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canad, Ltd., Dundas, Ont.

RECORDERS, TEMPERATURE
Taylor Instrument Co., Rochester, N. Y.

RECORDERS, TIME
Gisholt Machine Co., Rochester, N. Y.
Taylor Instrument Co., Toronto, Ont.

REGULATORS, TEMPERATURE
Taylor Instrument Co., Toronto, Ont.

RIVETS AND BURRS
Parmenter & Bulloch Co., Gananoque, Ont.
Steel Co., of Canada, Ltd., Hamilton.

RIVETS, CHAIN
Pittings, Limited, Oshawa, Ont.

RIVET-MAKING MACHINERY
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

RIVETING MACHINES
Can. Fairbanks-Morse Ltd., Montreal Q.
High Speed Hammer Co., Rochester, N.Y.
Parmenter & Bulloch Co., Gananoque Ont.
Petrie, Ltd., H. W., Toronto, Ont.

RUDDER FRAMES, STEEL
Can. Steel Foundries, Montreal, Que.

RUBBER MILL MACHINERY
Bertram Ltd., Edinburgh, Scotland.

RULES, STEEL AND WOOD
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Windsor, Ont.

RUST PREVENTATIVES
Oakley Chemical Co., New York, N. Y.

SAND EQUIPMENT
Can. Link-Belt Co., Toronto, Ont.

SAND RAMMERS, PNEUMATIC
Cleveland Pneumatic Tool Co., Toronto.

SAW FRAMES AND BLADES, HACK
Atkins & Co., Inc., E. C., Indianapolis,
Diamond Saw & Stamping Works, Buffalo, N. Y.
Rice Lewis & Sons, Ltd., Tornto, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWING MACHINES, POWER HACK
Atkins & Co., Inc., E. C., Indianapolis,
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

SAW SHARPENING MACHINES
Atkins & Co., Inc., E. C., Indianapolis,
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

SAW SHARPENING MACHINES
Atkins & Co., Inc., E. C., Indianapolis.

SAW TABLES, UNIVERSAL
Petrie, Ltd., H. W., Toronto, Ont.

SAWS, CIRCULAR METAL
Atkins & Co., Inc., E. C., Indianapolis.
Pryibil Machine Co., New York, N. Y.
Gisholt Machine Co., Madison, Wis.

SAWS, HAND
Atkins & Co., Inc., E. C., Indianapolis
Simonds Canada Saw Co., Montreal, Q.

SAWS, HOT AND COLD
Atkins & Co., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Q.

SAWS, HIGH SPEED STEEL
Atkins & Co., Inc., E.C., Indianapolis, I.
Butterfield & Co. Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWS, METAL BAND
Atkins & Co., E. C., Indianapolis, I.

SAWS, METAL CUTTING
Brown & Sharpe Mfg. Co., Providence.
Butterfield & Co., Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.
Starrett Co., L. S., Athol, Mass.

SAWS, SCREW SLOTTING
Atkins & Co., Inc., E., C., Indianapolis.
Butterfield & Co., Inc., Rock Island, Q.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canda, Ltd., Dundas, Ont.

SAWS, SCREW SLOTTING
Atkins & Co., Inc., E. C., Indianapolis.
Butterfield & Co., Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q

SAWS, WOOD
E. C. Atkins & Co., Indianapolis, Ind.

SCALES
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Ltd., Montreal, Q
Lufkin Rule Co., Windsor, Ont.

SCREENS
Dominion Engineering Works, Ltd., Montreal, Que.

SCREW DRIVERS, OPTICAL, JEWELRY AND NOVELTY
Strand & Co., N. A., Chicago, Ill.

SCREW MACHINE WORK
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Montreal, Que.

SCREW MACHINERY, WOOD AND LAG
Cook Co., Asa S., Hartford, Conn

SCREW MACHINES
Brown & Sharpe Mfg. Co., Providence, Rhode Island.

SCREW MACHINES, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.

SCREW MACHINE PRODUCTS
National Acme Co., Montreal, Que.

SCREW PLATES
Butterfield & Co., Inc., Rock Island. Que.
Jardine & Co., A. B., Hespeler, Ont.

SCREWS, CAP AND SET
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

SCREWS, SAFETY, SET
Galt Machine Screw Co., Galt, Ont.

SECOND-HAND MACHINERY
See last page of directory.
Petrie, Ltd., H. W., Toronto, Ont.

SEPARATORS, MOISTURE AND OIL
Bowser, S. F., & Co., Ltd., Toronto, Canada.

SEPARATORS, OIL AND WASTE
Bowser, S. F., & Co., Ltd., Toronto.

SHAFTS, FLEXIBLE
Strand & Co., N. A., Chicago, Ill.

SHAFTING
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
Williams Machinery Co., A. R., Toronto.

SHAPES, COLD-DRAWN SPECIAL STEEL
Union Drawn Steel Co., Hamilton, Ont.

SHAPING MACHINES
Hendey Machine Co., Torrington, Conn.
Morton Mfg. Co., Muskegon, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Williams Machinery Co., A. R. Toronto.

SHEARS HAND
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

SHEARS, POWER
Bliss Co., E. W., Brooklyn, N. Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Stoll Co., Inc., D. H., Buffalo, N. Y.
Williams Machinery Co., A. R., Toronto, Ont.

SHEARING MACHINES, ANGLE, IRON BAR AND GATE
Bertrams Ltd., Edinburgh, Scotland.

SHEET LEAD
Canada Metal Co., Ltd., Toronto, Ont.

SHEET METAL WORKING MACHINERY
Bliss Co., E. W., Brooklyn, N. Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Stoll Co., Inc., D. H, Buffalo, N.Y.

SHEETS, NICKEL, MONEL AND FIBRE
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.

SHEETS, O.P.C.R. & B. A. AND BLUE ANNEALED
Steel Co., of Canada, Ltd., Hamilton, Ont.

SIDE FRAMES, LOCOMOTIVE
Can. Steel Foundries, Montreal, Que.

SLOTTING ATTACHMENTS
Brown & Sharpe Mfg. Co., Providence, R.I.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

SLOTTING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.

SOLDERS
Canada Metal Co., Ltd., Toronto, Ont.

SPECIAL MACHINERY AND TOOLS
Brown Engineering Corp., Ltd., Toronto.
Gisholt Machine Co., Madison, Wis
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont
National Acme Co., Cleveland, O.

SPIKES, RAILWAY AND PRESSED
Steel Co of Canada, Ltd., Hamilton, Ont.

SPINNING LATHES
Prybil Machine Co., P., New York City.

SPRING, MILLED
Barnes & Co., Wallace, Hamilton, Ont.

SPRINGS, SMALL SPIRAL HELICAL, COMPRESSION, EXTENSION, TORSION AND SPECIAL
Barnes Company, Wallace, Hamilton.

SPRINGS
Barnes Company, Wallace, Hamilton.
Cleveland Wire Spring Co., Clevleand, O.
Steele Ltd., James, Guelph, Ont.

SPRINGS, FLAT STEEL, BRUSH HOLDER, CLOCK, SMALL FLAT SPRINGS
Barnes Company, Wallace, Hamilton.

SPROCKETS AND CHAINS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Renold Hanson of Canada, Ltd., Montreal, Que.

SQUARES
Brown & Sharpe Mfg. Co., Providence, R.I.
Lufkin Rule Co., Windsor, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

STAMPING, METAL
American Pulley Co., Philadelphia, Pa.
Barnes Company, Wallace, Hamilton.
Diamond Saw & Stamping Works, Buffalo, N. Y.
Parmenter & Bulloch Co., Gananoque, Ont.

STAMPS, STEEL
Diamond Saw & Stamping Works, Buffalo, N. Y.

STEEL CONCRETE REINFORCEMENT
Steel Co. of Canada, Ltd., Hamilton.

STEEL PLATE
British Empire Steel Co., Montreal, Que.

STEEL AND IRON BARS
Steel Co. of Canada, Ltd., Hamilton.

STEELS TOOL
British Empire Steel Co. Montreal Q.

STEEL, COLD-ROLLED STRIP
British Empire Steel Co., Montreal, Q.
Barnes Company, Wallace, Hamilton.

STEEL, CRUCIBLE, SPRING
Barnes, Company, Wallace, Hamilton.
British Empire Steel Co., Montreal, Q.

SHEETS, OPEN HEARTH STEEL
Steel Co., of Canada, Ltd., Hamilton.

STEEL, SHAFTING AND FREE CUTTING SCREW
Union Drawn Steel Co., Hamilton, Ont.

STEEL, SHEET
British Empire Steel Co., Montreal, Q.
Rice Lewis & Son, Ltd., Toronto, Ont.

STEEL, STAINLESS
Steel Co., of Can. Ltd., Hamilton, Ont.

STEEL STAIRS
Roebotson Elevator Works, Galt, Ont.

STEELS, ALLOY AND CARBON
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Can. Steel Foundries, Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton, Ont.

STEELS, HIGH-SPEED
Armstrong Bros. Tool Co., Chicago, Ill.
Atkins & Co., Ltd., Wm., Sheffield, England.
British Empire Steel Co., Montreal, Q.
Rice Lewis & Son, Ltd., Toronto, Ont
Steel Co., of Canada, Ltd., Hamilton

STEEL TUBING, CLOSE JOINT AND WELDED
Standard Tube & Fence Co., Ltd., Woodstock, Ont.

STERN FRAMES, CAST STEEL
Can. Steel Foundries, Montreal, Que.

STRAIGHTENING MACHINERY
Bertram Ltd., Edinburgh, Scotland.
Williams & Co., Ltd., J. H., Brooklyn, N.Y.

STUDS
Geometric Tool Co., New Haven, Conn.
Galt Machine Screw Co., Galt, Ont.

BUYERS' DIRECTORY

SWAGING MACHINES
Atkins & Co., Inc., E. C., Indianapolis, Indiana.

SWITCHES, RAILWAY
Can. Steel Foundries, Montreal, Que.

TACHOMETERS
Bristol Co., Waterbury, Conn.

TANKS AND PUMPS, OIL
Bowser, S. F., & Co., Ltd., Toronto.

TAP HOLDERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
William L. Procunier, Chicago, Ill.

TAPER PINS
Galt Machine Screw Co., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

TAPES, MEASURING
Starrett Co., L. S., Athol, Mass.
Lufkin, Rule Co., Windsor, Ont.

TAPPING MACHINES AND ATTACHMENTS
Burke Machine Tool Co., Conneaut, O.
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Wm. L. Procunier, Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

TAPS AND DIES
Butterfield & Co., Inc., Rock Island, Q.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

TAPS, COLLAPSING
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.

TEETH, DREDGE BUCKET
Kennedy & Sons, W., Owen Sound, Ont.

THERMOMETERS
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Greenfield Tap and Die Corp., Galt, Ontario.

THREAD-CUTTING TOOLS
Butterfield & Co., Inc., Rock Island, Q.
Greenfield Tap and Die Corp., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

THREAD CUTTING MACHINES
Landis Machine Co., Inc., Waynesboro, Pa.

THREADING MACHINES
Acme Machinery Co., Cleveland, Ohio.
Geometric Tool Co., New Haven, Conn.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Williams Tool Corp., of Can. Ltd., Brantford, Ont.

THREAD LEAD TESTING MACHINES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

THREAD-ROLLING MACHINES
Bliss Co., E. W., Brooklyn, N. Y.

TIE PLATES
Steel Co. of Canada, Ltd., Hamilton.

TIME RECORDERS
International Business Machine Co., Ltd., Toronto, Ont.

TONGS
Hepburn Ltd., John T., Toronto, Ont.

TOOL CASES
Rice Lewis & Son, Ltd., Toronto, Ont.

TOOL HOLDERS
Armstrong Bros., Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Bertrams Ltd., Edinburgh, Scotland.

TOOL POSTS, LATHE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Williams & Co., Ltd., J. H., Brooklyn, N.Y.

TOOLS, SMALL
(See Machinists' Small Tools)
Armstrong Bros. Tool Co., Chicago, Ill.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Lufkin Rule Co., Windsor, Ont.
National Machine Tool Co., Racine, Wis.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S. Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A.R., Toronto,

TOOL WORK
Brown Engineering Corp., Ltd., Toronto, Ontario.

TORCHES, BLOW
Rice Lewis & Son, Ltd., Toronto, Ont.

TRACKWORK, RAILWAY
Can. Steel Foundries, Montreal, Que.

TRACKWORK, MANGANESE STEEL
Can. Steel Foundries, Montreal, Que.

TRANSMISSION MACHINERY
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound.
Petrie, Ltd., H. W., Toronto, Ont.
Renold, (Hans) of Canada, Ltd., Montreal, Que.

TROLLEYS AND TRAMWAYS
Can. Link-Belt Co., Toronto, Ont.
Northern Crane Works, Walkerville, Ont.
Wright Mfg. Co., Lisbon, Ohio.

TROLLEY WHEELS
Langley & Austin, Galt, Ont.

TROWELS, PLASTERING
E. C. Atkins & Co., Indianapolis, Ind.

WRENCHES, MACHINISTS'
Armstrong Bros. Tool Co., Chicago, Ill.

TRUCKS
Can. Fairbanks-Morse Ltd., Montreal, Q.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.

TUBING, SEAMLESS STEEL, BRASS AND COPPER AND FIBRE
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

TURRET HEADS
Bertram & Son Co., Ltd., The John Dundas, Ont.

TURRET MACHINES
(See Lathes, Horizontal Turret)
Acme Machine Tool Co., Cincinnati, O.
Cook Co., Asa S., Hartford, Conn.
Gisholt Machine Co. Madison Wis.
National Acme Co. Cleveland O.
Pratt & Whitney Co. of Canada Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin

TURRETS, TOOL POST
Gisholt Machine Co. Madison, Wis.

UNIONS, PIPE
Fittings, Limited, Oshawa, Ont.

VALVES
Canada Metal Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Mon-
Dominion Engineering Works, Limited. Montreal, Que.

VISES, DRILLING MACHINE
Burke Machine Tool Co., Conneaut, Ohio.
Charles Parker Co., Meriden, Conn.
Cleveland Pneumatic Tool Co., Toronto, Ontario.
Kempsmith Mfg Co., Milwaukee, Wis.

VISES, PIPE
Charles Parker Co., Meriden, Conn.

VISES, PLANER AND SHAPER
Bertram & Son Co., Ltd., The John Dundas, Ont.
Philip Gies Foundry, Kitchener, Ont.
Hendley Machine Co., Torrington, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.

VISES, WOOD WORKERS'
Charles Parker Co., Meriden, Conn.
Parmenter & Bulloch Co., Gananoque, Ontario.

VOLTMETERS
Bristol Co., Waterbury, Conn.

WAGON LEADERS
Can. Link-Belt Co., Toronto, Ont.

WASHERS, LOCK, SPLIT AND SPRING
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WELDING APPARATUS, OXY-ACETYLENE
L'Air Liquide Society, Toronto, Ont.
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto, Ont.

WELDING APPARATUS
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L'Air Liquide Society, Toronto, Ont.

WELDING, ELECTRIC, ARC, SPOT AND BUTT
International Malleable Iron Co., Guelph, Ont.

WELDING MACHINES, OXY-ACETYLENE
Carter Welding Co., Ltd., Toronto, Ont
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.

WELDING, ELECTRIC
McLaren Belting Co., J. C., Montreal. Que.
Steel Co. of Canada, Ltd., Hamilton.

WELDING ROD, TOBIN, MANGANESE, BRONZE AND ALUMINUM
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto, Ont.

WELDING SUPPLIES
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.

WHEELS, INDUSTRIAL
American Pulley Co., Philadelphia, Pa.
Hull Iron & Steel Foundries, Hull, Que.
Kennedy & Sons, Wm., Owen Sound, Ontario.

WINCHES, HEADGATE
Kennedy & Sons, Wm. Owen Sound, Ontario.

WINCHES, STOPLOG
Kennedy & Sons, Wm., Owen Sound. Ontario.

WIRE
Barnes Company, Wallace, Hamilton.
Canada Metal Co., Ltd., Toronto, Ont.
Dennis Wire & Iron Works, London, Ontario.
Greening Wire Co., B., Hamilton, Ont.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

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Barnes Company, Wallace, Hamilton.

WIRE, COPPER AND BRASS, FINE AND HEAVY
Steel Co., of Canada, Ltd., Hamilton, Ontario.

WIRE STRAIGHTENING AND CUTTING MACHINERY
Brown, Boggs & Co., Ltd., Hamilton, Ontario.

WIRE, WELDING
L'Air Liquide Society, Toronto, Ont.
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.

WIRES, SPECIAL
Dennis Wire & Iron Works, London, Ontario.
Greening Wire Co., B., Hamilton, Ont.

WOODWORKING MACHINERY
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Williams Machinery Co., A. R., Toronto, Ontario.

WRENCHES, DROP FORGED
Armstrong Bros. Tool Co., Chicago, Ill
Canada Foundries & Forgings Co., Welland, Ont.

When answering advertisements kindly mention Canadian Machinery

List of Directory of Dealers will be Found above Advertising Index

DIRECTORY OF DEALERS

THE Buyers' Directory of CANADIAN MACHINERY was originally intended to contain information regarding lines actually manufactured by our advertisers. We now carry the advertising of leading machinery dealers, some of whom represent scores of manufacturers in addition to being manufacturers themselves in some cases. We recommend, therefore, if our subscribers cannot find what they want in our Directory that they communicate with the dealers whose names appear herewith.

MACHINE TOOLS, ETC.

Bertram & Sons, Ltd., John, Dundas, Ont.
The Canadian Fairbanks-Morse Co., Montreal, Que.
Garlock Machinery Ltd., Toronto.
Herbert Ltd., Alfred, Toronto, Ont.
H. W. Petrie, Ltd., Toronto, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
Yeates Machinery Co., London, Ont.

SHOP and FACTORY SUPPLIES

The Canadian Fairbanks-Morse Co., Montreal, Que.
Garlock Machinery Ltd., Toronto.
Herbert Ltd., Alfred, Toronto, Ont.
H. W. Petrie Ltd., Toronto, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
Yeates Machinery Co. London, Ont.

POWER EQUIPMENT, ETC.

The Canadian Fairbanks-Morse Co., Montreal, Que.
Herbert Ltd., Alfred, Toronto, Ont.
H. W. Petrie, Ltd., Toronto, Ont.

WOODWORKING MACHINERY

The Canadian Fairbanks-Morse Co., Montreal, Que.
Garlock Machinery Ltd., Toronto.
Herbert Ltd., Alfred, Toronto, Ont.
H. W. Petrie Ltd., Toronto, Ont
A. R. Williams Machinery Co, Toronto, Ont.
Yeates Machinery Co., London, Ont.

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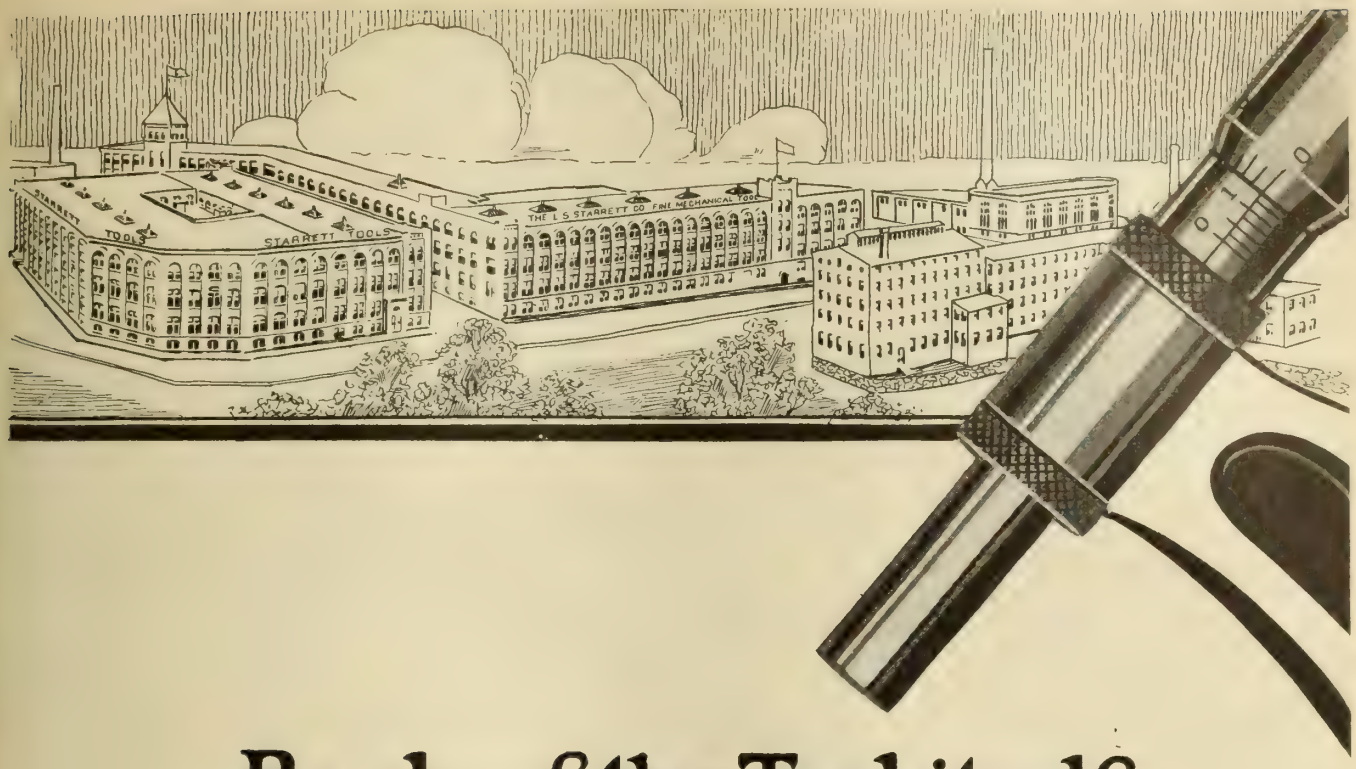

Back of the Tool itself

Back of every Starrett Tool is the reputation of The L. S. Starrett Co., the largest makers of precision tools and fine hacksaws in the world.
Send for Catalog No. 22 '3' and the Supplement describing the new Starrett Tools.

THE L. S. STARRETT CO.
The World's Greatest Toolmakers
Manufacturers of Hacksaws Unexcelled
ATHOL, MASS.

Starrett Tools

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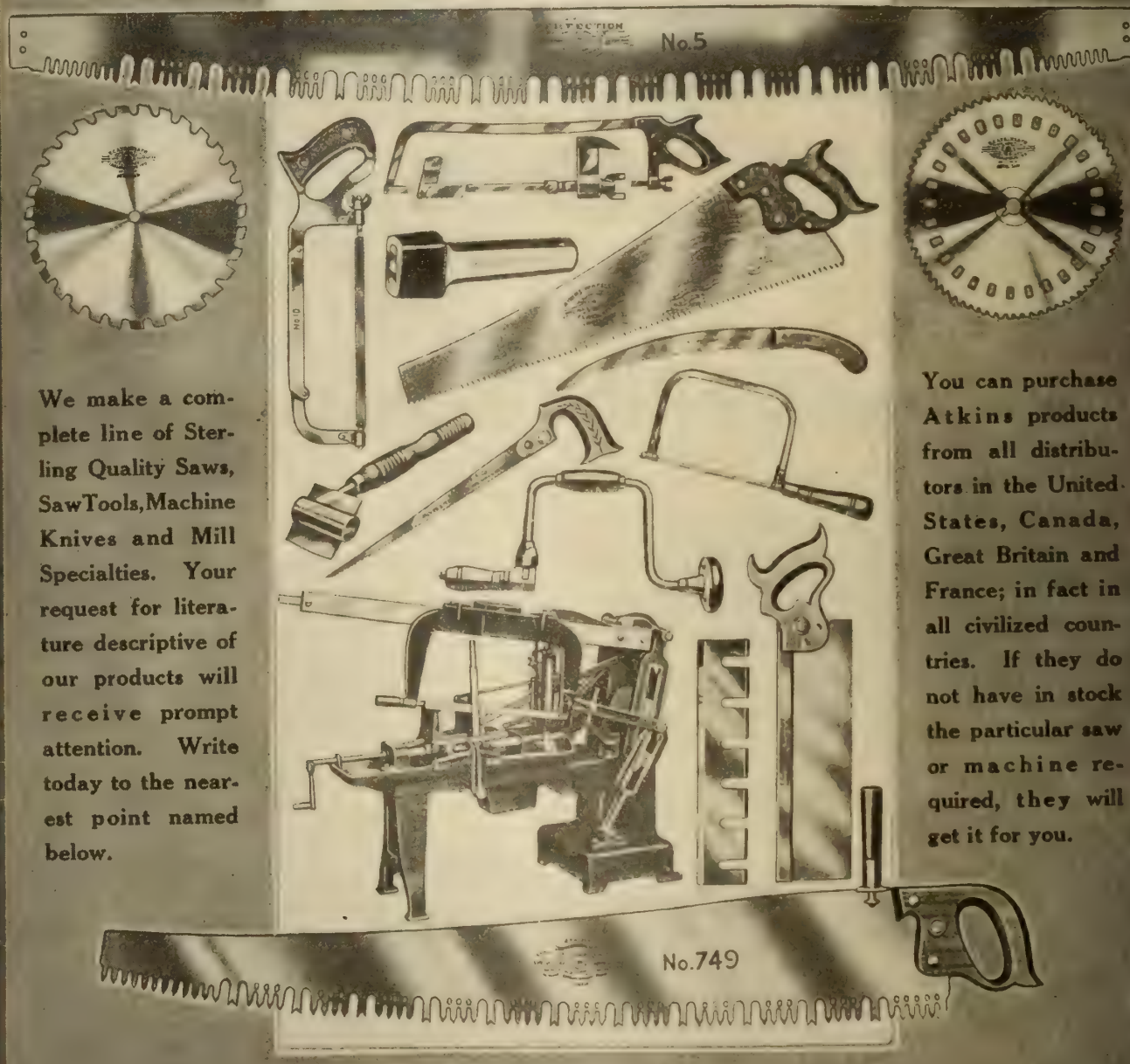
ATKINS
STERLING QUALITY
SAWS and TOOLS
A Perfect Saw for every Purpose

"Finest on Earth"

"Finest on Earth"



We make a complete line of Sterling Quality Saws, SawTools, Machine Knives and Mill Specialties. Your request for literature descriptive of our products will receive prompt attention. Write today to the nearest point named below.

You can purchase Atkins products from all distributors in the United States, Canada, Great Britain and France; in fact in all civilized countries. If they do not have in stock the particular saw or machine required, they will get it for you.

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Established 1857

Canadian Factory: HAMILTON, ONTARIO

Branch: VANCOUVER, B. C.

CANADIAN MACHINERY
AND MANUFACTURING NEWS

Vol. XXVIII. No. 13 | Published Weekly by the MacLean Publishing Company, Limited, Toronto, Ont. | Sept. 28, 1922 | $4.00 a Year Subscription Price

READ AND PASS TO	Check	See Page	READ AND PASS TO	Check	See Page

BERTRAM
MACHINE TOOLS

18-inch Crank Slotting Machine

A. C. Motor Drive Through Speed Box

10 H.P. Motor—1,000 R.P.M.

The John Bertram & Sons Co., Limited
Dundas, Ontario

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WALKERVILLE
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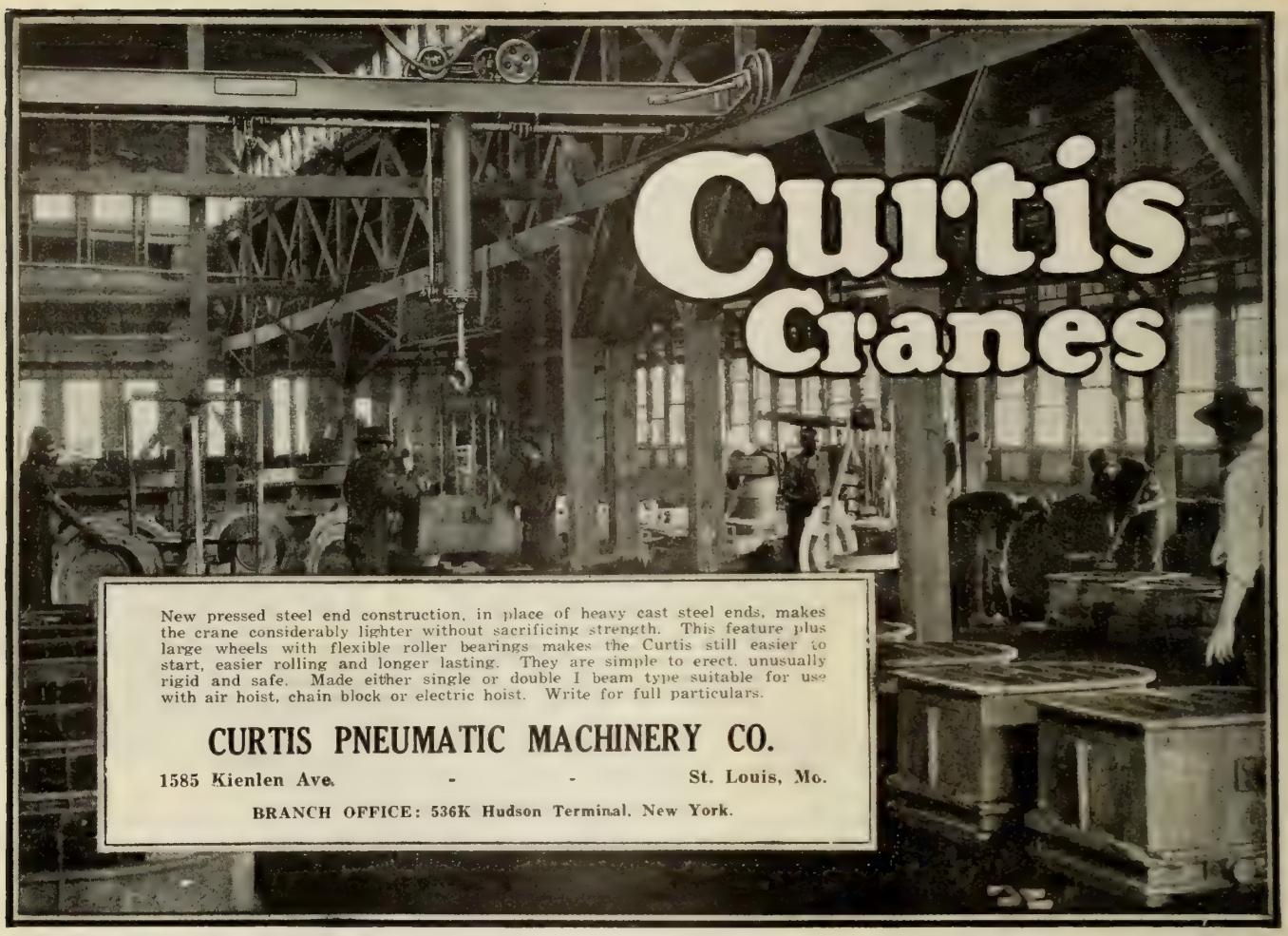
TORONTO
32 Front St. W.
WINNIPEG
1205 McArthur Bldg.
HALIFAX
Roy Building



New pressed steel end construction, in place of heavy cast steel ends, makes the crane considerably lighter without sacrificing strength. This feature plus large wheels with flexible roller bearings makes the Curtis still easier to start, easier rolling and longer lasting. They are simple to erect, unusually rigid and safe. Made either single or double I beam type suitable for use with air hoist, chain block or electric hoist. Write for full particulars.

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BRANCH OFFICE: 536K Hudson Terminal, New York.

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Machine Bolts Blank Bolts End Spring Bolts
Carriage Bolts Stud Bolts Cant Dog Bolts
Plow Bolts Bridge Bolts Coupling Bolts

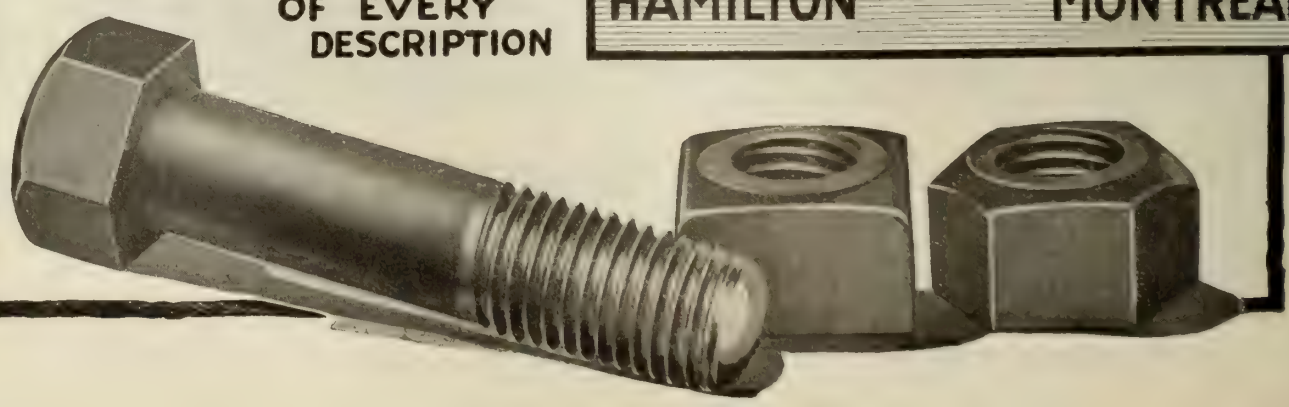
ALSO

NUTS, WASHERS AND RIVETS

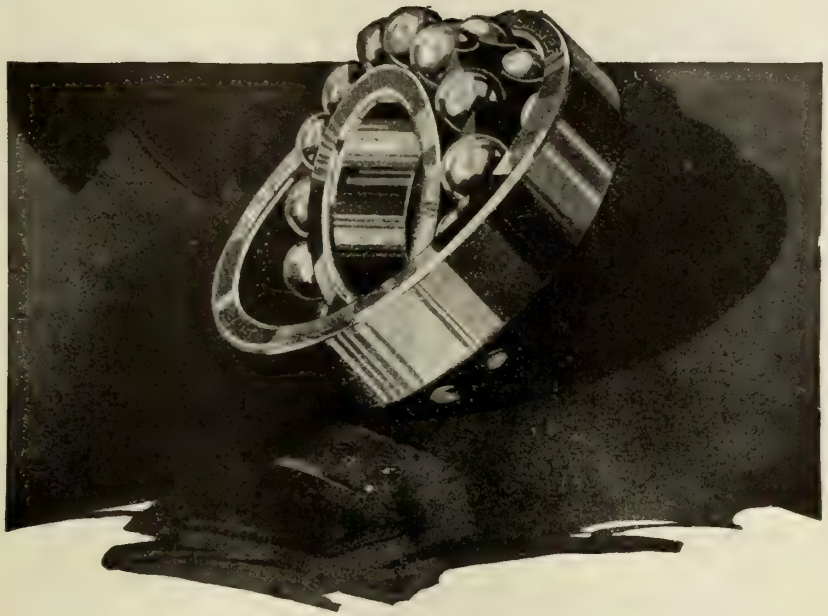
OF EVERY DESCRIPTION

THE STEEL COMPANY OF CANADA LIMITED

HAMILTON MONTREAL



SKF



Wherever Misalignment is a Factor

THE operation of your machine will not be successful unless its bearings function in complete harmony with other parts. Deflections in the shaft, weaving in the frame and other causes may create severe stresses in all parts of the bearing, unless the latter has some inherent means to compensate for this misalignment.

The SKF marked self-aligning bearing operates on the same principle as the ball and socket joint and is therefore capable of taking care of the severest misalignment. Moreover the aligning action is positive, immediate and automatic.

The self-aligning bearing is a product of the Canadian SKF Company, Limited, and is sponsored by the SKF Industries. Its manufacture embodies all the minute care, precision and quality for which the mark SKF stands. The world-wide experience of this organization is put at your disposal, free of any obligation on your part.

CANADIAN SKF COMPANY LIMITED

TORONTO - MONTREAL

Made in Canada

Beams and Channels Angles, Zeebars, Rounds and Squares and Flat Bars

Open Hearth Alloy Steels
Chrome-Vanadium, Chrome-Nickel, Nickel

All These Steels We Supply in HOT ROLLED BARS

We Also Furnish in
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Sault Ste. Marie, Ontario

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As soon as the teeth of a file have lost their original keenness, the file should be discarded.

Otherwise, time and effort are wasted. A new file costs less than that unproductive labor costs.

These standard brands retain their keenness for the maximum time.

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Great Western
American
Arcade
Globe

Nicholson File Company

Port Hope - Ontario

Cut Your Painting Costs The "SPRACO" Way

It makes some difference!--

whether you paint 1,000 sq. ft. a day or 8,000 sq. ft. a day. Yet that's the difference in the cost of painting buildings, bridges and other large structures by hand and brush and of painting it with the Spraco Paint Gun—for the same amount of time and labor are consumed in each case.

"SPRACO" Pneumatic Painting Equipment

effects tremendous savings. One handy man with Spraco Pneumatic Painting Equipment can outstrip five or six men with brush and pail. And he will use less paint, lay on a smoother, more uniform coating and get into cracks, crevices and corners where good hand-brush work is impossible. Thus saving 70% in labor and time while doing much better work.

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There are Spraco painting devices for every class of work from the finishing of the finest furniture to the painting of the hulls of ships.

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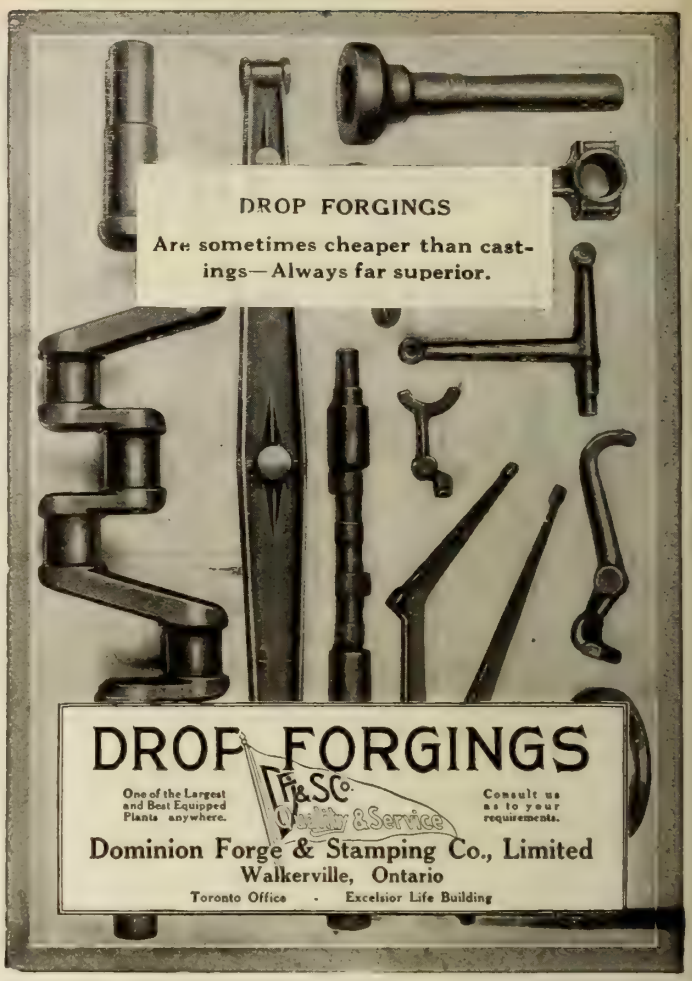
Welland, Ont.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Are sometimes cheaper than castings—Always far superior.
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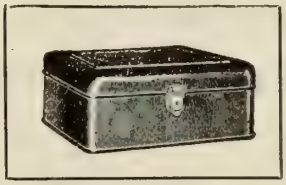
One of the Largest and Best Equipped Plants anywhere.
F & S Co.
Quality & Service
Consult us as to your requirements.
Dominion Forge & Stamping Co., Limited
Walkerville, Ontario
Toronto Office - Excelsior Life Building



What Kind of Securities In Your Strong Box?

Is every bond you hold paying interest regularly and are all your stocks earning dividends? Are your life insurance policies the best for your needs? Are your investments the kind that will help you attain your ambitions?

You ask yourself these questions from time to time. If you feel the need of advice in investment and financial matters, if you want to keep informed as to business movements affecting yourself you need THE FINANCIAL POST, Canada's dominant investment weekly. $5 will bring it for one year, 52 issues containing the solution of your own investment problems.

Pin $5 to this advertisement (or your letter), write your name and address and mail to us to-day.

THE FINANCIAL POST
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DO YOU look for quality—so high that the spring will function efficiently under all conditions; that it will "stand up" under the severest usage; that it will outlive several others in usefulness?

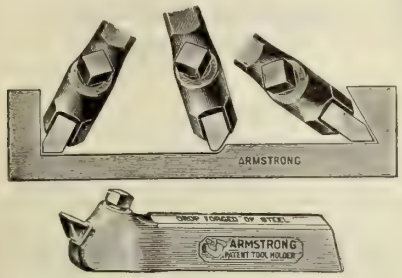
These are attributes long associated with RAYMOND SPRINGS and which owe their being to scientific heat treatment by experts and the facilities of our up-to-date plant.

There is a RAYMOND SPRING for every purpose.

Raymond Mfg. Co., Ltd.
Corry, Pa., U.S.A.

Tool Holders vs. Forged Tools

One Pound of Steel



Equal to 10 Forged Tools

THE simplicity, strength and convenience of Armstrong Tool Holders is appreciated by practical machinists. They recognize the fact that the saving in time, steel and annoyance effected by Armstrong Tool Holders can hardly be over-estimated.

Where they once carried large stocks of heavy tool steel and ground it to waste, they now turn up cutters from the bar at less than one-tenth the cost. Send for catalogue

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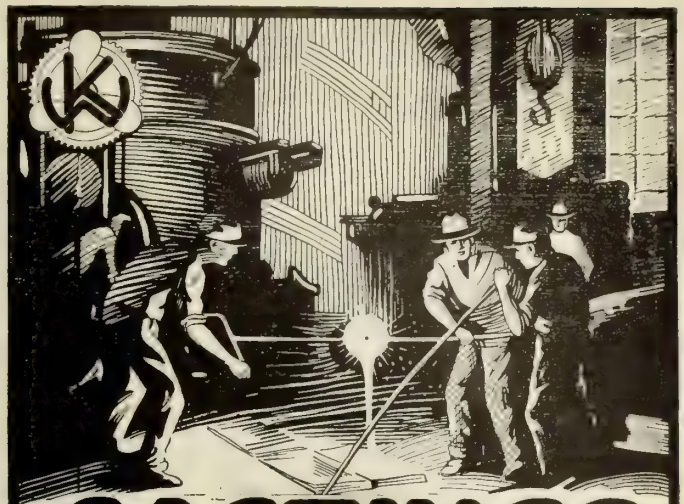
STRONG "THE TOOL HOLDER PEOPLE" STRONG
505 N. FRANCISCO AVE. CHICAGO, U.S.A.

CANADIAN AGENTS:—A. R. Williams Machinery Co., Toronto. St. John, Halifax; Williams & Wilson, Montreal.



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MALLEABLE IRON, GREY IRON, STEEL, ALUMINUM, BRASS and BRONZE.

The Wm. Kennedy & Sons
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Distributors:
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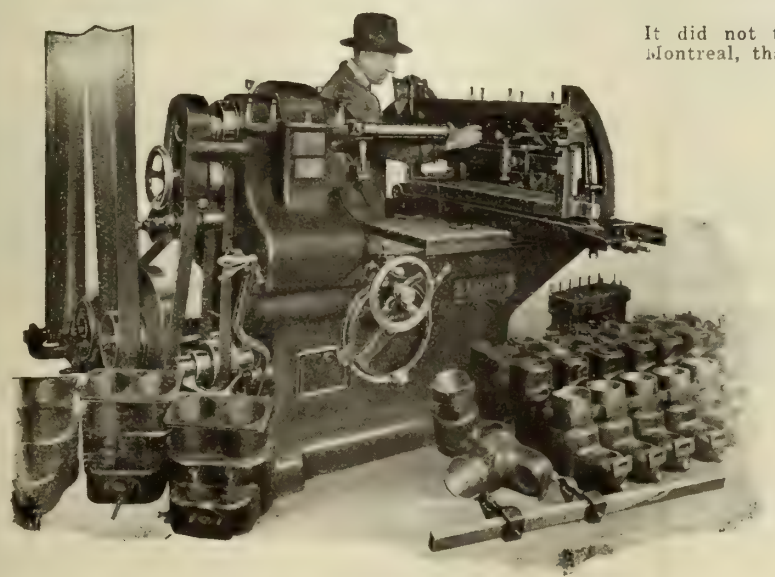


No. 5 Cylinder Grinding Machine in the plant of H. E. Bourassa, Montreal.

It did not take long to convince Mr. H. E. Bourassa, of Montreal, that this

LANDIS No. 5 CYLINDER GRINDING MACHINE

is a money-maker for Garages, Repair Shops and small Machine Shops—it increased his profits right from the start.

The Landis No. 5 Cylinder Grinding Machine assures big returns from your investment. It was specially designed for rapidly and accurately regrinding motor vehicle cylinders.

Set-ups are easy and operating time is speedy. In addition, it has a range as broad as the **Landis** reputation in the machine tool field and will handle any type of cylinder that comes into your shop.

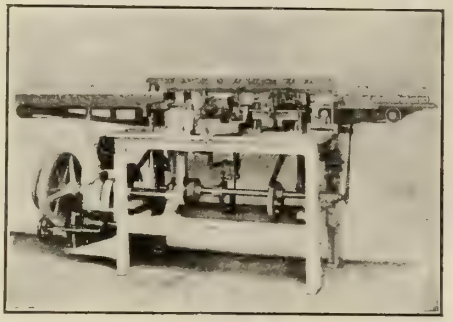
Send for "Interesting Facts on Regrinding"—it's free on request.

LANDIS TOOL COMPANY, Waynesboro, Pa.

CANADIAN AGENTS: A. R. Williams Machinery Co., St. John, Halifax, Winnipeg, Vancouver; Williams & Wilson, Montreal; F. F. Barber Machinery Co., Ltd., Toronto.

THE JOHNSON FRICTION CLUTCH

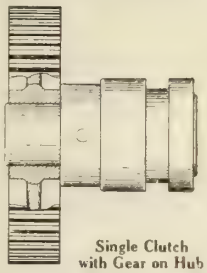
as used on the
WEEKS AUTOMATIC LABELER
For Oval, Round and Square Bottles



The No. 2 single Johnson Friction is located on the drive shaft direct from ¼ h. p. motor. Clutch is adjusted to drive the machine but will slip when bottle is caught which prevents breakage.

Courtesy: F. W. Horstmann Co., Irvington, N. J.

There is only one clutch that can readily be made to meet so many varied conditions — the Johnson Friction Clutch. A product of great merit. Built in nine sizes from ¼ to 20 h.p. Can be run at high speed without vibration.



Single Clutch with Gear on Hub

Write for "Yellow Friction Control" Catalog.

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GISHOLT

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TURRET LATHES
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For Chucking Work
VERTICAL BORING and TURNING MILLS
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CYLINDER GRINDERS
TOOL-POST TOOL HOLDERS
REAMERS, "SOLID ADJUSTABLE"
Shell and Chucking
BORING BARS
With Adjustable Cutters
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Drills and Grinders
Can be Attached to any Lamp Socket

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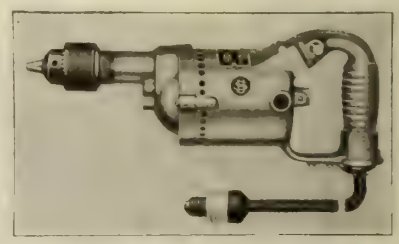

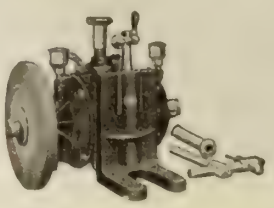

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Holders of the maturing bonds who wish to avail themselves of this conversion privilege should take their bonds AS EARLY AS POSSIBLE, BUT NOT LATER THAN SEPTEMBER 30th, to a Branch of any Chartered Bank in Canada and receive in exchange an official receipt for the bonds surrendered, containing an undertaking to deliver the corresponding bonds of the new issue.

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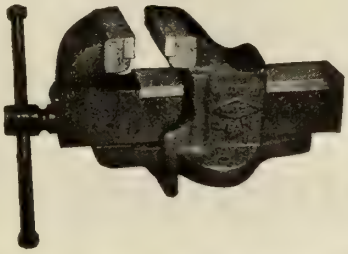

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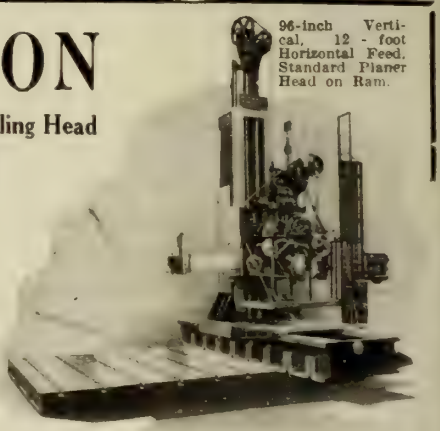

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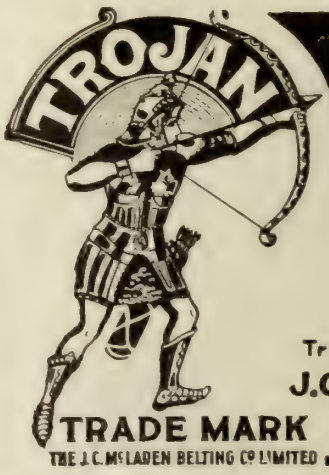

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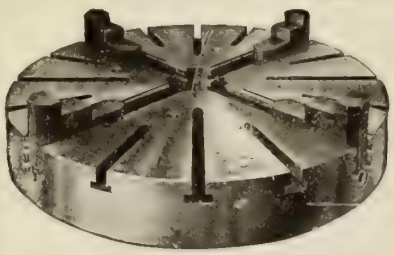

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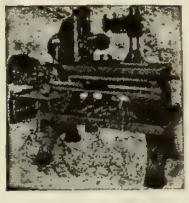

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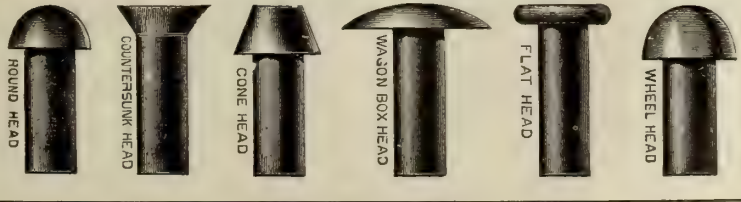

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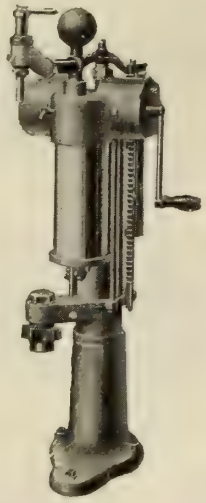

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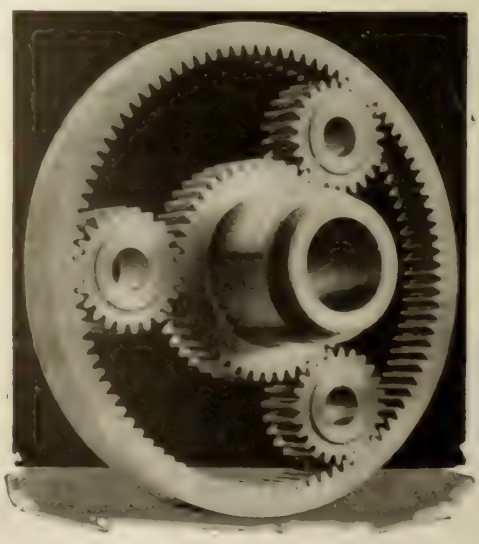

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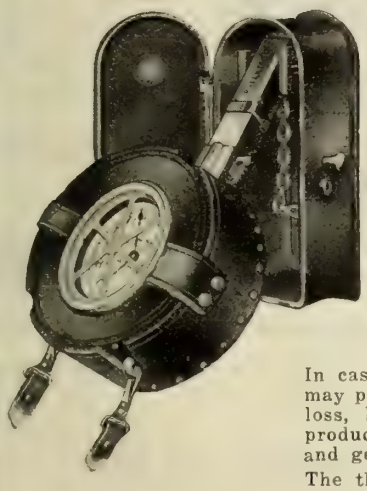

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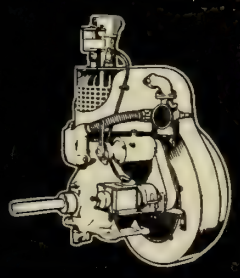

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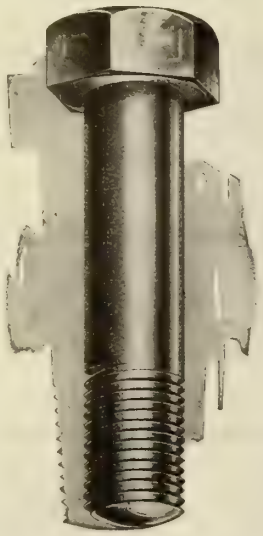

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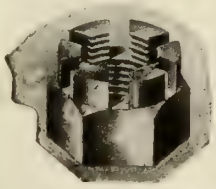

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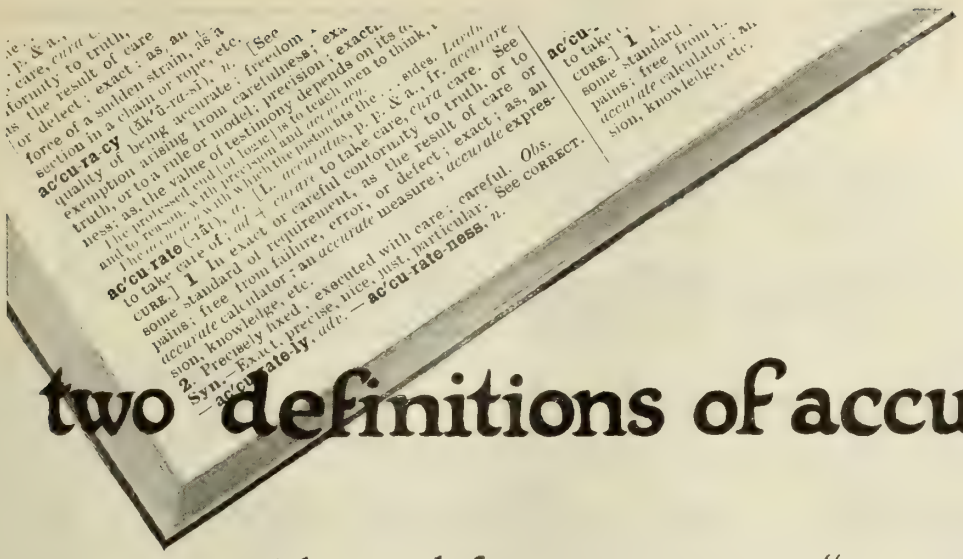

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CANADIAN MACHINERY
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MANUFACTURING NEWS

VOL. XXVIII, No. 13 SEPTEMBER 28, 1922

Doing It Pneumatically

IT SOUNDS as though Dean Inge, the man of gloom, might have said it—that the pneumatic hammer is, of all tools, most typical of modern life, with its speed, its noise, and its generally nervous disposition. But to be fair to the hammer, even if it does detract from human merit, the tool is noted for its efficiency. Herein the comparison may lose its adroitness for air, hot or cold, is not commonly associated with persons who have gained appreciable reputations.

PNEUMATIC hammers represent a small part in the development of utilities to which compressed air has been applied. It is but one of a great variety of functions, although its voice is the voice of industry. Where drilling, ramming, hammering, riveting, caulking and boring are to be done, compressed air is employed. Hoists, jacks, cutters, grinders, bull-dozers, presses, paint sprayers, and sand blast attest the high efficiency and economy of air.

Old chronicles are interesting, and they reveal that in 1667 some genius "described a plan by which the air in a tube was exhausted in such a way that a piston working in the tube would be drawn in the direction of the suction." He had discovered the pneumatic despatch tube. This, however, was in the reign of Charles II, whose memory not only recalls Paradise Lost and Pilgrim's Progress and Puritanism, but also the founding in 1660 of the Royal Society for the Promotion of Natural Science. It brought together men who are said to have thought more about air pumps than about theology.

The first useful pneumatic tool was a rock drill, having a hammering piston, patented in England in 1865. This was also used in riveting. Followed in 1867, a drill with a grasping handle with controlling throttle valve. The first pneumatic hand tool is said to have been a dental mallet which appeared in 1897. Then came many American developments, including in 1899 a "long-stroke pneumatic hammer where a short piston travelled a distance greater than its own length." Such names as Keller, Tierney, Kimman, Richards and Meissner appear in the records of development of pneumatics and apparatus of the valve and valveless types soon displayed great variety of design to meet many requirements.

Pneumatics have lent themselves wonderfully to that phase of mechanical economics embodied in bringing the tool to the work. Ship-building, locomotive and rolling stock construction, mining, steel fabrication, the building of skyscrapers, owe much to pneumatics. They have contributed their part to sanitation and cleanliness, have eliminated many laborious operations in work of all kinds and have made speed and efficiency compatible terms in many fields of activity. The introduction of the air brake in 1869 revolutionized railroading, and much other safety apparatus is dependable upon compressed air. The railroad machine shop without pneumatic equipment would find its equivalent in a reversion to horse cars for city transportation service. While here it may be observed that the gigantic program now being carried out by the Transportation Commission in Toronto in tearing up miles of pavement and car tracks and laying anew, has been facilitated immeasurably by the most practical application of pneumatics—drills, hammers, tampers, etc. It was here that team work employing electricity and compressed air was seen to particular advantage.

Many are the utilities of compressed air and pneumatics. The term "do it pneumatically" carries with it great significance to the modern industrial world and to all engaged in it.

Air Tools—Manufacture, Service and Operation

Early Development of Pneumatic Equipment—Rapid Improvement in Design and Efficiency—Accuracy of Construction—Every Tool Carefully Inspected and Tested—Proper Oiling Necessary

THIS article has been prepared with the desire to create a personal interest in pneumatic tools by showing how carefully they are made, which it is hoped may eventually improve the conditions surrounding their care and use. The manufacturers of air tools owe a lasting debt of gratitude to the foundrymen of the past two decades for their generous assistance during their early struggles for recognition and for the opportunity afforded them of using the foundry for their experimental work.

The first model of the air tool was the reciprocating type of machine such as the riveting and chipping hammer in which the plunger is thrown back and forth in the hammer cylinder by compressed air, the action of the plunger being controlled by an air operated valve enclosed in a valve cage at the rear end of the hammer cylinder. The first tools were, of course, crude in their construction, very heavy and hard to hold on the work as no way at that time had been discovered to cushion the blow of the plunger on its return stroke, and it hit about as hard in one direction as in the other. Operators complained about the "kick" and the excessive vibration, and some trouble was had to induce men to use them at all. Notwithstanding these discouraging features the inventors did not lose faith in the ultimate success of the air hammer, but steadily pushed on, making changes here and there which eventually overcame the trouble.

Early Air Motor

Following closely on the heels of the riveting and chipping hammer came the air motor, likewise crude and heavy at the start. Several different types were tried out and finally the four-piston motor was found best for general work and was adopted as the standard type of air motor. As time progressed, so also did improvements of air tools, and the manufacture of them in large quantities began in earnest. Capital was attracted to this new industry and companies were formed and factories built for their production on a large scale.

It is not the intention to write an extended history of pneumatic tools, or follow them through every change of design which has occurred in the past 25 years, but merely to touch the high spots, giving a glimpse of the beginning of the industry as compared to present day construction. Air tools have now reached such a degree of perfection in design, workmanship and operation, that it seems impossible to further improve them. Every type of pneumatic tool now made is used in some capacity in foundry service, for which they were originally designed. Other steel industries finally adopted the air tool, but only after the foundries had been using them successfully for several years.

Pneumatic tools have revolutionized the world's work in the fabrication of steel, in the mining of coal, gold and silver, in the quarrying of rock, in monumental work, and in the foundry. They built the battle fleets of the world and every steel ship afloat. The air gun is the "peace gun" of the future, and will help rebuild the countries destroyed by the ravages of war.

Heat Treating Handles of Air Hammers

The handles are first heated uniformly to the desired degree of heat, depending upon the carbon ratio, then are cooled in oil, again re-heated for temperment in the drawing furnace and air cooled. The handle forgings after heat treatment are carefully polished and sand-blasted, which gives them a velvet-like finish.

When turning hammer cylinders from bar stock, the cutting tools have tubes through which the cutting compound is fed to the cutting edge of tools,—the bar holder used in reaming the cylinder bore has inner bearings through which the reamer operates, insuring perfect alignment and uniformity of the holes. The drill press is used to bore the long ports in hammer cylinders, each cylinder having six long ports, varying in length from 3 to 12 inches in depth and ⅛ to 7/32 inches in diameter. The internal drilling tool is ingeniously designed to operate

Cuts and information through courtesy of the Cleveland Pneumatic Tool Co.

Figs. 4, 5, 6—Three applications of small breast drill. Right—Riveting in various positions.

Figs. 1, 2, 3.—Caulking and chipping with air hammers.

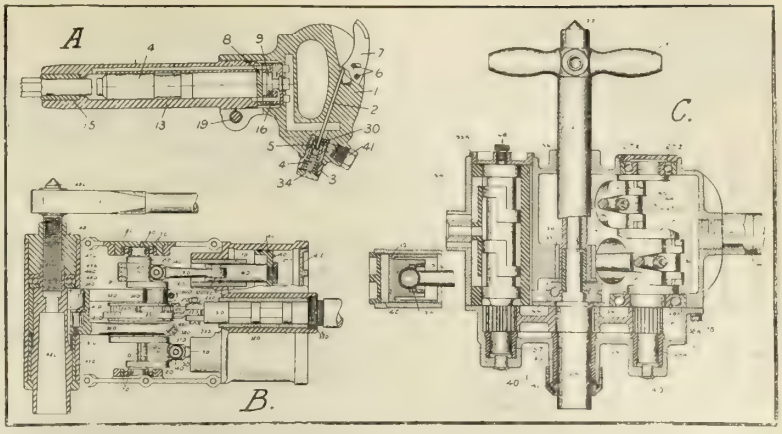
within the bore of the hammer cylinder and drills holes at right angles to meet the down holes in the wall of cylinder. The old practice of drilling from the outside of cylinder and plugging holes is now obsolete.

Tempering Room

In this room all tempering of steel parts is done, it is provided with every device for the proper hardening of the different parts of the air hammer and air motor. Some parts require different treatment than do others, based on the service and strain to which they are subjected. Some parts are made of mild steel and are given surface hardening only, which is better than hardening throughout; delicate pieces are heated in lead.

Inspection Room

Every necessary implement for measuring, gauging and testing for hardness is employed here, a triple checking system is used to detect individual errors. Careful inspection is exercised at every stage of manufacture, and all parts rigidly tested for extreme service so that any weakness which may have escaped surface inspection may be detected before final assembly. Both external and internal grinders are used in finishing hardened parts, such as plungers, valves, valve blocks, cylinders of chippers and riveters, motor valves and pistons, cranks and other hardened parts of air tools. Accurate jigs and templates are provided for each kind of part to insure extreme accuracy in their production. The finest machinery obtainable is used in the production of air tools, each machine is selected and properly tooled for the class of work upon which it is to be used.



Sectional views of hammer, corner drill and four-piston air drill.

The Assembling Room

The assembling of air hammers, air motors and other tools requires men of a high order of intelligence. The general knowledge they acquire in this department fits them for the saleswork to which they are promoted as occasion requires.

We have given but a bare outline of the construction of air tools, sufficient however to convince the reader that the most painstaking care is exercised in the making and finishing of each individual part entering into the complete air tool, thus insuring perfect interchangeability of all parts when required for replacements.

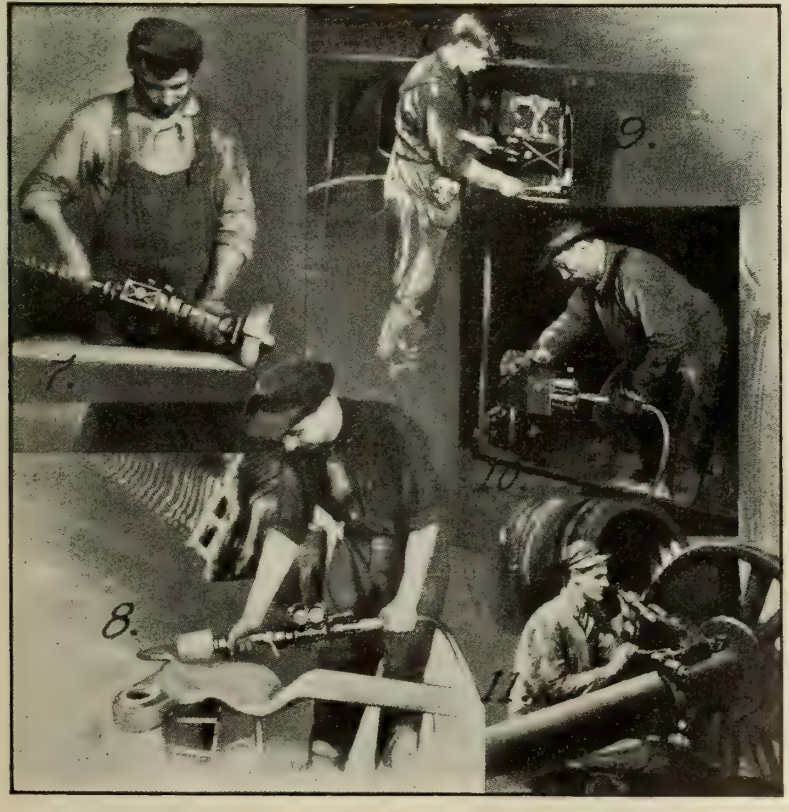
Care and Use of Pneumatic Tools

Compressed air is the most useful power generated; unlike steam it can be piped long distances without much loss in transmission if large pipes are used. Builders of air compressors have given some very reliable data on the transmission of air and the loss in pressure by friction. They claim a frictional loss of 8 lbs through a 1-inch pipe in a travel of 1,000 ft. but no appreciable loss in the same distance through a 3-inch pipe. It is unfortunate when reliable data may be had, that users of air should continue to use small pipes in their systems and numerous elbows, all of which are so detrimental to the efficient operation of air tools.

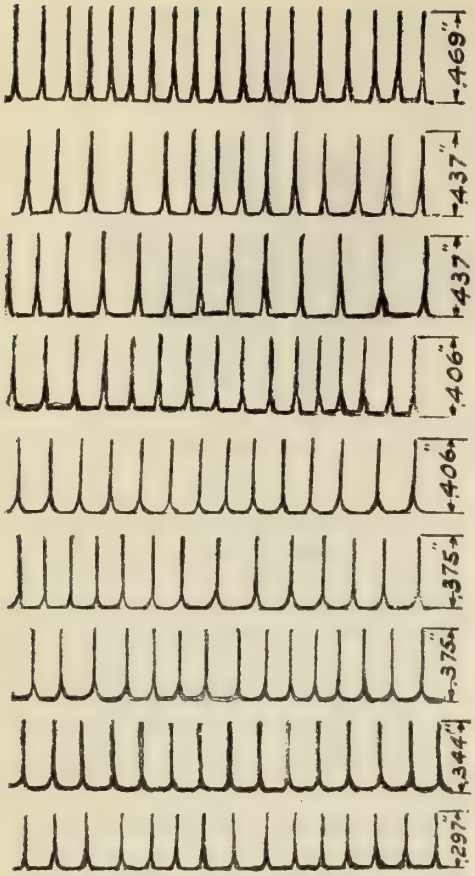
There are four indispensable things required in the successful operation of the air tool, and these are dry air, volume, uniform pressure and lubrication. Dry air may be had by piping the receiving tank in the following manner: The receiving tank should be of generous size even larger than the usual sizes specified for standard size compressors for the reason that the process of cooling and draining moisture from the air in the initial tank is now recognized by users as a safeguard against moisture in the shop lines. The tank should be set in a vertical position and provided with a drain cock at the outside and close to bottom of tank. The intake pipe from the compressor should enter the tank above the center. The supply pipe (shop main) should be placed within 10 inches to 12 inches from bottom; this leaves a water space of 10 inches at bottom which can be avoided at intervals as needed. By this plan of piping the tank the air is trapped—the hot air from the compressor enters at center of tank, rises to the top as does each pulsation, as the air cannot escape except through the shop pipe at bottom of tank it must necessarily remain until cool—as it cools and drains it moves downward until it finally reaches the mouth of the shop pipe and moves onward through the system in good working condition.

Volume and Pressure

To maintain adequate volume and uniform pressure the shop mains should be large as they are the trunk lines which carry the air to the most distant points of the system, the mains should have a gradual rise until when they reach the most distant point they are considerably higher than the receiving tank. All branch lines which cross the path of the



Figs. 7 and 8—Portable grinding work. Figs. 9, 10, 11—Three uses for the corner drill.



8-inch Stroke, 1 1-16-inch Piston Diameter.
1080 Blows per minute.
Weight 21 pounds.
Length of Tool, 19 inches.

8-inch Stroke, 1 1-16 inch Piston Diameter.
852 Blows per minute.
Weight 22 pounds.
Length, 20½ inches.

8-inch Stroke, 1 1-16-inch Piston Diameter.
816 Blows per minute.
Weight 21½ pounds.
Length 19⅜ inches.

8-inch Stroke, 1 1-16-inch Piston Diameter.
948 Blows per minute.
Weight 21 pounds.
Length 19½ inches.

8-inch Stroke, 1 3-16-inch Piston Diameter.
840 Blows per minute.
Weight 21½ pounds.
Length 20½ inches.

8-inch Stroke, 1 1-16-inch Piston Diameter.
852 blows per minute.
Weight 23 pounds.
Length 20½ inches.

8½-inch Stroke, 1 3-16-inch Piston Diameter.
900 Blows per minute.
Weight 20½ pounds.
Length, 19½ inches.

8-inch Stroke, 1 1-16-inch Piston Diameter.
924 Blows per minute.
Weight 23¾ pounds.
Length 20⅜ inches.

7¼-inch Stroke, 1⅛-inch Piston Diameter.
912 Blows per minute.
Weight 19 pounds.
Length 20½ inches.

Comparative power and speed records of various riveting hammers—the top card taken from most recent designs of Cleveland hammer.

main trunk line, from which they draw their supply, should always pass above and take their air from the top of the main pipe. If there is any water still in the mains it is at the bottom working its way back to the supply tank.

Compressed air is saturated with oil from the compressor and is never quite eliminated at the receiving tank where the first cooling of the air takes place as previously mentioned. A considerable proportion of the oil therefore passes on through the shop mains and branches to the drop pipes at which point the hose line is attached, leading directly to the air tool. The oil has a detrimental effect on the rubber inner tube of the hose causing it to disintegrate, particles of which become detached and enter the air tool, where they lodge in the valves and air ports of the hammer, causing serious trouble. The manufacturers of air tool hose were forced to find a remedy to correct this trouble, and finally brought out a type of hose having a composition inner tube which neutralizes the action of the oil to a certain extent but does not wholly eliminate the trouble.

Inventive minds working on this problem have recently discovered a simple device which we believe to be a solution of the trouble. This is an oil and water separator that may be made in your own shop at a nominal cost. It consists of a 3 foot section of 5 inch iron pipe, capped at top and bottom and attached to the branch air pipe lines which feed the drop pipes and hose lines. The branch pipe enters the separator at the top through one side of the cap and runs down the inner side of the separator to a point 3 inches from the bottom, when the air is liberated, escaping into the cylinder and returning to the top of the cylinder through a series of perforated baffle plates, the oil clinging to the baffle plates.

The air leaves the separator at the top, entering the branch outlet pipe attached to the cap at the opposite side of the inlet. The air is thus freed from oil and such water as may still remain in the system. The separator is drained of its accumulated water and oil through the drain cock provided at the bottom of the separator. Occasionally the lower cap of the separator should be removed and the baffle plates cleaned by means of a stream of compressed air which quickly removes the oil adhering to them.

Fittings

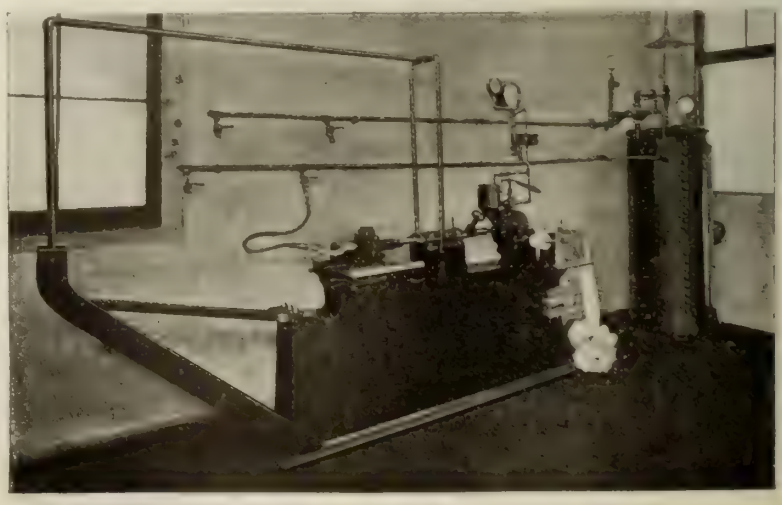
The selection of proper fittings that will offset least resistance to the passage of the air is just as important as large pipe lines to aid in the reduction of friction in transmission of the air from the drop lines through the hose to the air tool. Air valves which have any angle turns in the air passages are objectionable because they impede the direct travel of the air into the hose. Hose couplings, like the valve, should have an unobstructed air passage.

Lubrication

The close fit of all working parts of the air tool necessitates frequent lubrication, particularly in the riveting and chipping hammers. The oil used should be of good quality that will not gum, heavy black machine oil should never be used as there are numerous air ports in valve blocks and cylinders that must be kept open. The tendency of the heavy oil is to clog these parts, which impedes the proper circulation of the air.

If the air is charged with water it washes away all lubricant and the hammer loses its efficiency, refuses to work and the delicate parts and polished surfaces become rusted. The hammer should have a bath every night in coal oil, which soaks up the worn out oil of the day, and each morning should be attached to the hose and blown out thoroughly, then fresh oiled and put in service. If treated in this fashion it will perform like a new tool.

We do not deem it necessary to dwell further on the care and use of the air tool, except to recapitulate and say that if dry air, in sufficient volume at adequate pressure, be furnished, plus suitable lubrication, we predict that your air tool troubles will be greatly reduced and the working efficiency of the equipment correspondingly increased.



All hammers are tested on this machine before leaving the factory.

Utilization of Compressed Air on Draw Presses

Overcoming Difficulties of Wrinkled and Broken Pieces—Air Cushions Give Uniform Pressure on Drawing Ring—Heavier Draws on Lighter Presses—Used Singly or in Batteries

DRAWING operations on sheet metal frequently necessitate some intricate designs of dies and one of the vital factors involved in the problem is the character of the pressure that must be applied on the metal as the flat blank is drawn into the desired shape. This is a feature of sheet metal drawing that has always been difficult to overcome. The pressure on the draw surface should be just sufficient to keep the metal of the formed portion of the shell smooth at all stages of the operation. Should undue strain be placed on the metal at any period during the process, it destroys the toughness, often resulting in the cracking or splitting of the metal, either in that particular draw or succeeding operations. If the pressure is too light the result is to create wrinkles, and once these appear any attempt to reclaim the piece means failure.

The trouble is the irregularity of the pressure throughout the period of the draw, the use of springs or rubber giving an increasing resistance as the punch descends. The draw surface decreases as the piece is being shaped and extreme pressure on the smaller area causes excessive wear on the faces of the blank holders. In some cases the pressure of wrinkles, if not pronounced, is not objectionable but it indicates a poorly working set of tools. If dies are permitted to operate long under such conditions the rapid wear soon necessitates their removal to the tool room for repairs. It is always advisable to obtain as smooth a draw as possible.

Developments of Die Cushions

The double-action or toggle type of press was designed to produce a uniform pressure on the blank during the operation, and has proved a success in most cases. In some instances, however, this type of press has proved inefficient and pneumatic die cushions have been developed to remedy conditions. By means of these cushions a uniform pressure can be applied on the shell at all times regardless of the unevenness of the blank or the thickness of the metal during the operation. This is the greatest factor in favor of air cushions for this purpose, but there are others, some of which are as follows: (1) The initial cost of a single-action press equipped with pneumatic cushions which will perform operations usually performed on double-action presses, is only about one-half that of a double-action press. (2) The equipment is less cumbersome and can be operated at higher speed. (3) A machine provided with this equipment can be used for more than one purpose, whereas an ordinary drawing press is suitable only for a drawing operation. (4) A smaller machine can be used when air cushions are applied to supply pressure on the blanks, because it is not necessary to overcome increasing pressure, and so power is saved and unnecessary strain on the machine is eliminated.

Air Cushions of Various Types

In many instances air cushions have proved a successful and economical solution to metal-drawing problems.

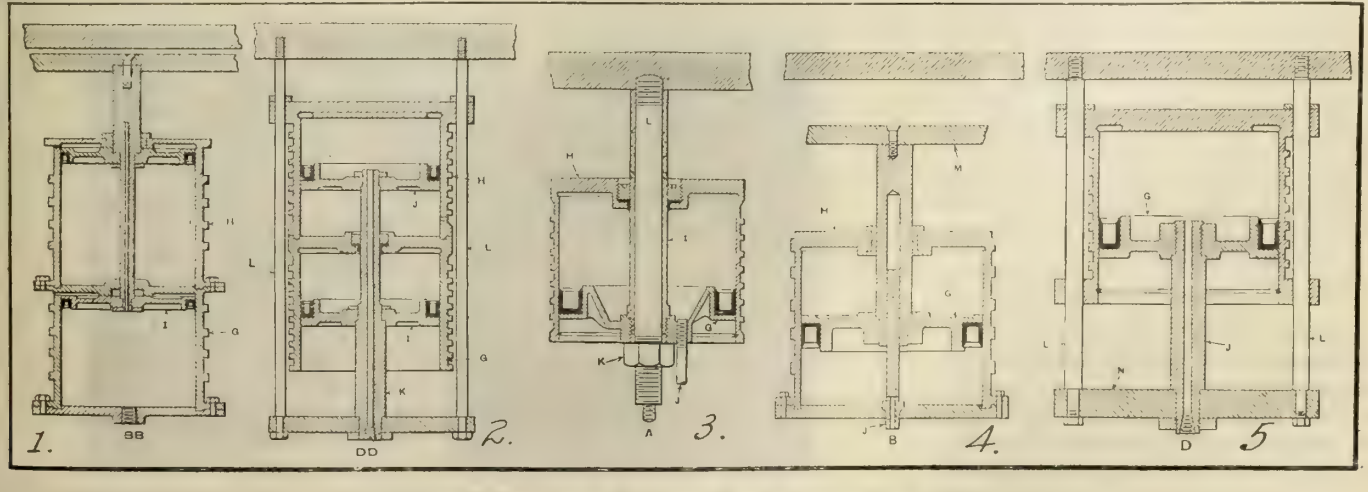
Various designs of these pneumatic cushions have been recently developed by the Marquette Tool & Mfg. Co., of Chicago. These are constructed to meet a wide range of requirements with pistons from 6 in. in dia., which are suitable for machines drawing shells to a depth of 2 inches, to cushions which have a piston 20 inches in diameter, which are intended for presses drawing shells to a depth of 8 inches. These cushions can be applied to machines singly or in batteries.

Design For Any Purpose

Some of these cushions are shown in Figs. 1 to 5. Fig. 1 represents a two-piston type of cushion. This design permits of double the pressure on the draw ring to that contained in the pipe line and tank. When there is sufficient room under the press it is usually an advantage to use this type when considerable pressure is required on the draw ring. Where large area blanks are being operated on cushions of this class are applied in batteries and as all are connected to a common source of supply, the pressure is uniform on all points of the pressure plate, a feature that eliminates the difficulty of adjusting springs under the pressure plate to the same tension. These are particularly applicable to the drawing of auto body parts, steel barrels, radiator fronts, fenders and similar large pressed steel parts. It will be noted that in this type the pistons are attached to the pressure plate, while in that in Fig. 2 the cylinder is the movable member.

Stationary Piston Type

In Fig. 3 the piston G remains stationary when air is admitted into cylinder H, while the cylinder rises vertically on sleeve I. The pins that support the drawing ring of the die rest upon the top surface of the cylinder, and thus as the cylinder is forced upward, pressure is applied on the drawing ring. The air is admitted into the cylinder through pipe J. Nut K permits the various parts of the cushion to be removed from the machine without requiring stud L to be disassembled. This cushion design is used singly, as a rule, but it can also be applied in mul-



Figs. 1 to 5.—Sectional views of various types of pneumatic die cushions.

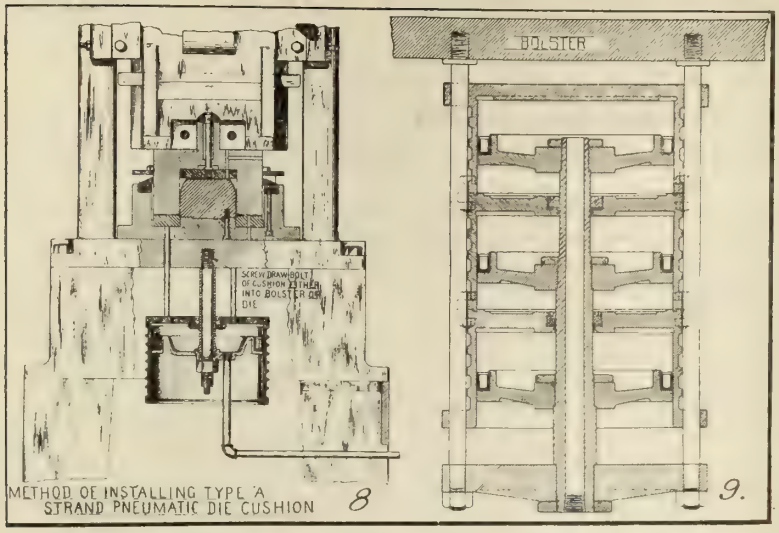


Fig. 8—Method of installing die cushion.

Fig. 9—Three-piston type of cushion.

tiples on double or multiple-crank presses.

Movable Piston

In the design shown in Fig. 4, cylinder H remains stationary and piston G is forced vertically upward when compressed air is admitted into the cylinder through connection J. The drawing-ring pins rest upon the pressure-pad M. This type of cushion is installed principally in batteries on double or multiple-crank presses. Another design of cushion in which the piston remains stationary while the cylinder is forced upward when air is admitted into it is shown in Fig. 5. Piston G is supported upon fitting J through which air is forced into the cylinder. This fitting is mounted in plate N, which is attached to the bolster of the press by four rods L which also act as guides for the cylinder. The die pins rest upon the top of the cylinder.

The battery method of installation should be used when a number of presses are connected to the same main tank of compressed air. It is very important to provide each machine with an individual supply tank and an air regulator so that a definite pressure can be maintained on any one machine independently of the rest. When only one machine is supplied from the main tank the cushion can be connected directly to it. It is advisable to keep a record of the pressure on each job so that experiments are unnecessary when a similar operation has to be performed. The total pressure on the draw ring can be determined by multiplying the pressure in pounds per sq. in. by the area of the piston in square inches.

Uniform Pressure

In order to exert an even pressure on the drawing ring during an entire operation, it is necessary that the individual tank used in conjunction with the cushion be of ample capacity. When the tank is too small, the air pressure will be greatly increased as the air in the cushion is forced back into the tank on the downward stroke of the press ram, and, of course, the pressure on the drawing ring will be subsequently greatly increased. If the tank is large enough, however, no trouble arises from this source. The air cushion should also be of sufficient size so that a high air pressure in pounds per square inch is not necessary in order to obtain sufficient pressure on the drawing ring. One-stage air compressors are generally used in connection with these cushions, but their operation is uneconomical when the air pressure is more than 100 pounds per square inch. Besides this, excessive pressures are detrimental to the cushions. More pressure is required on the drawing ring when a part drawn from a thin-gauge metal is being produced than when a thick-gauge metal is being used, and so it is evident that a larger cushion is required for drawing light metal than for drawing heavy metal.

Making Steel Helmets

The production of steel helmets for the United States Army was a metal problem which occurred during the recent war. These helmets were drawn from a high manganese steel of about 0.036 inch in thickness. The specifications required that the minimum thickness of the helmet should not be less than 0.030 inch at any point and that the height from top of the crown to the rim should be 4⅛ inches. It was generally thought that two operations on double-action presses were required to produce the part, and this method was used with varied success.

Difficulty Solved

The above facts were called to the attention of the firm by a manufacturer who desired to produce helmets on a single-action press. The press was subsequently equipped with pneumatic die cushions, the female part of the die being held in the press ram. A pressure of about 21 tons was applied on the drawing ring by the cushions. The result was an average production of nine helmets per minute, the surfaces of which were smooth and the minimum thickness of each shell not less than 0.032 inch. The reason that the helmets were drawn in this manner without being excessively stretched was that the pressure on the drawing ring was the same during the entire operation regardless of the thickness of the metal. When these helmets were subjected to the shooting test, they were not penetrated by bullets, owing to the fact that the metal had not lost any of its toughness as a result of the drawing operation.

Several Installations

Fig. 6 illustrates a large draw press equipped with a battery of double-piston air cushions for drawing auto fenders of all types and dimensions. The press operates at a speed of 10 r. p. m. It has a long stroke and is fed continuously without stopping. Fig 7 shows a Niagara press equipped with a battery of single-cylinder pneumatic die cushions used for drawing automobile bodies, the die cushions replacing the pile of heavy coil springs shown at the side of the machine. Fig. 8 shows a sectional view of a die cushion installation. The draw bolt is screwed into the die or bolster. The necessary number of spacing collars are then placed on the draw bolt to keep the cushion at the proper distance from the die; the cushion is passed over the draw bolt and additional spacing collars placed on the draw bolt. The nut is then placed on and air connected. Fig. 9 illustrates a special, heavy draw air cushion fitted with three pistons.

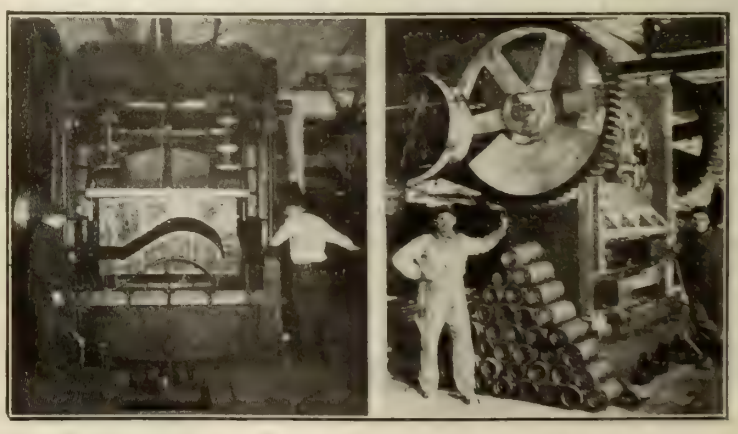


Fig. 6—Drawing auto fenders of all types and dimensions. Fig. 7—Die cushions replace many heavy coil springs.

Cleaning of Machine Parts by Sand Blasting

Widening Application of the Process—Installations to Meet a Variety of Needs—Mechanical Handling and Screening of Sand —Constant Change of Air Required—Automatic Equipment

HOW little does the average person realize to what extent the process of sand-blasting is utilized in every phase of life and industry. Your morning bath is taken in a cast-iron tub —sand-blasted to prepare it for enameling; the nickle-plated faucets through which the water is run are also subjected to the same treatment before they are plated in the plating bath. Your breakfast is probably cooked on an enameled range, the parts having been cleaned with a sand-blast to prepare them for the coating of enamel. After you step into your auto to go to business; the motor has been sand-blasted in one plant, the transmission gears in another, and if wire wheels, the metal in the felloes has been cleaned by this process before it is fabricated. On your arrival at the office you are probably carried to the upper floors in an elevator cage which also has been sand-blasted. As you reach for the telephone you do not stop to think that its parts have also been sand-blasted before fabrication. You may have stopped on your way down to get shaved. In that event you sat down in a barber's chair that had also been similarly treated before it had been enameled and nickeled. Possibly your tooth aches, and as you stop into the dentist's office his white furniture has also been sand-blasted for enameling, and it may be that the handles of his tools have been given a matte finish with the blast so they will not slip in his hands. At noon, at the hotel or club, the dishes on which your meal is served have been sand-blasted before receiving the glazed finish. In the afternoon you may attend a funeral. If a metal casket is used, this too has been cleaned by a blast of sand, and if the monument maker is at all progressive, the head-stone has been lettered with the sand-blast. Possibly at the end of the day you slip into an enameled bed, and reach to turn off the electric light, both of which have also been sand-blasted.

Varied Application

Sand-blast equipment is not necessarily designed to a single trade, as for instance the same machine that sand blasts dishes is also used for cleaning automobile crank-shafts and other metal pieces. As a rule the type of machine selected is governed more by its size to accommodate the pieces and its method of handling them, and the blast action is accommodated to different commodities by regulation of pressure and grade of abrasive.

Every foundry has conditions and operations peculiar to itself. A sand-blasting installation should be an entirely individual problem. If you are to get results, which is the final test of the cost of a sand-blast system, it is necessary to secure experienced advice from those who have made a special study of sand-blast engineering and practice.

Four General Groups

Basically sand-blast machines will divide into four general groups as follows: Hose machines; cabinets; barrels; and tables. The method of operation may be by either the direct pressure, the suction (syphon) or the gravity systems.

In direct pressure systems the sand is under pressure in a sealed container, sand and air being discharged in combination without expansion through a hose nozzle giving the greatest velocity and highest efficiency possible. The majority of hose machines are of the direct pressure type; indeed, the first application of sand-blasting was the hose machine type and it is still used without exception in sand-blast room installations. It offers a range of application that is possible with no other type. For a line and character of work that is varied and of medium volume it undoubtedly represents the most satisfactory equipment. Where the tonnage is large and the pieces are of a weight and size too great for convenient handling it is indispensable. The use of the hose machine demands some enclosure and experience has shown the wisdom and economy of a well ventilated and well lighted room for the purpose.

While the cleaning cost will always be reduced by mechanical methods of handling the work and the abrasive for reuse, a very convenient room can be provided with small outlay and may be built of rough lumber, with an exhaust fan in the ceiling or wall, carrying the dust-laden air into a settling box or chamber that will retain the heavier particles, the lighter material being carried off into the atmosphere.

Location of Sand-Blast

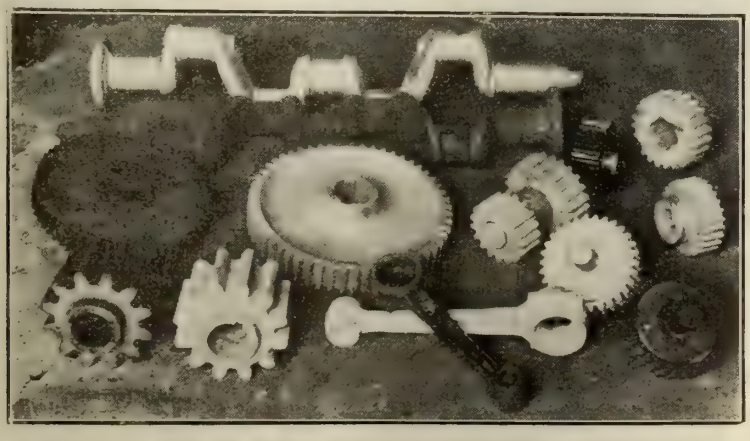
The inclusion of mechanical handling and screening of the abrasive makes a steel room most advantageous and economical. The simplest of these provides for the location of the sand-blast outside the room which is left free for the blasting operation, with controls extending inside to within easy reach of the operator. A mechanical separator, driven by a powerful air motor, at one operation removes both fine and coarse material. The clean, sharp abrasive for reuse is delivered by an elevator to a sand storage bin above the sand-blast machine for refilling. In this type of room the spent abrasive is shoveled from the floor to a chute in the side of the room connected to the separator.

Meeting Growing Requirements

As the daily tonnage rises, the capacity of the sand-blast installation expands (and without added cost for labor) in proportion as appliances are added for the mechanical handling of the abrasive, and the work is properly handled and routed. The problem of handling the abrasive can be met by a grated floor in the room through which the spent abrasive falls to a conveyor below, which carries it to the elevator boot. Built into the elevator system should be an efficient separating system, preferably a combination of mechanically operated screens, with an exhaust to remove the fine material. Thus both the coarse material that will not pass the nozzle and the disintegrated abrasive, core sand and all fine stuff without abrasive qualities are removed.

The clean, sharp abrasive passes to a storage bin and is afterwards refilled in

Cuts supplied through the courtesy of the Pangborn Corp., Hagerstown, Md.

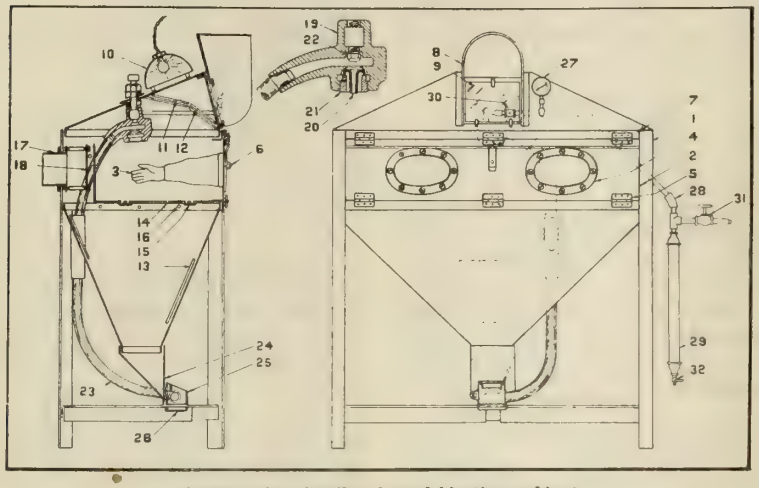


Gears and forgings before and after sand-blasting.

Approximate flow in pounds per hour of various abrasives through different nozzle openings

NOZZLE SIZE	3/16"	1/4"	5/16"	3/8"	7/16"	1/2"
Sand	500	900	1200	1700	2200	3000
Metal Abrasives	1250	2250	3250	4250	5500	7500
Maximum Size Sand	No. 1	No. 2	No. 2	No. 3	No. 3	No. 4
Appropriate Size Steel Shot	*No. 5 *No. 12	No. 12 No. 13	No. 12 No. 13	No. 3C No. 11	No. 3C No. 11	No. 1
Angular Grit	*No. 40 *No. 30	No. 20 No 12	No. 20 No. 12	No. 12 No 10	No. 12 No. 10	No. 10 No. 6

*APPROXIMATE RATINGS OF DIFFERENT BRANDS



Construction details of sand-blasting cabinet.

the machine and controlled from within the room. The waste material is carried to a bin with convenient outlets. An auxiliary sand-storage bin loads through a grating opening outside the room, and carries several days' supply of abrasive, which is fed to the system through a gate as renewal is required. This continuous operation may also be accomplished by placing the sand-blast machine itself in a pit beneath the grated floor, but the depth required for properly proportioned hopper to accommodate the entire floor area and the separating system results in a depth of pit and foundation that while showing no economy in cost even by the elimination of the conveyor and elevator, is frequently impracticable due to water conditions and also it makes impossible the advantage of the auxiliary sand-storage for handling the abrasive in volume. Where floor area is, however, at a premium this system may be found advantageous.

Light and Ventilation

Light and ventilation are of course necessary to adequately handle any considerable volume of work. Electric light fixtures with parabolic porcelain enameled reflectors will probably diffuse light equally to all points, and if fitted with protective fronts a perfect protection is afforded the lamps from flying abrasive.

Ventilation which should be ample will of course be governed by the requirements of the work in hand. No hard and fast rule can be suggested for this, but a constant change of air is required and this should be a minimum of say four to six changes per minute for the general run of brass and malleable castings, six to eight changes for cast iron and 10 for steel. A slow-speed exhauster of low horsepower requirements is most satisfactory as well as most economical.

Exhaust System

Some diversity of opinion is expressed as to the most satisfactory system for removing dust-laden air. Theoretically it is desirable to keep the dust in transit below the operator's head, and this theory creates some adherents for the down-draft system whereby the dust-laden air is drawn downward through the grated floor. Failure in practice to keep the gratings clear, however, seriously retards circulation and experience has demonstrated that more positive results are obtained from an up-draft, where there can be no interruption to the draft, and generally better operating conditions secured. As the dust is created where the blasting operation takes place, well above the floor line, and with a general tendency to rise, the up-draft system removes it without change of direction.

In considering claims for conditions provided within sand-blast rooms common sense tells us the dust is there and no improvement is possible over its removal as fast as created. Not only is this rapidity of removal essential from the standpoint of hygiene and sanitation, but equally so to provide for clear vision for efficiency in cleaning. Obviously protection for the operator from the dust-laden air and the flying abrasive other than afforded by the exhaust system must be provided. The most satisfactory device is a dust-proof ventilated helmet. Air is introduced into the helmet from the compressed air line, to which the helmet is connected by a small flexible hose, weighed over pulleys to take up slack in any position and permit ease of movement to the operator.

Cleaning Fragile Pieces

There are classes of work that by reason of shape do not adapt them to barrel cleaning. This includes precision work or pieces that are so light and fragile as to not admit of this method of sand-blasting and are yet too small for individual cleaning to advantage with the hose machine in room installation. For this character of output the automatic revolving table sand-blast, Fig. 10, has found high favor. A grated-top table half exposed and half housed revolves at a slow speed. Within the housed portion a series of nozzles, fed from a direct high-pressure hose blast, are oscillated in adjustment with the varying peripheral speeds of the table so that all points are brought with equal duration within the path of the blast stream. The pieces to be cleaned are placed on the exposed portion of the table as it revolves; they are turned as required and removed when cleaned. A flexible sectional rubber curtain permits passage of

(Continued on Page 32)

Sand blasting department of a large forge shop.

Efficient Lubrication of Air Compressors

Good Body Oil Required—Destructive Nature of Carbon Deposit —Affects the Proper Operation of Valves—Danger of Vapor Ignition—Cleaning Compressor and Piping System

SECOND only to the mechanical construction the efficiency of an air compressor depends on the systematic lubrication of the reciprocating and other movable parts which come in contact with the air being compressed. The purpose of lubrication is to reduce friction to the lowest possible degree and minimize the carbonization of the oil. The element of friction is probably the most serious as this is the primary reason for using the lubricant. The oil selected should have sufficient body to sustain the weight of the moving parts and form a film that will effectually prevent the piston rings coming in direct contact with the walls of the cylinder. On the other hand the oil should not be so heavy that excessive power is required to overcome the viscosity of the oil itself.

Carbon Deposit

The accumulation of carbon deposit resulting from the carbonization of the oil takes on a sticky condition when first attaching itself to the bearing surfaces but after a time becomes hard and flinty. This objectionable substance adheres to the cylinder passages, on the valves and in the pipe lines and air receiver. The inefficient operation of most compressors may be traced to the sticking or partial closing of the valves caused by the presence of this carbonized scale.

Other factors may be responsible for the accumulation of carbon deposit, but those generally found are:—the use of unsuitable oil, such as that used for steam engine cylinders, an oil that decomposes easily and quickly in the heat of the air cylinder; the use of too heavy an oil where the excessive viscosity prevents proper atomization, thus remaining too long in a liquid state on the hot walls of the cylinder and quickly forming into sticky deposits of carbon; too great a volume of oil, as too much good oil may have the same effect as a smaller quantity of heavier oil. The protection of the air intake is very important, as the entrance of dust, especially from coal, is detrimental to the proper operation of the compressor.

Fire Hazard

Apart from the objections just mentioned the presence of carbon deposit should be guarded against on account of the hazard that is associated with it. Particles of carbon may be torn loose and becoming incandescent might come in contact with the vaporized oil, given off by the lubricant, and igniting, the resultant fire being great or small dependent on the amount of carbon and vapor in the piping and receiver. Danger from this source can be practically eliminated by systematic cleaning of the carbon deposit.

As the temperature of compressor cylinders is governed more or less by the pressure of the air therein, the consistency of the lubricant used should conform to heat requirements. At the final stage of compression the air that has entered at atmospheric temperature has been raised from two to ten times; for instance, when maintaining a pressure of 10 lbs. gauge the compressed air when on the point of discharge from the cylinder will have a temperature of 145 deg. F., while the final temperature at 250 lbs. gauge pressure will be about 750 deg. F.

Rise in Temperature

The following table gives the temperature in degrees F. for air compressed to pressures of from 10 to 250 lbs. per sq. in. These temperatures are for single stage compressors—when using two-stage units the final temperatures will be approximately half of that recorded for single stage.

Air Compressed to	Final Temperature
10 lbs. gauge	145 deg. F.
20 lbs. gauge	207 deg. F.
30 lbs. gauge	255 deg. F.
40 lbs. gauge	302 deg. F.
50 lbs. gauge	339 deg. F.
60 lbs. gauge	375 deg. F.
70 lbs. gauge	405 deg. F.
80 lbs. gauge	432 deg. F.
90 lbs. gauge	459 deg. F.
100 lbs. gauge	485 deg. F.
110 lbs. gauge	507 deg. F.
120 lbs. gauge	529 deg. F.
130 lbs. gauge	550 deg. F.
140 lbs. gauge	570 deg. F.
150 lbs. gauge	589 deg. F.
200 lbs. gauge	672 deg. F.
250 lbs. gauge	749 deg. F.

The above temperatures are not to be taken as absolute, as variations from those given in the table will occur when air cylinders are water-jacketed and from radiation. Under good working conditions the higher temperatures given may be less in practice, while heat may be greater when machines are working at high speed on light pressure. Given temperatures are especially useful in testing oils to determine their resistance against the formation of carbon when raised to high temperatures. These given temperatures, however, are not to be taken as limits establishing the highest allowable flash point for an oil that may be used safely in lubricating air cylinders.

Mineral Oil Best

The most suitable oil for the specific purpose of air cylinder lubrication would be a pure mineral oil of high quality, free from any animal or vegetable oil mixture. The oil should be carefully filtered. Oils that have an asphaltic base are to be preferred over those produced from a paraffin base, as no matter how carefully the oils may be filtered, a small portion of carbon content will remain. Carbon deposited from asphaltic base oils is of a fluffy nature and may easily be removed from the cylinder wall and valve seats, while that deposited from paraffin oils soon takes on a hard, flinty appearance and is difficult to remove.

When using paraffin base lubricant on medium pressure machines the physical test should conform to that given in the table below:—

Gravity, Baume ..... 25 to 30 deg. F.
Flash Point (open cup) 400 to 425 deg. F
Fire ..... 450 to 475 deg. F.
Viscosity (Saybolt) at 100 deg. F. ..... 230 to 315 sec.
Color ..... Reddish
Congealing Point ..... 30 deg. F.

Oil having the above test figures is generally recommended unless a compressor manufacturer specifies that a high flash point lubricant should be used to meet the conditions peculiar to that particular machine. The possibility of carbon deposit is more likely from high flash point oil.

Asphaltic-Base Oil

For the selection of a suitable asphaltic-base lubricating oil the table below has been compiled. The figures given are for average working conditions.

Gravity, Baume ..... 19.8—21 deg. F.
Flash Point (open cup) 315—335 deg. F
Fire ..... 370—400 deg. F.
Viscosity (Saybolt) at 100 deg. F. ..... 275—325 sec.
Color ..... Pale Yellow
Congealing Point ....—0 deg. F.

When compressors are first installed they require a greater volume of oil owing to the character of the friction surfaces, but after the walls of the cylinder become smooth the quantity of oil may be reduced to avoid the possibility of carbon deposit. No more oil should be used than can be absorbed for adequate lubrication. Too much may be as destructive as too little.

A leading authority on compressor engineering contributes the following: "The best way to determine the proper amount of lubrication is to take out the valves from time to time and examine the cylinder. All parts should feel that there is oil thereon. If they feel dry, the lubricators should be adjusted to feed a little more oil, whereas if oil lies in the cylinder and its parts show ex-

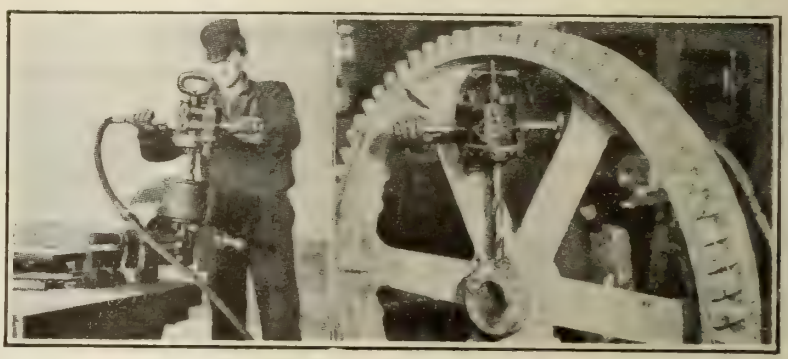
(Continued on Page 34)

Economy of Operation Dependent on Proper Care

Fine Mechanism of Air Tools Requires Special Attention—Keep Records of All Repairs—Place Responsible Man in Charge—Supply of Extra Parts Should be Stocked

WHEN you compare pneumatic tools with other shop equipment, such as the drill press, lathe and milling machine, you will observe that while the latter are of fine material and workmanship, the air tool is an exceptionally fine piece of mechanism. Being for portable use it must be sufficiently light for convenience in handling, while the service required demands great power and speed. Although other tools are generally used in the tool-room or factory under the most favorable conditions and kept well lubricated, cleaned and free from rust, the air tool is often used in the foundry or shop yard, exposed to sand or dirt and weather conditions and often goes without lubrication until it stops. However, in justice to the user we must say these conditions are fast improving, as he is beginning to realize the importance of caring for this equipment.

Probably the most important factor in any well organized system of maintenance of air operated portable equipment is that of proper facilities for adequate repair and storage when not in service. When a relatively large number of such tools are in constant use it is advisable to have a separate and distinct department especially equipped to look after all repairs. Every pneumatic tool in the shop and every length of hose should be kept track of by record, and a stock book kept to indicate any ordinary or special repair done to the machine, such as fitting new pistons, cylinders, etc. In any plant of considerable size there should be one man who is responsible for the maintenance of the hose and for keeping it in perfect order. In large plants it pays to have one or more inspectors doing nothing else but going round keeping receivers free from water and stopping leaks. He should be given power to put his knife through any faulty hose, and take the number of any man persisting in wasting air. Faulty hose will soon waste money enough to pay the wages of a good many men. Through imperfect supervision a drop of 15 lbs. per square inch has been observed in a plant of 5,000 cubic feet capacity, which was remedied in two days by a change of method of supervision.



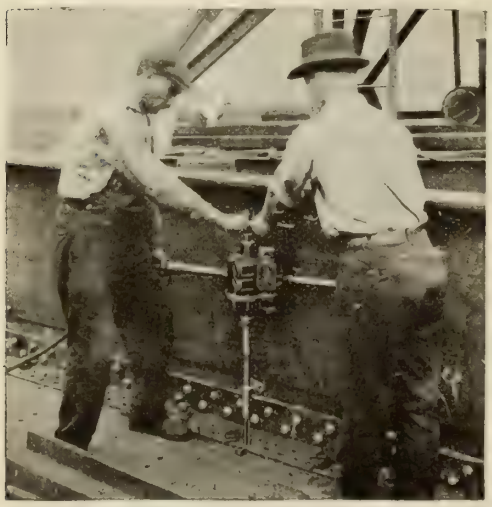
Left—Grinding throttle joints with reversible drill. Right—Piston air drill drilling 1-in. oil hole 3½ in. deep in cast steel gear wheel.

All hose used in connection with compressed air should be of the best quality fitted with a good oil-resisting lining. Poor lining deteriorates rapidly causing pieces to be torn away, stopping the passage of the air and entering and affecting the satisfactory operation of the motor. Very frequently, when a faulty machine is recorded, it will be found that the hose is the cause. Workmen should be furnished with a suitable check spanner, one that can easily be carried in the pocket, for tightening up the hose. It is advisable to supply him with extra washers for service in stopping leaky joints. Faulty connections and leaky cocks can easily be traced if the pressure is left on for a short time after work ceases, as the escaping air can readily be detected when other noises are stopped.

All the tools should be returned to the store at the end of the day, or sooner, if finished with. Tools left outside all night with moisture inside and out soon corrode and lose efficiency. This situation is not improved if the workman takes the next day off and the tool is still left lying about. A little firmness at the start, together with efficient checking of tool numbers, will convince the laziest of workmen that it does not pay to disregard this rule. But it must be clearly understood that the management should back up the tool room foreman strongly in this respect. Any weakness is fatal to the chance of success. Every tool should be looked over for injury or loose parts on its return to store. If anything is reported or noticed wrong, the tool should be passed straight to the fitter's bench, put right, oiled and then placed in its proper rack ready for reissue. Any tool likely to remain in rack for a lengthy period should be oiled and gently worked to allow oil to spread through the working parts before being placed in the rack. All tools should be placed in the paraffin bath at least once a week to clean them of grit. The sockets, etc., should be examined regularly to see that the gauge tools, i.e., drills, reamers, snaps and chisels fit accurately. This is important since in these days of high-speed steel a badly fitting taper socket means broken tangs on expensive drills and reamers; and sleeves worn large in hammers means loss of pressure and hitting power.

Generally speaking, beyond the replacing of worn and broken parts with

Cuts supplied through courtesy of the Independent Pneumatic Tool Co., Chicago.



Operating on bridge construction.

Lifting heavy roll with air hoist.

Working in close quarters.

those usually carried in stock in the tool room, very little can be done by the purchaser in the way of repairs to pneumatic tools. For instance, repairs to damaged drill casings, hammer cylinders and handles would be found rather difficult in the ordinary tool room. However, practical economy can be effected by a careful foreman in noting actual wear and tear, and keeping a good supply of spares for the parts that wear most. This may obviate a lot of trouble through tools being out of action, perhaps when most urgently wanted on a rush job. A good investment for the tool room is the provision of a portable testing outfit, consisting of a pressure gauge and air

Reaming end sills on steel car.

meter, capable of recording the air used by any tool in actual work. This is useful when buying new tools to test one make against another, and also to note the efficiency of any tool after so many months or years of use.

If the following rules are observed it cannot help but result in more efficient service and longer life for the air tool: Always blow out the hose and see that tool is well oiled before attaching hose. It will pay to use a lubricant of good quality. For drills use a good grease for crank chamber, and a light mineral oil—that will not gum—for the drill

Driving ¾ in. and ⅞ in. rivets on steel underframes.

valves and air hammers. Wash machines out occasionally with kerosene, after which they should be thoroughly oiled.

Oil tools at least once every hour when in service. Some plants adopt the system of having a man whose special duty it is to make the rounds of the shop, oiling all tools in service. By oiling around the chisel shank in chipping and calking hammers, the tool will work better and last longer.

Do not overload tools by selecting a machine to do work beyond its rated capacity. Care should be taken to see that air drills are the proper speed for the work. Do not use a high speed machine where slow speed is required. What is gained in speed will be lost in power and it will damage the motor.

When tools are taken out of service they should be returned to the tool room and placed in a solution of gasoline and signal oil, equal parts. This will cut the dirt or other foreign matter—then blow out thoroughly and lubricate before using.

Compressed Air in Saw Mills

FIRE hazard is an ever present problem in the operation of saw mills, particularly those of the larger variety where considerable haulage of material is necessary in transporting the timber and finished material to and from the mill. The danger that is associated with the use of steam or electric locomotives makes this class of equipment very unreliable from the factor of safety, owing to the possibility of sparks igniting shavings and inflammable material that abounds in industries of this kind. Compressed air haulage has many advantages over other methods where immunity from fire risk is of prime importance.

The efficiency of a modern compressed air haulage system, when properly designed is extremely high, comparing favorably with steam and electric haulage, over which it has the additional advantages of cleanliness and freedom from breakdowns; absolute elimination of fire risk; great flexibility of the system as a whole, since the locomotives are self contained all that is necessary to extend the system being to lay new tracks; and the fact that the air compressor, whether steam or electric driven is located in the power house under the eye of the engineer and under conditions most favorable to efficient operation. The system is so simple that anyone can handle it and if repairs are necessary, they can be made by an ordinary mechanic.

In lumber yards, where fuel is cheap and operating economy is not of first importance, the chief advantage to be derived from compresssed air haulage can be considered as the immunity from fire risk. This results in a material reduction in insurance rates, an advantage of the utmost importance.

Compressed air locomotives of the most modern two-stage design are very simple in construction and easy to understand, they are cleanly, have a large reserve power and a radius of action, in the various sizes, amply large enough, they are quicker and more convenient to handle than steam locomotives, they require no fireman and carry no coal or water. In operating economy they are far superior to storage battery locomotives and about equal to steam locomotives or electric locomotives taking their current from a trolley. The operating economy, compared to other types, cannot be accurately estimated since it depends almost entirely upon the type of locomotive and air compressor installed and upon the character of the installation in general. The question of fire risk and convenience far outweigh any slight difference in operation economy.

Many mills are now using air for the operation of drag saws, cut-off saws, log dogs, kickers, for putting the strain on upper band mill wheels, and many other similar devices. The pneumatic system has proven quicker, cleaner, more easily controlled and especially effective for fire prevention. It has the advantage that the power can be piped in from an isolated generating plant located at a safe distance from all inflammable material.

The installation of a dry pipe sprinkler system in saw mills is another recommendation for compressed air.

Pneumatic hoists for lifting, hauling and placing timbers, transporting and unloading cars, are a great convenience in any wood-working mill. The amount of air used is very small when compared to the added efficiency, the increased production per man and machine. Direct acting cylinder hoists are generally used for straight lifting work through limited distances, for keeping machines supplied with material, erecting machinery and other varied purposes. Air-operated tools of all kinds are extensively used in every up-to-date saw mill and wood-working establishment.

The air lift pump is another application where pneumatics has solved a problem of deep well water supply, a condition frequently prevailing in lumbering camps and large saw mills. The air lift pump is without question the simplest form of pumping apparatus made; there are no moving parts in the well, simply two pipes, an air and a water pipe. The operating compressor can be situated any distance from the well and any number of wells can be pumped by one compressor. The compressor is located in the power house, under the best operating conditions and under the constant supervision of the attendant. Two great advantages of the air lift pump are its ability to pump all the water a given size well will yield and the fact that, when there is sufficient water flowing to the well, the yield is increased with time.

Spray Painting and Finishing by Compressed Air

Spraying Method Maintains Quality and Reduces Production Costs—Suitable Booth Should be Provided—Agitation of Heavy Materials—Less Scaffolding Required on High Structures

By RAY W. TRIPP

WE ARE living in a period where the mechanical method is supreme, and shop worn, laborious hand processes are replaced by the more efficient and modern ones. The modern method of applying paints and finishing materials is of course, by means of compressed air and a spray gun. This practice although quite limited a few years ago has now become widely extended.

Competition to-day is exceptionally keen and for this reason alone everyone is compelled to reduce production costs. All devices which are designed to maintain quality and lessen labor outlay are receiving serious thought from the factory executive. Cost cutting methods have been found necessary in various shop departments, and the painting or finishing department has been no exception. The spray method of coating metal or wood products has solved the finishing room problem, as costs are cut, production increased, finishes improved, space is saved and the department is placed on an efficient and more healthful basis. Hand brushes are practically done away with, in fact, many of the newer factories have never used anything but a spray gun or air brush as they are sometimes called.

A spray finishing plant consists of an air compressing unit, a spray booth and the spray equipment with accessories, size of each depending on class and nature of work. The compression unit consists of an air compressor of sufficient size to furnish the required number of cubic feet of free air per minute at the proper pressure, an air receiver and motive power. The finishing is done within a metal spray booth equipped with a motor driven exhaust fan. The spray unit consists of material container, hose, spray guns, air regulating and purifying means and duster.

Observation and experience on many thousands of satisfactory installations have disclosed interesting facts worth noting at this time. When single coat work is wanted, a lighter or heavier coating can be obtained than is possible with a hand brush. Brush marks, skimped places and laps are entirely eliminated and the covering and wearing qualities of materials are increased. It is practical to spray fillers, shellacs, varnishes, enamels, lacquers or paints and materials giving good results when brushed will give equally satisfactory service when sprayed. Furthermore, the only practical way to apply lacquer to wood or metal is by means of the spray method. Inaccessible as well as irregular surfaces that are difficult to reach with a hand brush are rapidly coated with a spray gun. Any workman of ordinary intelligence can become a skilled spray gun operator in a remarkably short time. Price of hair brushes—a considerable item—eliminated. Time saved on sanding operation due to uniform surface produced by spray methods. Fire risk is reduced as all fumes and excess paint are exhausted. The two biggest points in favor of spray painting are the facts that one spray gun operator will cover as much surface as five painters using hand brushes, and will secure a more uniform coating which will be free of brush marks.

In order to obtain satisfactory results on some materials, such as cold-water paints, it is necessary to keep the liquid constantly agitated to keep the heavier parts in suspension. An agitating apparatus should be used when materials of this character are to be applied. The agitating is accomplished by means of compressed air, which, after passing through the attachment, bubbles up through the paint, and then escapes by means of the bleeder valve on the control head.

The average skilled hand-brush painter will apply from 2½ to 3 gallons of paint to about 900 or 1,100 sq. ft. of surface in an eight-hour day. An experienced operator with an efficient spray gun on such work as mill interiors can easily apply from 15 to 20 gallons to a surface approximately 7,000 sq. ft. in the same period of time. A speed of over 10,000 sq. ft. a day has been achieved in many instances. This is based on a covering capacity of about 350 sq. ft. to the gallon. On rough work, such as the hulls of vessels, special large size openings are used on the guns and speed of operation is greatly increased, with increased consumption of air and paint for surface covered. Speed up to 20,000 sq. ft. a day has been accomplished on this class of work.

One of the outstanding advantages of the spray gun when using the extension pole attachment is the saving effected in the erection of scaffolding, staging and long ladders. It is possible for the operator to reach eight feet or more from his standing position with as little effort

Author is associated with the Spray Engineering Co., of Boston, Mass.

Getting castings ready for shipment.

Spraying work that is hard to brush.

Putting the finish on interior wall.

as it takes a brush man to reach two. This is especially serviceable when painting large vertical or inclined surfaces, such as walls, ceilings, hulls of ships, stacks, etc.

When applying certain classes of varnishes and enamels it is often advisable to have the spray at a definite temperature somewhat higher than the surrounding atmosphere. For this purpose an electric heating attachment has been developed, which heats the air just as it enters the gun which assists in warming the material flowing through the gun passages. Where there is an excessive amount of moisture or oil in the air being used a separator should be installed in the pipe line to protect the spray gun from the possibility of clogging with dirt.

It might be well at this time to mention that resolutions favoring the use of spray painting machines were passed by the Paint Manufacturers Association of the United States and approved by the Board of Directors of the National Varnish Manufacturers Association.

Equipments are designed as a general rule for a special purpose, portable units for large work such as building interiors and exteriors, and stationary outfits for various classes of industrial finishing room work. In both classes there are small combinations where amount of work is limited, as well as larger where quantity production is needed. The selection of the right type of equipment and accessories is of greater importance than the average user appreciates and it would be advisable when in the market for equipment of this nature to place your problem up to a recognized manufacturer. With their years of experience in this line they are in a position to recommend the proper equipment and layout, and possibly make helpful suggestions as to the finishing of your product.

Compressed air has replaced manual labor and multiplied the efficiency of workmen in many lines, but especially in the application of protective as well as decorative surface coatings. The benefits to employer, employee and customer have earned a permanent place in modern business practice for spray painting equipment. It is without a doubt one of the most important agencies through which the wise and comprehending employer makes his employee's job a pleasant and healthful one, at the same time securing more and better work. Surely every user of paint or finishing material owes it to himself to fully investigate the possibilities of the spray method as applied to his particular work.

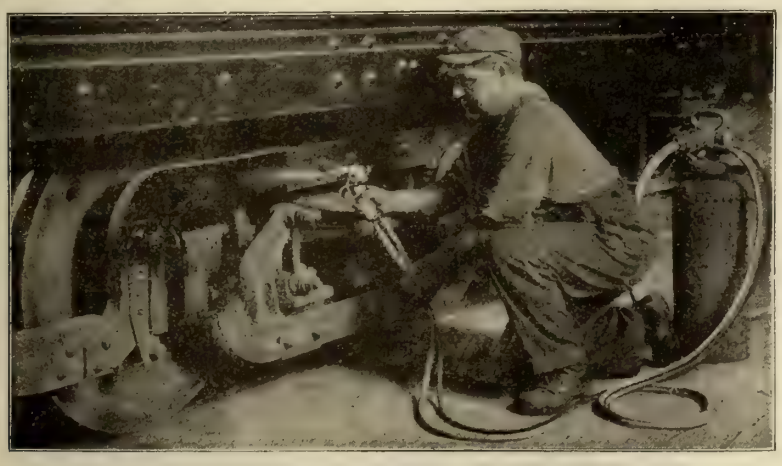
STEADILY INCREASING SERVICE FOR PAINT SPRAYING METHOD

Large industrial and manufacturing plants are now recognizing the economic advantages of painting by the spraying process. This is particularly true as regards the practice on railroads, as these companies have developed the method of painting to such a degree that the greater proportion of all equipment, including locomotives and box cars, are now painted in this way. One of the many advantages is that it is often possible to obtain equally good results from a lower priced operator than under the old brush method. The possibilities of economy may be appreciated by consideration of a typical example. A box car has been spray-painted by one 54-cent man in fifteen minutes, whereas it would take a 72-cent man about four hours to apply the paint with a brush. The relative amounts of paint used are nine and eleven gallons.

Finishing woodwork in offices.

BOOK REVIEW

Modern Workshop Practice is the title of a practical text book recently published by the D. Van Nostrand Co., New York City. The book is divided into 24 chapters, each one dealing with some phase of mechanical design, construction or operation. The opportunity has been taken by the author, Ernest Pull, to deal with some of the important improvements and developments made during the war. Included in the various chapters are those devoted to measuring tools and measuring machines; gauges and gauge systems; common workshop tools; soldering and brazing; bench work; heat treatment of metals; lathes; tool holders; lathe tools, speed and feeds; turning; screws and screw cutting; turret lathes; plain and universal milling; gears and gear cutting; gear hobbing and planing machines; boring and slotting machines; planing, shaping and drilling; grinding forge work; and power transmission. The book also includes 10 large folding plates, illustrating different views of large engineering plants. The book contains 675 pages and is profusely illustrated with half tones and line drawings. Price $5.00.



Showing a job that would be difficult to brush.

Showing application of extension pole attachment.

Relative Tendencies in Machinery and Pig Iron

Predicted Upswing in February and March Next Borne Out by Canadian Statistics—Graph Shows Change for Better is Due—Depression Since August Due to Labor Troubles—Demand Developed Strength

PREDICTIONS are made, based on records of iron and steel production and their industrial significance that demand for machine tools should show an upswing in February and March of next year. Authorities who have made the closest study of cycles, and have studied the indications and tendencies and comparisons of many years, declare that it has developed invariably that machinery business improves materially and has been known to assume its normal stride twenty months after pig iron production has passed its lowest point and moves toward higher levels. It is pointed out that the middle of 1921 saw the reverse peak in pig iron, and that this was a general characteristic of the business trend, or of the swing of the pendulum towards normal. It may be observed that August saw a still lower record, but according to procedure in calculations of this kind, the industrial unrest which caused this slump—or in fact any other trouble, such as wars—are but incidents in cycles which recur on an average of seven years. The present slump is one that affects one side of the problem, that of production. Demand has been good.

Official statistics based on Canadian industrial records show that movements in pig iron and in machinery have a relative significance. The accompanying chart illustrates the point. The upper line indicates pig production in Canada as between 1906 and 1922, a period of 16 years. The lower line is indicative of machinery demand, without specific relation to definite quantity or value, but as representing approximately the rise and fall in the years selected. The graph indicates at least that the peaks in the two industries have marked coincidence; that an uptrend in one is followed closely by a similar movement in the other, that the theory of seven-year frequency of depressions has some corroboration in the Canadian record, and that a decided change for the better is about due.

Pig iron production figures show an increase as between 1906 and 1907, during which period, it is a matter of record, machine tool business was good, while as to woodworking machinery demand, one manufacturer declares "We shall never see its like again." There was a sharp slump, 1907-08, and here, too, pig iron production declined. The improvement from 1909 up to 1913 was gradual but definite. The peak of pig production came in the latter year with 1,128,967 gross tons. Then in 1914, came a sharp fall to 783,164 tons gross, but with the war the turn for the better was greatly accelerated. Advancing prices are indicated by the fact that while in 1913 the tonnage above given was valued at $16,540,012, a tonnage of 1,090,396 in 1920 brought $30,319,024, the so-called composite price for the former being $14.65 per ton and for the latter $27.80 based on official figures of total production and value, although prices at certain periods during the war went to much higher levels. Following the armistice and cessation of munition making, there was again a drop in pig production, with an upswing in 1920, a year in which industry made good records. Last year saw a depression on which it is not necessary to recall harrowing details, while for eight months this year, due to strike troubles, the pig production has been little better than a quarter million tons. It will take some months for industry to assume its stability.

Following is the pig iron production record and values from 1906 to 1922, according to figures prepared by the Dominion Bureau of Statistics:—

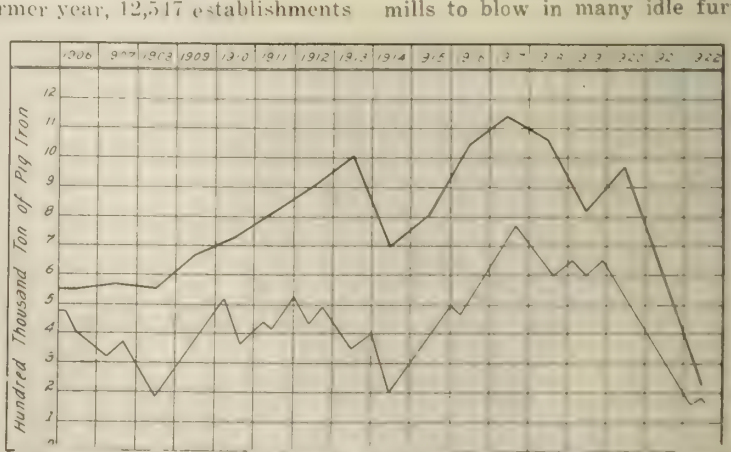
Annual production of pig iron in Canada
Years 1906 to 1922

Year	Pig Iron Quantity Gross tons	Pig Iron Value $
1906	598,411	$ 7,955,136
1907	651,962	9,125,226
1908	630,835	8,111,194
1909	757,162	9,581,864
1910	800,797	11,245,622
1911	917,535	12,307,125
1912	1,014,587	14,550,999
1913	1,128,967	16,540,012
1914	783,164	10,002,856
1915	913,775	11,374,199
1916	1,169,257	16,750,898
1917	1,170,480	25,025,960
1918	1,195,551	33,495,171
1919	917,781	24,577,589
1920	1,090,396	30,319,024
1921	665,676	
1922 eight months (See chart)	251,015	

Statistics show the remarkable industrial growth as between 1905 and 1918. In the former year, 12,517 establishments produced goods to the value of $706,446,278, while in 1918, the last year of the war, these had increased to 34,797, with products of $3,458,036,975. It was in those years of war that Canadian manufacturers established high standards of quality and production.

While the horizon may not appear at the moment as cloudless as all would desire, the stage nevertheless seems set for better things. The crop outlook, always a basic consideration, is most promising, demand for iron and steel continued good through midsummer and still shows strength, the unemployment problem has nothing of that acuteness apparent at this time last year, lumbering interests are preparing for heavy production in the woods this coming winter, the railways display some revival of buying interest, and all things considered, the prospect is full of promise.

Indicative of the trend affairs are taking in United States, a despatch from New York states: "The issuance recently of upwards of $80,000,000 of bonds, notes and other obligations was of especial significance in revealing to what extent the big industrial leaders of the nation are laying plans for business expansion. It is hardly likely that any such amount of money would be borrowed at this time unless the borrowers were able to see pretty plainly that they may derive extraordinary benefits therefrom. Newest reports from trade circles bear out this theory. In the steel industry especially steps are already being taken to revive the activity which was hampered materially by the shortage of fuel and the railway strike. Assurance that coal soon will be produced in an almost normal fashion and indications that a final settlement of the shopmen's strike is at hand have caused the steel mills to blow in many idle furnaces."



Comparison of movement in pig iron and demand for machinery since 1906. Upper line shows pig iron production, while lower line represents machinery fluctuations based on approximate estimate without reference to definite amount. Side figures refer to pig iron only.

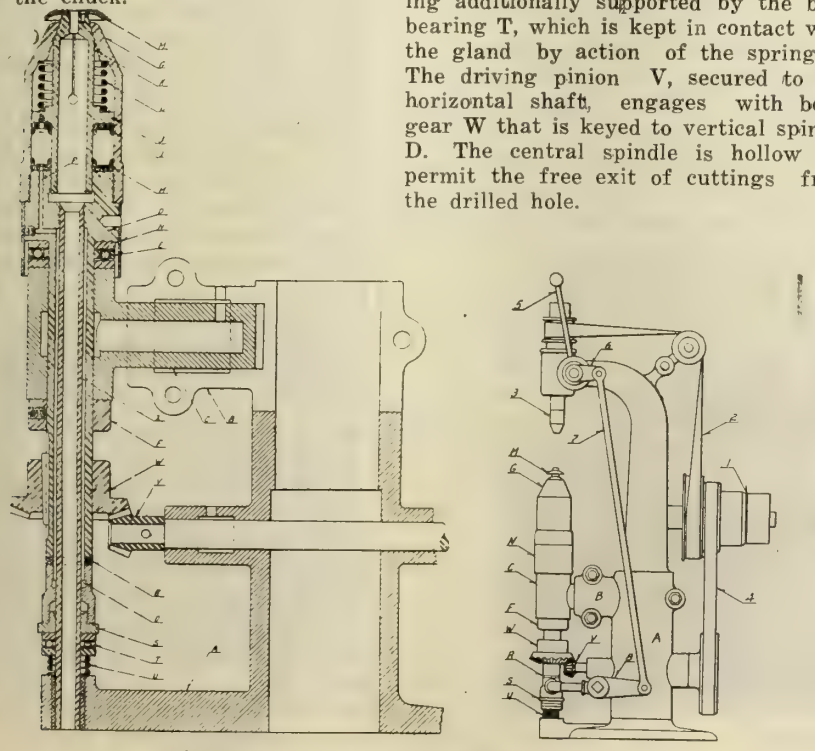
Practical Ideas From Practical Men

DRILLING CONCENTRIC HOLES IN SMALL ROUND PIECES

By R. Hamilton

In the manufacture of many small parts it is often necessary to drill a small hole in the centre of a piece already machined. When the part is of small dimensions it is often difficult to hold it conveniently and yet attain the required speed of production. The accompanying machine illustrates an interesting method of drilling a small hole in the short piece of ¼-inch stock and exactly in the center. The machine is so constructed that the drill spindle is made to revolve at a speed of about 1,200 r. p. m., while the lower portion that carries the work revolves at a speed of about 300 r. p. m. in the opposite direction, so that the actual speed of the drill in relation to the work is practically 1,500 r. p. m. This virtually insures a drilled hole central and concentric with the outer circumference. A notable feature in connection with the operation of this attachment is the joint control of the drilling and the chucking of the work with the one motion of the lever. After the work is placed loosely in the chuck the downward movement of the lever 5, which actuates the drill spindle 3, also operates the air valve on the lower end of the connecting rod 7, which is so adjusted that the initial movement of the sensitive lever opens the valve and allows air to enter the operating cylinder, the reverse motion of the lever raising the drill and releasing the chuck.

A detail sketch of the lower chucking arrangement and operating mechanism is shown in the sectional view. The frame or stand A is bolted to the bench, the upper extension B carrying the tee-piece C the vertical portion of which supports the entire mechanism. The outer spindle D to which the chuck is attached is supported on the ball bearing E that insures accurate movement with the least possible friction, vertical motion being prevented by means of the adjustable collar F. The shell G of the chuck is threaded to the upper section of the spindle D, the U-shaped leathers providing air tight joints between the outer cylinder and the smaller portion of the piston J, the top section of which is split to form the collet chuck K. When the air is released the collet is lowered by the reaction of the coil spring L. A small cup-shaped piece of sheet steel is fastened to the top of the collet to prevent the dirt or cuttings from entering into and destroying the sliding portion. A similar cylindrical shield is attached to the side of the main spindle to protect the ball thrust bearing E. The air enters by way of the inlet shown in the assembled sketch, and passes into the space O, up between the outer and inner spindles and through the small opening P, and thence into the cylinder. A fibre washer is used between the stationary connection and the main spindle to seal the air in its passage through the enclosed space. The lower portion is made air tight by the gland S; the spindle and gland being additionally supported by the ball-bearing T, which is kept in contact with the gland by action of the spring U. The driving pinion V, secured to the horizontal shaft, engages with bevel gear W that is keyed to vertical spindle D. The central spindle is hollow to permit the free exit of cuttings from the drilled hole.



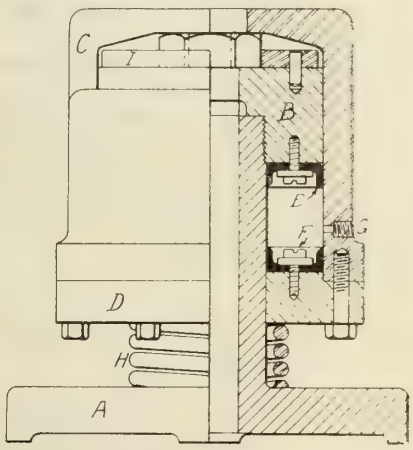
Drilling Eccentric holes in small round pieces.

AIR-OPERATED DRILL JIG

By J. H. R.

The more general application of compressed air to jig work is worthy of greater consideration from designers who are called upon to plan out fixtures for rapid handling of small pieces on an economic basis; particularly is this true where large quantities are being manufactured and the necessary machining takes but a short time when compared to the complete cycle of handling and tooling of the part.

The sketch illustrated shows a jig that was developed as a result of a similar one which proved very effective in machining a fuse part during the war. This jig was utilized for re-tapping a large number of nuts that had been re-



Air-operated drill jig.

claimed from scrap. The base A, which is bolted to the table of the drill press, carries the central post on which is screwed the top head B that constitutes the piston of the device. The cylinder or compression chamber is formed by the walls of the centre post and the outer shell, the upper part of the latter extending into three arms C with a central clamping ring. The leather washers E and F are secured on the pieces B and head D by means of six small screws. When air is released the spring H forces the outer shell and clamping ring upwards so that work may be easily removed. The ring I is doweled to head B, and may be replaced by others with the opening to fit other size nuts or irregular shaped work of any description within the range of the fixture. The air hose is connected at G. This device assures the thread being square with the clamping face of nut.

Care should be taken in the storing of grinding wheels. They are kept best when stored in dry places and it is desirable to stand them on edge in racks.

JIG AND FIXTURE DESIGN

By S. S. Moore

In the operation of jigs and fixtures rapidity of action is second only to the accuracy of the device in which the work is held. As in all other classes of machine shop work, the handling of the material and the time required to set the tools or attachments are the essential factors upon which efficiency is based; and it is therefore imperative that, apart from the actual machining of the piece, the period between operations—or the handling of the work—should be reduced to the lowest possible minimum. Where pieces are to be placed in jigs or fixtures for subsequent machining, it is very important that the clamping arrangement be of such a character that the pieces can be inserted and removed from position with minimum effort and loss of time. Various methods are adopted for holding work in fixtures during machining operations, the general practice being by the use of wing nuts or suitable cam clamps. While the effort required on the part of the operator is seldom such that actual fatigue results from work of this nature, it is often advisable to give due consideration to the conservation of the workman's energy even in those details that are invariably classed as insignificant.

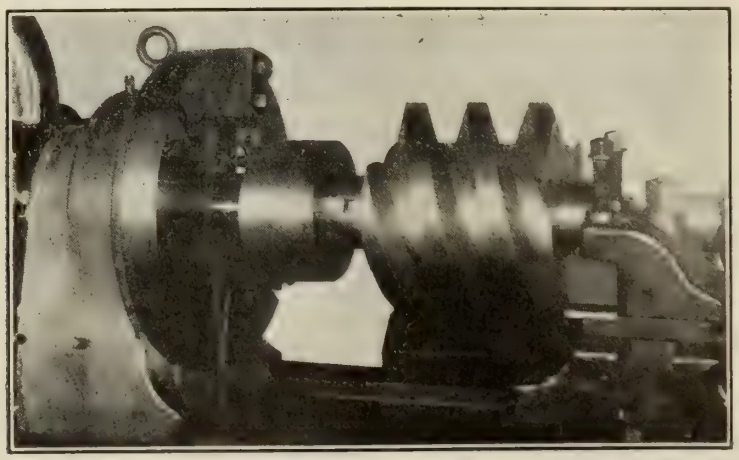
The possibilities of compressed air in the operation of jigs and fixtures should receive greater attention where rapidity of action goes hand in hand with economic production.

CUTTING LONG LEAD THREADS

By H. R. James

The chasing of screw threads having unusually long leads has very often been a perplexing problem and an undertaking that cannot always be accomplished on the ordinary engine lathe. A subhead has been developed by the Hendey Machine Co. that facilitates the cutting of coarse pitch worms on the common lathe without any addition of extra gearing. As illustrated herewith the device consists of a special head supported on the ways directly in front of the head stock, the faceplate being driven through reduction gearing from the nose of the spindle, the work being carried on a dead centre. The ratio of spindle speed to that of the work is 6 to 1. This arrangement provides for the cutting of a 6-in. pitch with the pressure on the lead screw the same as when ordinarily cutting a one-inch pitch thread.

The sub-head is designed so that it can be located in position quickly, two bolts only being required to secure it to the bed. By the use of two dead centres the work is carried in the same manner as in cylindrical grinding, thus increasing the finished accuracy of the work. The subhead can be adapted to the forming of special shapes, where it is necessary to use wide tools and slow speeds.

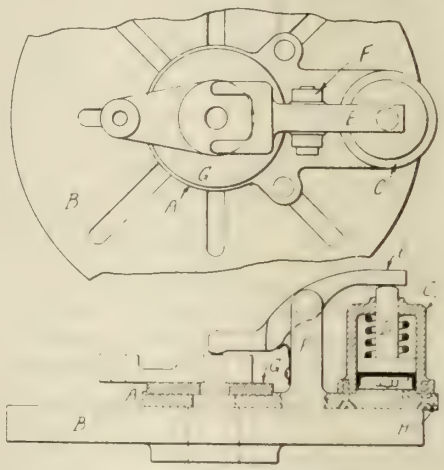


Cutting long lead threads.

PNEUMATIC CLAMPING DEVICE

By J. Garth

An interesting design of air-operated fixture is shown herewith. The jig is primarily intended for use on the drill press where light drilling is required, but may be used to advantage on a variety of machines or on bench work.



Pneumatic clamping device.

It will be seen that the jig is self-contained and may be used for many purposes. It is here shown fixed to a table of a drill press. The base A carries on one end the small cylinder C, held in position by screws shown. The air enters the opening H through the base of the fixture. The steel plate G is recessed into the base A and may, if desired, have a shape to suit any particular piece of work. In action the air forces the plunger D against the heel of the clamping lever E which is pivoted on the vertical piece F. The toe of the clamp is thus forced against the work. If desired, pin gauges may be located in the plate G. for accurate setting.

CLEANING OF MACHINE PARTS

(Continued from Page 24)

the pieces to and from the housing while retaining the abrasive within the enclosure and protecting the operator from dust and flying particles. An elevator and separator as in the barrel provide for cleaning and feeding the abrasive, making a continuous feed, self-contained unit. The installation of barrel and table together is frequently found advantageous.

Provision in all of these devices is also made for connection to the exhaust system, and it may be noted in passing that exhaust for the cabinet, barrel or table, or all in combination, with grinders as well where desired, can be connected to the exhaust-arrester system of the room installation.

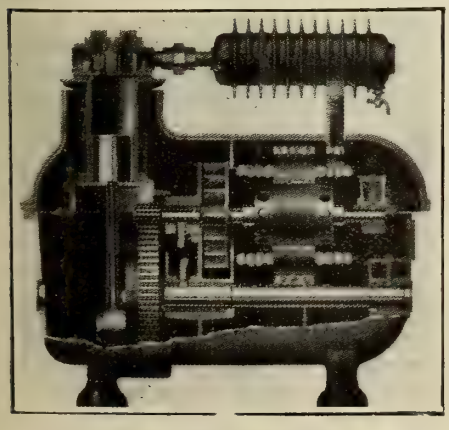
Saving Effected

The keeping of costs on this character of work seems to be fitted more in the breach than in the observance. This may be due to the fact that it may vary in different plants due to the individual conditions, and the fact that there are few plants turning out identically the same pieces. Another reason may be a disposition on the part of the manufacturer to keep these figures to himself, so that it is only in generalities that we can answer this question. For instance we have in mind a gas engine cylinder weighing upwards of eight tons that to remove the cores and clean the casting required two men fifteen hours, or thirty man-hours. With the sand blast cores were removed and the casting cleaned more thoroughly and more efficiently by one man in one hour. In a plant making roller-bearings the raceways have the bore ground on internal grinding machines. Sand-blasting these before grinding increased production on the grinding machines fully fifty per cent., due to removal of oxide scale in the treating furnaces, cleaning of which reduced glazing of the grinding wheels with less dressing required. Not only did production increase fifty per cent., but the working life of the wheels was materially lengthened. In another plant preparing metal for galvanizing where pickling had been previously used, a special sand-blast machine was designed and it is estimated that the first year's use will reduce operating cost by $25,000. Parts to be machined work faster, and as the sand-blast removes the outer scale or skin from the casting, which is most detrimental to the tool, saving in machining cost is effected which varies from fifteen to forty per cent. according to individual conditions.

New Things in Shop Equipment

ELECTRIC COMPRESSORS

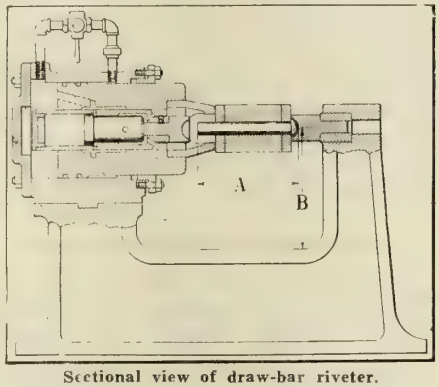
The accompanying cut shows a sectional view of a motor driven air compressor. It is built in two sizes, having capacities of six and twelve cu. ft. per. min. The former is capable of working up a pressure of 200 lbs. and the latter 75 lbs. pressure. The 2 h. p. motor is designed especially for this machine. The unit is self contained, motor gear-train and compressor being mounted in the one housing. Top cover is in two sections, individually removable. This permits of easy access to the interior mechanism. The removable cylinder head carries intake and outlet valves, both of which are arranged for pipe connections, so that the intake pipe may be used to bring pure, clean air to the compressor; this also makes it possible to use these machines for vacuum work by merely reversing the pipe connections. The valves are of automobile poppet type and ground individually to a perfect seat and tested under high pressure. The piston is of aluminum alloy, its light weight reducing inertia and vibration. Single reduction gearing is employed, the shafts running in extra large bronze bearings. The housing forms one big air jacket and a centrifugal fan on the armature shaft circulates air all through the housing and forces it out through opening under projecting flange of valve head, thus cooling commutator, windings, bearings, cylinder and valve head. The compressed air passes from the cylinder into a cooling and condensing chamber provided with fins to assure rapid dissipation of compression heat. There is no water to freeze up or evaporate. These electric air compressors leave the factory fully lubricated and ready to run. There are no coil cups to refill, nor any oil level to maintain. Grease is fed to all bearings through felt wicks by capillary attraction. Gears run in grease and cylinder walls are grease-lubricated by means of felt lubricating pad into which the piston is pressed slightly at the bottom of each stroke. On each up-stroke a thin film of grease is deposited on the cylinder walls. Minimum attention to lubrication is obtained by this system. Grease requires renewing only at three-month intervals. These compressors are made by the Black and Decker Mfg. Co., Baltimore, Ind.



Electric-driven compressor.

DRAW BAR RIVETER

The accompanying cut shows a sectional view of a draw bar riveter operated by compressed air, made by the Canton Pneumatic Tool Co., Canton, Ohio. This is used where railroad cars are built and it is for riveting yokes to car couplers. These rivets are usually 10 or 12 inches long and the plate closer presses the plates firmly together while the head of the rivet is being formed. This machine has two advancing cylinders, the larger operates the plate closer and the smaller, which works within the large, carries the piston and follows as the head of the rivet is formed. This machine is equipped with double acting cylinder so that the larger cylinder is returned by compressed air and as it is returning the smaller cylinder is carried with it. This device is used for testing heavy springs such as are used on trucks, etc., and if the spring bends or breaks, it is rejected. The advantage in using air for testing springs is on account of its quick action.



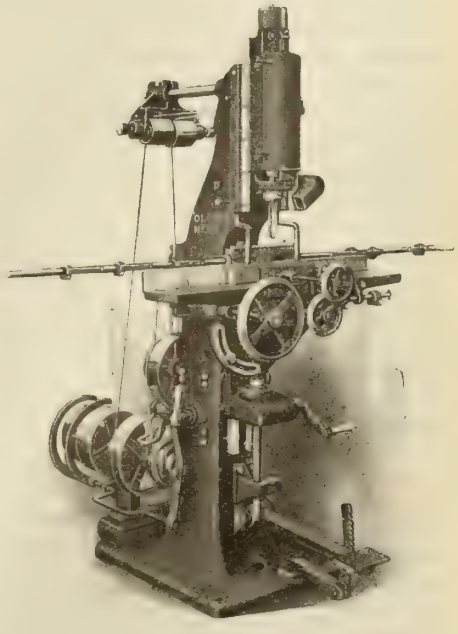
Sectional view of draw-bar riveter.

The piston has a weight of 8 lbs., the diameter of the ram being 10 in. The floor space required is 1 ft. 3 in. by 4 ft. 3 in. The machine has a capacity up to 1½ in. rivets, operates at a pressure of from 80 to 100 lbs., and weighs about 1,200 lbs.

HOLLOW CHISEL MORTISER

A power feed hollow chisel mortising machine designed particularly to meet the demand for greater production, and especially serviceable in factories engaged in multiple quantity manufacture of cabinets, furniture, sash and similar woodwork, has been placed on the market recently. A few of the outstanding features of this machine are the flexible power stroke, the quick return stroke, direct thrust support for the table and the efficient handling of the bit and spindle thrusts. It is speedy in operation, convenient to operate and compact in construction. The machine has a capacity of hollow chisels from ¼ in. to ¾ in. square. The stroke may be adjusted from 2½ to 4 in. Stock 6 in. wide can be centered beneath the chisel; 12 in. material can be mortised with 4 in. blades. The column is rigid and of hollow, box type pattern, made in one casting with wide flanged floor support. The power feed mechanism is enclosed within the column, the drive pulley being located outside.

The mortising ram or plunger reciprocates in adjustable gibbed ways and has a table travel of from 2¼ to 4 in., controlled by the foot treadle for single or continuous power feeding strokes. A swinging guard covers the spindle and the pulley affording maximum safety to the operator from revolving parts. The spindle is supported in self-lubricating bearings with special attention to taking care of end thrusts. The power feed mechanism is extremely simple and yet very effective. It is controlled by the foot lever and is brought into action by a belt tightener which, when released, brings a brake into action on the rim of the drive pulley. A ratchet is provided to hold the lever down for continuous feeding. The power feed has three rates of feed—18, 26 and 36 strokes per minute by means of cone pulleys and a feed belt shifter. By



Hollow chisel mortiser.

throwing out the ratchet the continuous feed mechanism may be instantly stopped and the machine operated by single strokes.

A universal compound table with screw clamp for 6-inch wide stock and hand wheel, rack and pinion for longitudinal travel, gauged by adjustable stops, is regularly furnished and very highly recommended as the most satisfactory form of table on machines of this type. Table is 36 in. long, 6 in. wide, 32 in. above floor at lowest position and 44 in. above floor at highest position. It is fitted with a vertically adjustable back fence which has a lip hold down and also carries a 6-foot layout stop rod with six spring stops for automatically locating mortises on the pieces. A rod and two adjustable stops directly in front of table govern the length of mortises. Two swinging hold down fingers which are held in the column of machine, project over the table and prevent work climbing up when chisel recedes.

The countershaft is supported on the base of the machine in adjustable bearings and has self-contained belt shifter with handle conveniently carried on column of machine. The machine is equipped with a 3 h. p. motor operating at 1,200 r. p. m. The floor space required is 3 ft. by 5 ft., and machine has a height of 6 ft. The mortisers are manufactured by the Oliver Machinery Co., Grand Rapids, Mich.

MOTOR DRIVEN BENCH GRINDER

A motor-driven bench grinder especially designed for use in garages and small machine shops has been placed on the market recently. This grinder is light and strong and particularly adaptable for tool grinding, wire-brushing, polishing and general utility work. The device is supplied with two 5 in. dia. wheels operating at a speed of 4,500 r.p.m., giving a surface speed of about 5,900 ft. per min. The wheel spindle runs in dust-proof parallel bronze bearings. The motor is of the universal type, driving the spindle through reduction gearing, the steel pinion on the rotor shaft meshing with a fibre gear on the wheel shaft. Long work can be ground parallel with the spindle without interference with the frame. The cover is close fitting and adequately protects the interior from dust and dirt. It is easily removed for inspection and adjustment. The height from base to wheel centre is 3 in. and wheels are 9¾ in. apart. The machine is shipped with complete attachments ready for installation. The weight of finished machine is 25 lbs. It is made by the J. A. Finley Co., Allston, Mass.

NEW NON-FERROUS ALLOY

A new metal alloy of the tungsten-chromium-cobalt class has recently been developed and it is claimed that remarkable speeds and endurance cutting tests on cast iron and alloy steels have been achieved. This metal is non-magnetic, contains no ferrous compounds, but has the appearance of steel. The metal is melted in electric furnaces and cast into molds of steel in the form of tool bits, twist drills, reamers, inserts for built-up milling cutters, etc. It is impossible to forge or anneal the metal and the only way to alter the shape is by grinding. The metal is very dense and is stated to be free from blowholes and internal strains, with a high resistance factor that makes it particularly adaptable to cutting metals. It can be given excessive rake and clearance angles. Standard sizes of bits for commercial tool holders are made and also heavy duty slabs or blocks welded to carbon steel shanks. This metal is marketed by the De Bats Sales Inc., Boston, Mass.

"KANT-SLIP" WRENCH

A wrench that is capable of gripping work of any shape and which will automatically adjust itself to any size within its range, has been placed on the market recently. There are no screws, pins or springs to wear out or break, and the fulcrum is always close to the load. The stationary jaw may be used as a hammer for light work, a flat at the back of the head being used for this purpose; a screw driver end is located on the handle of the wrench. It is claimed that the wrench can be used on any size pipe without damaging the pipe. This tool is made by the Allan-Diffenbaugh Wrench and Tool Co., Baraboo, Wis.

AMENDED CUSTOMS FORMS

Forms have been sent out by the Department of Customs and Excise, Ottawa, which embody the amendments to the act assented to in June last. These repealed the provision requiring appraisal on imports on the basis of the cost of production plus a reasonable profit and specify that the volume for duty on foreign goods shall be the same as on similar goods from the United Kingdom. Under the new requirements every invoice of goods entered under the general tariff must bear a certificate form by the exporter that each article in the invoice is bona fide the produce or manufacture of the country specified in the column provided for that purpose. It should further be noted that the present authorized certificate of the exporter showing the relative value in standard currency in paper currency of the invoice will be accepted by the Customs, subject to the usual verification by the Collector, on invoices of goods imported from a country the currency of which is not regarded by the Customs as substantially depreciated. The only countries whose currency is regarded by the Customs at present as being substantially depreciated are:—Germany, Austria, Hungary, Jugo-Slavia, Czecho-Slovakia and Russia. Invoices of goods from Austria, Hungary, Jugo-Slavia, Czecho-Slovakia and Russia are to bear thereon a currency certificate of a Consul, Canadian Trade Commissioner or Bank that on the date of exportation of the goods described in the within or annexed invoice the true value of the currency in which the invoice is made out as compared with the standard dollar of Canada is (at the rate of dollars .....cents.....) per ..... (unit of invoice.") This certificate is also required on invoices of goods imported from a country where currency has no fixed standard value. Collectors of customs are instructed that in cases where appreciation or depreciation of a currency is less than one per cent. the home consumption value on the invoice is to be computed for duty purposes at the par of exchange.

The new forms come into effect on and after Dec. 1st next.

BOOKLET

The B. F. Sturtevant Co. of Hyde Park, Boston, Mass., has just issued a new 72-page Engineering Bulletin on Pneumatic Collecting & Conveying. It contains 33 pages of pictures and diagrams, 17 pages of useful tables—how to find the size of fans, the suction, volume, r. p. m. and horsepower for any system, cubic feet of air handled per minute, size of pipe and ducts used, and various other valuable tables. Data are also given on dust collecting from grinding and polishing machines, tumbling barrels, sand blast machines, coal breakers, shoe machinery and the removal of fumes, gases, etc. In addition, there are parts on the conveying of pulverized coal, fibrous materials, coffee, ashes, wool, wood chips, etc., etc. It is a most comprehensive treatise on Pneumatic collecting and conveying systems.

EFFICIENT LUBRICATION

(Continued from Page 25)

cessive oil thereon, the quantity fed by the lubricators should be reduced. By thus examining the machine a few times, the proper amount of oil can be determined to suit the characteristics of the particular lubricant used and the conditions under which the machine operates."

Regular Cleaning

No matter how high the quality of the oil may be periodical cleaning should be consistently carried out to keep the walls free of carbon. Different methods are used to perform this duty but few, if any, will surpass the results obtained from the use of soap suds having the consistency of one part soft soap to fifteen of water. This mixture should be fed to the compressor through the oil inlet at about ten times the speed of the oil. This practice is advisable at least every two weeks, and during the process the air valves should be inspected to see the effect of the cleaning process and to act as a guide to the operator as to the quantity of solution to use. The machine should not be left after cleaning until it has been operating again for some time with the regular feeding of lubricating oil. This is necessary to prevent the possibility of corrosion.

CANADIAN MACHINERY
AND MANUFACTURING NEWS

Published in the Interests of the Machinery, Manufacturing, Iron, Steel, and Metal Working Industries.

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Advances Agreeably Absorbed

SCARCELY a week goes by that there is not an advance, of more or less importance, in prices on the steel and metal markets. It is remarkable that these are being so easily absorbed by industry generally. In striking contrast are the protests of pre-war days when advances that would be considered slight to-day brought forth vigorous demands for investigation of the most drastic kind. Yet to-day, frequent advances of several dollars per ton seem to be accepted as an essential of the industrial record. It may be that extraordinary circumstance is responsible, as in the jump of $10 per ton in the price of pig iron in the past two months, due largely to strikes. During the war and subsequently, these things carried with them something of the inevitable. It would seem indeed, that repeats of this kind tend to wear down that sense of protest which, in the piping times of peace, was very easily aroused. Nevertheless, some very peculiar mental slants are encountered. Advised that they would have to pay more for their pig iron, their bars or sheets, there are buyers who have quite seriously declared their approval and soberly express hopes that prices would go higher. Such an attitude might reflect a conviction that higher prices mean better business or the elimination of an undesirable feature of competition in the finished article, or as assisting in a plausible explanation of advances more or less essential in the manufactured article.

* * * *

Would Stabilize Coal Industry

PERIODIC warfare and futile attempts at solution in connection with the coal industry in the United States, have at last developed a problem which is to be submitted to a commission appointed by the president. Various conferences in official circles have brought out several proposals by way of probable solution. It is pointed out that larger storage by the railways at times when the public demand is slack would overcome competition by the railways with the public for coal. Larger storage by public utilities is suggested, also that co-operative marketing after the system developed by farmers' organizations might reduce distribution costs. It is evident that one of the chief causes of trouble is the instability of employment, and strained relations between employer and employee as the result of this intermittence. Under such conditions, the principle of collective bargaining to which some improvement in the conditions of employment may be ascribed, breaks down and strike follows strike. Minorities of speculative operators and narrow-minded labor leaders oppose constructive policy desired by the better element on either side, with the result that there has been constant warfare.

"Organs" Waste Advertising Funds

THAT AN association should be that only and not pretend to give service to advertisers is the important principle which has been adopted by the Associated Advertising Clubs of the World in regard to "Associated Advertising" which in future will not sell space. This decision by an organization of leading American financial, manufacturing, mercantile and other business concerns is a highly important one in the field of advertising and publicity.

Congratulations to the Associated Advertising Clubs in taking this stand, are offered by Printers Ink which points out that the Clubs "can now take a fearless stand in their opposition to nondescript mediums which are organized and conducted solely for the purpose of producing revenue and for which there is no real need in the field."

Particular emphasis is laid upon Trade Associations as offenders in this respect: We read:

Trade associations have been our greatest offender in this respect. Advertising-soliciting organs of this sort are started for many reasons, but generally with the hope that the revenue thus raised will help to defray the expenses of the Association. Thus the organization launches itself into a separate outside business about which it knows nothing and which it conducts merely as a side-line. The fact that in most cases these publications are money-losers does not deter others from trying to be the exception.

From the advertiser's standpoint, the greatest objection to nondescript mediums is that they subtly dissipate appropriations. In one guise or another, these mediums levy peremptorily on the advertiser's funds and thus exhaust appropriations, leaving the advertiser with the mission of his selling campaign unaccomplished. This is one of the most crying evils in advertising. The Clubs, and in fact every legitimate advertising interest, should join hands to stamp it out.

* * * *

Railways Are Buying

REMARKING upon general market conditions and tendencies, an authority declares that business is being booked for requirements of the immediate future, that forward buying is cautious, and that it is hardly reasonable to expect a boom although the underlying tone is most encouraging. Recent buying by the national railways for their machine shops was welcomed in a market which for some weeks has been almost featureless. It is hoped that this is the forerunner of other buying activities on the part of the railways, for in appraising the possible sources of business the machine tool dealer and manufacturer may be said to have had his ear to the rail for some time. Much industry depends upon railway activity. Busy, well-equipped roads and shops indicate basic prosperity.

Steel Tonnage for Canada Double that of Last Year

Hoops, Bars, Plates and Structural in Demand—Reflect Industrial Activity—Dealers Declare Growth Healthful Rather Than Spectacular—Steel Rail Advance, Oct. 1, May Bring Railroads Into Market—Non-Ferrous Situation Discussed.

WILL PRICES DECLINE OR HOLD ADVANCES?

WITH A temporary cessation of price advances, the next question that arises, is: Will the market remain stationary or will it decline? Certainly reports from Pittsburgh show that production is increasing and at the same time buyers show a reluctance to make commitments for the distant future, say December or the first quarter of next year. Some advance buying is being done, but it cannot be regarded as representative of the market. At the end of August steel mill operations had declined 50 per cent., while at the present time the increase is equal to 65 per cent. These increases do not indicate a uniform movement, but it shows to what extent furnaces are being blown in.

Transportation, however, is still the big problem, and shipments at best are irregular, although it is considered significant that several of the independent steel interests can now make shipment on new orders, in about thirty days. Pittsburgh declares it is not unlikely that in view of the attitude taken by buyers and that the dull period which comes with the year end is not so far distant, premiums of $3 to $5 per ton as a guarantee of shipment within reasonable time, will fade away altogether.

That tonnages of steel imported for Canadian industry have been double that of the same period last year is the statement received from large steel interests on this market. It has been a steady increase indicating sound underlying conditions, and this is borne out by the statements of dealers who point out that there has been nothing spectacular in the development and that it represents healthful growth. It is felt that, in spite of conservative tendencies, stocks have accumulated at lower prices. In fact, it is known that there was heavy buying in many quarters in anticipation of recent advances.

Spot buying is a feature of the pig iron situation. Supplies are limited and prices high and it is not surprising that buyers should indicate an inclination to look for lower quotations. Pittsburgh reports that "pig iron is stagnant; consumers apparently are unable to pay prices asked, while if they bought any considerable tonnage, prices would advance."

The recent advance of steel rail prices from $40 to $43 per gross ton by Oct. 1, may bring the Canadian railways into the market to cover temporary requirements before that time. It follows that an increase by the Steel Corporation means a similar movement in Canadian mills. It may be that recent orders executed for Canadian lines were in anticipation of present conditions.

Montreal reports that each month this year has shown an increase of about 10 per cent. over that preceding. Steel prices are firm, pig iron is scarce and structural sections slow in August show a marked recent improvement. Some fairly large steel orders have been placed with British mills. There is very little to choose from in deliveries for this or Pittsburgh sources. Machine shops are reported to be coming into the market for a fairly large quantity of material.

Toronto

September 27

STEADY business with no spectacular tendencies, is the character applied to the iron and steel market by dealers and manufacturers. The third quarter, now drawing to a close, has shown little change on the whole as compared with the two preceding, but the record shows that the demand has been a steady one with no breaks or booms that would indicate unhealthy conditions. Although buying does not indicate a strong tendency to anticipate future requirements, it is felt, nevertheless, that there has been quiet accumulation of stocks by those in a position to read the trend of affairs. It is regarded as certain that, while price advances are at their peak for the present, they will remain firm until well into next spring, and some buyers have anticipated this in their purchases. While local dealers, therefore, state that progress has been made along national lines, and that the outlook is encouraging, import interests representing large corporations declare that tonnages on structural, bars, hoops and plates have been exceptional, in fact, double that of last year. The increase from $40 to $43 on steel rails effective Oct. 1, announced by the U. S. Steel Corporation, may bring a rise out of Canadian roads to cover their requirements by the date specified. Although Algoma rail mills are not operating, development of business of this kind could be taken on, as it is only recently that they closed on completion of a rail order for Canadian lines.

Scrap metal markets have been somewhat characteristic of the market, demand and supply pursuing a somewhat even tenor with prices quite stable. In a sense this is a department which comes into close quarters with industrial activities generally, and reports declare the outlook to be encouraging and that evidences of depression are lacking. Prices follow:

Copper, light, per 100 lbs.	9 00
Copper, crucible	11 50
Copper, heavy	11 25
Copper Wire	11 25
No. 1 compositon	9 00
New brass cuttings	6 00
Red brass turnings	6 50
Yellow brass turnings	5 25
Light brass	4 50
Medium brass	6 00
Scrap zinc	3 50
Heavy lead	4 50
Tea lead	3 00
Aluminum	11 00
Boiler plate, per gross ton.	9 00
Heavy melting steel	10 00
Axles (wrought iron)	20 00
Rails (scrap)	11 00
Malleable	10 00
No. 1 machine castiron	18 00
Pipe, wrought	7 00

Non-ferrous metals continue to reflect varying influences but nothing that gives outstanding character to the market. Copper is said to have shown the depressing effect of war news, but the situation is described as firm. Tin values have also dropped; spelter will probably go higher, while lead is firm. Commenting on non-ferrous metal markets E. W. Knight of Frankel Bros., Toronto, had this to say:

"**Copper.** This market has suffered from the somewhat depressing effect of the war news, and also from the less satisfactory tone of the labor situation, both here and in the States. In addition, a great many works in the United Kingdom have closed down, and have requested that copper actually purchased here be held until further instructions are cabled.

"Actually there is no change in the situation, and unless the war clouds hovering over Europe develop into something more tangible than at present seems probable, no actual change seems likely. There will likely be flurries, and possibly some panic, and if this occurs it is pretty hard to say just what will happen to the market. It will likely cause spasmodic trading for a few weeks, with the market eventually settling at the present level of 1 cent, New York, or 17 cents, Toronto.

"The statistical position of the metal is sounder than has been the case for some time, and the situation is now on a firm basis. Personally I do not see any reason to change the views previously expressed, and I am under the impression that little alteration will take place this year.

"**Tin.** The outlook for tin is more promising than for some time, but values have sagged in sympathy with other metals. The same remarks as are applied copper, apply to tin, which accounts for the weakened condition of the market. There is a heavy demand for tin plates, and this is bound to be felt before many weeks are over. Very little speculative support has been given the

market in the last two weeks, but if the European situation improves, an advance is quite likely. The bulk of the buying is for prompt shipment, and little or no interest is shown in futures.

"**Spelter.** This metal is on the jump, and shows every indication of higher, and yet higher prices. Stocks are held in strong hands, and it would appear to be good policy to lay in present requirements.

"**Lead.** This market is firm and strong, and a great deal of speculative buying is taking place, but these things, notwithstanding, there does not appear to be any adequate reason why lead should advance beyond present levels.

"**Zinc.** This metal is in a stronger statistical position than at any time since the end of July, when 632½ East St. Louis was paid. There has been a very brisk demand from galvanizers, and brass mill purchases have also exceeded expectations. This market appears to be heading for higher levels, and consumers would do well to lay in stocks as soon as possible."

Local prices follow:

Lake copper	17 25
Electrolytic copper	17 00
Castings, capper	17 00
Tin	36 00
Spelter	8 50
Lead	7 00
Antimony	8 50
Aluminum	23 00

Bars and sheets while reporting a fair demand, show quite a stable price position, with the range from $3.25 to $3.40. The recent movement to establish the higher figure as the basis was not long lived, and whatever else may be said about Toronto markets, one thing is certain, unison on a maximum price will be a difficult, if not impossible proposition, so far, at least as bars are concerned. At the present there are two camps those who hold that a spread of $1.25 as between Pittsburgh and Toronto is by no means sufficient, cost of doing business being considered, while on the other hand there are those who feel that the spread of $1.25 represents a fair profit on a good customer, but that circumstances are always a factor for consideration and hence they prefer to maintain an independent leeway.

Sheets are a firm feature, with quite a lot of spot business offering. Some big buyers, reporting a shortage, have appeared on local markets for supplies to tide them over until shipments arrive. The rather pronounced upward swing in prices is recognized as having a stabilizing influence and that for first quarter, at least, there should be some strong buying by manufacturers who know they must have the goods. Local prices follow:

Iron bars	3 25	3 40
Steel bars	3 25	3 40
Reinforcing bars	3 25	3 40
Steel hoops		4 75
Tire Steel		3 50
Spring steel	7 00	14 00
Band steel, No. 10 gauge and 3-16 in base		3 90
Small shapes		3 50
Sheets, black, No. 28		5 50
Sheets, blue ann., No. 10		4 50
Canada plates, dull, 52 sheets		5 75
Canada plates, all bright		6 75
Galvanized Sheets, No. 28		6 75

Cotton ducks, 6 to 12 ounce have advanced from 1¼ to 2½ per lb. while Yarmouth army ducks advance 1¾ cents per lb. Plumbers' oakum is now quoted at $6.00 per cwt. a decline of 30 cents.

Toronto pig iron markets have as yet developed no remarkable demand indicating shortage among the foundries. There has been some spot buying, but the trade is evidently adopting a conservative attitude as to prices.

The advance from $40 to $43 a gross ton recalls that when the war demand for steel was at its peak, the highest price paid for steel rails, Pittsburgh, was $55 for Bessemer and $57 for open hearth during the months when the war demand for steel was at its peak. With the ending of the war and subsequent cancellations of contracts the market became an open one, the Steel Corporation and independent makers arriving at prices of $45 for Bessemer and of $47 for open hearth rails as a fair estimate of the situation. Reduction of rails to $40 last year came at a time when the steel market was greatly perturbed by the wave of depression and prices were fluctuating considerably. The announcement of the corporation at that time was regarded as a long step toward price stabilization.

Since the advance by the Steel Corporation in the wage paid to day labor, an advance which was promptly met by all the independents, there has been a tendency to mark up prices on the lighter steel products. Uncertainty surrounding the coal situation this winter and next spring also has been a factor in the price unsettlement during the last few weeks.

Montreal

September 27

FIGURES for the total volume of business handled by the local jobbers in the iron and steel lines for the month of September will show an increase over August, according to the advance information given out locally. Roughly speaking, each month throughout the calendar year has shown an increase of approximately ten per cent. over that of the previous month. Thus it is seen that the volume of business that existed in January is only about half of the volume moving at the present time. Steel deliveries are growing a little more distant each week and the prices are firm, and in some cases a slight advance is noted. The strike situation is clarifying itself slowly but the results will not be overcome for some time to come. Steel products are moving somewhat better than last week. Pig iron is still very scarce, most companies being reluctant to take on new business. The supply of pig iron from British sources is pretty well booked ahead, and chances of any large importation before the close of navigation, are small. Machine tools are not active, although the supply business keeps up fairly well. The nonferrous metals were quiet during the week. The scrap metal markets show an activity which is better than has been noted for some time past.

Iron and Steel. The demand for steel products has shown a very satisfactory improvement during the past few weeks. Prices are firm, the mills quoting $2.60 base to the large consumer, and $2.70 base to the jobber and contractor. The jobber is quoting to the small consumer $3.35 base. Merchant bars are not moving as well as they were a few weeks ago. On the contrary structural sections that were rather slow movers in August, have shown a marked improvement lately. Most of the specifications, however, are for out-of-town jobs. The city demand is rather quiet. Plates have had but little sale all season, but have recently started to move at a very satisfactory rate. Deliveries of plates from the Pittsburgh district on preferred orders, run from three to six weeks.

Quotations on British steel, delivered Montreal, are such that there is very little to choose between them and the Pittsburgh steel delivered Montreal. In the case of deliveries, the British firm can make shipment ten days to two weeks after receipt of orders, and it is invariably the case that the steel is on the dock at Montreal under six weeks after an order has been mailed from this side. Some fairly large orders have been placed with British mills recently.

Galvanized sheets are still in good demand. For some months the supply was barely able to take care of the demand. Some jobbers have been able to accumulate a fairly good stock while others are continually sold out of the standard sizes and gauges. Practically all of these galvanized sheets are imported from British mills.

Blue annealed sheets and black sheets are also moving well but not in the same measure as the galvanized sheets. The seasonal autumn demand for sheets is commencing and there will be a heavy movement of all classes of sheets from now on till the end of the year.

Small steel products such as nuts, bolts, spikes, etc., are moving well. Miscellaneous steel products such as reinforcing bars, spring steel, tire and band steel, etc., are also moving freely. The local mills are doing a fair business supplying the jobbers in the city. In spite of the unsettled outlook the business moving is very satisfactory. Local quotations are as follows:

Iron bars, base	3 15 to 3 25	
Steel bars, base	3 15 to 3 25	
Reinforcing bars, base	3 15 to 3 25	
Steel hoops		4 25
Tire steel	3 25 to 3 40	
Spring steel		7 00
Band steel, No. 10 gauge and 3-16" base	3 65	3 75
Small shapes	....	3 40
Sheets, black, No. 28	....	4 40
Sheets, blue ann., No. 10	....	4 05
Canada plates, dull, 52 sheets	....	5 50
Canada Plates, all bright	....	7 00
Galvanized Sheets, No. 28	....	6 50

Pig Iron. During the past ten days the supply of pig iron available for export from the British producers has been pretty well booked up. This fact has only tended to make more acute a rather awkward condition. Practically no Buffalo, or other U. S. iron is quoted for export. Heavy shipments of pig from Britain to the United States have cleaned up all the surplus there. Local pro-

ducers are short of coal and cannot book any more business until a further supply of coal and coke has been assured. Prices on Canadian iron are slightly over forty dollars a ton for the No. 1 iron. It is now shown that only a limited tonnage of pig can be shipped into Montreal from the Scotch furnaces before the close of navigation. In some quarters it has been stated that the ocean tonnage available for the carrying of such products, are now all engaged in carrying coal or have been chartered to carry the iron for orders that have already been placed. A shipment of Carron iron reached the city recently. It is quoted at $35.00 a ton in carload lots on dock. Jobbers have placed orders for a few small lots of Middlesboro and other British iron, securing same whenever price and delivery were attractive. Summerlee iron is quoted at $35.00 per ton in carload lots on dock. The local foundries have their nominal requirements pretty well covered, and although they would come into the market if iron could be secured at a reasonable figure, it is not felt that any shortage will develop. In some cases it will mean running pretty close to the hand-to-mouth principle. Local quotations are as follows:

Algoma, No 1, car lots on tracks, nominal quotation	40 50	....
Summerlee, 5-ton lots, warehouse	40 50	....
Summerlee, 30-ton lots, dock	35 00	....
Carron, 30 ton lots	35 00	....
Do., 5 ton lots, ex. warehouse	40 50	....

Machine Tools and Shop Supplies. Practically no change has occurred in the machine tool situation. Machine shop activity has not increased to such an extent that all the idle equipment is in use. For that reason it is practically impossible to interest shop owners in new equipment. Sales are usually for single small machines. Wood working tools still continue to lead the iron working tools in the volume of business moving.

The supply business continues to be very satisfactory. The shops are coming into the market for a fairly large quantity of material. Prices remain, on the whole, stationary, although there are continually small changes in discounts coming through. Prices on steel having risen, has tended to make prices on supplies rather firm in some cases.

Non-ferrous Metals. Very little activity has been manifested in the non-ferrous metal markets during the week. About the same amount of business is moving while prices remain practically unchanged, except in the case of lead and antimony, where slight advances were recorded. Orders are well scattered. Local quotations are as follows:

Lake Copper	17 75
Electrolytic Copper	17 50
Castings, Copper	17 25
Tin	35 50
Lead	7 50
Spelter	8 75
Antimony	6 75
Aluminum	22 00

Scrap Metals. The scrap metal market continues to show a slight improvement, as well as a manifestation in stiffening quotations. The iron market is more active than non-ferrous metals as the shortage of pig locally has led to the better demand for heavy scrap. The non-ferrous metals are a little more active than they have been during the last few weeks. The local quotations are as follows:

Copper, light ..... per 100 lbs.	9 00
Copper, crucible	11 50
Copper, heavy	11 25
Copper Wire	11 25
No. 1 composition	9 00
New brass cuttings	6 00
Red brass turnings	6 50
Yellow brass turnings	5 25
Light brass	4 50
Medium brass	6 00
Scrap zinc	3 50
Heavy lead	4 50
Tea lead	3 00
Aluminum	11 00
Boiler plate, per gross ton	9 00
Heavy melting steel	10 00
Axles (wrought iron)	20 00
Rails (scrap)	11 00
Malleable	10 00
No. 1 machine cast iron	20 00
Pipe, wrought	7 00
Car wheels	17 00
Steel Axles	15 00
Machine shop turnings	4 00
Stove plate	16 00
Cast boring	4 00

Pittsburg

September 27.

IT HAS become very plainly evident that, in general, price advances in the steel market are ended for the present at least. In prices actually being quoted and paid there is no decline, but underlying conditions are making for either a stationary or a declining market.

The two important underlying conditions in this connection are the increased production and the complete unwillingness of the average buyer to make commitments for the more distant future, say for December or the first quarter of the new year. There is some buying for such deliveries, but by comparison with the general run of steel business being put through, such buying is properly classed as exceptional rather than typical.

The average of steel mill operations has increased from the low point of 50 per cent. at the end of August, to nearly if not quite 65 per cent. at the present time. The increases have been variously distributed, being nothing like uniform among the different producers. As to the Steel Corporation, it has had a large increase in the Chicago district, but little if any increase in the Pittsburgh and valley districts. Among independents, the Jones & Laughlin Steel Company, Pittsburgh, has had the largest increase. This company was operating six of its 12 blast furnaces at the beginning of August and got down to three by the end of the month, while now it has eight stacks on and is planning to blow in two more. Aggressive efforts to sell are naturally to be expected in this quarter. The Cambria Steel Company, Johnstown, Pa., has also done well, so well that it is understood it has lately been offering some pig iron in the open market, apparently having a surplus over the requirements of its steel making departments. The Youngstown independents have done moderately well in resuming, by comparison, but they were at a very low operating rate at the end of August, and they are very far from a full operation at the present time.

Car Shortages the Rule.—Operations, of course, depend on fuel supplies, and fuel supplies in turn depend upon transportation, not upon coal mining capacity. Naturally there are great differences in the facility with which coal can be moved between different points. The rapid resumption by the Jones & Laughlin Steel Company is due to the fact that it moves its coal by water from its own mines. Especial mention should be made of conditions in the Connellsville region. The strike is still on there, in that there are thousands of idle men there who consider themselves on strike, yet as to the production of the region in general, it has lately been up to the limit of railroad transportation, as car shortages have been the rule for a fortnight. There are thousands of men working in the Connellsville region who never worked there before. Not a few of them are of African descent. This does not present the whole picture, however, for the Steel Corporation has many mines in the region which normally ship coal by water to the great by-product plant at Clairton, also to points where the coal can be transferred to cars. More coal could be moved from these mines if there were more men at work.

In the trade it is considered a very significant fact that several of the independent steel interests can now make shipment on new orders in about 30 days. In nails, still earlier shipment is possible, also of course, in tin plate, which is out of season. In pipe, on the other hand, all the mills are far behind.

Price Movements Change.—Before the war the market price of a steel commodity was always clearly defined. There was only one price, except that at times premiums had to be paid to secure particularly early delivery. Such premium prices, however, were regarded as irregular, the late delivery price being everywhere regarded as the real market. Since the war the case has been different. When there were two prices there has been a question which was the regular price and which the exceptional. In 1920, for instance, the Steel Corporation held its prices down to the Industrial Board level, allocated its tonnage, and could not make anything like early delivery on new orders. Independents secured much higher prices, sometimes double, and many observers considered the independent prices as the real market.

From say the middle of March to the end of August, there was a rising market, independents advancing first and the Steel Corporation afterwards. A month ago the common view seemed to be that the independent prices represented the real market, that whatever price the independents established the corporation would eventually get up to, so that the corporations quoting a lower price represented a temporary and exceptional condition.

(Continued on Page 16)

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Toronto price:—

Silicon, 2.25% to 2.75%	39 30
Algoma, No. 1, Montreal,	40 80
Summerlee, Scotch, Montreal dock	35 00
Summerlee, Warehouse, 5-ton	40 50
Carron, Montreal docks	35 00
Grey forge Pittsburgh	37 77
Lake Superior, charcoal. Chicago	36 15
Standard low phos., Philadelphia	38 00
Bessemer, Pittsburgh	35 77
Basic, Valley furnace	34 00

METALS

	Montreal	Toronto
Lake Copper	$17 75	$17 25
Electrolytic Copper	17 50	17 00
Castings, Copper	17 25	17 00
Tin	35 50	36 00
Spelter	8 75	8 50
Lead	7 50	7 00
Antimony	6 75	8 50
Aluminum	22 00	23 00

Prices per 100 lbs.

BILLETS

F. O. B. Pittsburgh

	Per gross ton
Bessemer billets, 4 in. x 4 in. and larger	40 00
Open hearth billets	40 00
O. H. sheet bars	40 00
Forging billets	45 00
Bessemer rods	47 50

IRON AND STEEL

Per 100 lbs. to large buyers

Iron bars, base, Toronto	$3 25	3 40
Steel bars, base, Toronto	3 25	3 40
Small shapes, base		3 50
Iron bars, base, Montreal	3 15	3 25
Steel bars, base, Montreal	3 15	3 25
Reinforcing bars, base	3 35	3 40
Steel hoops		4 50
Tire steel, base		3 50
Spring steel	7 00	14 00
Band steel, No. 10 gauge and 3-16 in. base		3 90
Chequered floor plate ¼" and heavier		7 00
Bessemer rails, heavy, at mill		2 35
Steel bars, Pittsburgh mill prices		2 25
Tank plates, Pittsburgh mill prices		2 25
Structural shapes, Pittsburgh mill prices		2 25
Steel hoops, Pittsburgh	2 75 to	3 00

F. O. B. Chicago Warehouse

Steel bars	2 80
Structural shapes	2 90
Plates	2 90
Small shapes under 3-in.	2 90

PLATES

Plates 3-16 in.	$3.85	$3 60
Plates, ¼ up	3 50	3 40

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$3 70	$5 50
Sheets, blue ann., No. 10	4 70	4 50
Canada plates, dull, 52 sheets	5 50	5 75
Can. plates, all bright	7 00	6 75
Galvanized sheets, No. 28	6 75	6 75
Queen's Head, 28 B.W.G.	7 25	
Fleur de Lis, 28 B.W.G.	7 00	
Gorbal's best, No. 28		
Colborne's Grown, No. 28		
Premier	6 85	6 35
Premier 10¾ oz.	6 85	6 75
Zinc sheets	9 25	11 00

FREIGHT RATES

	Per 100 lbs. C.L.	L.C.L.
Pittsburgh to Following Points		
Montreal	52	65½
St. John, N. B.	76	96
Halifax	77½	97
Toronto	34	48½
Guelph	34	48½
London	34	48½
Windsor	31½	45½
Kingston	48½	61

Current surcharge 1 per cent.

OLD MATERIAL

Dealers' Average Buying Prices

	Montreal Per Ton	Toronto Gross
Boiler plate	$ 9 00	$ 9 00
Heavy Melting Steel	10 00	11 00
Axles (wrought iron)	20 00	16 00
Rails (scrap)	11 00	11 00
Malleable scrap	10 00	11 00
No. 1 Machine cast iron	20 00	18 00
Pipe, wrought	7 00	6 00
Car wheel	17 00	16 00
Steel axles	15 00	15 00
Mach. shop turnings	4 00	6 00
Stove plate	16 00	14 00
Cast boring	4 00	6 00
Copper, light	9 00	8 50
Copper, crucible	11 50	11 00
Copper, heavy	11 25	11 00
Copper, wire	11 25	11 00
No. 1 machine composition	9 00	9 00
New brass cuttings	6 00	6 00
Red brass turnings	6 50	6 50
Yellow brass turnings	5 25	4 85
Light brass	4 50	3 50
Medium brass	6 00	4 50
Scrap zinc	3 50	4 00
Heavy lead	4 50	4 50
Tea lead	3 00	3 00
Aluminum	11 00	11 00

COLD ROLLED STEEL

(At Warehouse)

Rounds and squares	$4 75 base
Hexagon and flats	$5 75 base

COPPER PRODUCTS

Prices per lb.

	Montreal	Toronto
Copper Bars, ½ to 2 in.	.29	.28
Brass Tube		.28
Plain sheets, 16 oz. in. 30 x 72	.30	.29
Copper sheet, tinned, 16 oz.	.37	.36
Copper sheet, planished, 16 oz. base	.42	.41
Braziers', in sheets, 6 x 4 base	.30	.29
Copper tubing, seamless		.32

LEAD SHEETS

Roll Lot Prices

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$ 9 00	$ 11 50
Sheets, 3 1-2 lbs. sq. ft.	9 00	11 50
Sheets, 4 to 6 lbs. sq. ft.	8 50	10 00

Cut sheets, ¾c. per lb. extra

Cut sheets to size, 1c. per lb. extra

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	20
Brass sheets, 24 gauge and heavier base	23
Brass tubing, seamless	28

WROUGHT PIPE

Price List No. 56. **August 23, 1922.**

Standard Buttweld Pipe S/C

Size	Steel Blk.	Steel Galv.	Gen. Wrot. Iron Blk.	Gen. Wrot. Iron Galv.
⅛ in.	6 00	8 00	....	....
¼ in.	3 96	6 00	7 20	9 30
⅜ in.	3 96	6 00	7 20	9 30
½ in.	5 02	6 55	7 31	8 93
¾ in.	6 10	7 82	8 86	10 70
1 in.	8 50	14 22	12 58	15 30
1¼ in.	11 50	15 18	17 02	20 70
1½ in.	13 75	8 15	20 35	24 75
2 in.	18 50	24 42	27 38	33 30
2½ in.	29 25	38 61	....	....
3 in.	38 25	50 49	....	....
3½ in.	49 68	64 40	....	....
4 in.	58 86	76 30	....	....

Standard Lapweld Pipe S/C

Per 100 feet.

Below dividing line—price per foot.

Size	Steel Blk.	Steel Galv.	Gen. Wrot. Iron Blk.	Gen. Wrot. Iron Galv.
2 in.	22 20	27 75	31 08	37 00
2½ in.	32 76	41 54	46 80	56 16
3 in.	42 84	54 32	61 20	73 44
3½ in.	50 60	66 24	72 68	89 24
4 in.	59 95	78 48	86 11	105 73
4½ in.	68 58	87 63	1 04	1 24
5 in.	79 92	102 10	1 21	1 45
6 in.	1 04	1 32	1 57	1 88
7 in.	1 38	1 79	2 02	2 45
8L in.	1 45	1 88	2 13	2 58
8 in.	1 67	2 16	2 45	2 97
9 in.	2 04	2 62	2 97	3 59
10L in.	1 89	2 43	2 75	3 33
10 in.	2 43	3 13	3 54	4 28

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4-in. and under 55 per cent.

4½-in. and larger, 45 per cent.

4-in. and under running thread, 35%.

Standard couplings 4-in. and under 25%.

Do., 4½-in. and larger 5 per cent.

MALLEABLE FITTING LIST

1 in. elbow	.32	.53
2 in. elbow	1.05	1.70
1 in. tee	.43	.70
2 in. tee	1.45	2.40
1 in. coupling	.33	.53
1 in. locknut	.15	.23

Discounts to dealers—Class A, 70 per cent, Class B. and C., 60 per cent.

BOILER TUBES

Size	Lapweld Toronto	Seamless Montreal	Lapweld Montreal
1 in.	19 00		
1¼ in.	21 00		
1½ in.	20 00		
1¾ in.	23 00		
2 in.	18 00	20 00	19 00
2¼ in.	20 00	23 00	21 00
2½ in.	21 50	26 00	22 50
3 in.	27 50	32 00	28 50
3½ in.	30 50	37 00	33 00
4 in.	39 00	47 00	42 00

Prices per 100 ft., Montreal and Toronto

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, 7-16 and up	30
Carriage bolts, ⅜ in. and smaller 6 in. and shorter	40
Coach and lag screws	45
Stove bolts	72½
Wrought Washers	60
Do., corru. head	60
Machine bolts, 7-16 and over	35
Machine bolts, ⅜-in. and less	35
Blank bolts	35
Bolt ends	35
Machine screws, fl. and rd. hd., steel cut thread	37½ & 10
Machine screws, o. and fil. hd., steel cut thread	30
Machine screws, o, and fil. hd., brass cut thread	15
Standard couplings, 4-in. and under, brass cut thread	30% 30
Nuts, square, blank off net list	$1.00
Nuts, square, tapped off net list	50c.
Nuts, hex., blank off net list	50c.
Nuts, hex., tapped net list	
Copper rivets and burrs, list less	32c.
Burrs only, list plus	10%
Iron rivets and burrs	47%
Boiler rivets, base ¾ in and larger	$5.75
Structural rivets, as above	5 65
Wood screws, O. & R., bright	80
Wood screws, flat, bright	82½
Wood screws, flat brass	77½
Wood screws, O. & R., brass	75
Wood screws, flat, bronze	72½
Wood screws, O. & R., bronze	70

NAILS AND SPIKES

Wire nails, base	$3 65
Cut nails, base	4 35
Miscellaneous wire nails	72½%

MILLED PRODUCTS

(Prices on unbroken packages)

Set screws	65
Square and hexagon head cap screws	60
Round head cap screws	20
Fillister head cap screws	35
Flat head screws	25
Button head cap screws	20
Studs	45
Semi-finished nuts up to and including 9/16 in.	70
Semi-finished nuts ⅝ to 1¼ in.	65
Semi-finished nuts 1⅜ to 2 in	35
Coupling bolts	35
Taper pins, No. 2 to No 5	65
Taper pin No. 6 and over	10
Planer bolts without fillet	10
Planer bolts with fillet	Net
Patch bolts	Plus 10%
Hollow set screws	20
Thumb screws	50
Thumb nuts	70

CARBON DRILLS AND REAMERS

	Discount.
S. S. drills, wire size	60
Can. carbon cutters	plus 10
Standard drills, all sizes	60
3-fluted drills, plus	10
Jobbers and letter sizes	60
Bit stock	50
Ratchet drills	25
S. S. drills for wood	10
Wood boring brace drills	50
Electricians' bits	30
Sockets	50
Sleeves	30
Taper pin reamers	25
Drills and countersinks	20
Bridge reamers, carbon	50
Centre reamers	Net
Taps, machine screw	50 to 60
Taps, hand, sizes up to 1"	30 to 60
Chucking reamers	20 off
Hand reamers	20
High speed drills, list	40
Can. high speed cutters	plus 10
American	plus 40

FILES AND RASPS

Globe	60/5
Vulcan	50
P. H. and Imperial	60/5
Nicholson	40
Black Diamond	40
Heller	40
Jowitts	net
J. Barton Smith, Eagle	55
McClelland, Globe	50
Delta Files	20
Disston	40
Disston	50
Great Western-American	50
Kearney & Foote, Arcade	60 5

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

PROOF COIL CHAIN

B. B. B. CHAIN

⅝ in., $16.45; 7-16 in., $14.00; ½ in., $12.95; 5-8 in., $13.15; ¾ in., $12.75; ⅞ in., $12.25; 1 in., $11.85; 1⅛ and 1¼ in., $10.55. Fire weld chain same sizes respectively are $14.00; $11.50; $10.40; $10.55; $10.15; $9.75; $9.35; and $8.25.

ELECTRIC WELD COIL CHAIN B.B.B.

⅛ in. $20.00; 3-16 in. $16.50; ¼ in. $15.50; 5-16 in. $12.70.

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	30%
Standard	30 and 10%
Cut leather lacing, No. 1	1.75
Leather in side, (Lacing)	1.50

RUBBER BELTING

Standard 36 ....28% Best grades 28%

TAPES

Chesterman Metallic, 50 ft.	$5 00
Lufkin Metallic, 603, 50 ft.	3 17
Admiral Steel Tape, 50 ft.	3 00
Admiral Steel Tape, 100 ft.	4 50
Major Jun. Steel Tape, 50 ft.	3 75
Rival Steel Tape, 50 ft.	4 00
Rival Steel Tape, 100 ft.	8 75
Reliable Jun. Steel Tape, 50 ft.	5 25

PLUMBING SUPPLIES

Plumbers' oakum, per cwt.	6 00
Solder, strictly	$0 22½
Solder, guaranteed	0 24
Soldering coppers, lb.	0 62½
White lead, pure, cwt	13 20
Red dry lead, 100-lb. kegs, per cwt.	10 75
Wood alcohol, per gal.	1 75
Whiting, plain, per 100 lbs.	3 00

ROPE AND PACKING

Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope ¾ and larger, base	0 21
British Manila rope	0 19
New Zealand hemp	0 19
Jute packing, fine	15c
Jute packing, coarse	11c

OILS AND COMPOUNDS

Castor Machine Oil, per lb.	34½
Royalite, per gal. bulk	20
Palacine	23
Machine oil, per gal.	39
Black oil, per gal. (Summer)	19
Cylinder oil, Capital	69½
Petroleum fuel oil bbls., net	10.80
Turp., single bbls., gal.	1.65
Linseed oil, raw, single bbls.	1.01
Premier galsoline	34

WASTE

XXX Extra	16	Atlas	18
Peerless	21	X Empire	13
XX Grand	15	Ideal	18
Superior	20	X Press	11½
X L C R	14		

Colored

Lion	12	Fancy	13½
Standard	10½	Popular	9
No. 1	13	Keen	7½

Wool Packing

Arrow	24	Anvil	16
Axle	20		

Washed Wipers

Select White	18	Dark colored.	13
Mixed Colored	14		

This list subject to trade discount

PLATING SUPPLIES

Polishing wheels, felt	$3 25
Polishing wheels, bull-neck	1 60
Emerey in kegs, Turkish	7½
Pumice, ground	04½
Emery glue	26
Tripoli composition	08
Crocus composition	12
Emery composition	11
Rouge, silver	60
Rouge, powder, nickel	35

Prices per lb.

ANODES

Nickel	.40 to .45
Copper	.38 to 22
Zinc	.16 to .12½

PLATING CHEMICALS

Acid boracic	.20
Acid, hydrochloric	.03¾
Acid, nitric	.10¼
Acid, sulphuric	.03¾
Ammonia, aqua	.20
Ammonium, Carbonate	.15
Ammonium, chloride	.18
Ammonium, hydrosulphuret	.75
Ammonium, sulphate	.10
Arsenic, white	.18
Copper carbonate, anhy.	.26
Copper, sulphate	.08
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.14
Nickel carbonate	.32
Nickel sulphate	.14
Potassium sulphide (substitute)	.40
Silver chloride (per oz.)	.85
Silver nitrate (per oz.)	.65
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.32
Sodium hyposulphite	.08
Sodium phosphate	.10
Tin chloride	.50
Zinc chloride, C. P.	.30
Zinc sulphate	.06

Prices per lb. unless otherwise stated

News From the Industrial Field

Beacon Electric Mfg. Co., Limited, Hamilton, has been incorporated with $50,000 capital to manufacture electric goods.

Electric Sales and Engineering Co., Limited, Fort William, has been incorporated to deal in and manufacture hydraulic and electrical equipment.

Keith Electric Refrigerator Co., Toronto, have been incorporated to manufacture refrigerators and refrigerating plants and appliances.

Fedders Mfg. Co., Limited, Bridgeburg, has been incorporated to manufacture automobile radiators, engines, boilers, tools, etc., with working capital of $50,500.

Pittsburgh reports indicate that coal prices are showing weakness. Run of mine coking coal is obtainable at $4.75 and steam coal at $4, a drop of fully $3 from the cost of one month ago.

The ten principal products of the mineral industry in Canada during first half of the present year in order of the values assigned were: Coal, $24,346,959; gold, $12,110,242; silver $5,997,199; lead, $2,882,047; natural gas, $2,448,829; copper, $2,337,093; asbestos, $1,894,232; nickel, $1,401,820; zinc, $1,370,460; and salt, $849,133.

Effective Oct. 1, the U. S. Steel Corporation has increased to $43 a gross ton the price of steel rails. This also covers deliveries for the first half of next year. The present price of $40 a ton announced in Oct. last, represented a reduction of $7 per ton from the level obtaining from March 1919, until that time. The increase is largely due to rise in rate of wages for day labor.

Industrial operations are again normal in the Ford plants and those associated concerns that were closed down on Sept. 17 as a protest against the high price and non-delivery of coal. At midnight on the morning of Sept 22, most of the plants affected were again working. Edsel Ford has made arrangements for a supply of fuel for continuous operation of all his factories.

When the United States Steel Corporation was granted a contract for steel rails for Glasgow, because their tender was £2,900 below that of British firms, labor took exception claiming that conditions of labor in the American industry were not satisfactory. It was pointed out in reply that the hours ranged from eight to ten hours and that as an indication of wages earned it was becoming quite a problem to provide space in which to park motor cars owned by the employees at the works.

From Washington comes a prediction by Secretary of Treasury Mellon, that a sharp expansion in industry and business may be confidently expected with end of coal and rail strikes.

The annual meeting of the American Electro-Chemical Society was held in Montreal during the past week. Many interesting papers in connection with electric heating were read and discussed.

Montreal.—Officials of the Eugene Phillips Electrical Works announced that construction would be commenced at an early date on the second manufacturing unit of the company's plant at Brockville. This unit will be the power cable mill.

A chain drive installation, said to be the largest in any grain elevator in the world, was recently placed in the Northern Central Elevator at Baltimore. This drive was one of 7,000 h.p. and made by the Morse Chain Co. Similar drives of approximately the same h.p. are located in other elevators in Canada and the United States.

A rail sawing plant which will employ from 20 to 30 men has been installed in the G. T. R. yards, Belleville. The object of the plant is to saw off battered end of rails, redrilling them, and replacing them upon the tracks. The only other plants of a similar nature on the line of the G. T. R. are located at Montreal and London.

Advices from London state that 300,000 tons of pig iron were shipped from the Old Country to United States since April 1, the beginning of the coal strike. Great Britain in August had an output of 411,700 in pig iron, an increase of more than 12,000 tons over preceding month. The number of stacks in operation increased from 117 in July to 126 in August.

Canadian mining men who have been urging the payment of a government bounty to encourage the development of the country's iron ore resources, will be interested in knowing that the union parliament of South Africa recently provided for the payment to any iron or steel company within the Union of South Africa, which provides plant and machinery capable of producing an output of 50,000 tons of pig-iron or 50,000 tons of steel per annum, of a graduated bounty, which will come to an end after eight years. For the first three years (1924-25 to 1926-27) the bounty shall be 15s. per ton for pig-iron and 15s per ton for steel. It then drops in succeeding years to 12s 6d., 10s., 7s. 6d., 5s., and (1931-32) 2s. 6d. per ton, thereafter terminating.

J. F. Letz, formerly with Michigan Optical Co., Detroit, has been appointed manager of the Interchangeable Counterbore Co., Walkerville.

Creelman's Limited, Georgetown, were recently incorporated with $200,000 capital, to manufacture knitting machinery of all kinds. Among the provisional directors are mentioned R. J. Creelman, and C. E. Creelman.

Port Arthur, Ont.—The Thunder Bay Company purpose to increase the output of its groundwood plant here to 100 tons a day. A paper mill unit capable of turning out 60 tons a day will also be constructed, it is said, if a suitable timber limit can be secured in the Nipigon forest reserve.

Hartville, N. S.—The Premier Paper and Power Company is preparing to install a standard newsprint machine in its plant at Hartville. The machine will have a capacity of 15,000 tons a year. In order to provide the necessary power the company is making an additional development of 5,000 horse-power on the river.

Regina, Sask.—Construction of two giant oil tanks is planned by Imperial Oil Co. on the 40 acre tract of land adjoining the Regina plant, which was recently purchased by that company. These containers will be the largest of their kind in Canada, if not on the continent. Each will have a capacity of over 90,000 barrels of oil.

Vancouver, B. C.—Returns made to the Provincial Government by 2,275 individual industrial firms in British Columbia, indicate that a total of $79,742,820 was paid in salaries and wages to employees last year, of which $65,314,624 was paid to wage-earners. The total paid out shows a reduction as compared with 1920, when more than $82,000,000 was expended.

According to iron and steel statistics from Washington, Canada was the foremost buyer of American material, in July taking 48,010 tons out of a total of 159,338 tons exported. Canada's purchases included 8630 tons of ingots, blooms, billets, sheet bars and skelp, 6427 tons of iron and steel bars and rods other than wire, 3808 tons of iron and steel plates, 5780 tons of structural material, 3526 tons of black steel sheets, 3101 tons of galvanized sheets, 2369 tons of steel rails, and 1899 tons of hoops, bands and strips. Japan, which was the second largest buyer in July, took 16,886 tons of steel rails, 8153 tons of black steel sheets, 2746 tons scrap iron and steel, 1339 tons tin plate, 1330 tons rail fastenings, 1284 tons of bars and rods, and 1210 tons of structural steel.

Unemployment at Sault Ste. Marie this Fall may call for more than normal action, and the city council may purchase a bush and set the unemployed to work cutting wood for the city.

Canadian railway Shopmen have expressed a desire to re-open direct negotiations with the companies on the question of wage rates. The conference may be opened next week.

Showrooms for Canadian products may be opened shortly in Shanghai, China, by the Department of Trade and Commerce. Manufacturers entering the exhibit may be asked to supply their own salesmen. If the plan is successful, it may be adopted in other countries.

By the use of electric steam generators in the Laurentide Paper Mills and the Belgo-Canadian Pulp and Paper Co.'s plant in the St. Maurice Valley, four hundred tons of coal are saved daily. Unlike other systems of generating steam, the off-peak hours can be utilized for this purpose.

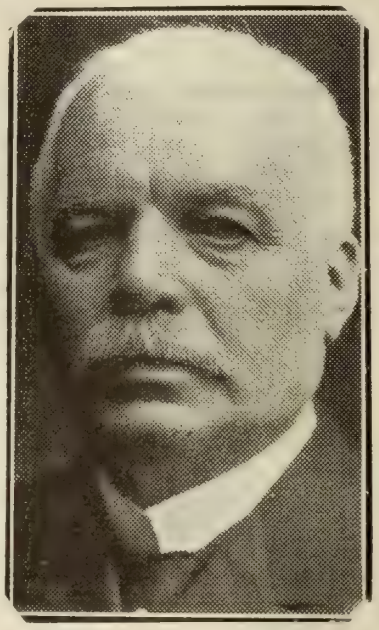
Regina, Sask.—Exceeding all previous figures forecast by various authoritative bodies this year the Manitoba Free Press in it nineteenth crop report estimates the wheat yield of the Prairie Provinces this year at 371,910,000 bushels from a total acreage of 21.471,000, giving the West the greatest wheat yield in its history. Other estimated yields are: oats 413,539,000 bushels; barley 61,080,000 bushels; rye 54,311,000 bushels; and flax 3,088,000 bushels.

Welland, Ont.—Another American firm has established a branch factory in Canada. The Dodds Canadian Iron Works have been incorporated with a capital of $200,000, for the purpose of manufacturing flour machinery. The Dodds Brothers have been engaged in the manufacture of flour mills in Decatur, Illinois, for the past couple of decades and the demand for their product has become so great in Canada that it was necessary to install a plant here in order to supply the market.

That the Birmingham, Eng., area should be considered as a market by Canadian manufacturers of rivets, nuts and bolts, is the suggestion made in a trade report, which adds: "Up to now Canada has not been able to compete with bright bolts and nuts, and still cannot. The sizes mostly in demand are ¼ inch up to 1-inch. The business is done on a 2½ per cent. discount basis. There seems no reason why Canadian manufacturers should not be able to secure a larger amount of business in these lines than in the past. Quality here will aid in the battle against European competition. With a good live agent on the spot a more aggressive attack can be made by the mere filling of spasmodic orders. Canadian spelter for galvanizing is in demand. The price is of course a fluctuating one in accordance with the supply and demand on the market."

OBITUARY

W. F. Johnston of Toronto passed away at his home last week after a long illness. He was born near Port Hope 72 years ago. During his early life he was associated with the Massey Manufacturing Co., of Newcastle, Ont. Some years ago this company was merged with the Massey-Harris Co. of Toronto.



THE LATE W. F. JOHNSTON.

He is said to be the last survivor of the former company of those associated with it at the time of the initial organization. For many years he was general superintendent of the Massey-Harris plant in Toronto. Mr. Johnston resigned from this position about 20 years ago to become managing director of the Noxon Co. of Ingersoll, Ont. Twelve years ago he retired from active business, since living in Toronto.

In the merger of Bethlehem and Lackawanna Steel Corporations it is evident that Buffalo is to be made an important center of selling operations, comprising as it does the important western New York territory, with which is included the important industrial section of Canada. In a recent statement Eugene G. Grace, president of the Bethlehem, said:— "We consider Buffalo an important commercial center, and we expect to develop an important selling office in that city to serve that district. It will be our policy to use as many of the present officers and managers of the Lackawanna Steel Company as possible in the combined organization."

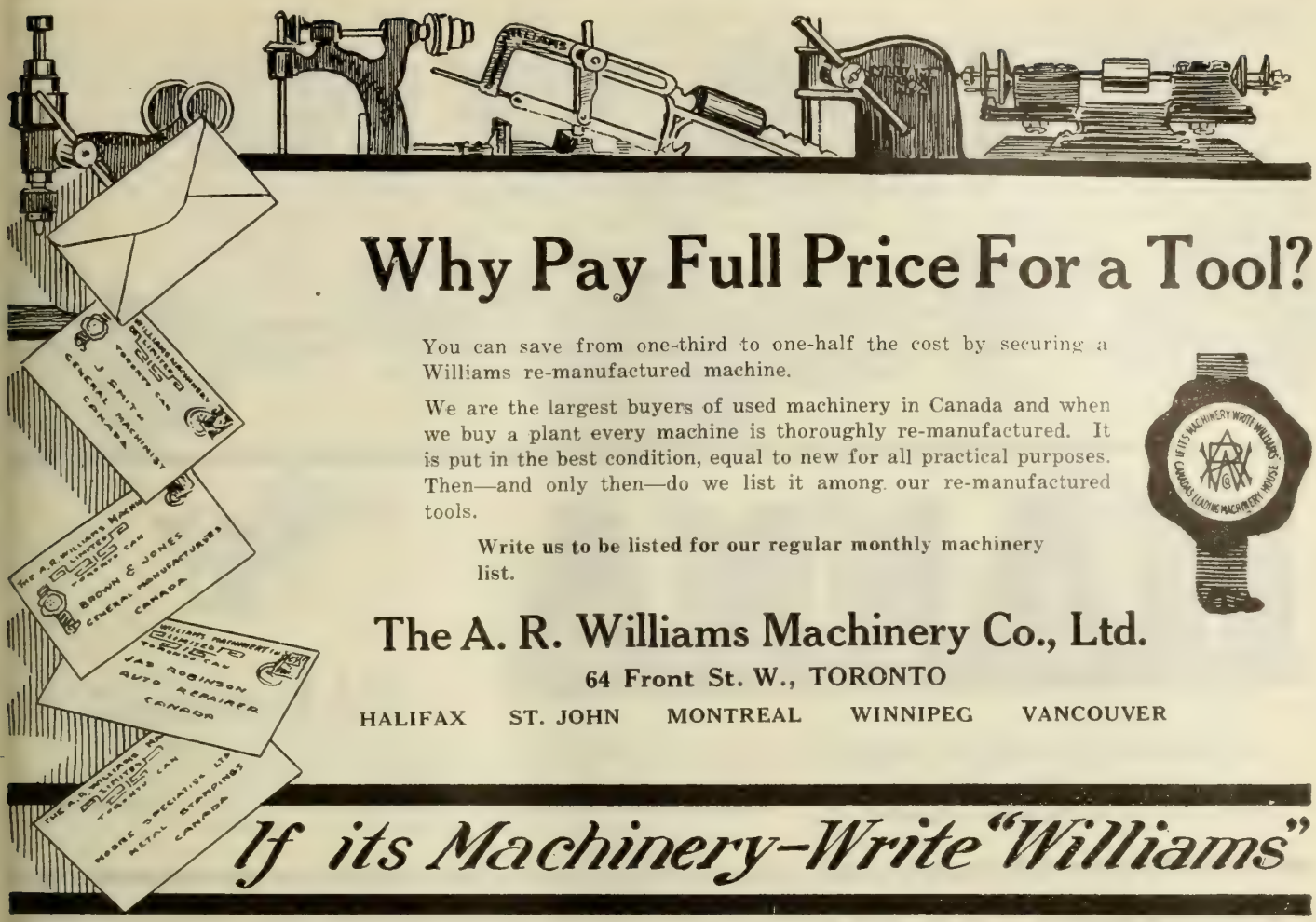
In the development of their plant at Ojibway, near Windsor, the Canadian Steel Corporation has completed a vessel slip 2,400 feet from the bank of the Detroit river. It is 202 feet wide, and dredged to a depth of 23 feet, will accommodate at the same time six of the largest lake carriers. Vessels may enter and leave the ship without tug or turning basin, as the constant current of the river makes this unnecessary. The different sections of the plant succeed each other from north to south according to the plan described some time ago. First, comes the battery of by-product coke ovens, then the coal dock, then the vessel slip and ore deck. Though docks and slip have been completed, the handling equipment is not yet installed. Two 600 ton units of the battery of blast furnaces, probably comprising fourteen units ultimately, south of the ore dock, are about completed. The open hearth furnaces are to follow, then the finishing units and auxiliary buildings. So far as plans are known production is likely to include rails, structural shapes, plates, bars, wire products, sheets, tin plate and tubes. Among the building completed are those of the general machine shop and the initial unit of the wire plant which is to be one of great proportions.

WELSH ANTHRACITE SCARCE

To indicate to what extent Americans and Canadians have been buying Welsh anthracite, states a Trade and Commerce report, a Glasgow importer told the writer, he had an inquiry from Toronto for 5,000 tons of anthracite. When he wired for quotations for early September delivery, the Cardiff firm whom he represents were unable to quote on anthracite at all, and forwarded quotations for a semi-anthracite which was the best obtainable at the moment. Canadian manufacturers will be interested in current coal prices in view of the Canadian situation. The best selected Welsh anthracite is quoted from 57s. to 62s. f.o.b. Swansea dependent upon quality, size and quantity. The ocean freight rate will total approximately 14s to Montreal which would make an average price of 74s. Montreal, which at the present rate of exchange of $4.50 would approximate $16.65 Canadian funds. As regards steam coal, prices range all the way from 20s. to 35s. dependent upon the various qualities and sizes; finest Yorkshire, which is the highest priced steam is approximately 35s., whilst ordinary steam Newcastle is nearer the lower-mentioned price.

BOOKLETS

Bearings and Bearing Metals is the title of an engineering bulletin just issued by the A. W. Cadman Manufacturing Co., Pittsburg, Pa. It contains a brief history of the development of bearing metals, covering the different types of metals and alloys used, the requirements of a bearing material, the friction in bearings and the proper lubrication of the same. This firm has likewise just issued a bulletin on Cadmar metals which comprises a digest of sixty years' pioneer work in the development of fine bearing metals. Both of these booklets are short treatises of semi-technical information on bearing metals and their uses.


Why Pay Full Price For a Tool?
You can save from one-third to one-half the cost by securing a Williams re-manufactured machine.
We are the largest buyers of used machinery in Canada and when we buy a plant every machine is thoroughly re-manufactured. It is put in the best condition, equal to new for all practical purposes. Then—and only then—do we list it among our re-manufactured tools.
Write us to be listed for our regular monthly machinery list.
The A. R. Williams Machinery Co., Ltd.
64 Front St. W., TORONTO
HALIFAX ST. JOHN MONTREAL WINNIPEG VANCOUVER
If its Machinery-Write "Williams"

NOBODY PAYS THIS BILL

SOME very interesting remarks on advertising were recently made by Sir Harold V. Mackintosh, who is described as head of the Halifax (Eng.) firm of toffee (candy) makers, and whose friends gave him a dinner in recognition of his having been made a knight. After speaking of the spirit of romance and adventure which advertising introduces into the too often dull routine of business, Sir Harold went on to say:

"Advertising is as necessary to the modern business as raw material. And the strange thing is that nobody pays the advertising bill. The bill of my own firm during the last 30 years has been something like half a million pounds for newspaper advertising alone, and our total selling costs to-day are less than they were 25 years ago. They are probably less than those of any of our competitors who may not spend a penny in advertising.

"That is a remarkable thing, but nevertheless, it is true. Nobody does pay the advertising bill if it is rightly done, but by increasing production and lessening overhead expenses and general selling costs advertising really gets thrown in. I recommend any business man who wants a hobby to do some advertising.

"I find advertising the most interesting part of my business, and I turn to it when I am 'fed up' with other things. If more business advertising were done, there would be less talk of business dullness and of getting out of it at the earliest possible moment. Advertising makes business a great game instead of a routine, and no business can succeed unless it is taken in the spirit of a game."

Sir Harold concluded by saying that every day he has surprising evidence that the public read advertisements. He mentioned a series of drawings done for his firm by a well-known comic artist. The artist's pencil had missed a stroke or two, and the consequence was that no fewer than 40 persons wrote pointing out that a lady in the picture appeared to have no arm.

CANADIAN BILLETS IN ENGLAND

There is no reason why at times, but it will only be at times, Canadian steel billets cannot come into this market, states a trade report from Birmingham. There is a steady demand, but from time to time the Germans and Belgians unload steel billets on the Birmingham market, knowing that the demand there is continuous. But as a rule, as they can obtain higher prices elsewhere, the Germans and Belgians avoid selling in the Birmingham area. However, at certain periods they are compelled to sell in this area, and then sell at a low price which knocks the bottom out of the market. This has happened quite recently and is the position to-day. At other periods, however, the price goes up after the stocks are unloaded, and then it is that Canadian steel billets might find a market. This office has arranged with an iron and steel agent in Bimingham, to notify it as soon as such an opportunity occurs. But sales of course will be governed by cables, and there will have to be immediate deliveries, for the market is a very sensitive one. At the same time, since the Germans came on the market, steel billets are selling at £6 6s. works. This it should be remembered is still £2 2s. above the German pre-war price.

An attempt has been made to sell Candian billets in the district, but the price quoted was $45—a figure quite hopeless in the present state of the market. Belgian billets figure prominently in the trade and can still be bought at under £7 per ton. The British makers show a determination to retain the semi-finished business, and have hastened to cut prices, orders being accepted at around £7 5s. for good lots—a figure at which English steel is generally preferred Higher prices are restricted chiefly to specialities, particularly to billets of the welding class for which excellent qualities are produced in this district.

CANADA A FIELD FOR ENGLISH FIRM

It is encouraging to receive further evidence that British manufacturers are seeking to extend their share of trade with Canada, from the news just to hand that the famous engineering and shipbuilding firm of John I. Thornycroft & Co., are sending a special representative from their London headquarters to tour through Canada and investigate the opportunities for their production. Thornycrofts are manufacturers of a wide range of marine and stationary oil engines, motor boats for pleasure and commercial service, motor vehicles for goods or passengers, and all types of river and ocean vessels.

Mention of the latter calls to mind the twin screw customs cruiser "Margaret" which was built for the Canadian customs by Messrs. Thornycroft's Southampton Works in 1914 for patrol service on the Atlantic coast. The firm were the pioneers of commercial motor vehicles and had the first successful vehicle running in England in 1896 which has proved the forerunner of the many thousands of Thornycroft lorries, motor omnibuses, etc., which are now running in all parts of the world, where also are to be found other productions of this British firm.

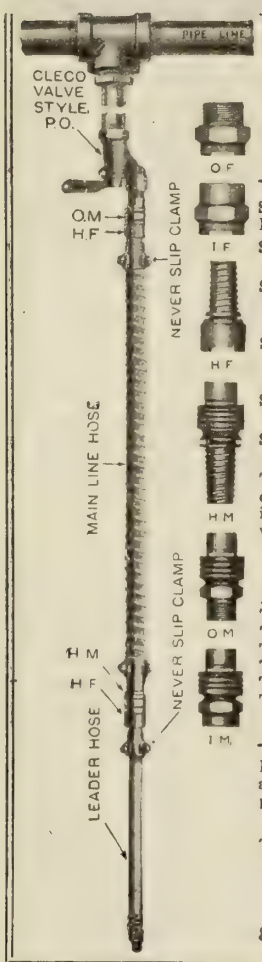
Their representative, Mr. A. Cameron, sails for Canada via New York on the White Star liner "Baltic," leaving Southampton on September 16th and on his arrival will proceed to Toronto where communications or enquiries will find him care The Bank of Montreal. He will be visiting all the principal cities of the Dominion through to Vancouver where he expects to be joined by another of the firm's representatives who is returning home after a similar mission in the Far East.

HANNA

—the name of a service for supplying pig iron to the merchant iron trade from eight separate localities strategically placed for advantageous shipping.

M.A. HANNA & CO.

Buffalo Detroit Cincinnati
Pittsburgh New York Philadelphia
Toronto



Cleco Pressure-Seated Air Valves

Bowes Air Hose Couplings—Cleco Never Slip Hose Clamps — Cleco Grooved Hose Nipples and Hose Clamp Tool

STYLE O.F. is an Outside Thread Female Pipe End. Made in sizes ¾-inch to 1½-inch.

STYLE I.F. is an Inside Thread Female Pipe End. Made in sizes ¼-inch to 1½-inch.

STYLE H.F. is a Female Hose End with spiral shank to insert into the hose and has groove for the Never Slip Hose Clamp. Made in sizes ¼-inch to 1½-inch.

STYLE H.M. is a Male Hose End with spiral shank to insert into the hose and has groove for the Never Slip Hose Clamp. Made in sizes ¼ inch to 1½-inch.

STYLE O.M. is an Inside Thread Male Pipe End. Made in sizes ⅜-inch to 1½-inch.

STYLE I.M. is an Inside Thread Male Pipe End. Made in sizes ¼-inch to 1½-inch.

The Male and Female Ends of Bowes Couplings interchange in sizes ¼-inch to ¾-inch. Sizes 1-inch and 1¼-inch interchange. The 1½-inch ends interchange only with themselves.

BOWES COUPLINGS

Are instantly connected or disconnected.
They are absolutely air-tight under all pressures.
They quickly pay for themselves by stopping costly leaks.
They interchange in sizes most commonly used.
They have no loose parts to be mislaid or lost.
They are made of brass and will not rust.
The U-shaped Gasket interchanges in couplings ¼-inch to ¾-inch.

CLECO AIR VALVES.

Style R.A.

Style P.O.

Style A.

Style P.O.—Made in sizes ¼ in., ⅜ in., ½ in., ¾ in., 1 in., 1¼ in., 1½ in., 1¾ in., and 2 in. Pipe Outlets. Inlets are one pipe size larger.
Style A—30° Angle Valves, are made in sizes ½ in., and ¾ in.
Style R.A.—Right Angle Valve, made in sizes ¼ in., ⅜ in., ½ in., and ¾ in.

CLECO GROOVED HOSE NIPPLES

Grooved Nipples when attached to the Hose with Wire Clamps as illustrated cannot "blow out." Wire clamp tool shown below applies the wires to hose.

The Lighting Hose Clamp Tool illustrated applies wire clamps at a cost of 1½ cents each.

In stock: Riveting and Chipping Hammers, Air Drills, Emery Grinders, Sand Rammers, etc.

Use Annealed Wire No. 14

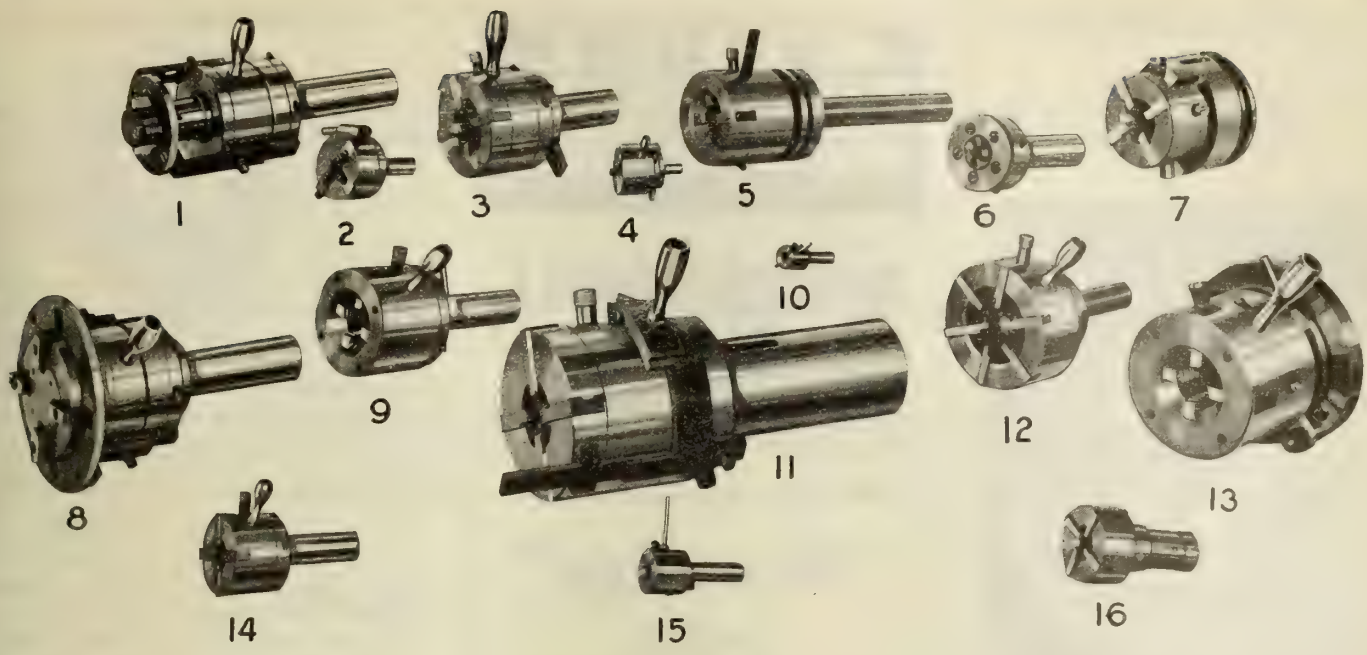
IMPORTANT:—The Small Leaks in your "AIR LINE" mean serious loss in DOLLARS. Have you any idea of the amount of "Air" wasted in small leaks at your connections? Air Leakage through 1-16 in. opening equals 5.32 cu. ft. per minute at 80 lbs. It will pay you to install Bowes Couplings and Cleco Valves, which will stop costly leaks.

Bulletin No. 50, mailed on request.

THE MODEL HOSE LINE illustrated shows correct styles of couplings and valve to use and proper way to attach the Cleco Never Slip Hose Clamps to Bowes Couplings. No "blow-offs" can occur when "Cleco" Clamps are used.

CLEVELAND PNEUMATIC TOOL CO. OF CANADA, LIMITED

84 Chestnut St., TORONTO, ONT. **337 Craig St. W., MONTREAL, QUE.**



—AND OTHERS

These are only a few of the Various Arrangements Of Geometric Thread Cutting Tools

Geometric Automatic Opening Die Heads and Collapsing Taps are adapted for use on the Turrets of practically all makes of Hand and Automatic Screw Machines and Turret Lathes. Where requirements are unusual, they are arranged to meet the most exacting conditions of machine and work.

GEO MET RIC

Right on the Lead

Make Screw Cutting the most satisfactory operation in your Shop. A Geometric will do it.

Sent on trial to reliable concerns

THE GEOMETRIC TOOL COMPANY

NEW HAVEN **CONNECTICUT**

Canadian Agents:

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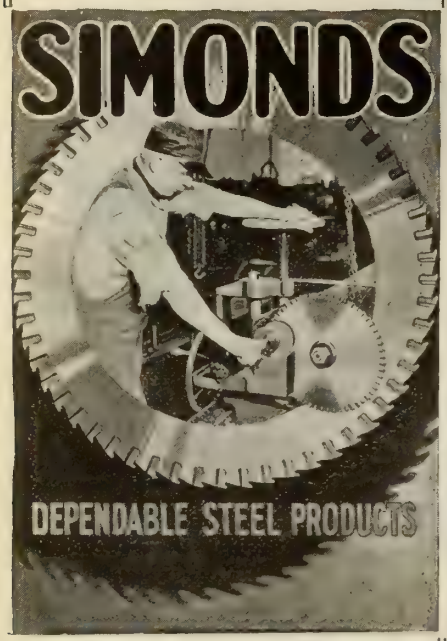

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The Simonds "00" style Inserted Tooth metal saw cuts only 3/16 inch kerf.

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Air Pressure Tanks, Air Receivers, Steel Plate Tanks, Pneumatic Tanks, Tote Boxes, Shop Barrels, Steel Factory Equipment, Smoke Stacks, Gasoline Tanks.
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Stitched Cotton Duck Belting
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for every purpose and the best for each use.

Special styles of all kinds to order.

THE CLEVELAND WIRE SPRING COMPANY
Cleveland, Ohio
U.S.A.

PITTSBURGH MARKETS

(Continued from page 38)

Now, however, the appearance has been reversed. With the easier supply of steel and the unwillingness of buyers to commit themselves far ahead, it appears now that instead of the independent prices being the major part of the market, and the corporation prices the exception, as was considered the case a month ago, the corporation prices represent the real market and the independent prices merely represent delivery premiums added. Furthermore, when the premiums are generally $3 to $5 a ton and secure shipments, in most cases in from two to five weeks, it seems rather likely that the premiums will fade away altogether. Such a view is much strengthened by considering what time of year this is. If there were to be a strong market, this is the precise time when particular strength should be exhibited.

In a few weeks it will be time to begin looking forward to the usual year-end dullness. A year ago the mills could make all the steel anyone wanted, having plenty of fuel and labor. Steel ingot production rose from 11,000,000 tons a year in July, to a rate of about 25,000,000 tons at the end of October, and then slid off to considerably below 20,000,000 tons by the end of the year, simply on account of decrease in seasonal demand. The general underlying conditions, as to commercial activity, were improving right along, as was proved by the much heavier steel demand that came out after the first of the year.

Range of Prices.—In general, the range of market prices is substantially as follows: Bars, $1.90 to $2.25; shapes and plates, $2.00 to $2.25; nails, $2.60 to $2.75; sheets, $3.35 to $3.50. Merchant steel pipe is uniformly at 68 per cent., basing discount for regular mill orders, with shipment much delayed. Tin plate is $4.75, with shipment delayed only by the time it takes to make the material. Hoops and hot rolled strips are $2.75 for heavy and $3.00 for light.

Pig iron continues stagnant. Consumers apparently are unable to pay prices asked, while if they bought any considerable tonnage prices would advance further. The merchant furnaces have much more difficulty in resuming than the steel works furnaces. Possibly the situation will be relieved by some of the steel works selling pig iron. The market is quotable, more or less nominal, at $34 Bessemer, $30 for basic and $35 to $36 for foundry, valley basis.

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"OVENS"
Japanning and Varnishing Ovens heated by Gas, Electricity, Steam or Coal. Kernchen and Apex Siphonage Ventilators, Bakers' Ovens, trucks, casters, etc. Write for Booklet.
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New Machines for Up-to-Date Shops

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THIS Company manufactures a high grade line of machines such as **Engine Lathes, Standard Cone Head Lathes, Motor Driven Lathes, Extra Heavy Plain Turning Lathes, Standard Geared Head Lathes, Radial Drilling Machines with or without Motor Drive, Vertical Surface Grinding Machines.**

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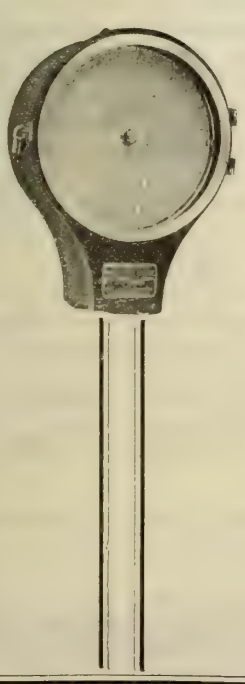

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Let every subscriber look at the address on the label on this issue of Canadian Machinery, and, if it is not correct, please fill in and mail to us the following—

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WANTED — FOREMAN FOR PLATE SHOP equipped with Hydraulic Machines, employing 30 men. Winnipeg. Apply Box No. 814.

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Light and Medium-Bench and Floor Repetition Castings; Capacity 15 tons per day.
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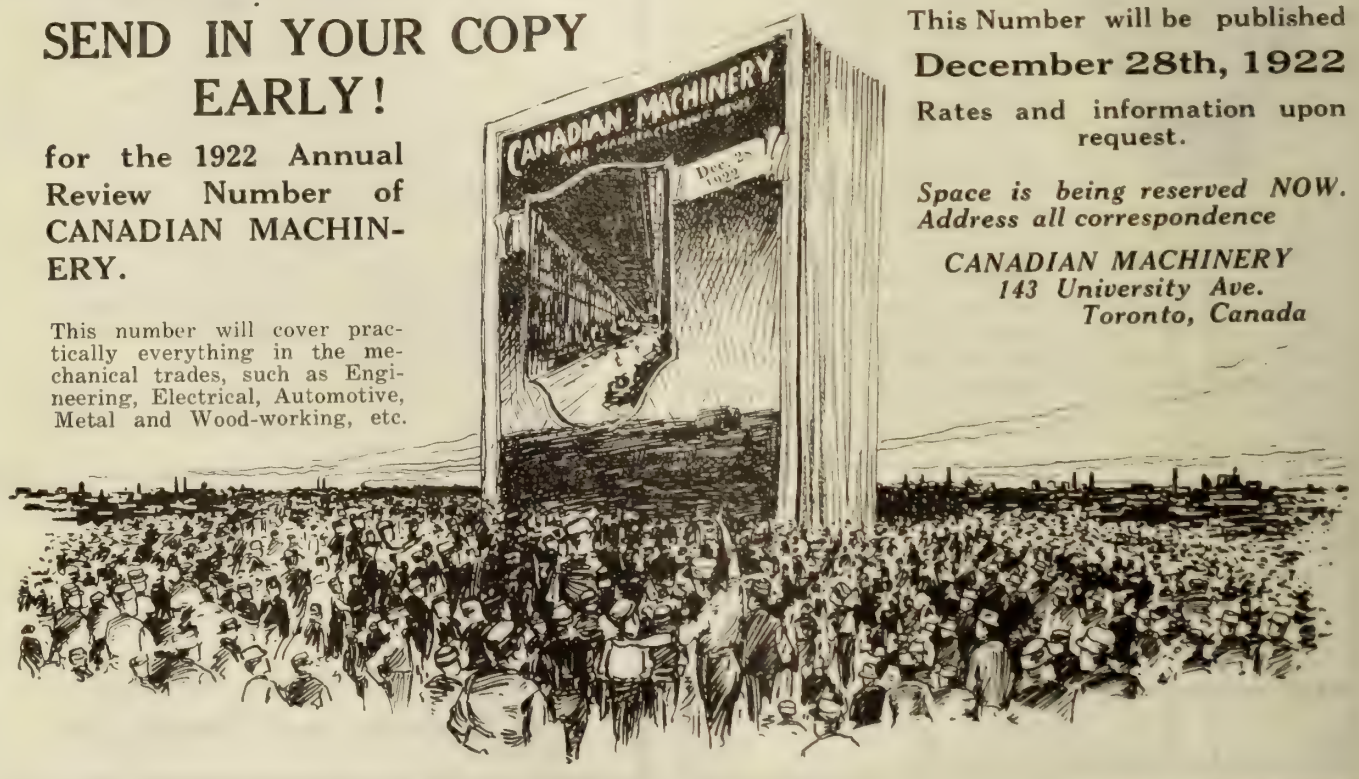

This Number will be published
December 28th, 1922
Rates and information upon request.

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Toronto, Canada

If interested tear out this page and place with letters to be answered

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Fisher Motor Co., Limited.
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Canadian Rumley Co., Limited
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TORONTO, ONT.
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Galt Malleable Iron Co., Ltd.
GALT, ONT.
Malleable.

S. Vessot & Company
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Hugh Park Foundry Co., Ltd.,
OSHAWA, ONT.
Grey Iron, Patterns, Etc.

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John T. Hepburn, Limited
TORONTO, ONT.
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Steel, Malleable and Heavy Grey Iron.
See Advertisement Page 7

Machinery & Foundries, Ltd.
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OSHAWA, ONT.
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GALT, ONT.
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ST. MARYS, ONT.
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MONTREAL, QUE.
Grey Iron and Semi-Steel to 75 tons.

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KITCHENER, ONT.
Aluminum, Brass, Bronze and Special Alloys.

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143-153 University Ave. Toronto, Ontario

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Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John, London, S.E., Eng.

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Dominion Oxygen Co., Toronto.
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AIR HAMMERS,
Independent Pneumatic Tool Co., Chicago, Ill.

AIR HOISTS,
Independent Pneumatic Tool Co., Chicago, Ill.

AIR HOSE
Independent Pneumatic Tool Co., Chicago, Ill.

AIR COUPLINGS
Independent Pneumatic Tool Co., Chicago, Ill.

AIR TOOLS
Independent Pneumatic Tool Co., Chicago, Ill.

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ANGLE BARS
Steel Co. of Can. Ltd., Hamilton, Ont.

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Petrie, Ltd., H. W., Toronto, Ont.

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Globe Engineering Co., Ltd., Hamilton, Ont.

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Brown & Sharrpe Mfg.Co., Providence,R.I
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.

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Canadian SKF Co., Toronto, Ont.

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Armstrong Bros. Tool Co., Chicago, Ill.
Bertram & Son Co., td., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

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Underwood Corp., H. B., Philadelphia.

BARS, STEEL
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Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
British Empire Steel Corporation, Montreal, Que.

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Canadian SKF Co., Toronto, Ont.

BEARINGS, ROLLER
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McLaren Belting Co., J. C., Montreal, Que.

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D. K. McLaren, Limited, Montreal,

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D. K. McLaren, Limited, Montreal,
McLaren Belting Co., J.C., Montreal, Que.
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Petrie, Ltd., H. W., Toronto, Ont.

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D. K. McLaren, Limited, Montreal,
McLaren Belting Co., J. C., Montreal, Que.
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Rockwell & Co., W. S New York, N Y

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Wright Mfg. Co., Lisbon, Ohio.

BLOCKS, DIE
Canada Foundries & Forgings Co., Welland, Ont.

BLOCKS, PILLOW
Can. Link-Belt Co., Toronto, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

BLOWERS
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

BOLT AND NUT MACHINERY
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Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
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Gisholt Machine Co., Madison, Wis.

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Gisholt Machine Co., Madison, Wis.
Landis Tool Co., Waynesboro, Pa.
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McDougall Co., Ltd., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont
Rockford Drilling Machine Co., Rockford,

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Petrie, Ltd., H. W., Toronto, Ont.
Pryibil Machine Co., New York, N Y
U. S. Electrical Tool Co., Cincinnati, O.

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Starrett Co., L. S., Athol, Mass.

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Canada Foundries & Forgings Co., Welland, Ont.

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(See Sheet Metal Working Machinery)
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Bliss Co., E. W., Brooklyn, N. Y.
Smooth Mfg. Co., Jersey City, N. J.

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Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.

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Wright Mfg. Co., Lisbon, Ohio

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See "Where to buy your castings" Section. Page number may be found by turning to Advertisers' Index.

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Can. Link-Belt Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont
Jones & Glassco, Montreal, Que.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

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Landis Machine Co., Inc., Waynesboro, a.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

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Acme Machine Tool Co., Cincinnati, O
Brown & Sharpe Mfg. Co., Providence, R. I.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

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Geometric Tool Co., New Haven, Conn
Gisholt Machine Co., Madison, Wis.
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Skinner Chuck Co., New Britain, Conn
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Starrett Co., L. S., Athol, Mass.

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Chicago Watchman's Clock Co., Chicago
Hardinge Bros., Limited, Toronto, Ont

CLOCKS, TIME
Gisholt Machine Co., Madison, Wis.

CLOCKS, WATCHMEN'S
Chicago Watchman's Clock Co., Chicago Ill.
Hardinge Bros., Limited, Toronto, Ont.

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Johnson Machine Co., Carlyle, Manchester, Conn.

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Can.-Link Belt Co., Toronto, Ont.
Roelofson Elevator Works, Galt, Ont.

COAL-STORAGE SYSTEMS
Can. Link-Belt Co., Toronto, Ont.

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Canada Foundries & Forgings Co., Welland, Ont.
Can. Link-Belt Co., Toronto, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

COLLETS
Butterfield & Co., Inc., Rock Island, Que.
Geometric Tool Co., New Haven, Conn.
Hardinge Bros., Inc., Chicago, Ill.
Hendley Machine Co., Torrington Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

COMPOUNDS, CLEANING
Oakley Chemical Co., New York, N.Y.

COMPOUNDS—CUTTING, DRILLING, GRINDING, SCREW CUTTING
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Oakley Chemical Co., New York, N.Y.

COMPRESSORS, AIR AND GAS
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont
Spray Engineering Co., Boston, Mass.

CONES, FRICTION
Norton Co., of Can. Ltd., Hamilton, Ont.

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Victoria Foundry Co., Ltd., Ottawa, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

CONVEYORS AND ELEVATORS (SEE ELEVATORS)
Jones & Glassco, Montreal, Que.

COTTERS
Steel Co. of Canada, Ltd., Hamilton, Ont.

COUNTERBORES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

COUNTERS, REVOLUTION
Starrett Co., L. S., Athol, Mass.

COUNTERSHAFTS
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Johnson Machine Co., Carlyle, Man-
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

COUNTERSINKS
Butterfield & Co., Inc., Rock Island, Que.
Pratt &Whitney Co., of Canada, Ltd., Dundas, Ont.

COUPLERS, CAR AND LOCOMOTIVE
Can. Steel Foundries, Montreal, Que.

COUPLINGS
Steel Co. of Canada, Ltd., Hamilton, Ont.

COUPLINGS, PIPE
Fittings, Limited, Oshawa, Ont.

COUPLINGS, SHAFT
Can. Link-Belt Co., Toronto, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

CRANES, ELECTRIC
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can.-Link-Belt Co., Toronto, Ont.
Curtis Pneumatic Machinery Co., St. Louis, Mo.
Hepburn Ltd., John T., Toronto, Ont.
Northern Crane Works, Walkerville, Ont.
Shepard Electric Crane & Hoist Co., Montour Falls, **N.Y.**

CRANES, LOCOMOTIVE
Can. Link-Belt Co., Toronto, Ont.

Bertram & Son Co., td., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Northern Crane Works, Walkerville, Ont.

CRANK PIN TURNING MACHINE
Underwood Corp., H.B., Philadelphia, Pa.

CUTTERS, GEAR
Brown & Sharpe Mfg. Co., Providence, R. I
Butterfield & Co., Inc., Rock Island, Q. Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CUTTERS, HIGH SPEED
Atkins & Co., Inc., E. C., Indianapolis
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CUTTERS, MILLING
Brown & Sharpe Mfg. Co., Providence, R. I
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.

CUTTERS, STAY BOLT
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.

CUTTING-OFF MACHINE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

CUTTING OFF MACHINES, PIPE (SEE PIPE-CUTTING AND THREADING MACHINES)
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.

CUTTING-OFF TOOLS
Armstrong Bros. Tool Co., Chicago, Ill.

CUTTING OIL FILTERS (SEE OIL FILTERING SYSTEMS
Bowser, S. F. & Co., Ltd., Toronto.

CUTTING, OXY-HYDROGEN
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

DETACHABLE CHAIN
International Malleable Iron Co., Guelph, Ont.

DIAMONDS, BLACK AND ROUGH
Can. Desmond-Stephan Mfg Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

DIAMOND TOOLS
Can. Desmond-Stephan Co., Hamilton,
Wheel Trueing Tool Co., Windsor, Ont.

DIAMOND CROSSINGS
Can. Steel Foundries, Montreal, Que.

DIAMONDS, IMPORTERS
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Co., Windsor, Ont.

DIES, SCREW AND THREAD CUTTING
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.

DIES, SHEET-METAL AND SUB-PRESS (See Tool Work)
Brown, Boggs & Co., Ltd., Hamilton, Ont.

DIES, FORGING
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

DIES, SELF-OPENING, ADJUSTABLE
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Landis Machine Co., Inc., Waynesboro,
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DIES, THREADING-OPENING
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DIVIDING HEADS
Burke Machine Tool Co., Conneaut, Ohio.
Hendey Machine Co., Torrington, Conn.
Kearney & Treacker Co., Milwaukee, Wis.
Petrie, Ltd., H. W. Toronto, Ont.

DOGS, LATHE AND MILLING MACHINE
Armstrong Bros. Tool Co., Chicago, Ill.

DRAFTING MATERIALS
American Lead Pencil Co., New York City, N.Y.

DRESSERS, GRINDING WHEEL
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ont.
Norton Co., of Can., Ltd., Hamilton.
Wheel Trueing Co., Windsor, Ont.

DRESSING TOOLS
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Co., Windsor, Ont.

DRILL HOLDERS
Armstrong Bros. Tool Co., Chicago, Ill.

DRILLING MACHINES, BENCH
Burke Machine Tool Co., Conneaut,, Ohio.
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal. Que.
Hardinge Bros., Inc., Chicago, Ill.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
U. S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, ELECTRIC AND HAND
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, GANG
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

DRILLING MACHINES, HEAVY DUTY
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
Rockford Drilling Machine Co., Rockford, Ill.

BORING, DRILLING AND MILLING MACHINES, (HORIZONTAL.)
Gisholt Machine Co., Madison, Wis.

DRILLING MACHINES, Multiple Spindle
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
National Acme Co., Cleveland, Ohio.

DRILLING MACHINES, Pneumatic
Cleveland Pneumatic Tool Co., Toronto. Ont.

DRILLING MACHINES, PORTABLE
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, RADIAL
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal. Que.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto,

DRILLING MACHINES, SENSITIVE
Burke Machine Tool Co., Conneaut, O.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Williams Machinery Co., A. R., Toronto.
Wisconsin Electric Co., Racine, Wis

DRILLING MACHINES, TURRET
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wisconsin.
Williams Machinery Co., A. R., Toronto.

DRILLING MACHINES, VERTICAL
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

DRILLS, CENTRE
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DRILLS, ELECTRIC
Independent Pneumatic Tool Co., Chicago, Ill.

DRILLS, ELECTRIC
Black & Decker Mfg. Co., Ltd., Montreal. Que.

DRILLS, HIGH SPEED TWIST
Butterfield & Co., Inc., Rock Island, Que.
Can Fairbanks-Morse Co., Ltd., Montreal, Que.
Cleveland Twist Drill Co., Cleveland, O
Greenfield Tap & Die Corp., Galt, Ont
Morse Twist Drill & Machine Co, New Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DRILLS, PNEUMATIC
Independent Pneumatic Tool Co., Chicago, Ill.

DRILLS, RATCHET
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont
Morse Twist Drill & Machine Co, New Bedford, Mass.

DRILLS, TWIST AND FLAT
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.

DROP FORGINGS
Steel Co of Canada, Ltd., Hamilton.

DUMB WAITERS
Roelofson Elevator Works, Galt, Ont.

DUST HANDLING EQUIPMENT
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

ELECTRIC DRILLS AND GRINDERS
Black & Decker Mfg. Co., Ltd., Montreal, Que.

ELECTRIC WELDING MACHINES
Globe Engineering Co., Ltd., Hamilton, Ont.

ELECTRICAL INSTRUMENTS
Bristol Co., Waterbury, Conn.

ELECTRICAL SUPPLIES
Atkins & Co., Inc., E. C., Indianapolis
Diamond State Fibre Co., Toronto, Ont
U.S. Electrical Tool Co., Cincinnati, O

ELEVATORS AND CONVEYORS
Can. Link-Belt C., Toronto, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q

ELEVATORS, FREIGHT AND PASSENGER
Roelofson Elevator Works, Galt, Ont.

EQUIPMENT, ELEVATOR SAFETY
Jones & Glassco, Montreal, Que.

EMERY WHEELS (See Grinding Wheels)
Lion Grinding Wheels, Limited, Montreal, Que.
Atkins & Co., E. C., Indianapolis, I.
Norton Co., of Canada., Ltd., Hamilton.

ENGINES, CAPSTAN
Kennedy & Sons, Wm., Owen Sound, Ont.

ENGINE LATHE MANUFACTURERS
Oliver Machinery Co., Grand Rapids, Michigan.

ENGINEERS, MECHANICAL
Dominion Engineering Works, Limited. Montreal, Que.
Gisholt Machine Co., Madison, Wis.
Hamilton Gear & Machine Co., Toronto.

EXPANDERS, TUBE
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

FANS, ELECTRIC
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

FANS, EXHAUST
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Petrie Ltd., H. W., Toronto, Ont.

FANS, VENTILATING
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

FIBRE
Diamond State Fibre Co., of Can. Ltd., Toronto, Ont.

FILES AND RASPS
Nicholson File Co., Port Hope, Ont.
Simmons Canada Saw Co., Montreal. Que.

FILLER, IRON (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J.

FIRE ESCAPES
Roelofson Elevator Co., Galt, Ont.

FITTINGS, PIPE
International Malleable Iron Co., Guelph
Fittings, Limited, Oshawa, Ont.

FLEXIBLE SHAFTS
Strand & Co., N. A., Chicago, Ill

FLUXES, WELDING
Carter Welding Co., Ltd., Toronto, Ont
Dominion Oxygen Co., Ltd, Toronto
Liquide Air Company, Toronto, Ont.

FORGING MACHINERY
Acme Machinery Co., Cleveland, Ohio
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown Boggs & Co., Ltd., Montreal.
National Machinery Co., Tiffin, Ohio.
Steel Co. of Canada, Ltd., Hamilton.

BUYERS' DIRECTORY

FORGINGS, DROP
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Ltd., Toronto, Ont.

FORGINGS, HAMMER
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Hepburn Ltd., John T., Toronto, Ont.

FOUNDRY EQUIPMENT
Rice Lewis & Son, Ltd., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

FOUNDRY SUPPLIES
Rice Lewis & Son, Ltd., Toronto, Ont.

FROGS, SPRING OR RIGID
Can. Steel Foundries, Montreal, Que.

FURNACES, ELECTRIC
Rockwell Co., W. S. New York City.
Hiram Walker & Sons Metal Products. Ltd., Walkerville, Ont.

FURNACES, HEAT TREATING COAL
Rockwell Co., W. S., New York City.

FURNACES, HEAT TREATING OIL ND GAS
Bellevue Industrial Furnace Co., Detroit, Michigan.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Rockwell & Co., W. S., New York, N.Y.

FURNACES TEMPERING AND ANNEALING
Bellevue Industrial Furnace Co., Detriot, Mich.
Brown & Sharpe Mfg., Co., Providence R. I.
Rockwell Co., W. S., New York City.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

FURNACES AND OVENS, ELECTRIC
Petrie, Ltd., H. W., Toronto, Ont.
Rockwell & Co., W. S., New York, N.Y.
Starrett Co., L. S., Athol, Mass.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

GAGES, MEASURING (See Tool Work)
Brown & Sharpe Mfg. Co., Providence, R. I.
Greenfield Tap & Die Corp., Galt, Ont.
Lufkin Rule Co., Windsor, Ont.
Starrett Co., L. S., Athol, Mass.

GAGES, RECORDING
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GAGES, SPECIAL MEASURING
(See Tool Work)
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GAGES, THREAD
Brown & Sharpe Mfg. Co., Providence R. I.
Starrett Co., L. S., Athol. Mass.

GALVANIZING
Fittings, Limited, Oshawa, Ont.

GAS, COAL COMPRESSED
L'Air Liquid Society, Toronto, Ont.

GAS, COMPRESSED
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

GASKETS
Diamond State Fibre Co. of Ca., Ltd., Toronto, Ont.
Smooth Mfg. Co., Jersey City, N. J.

GAUGES VACUUM AND PRESSURE
Taylor Instrument Co. Toronto, Ont.

GEAR BLANKS
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.
Dominion Engineering Works, Limited, Montreal, Que.

GEAR COUNTERS
Hart Mfg. Co., R. A., Battle Creek, Michigan.

GEAR CUTTING MACHINES
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Fellows Gear Shaper Co., Springfield, Vt.
Petrie, Ltd., H. W., Toronto, Ont.
Whiton Machine Co., D. E., New London, Conn.

GEAR TESTING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.

GEARS, CAST
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Hull Iron & Steel Foundries, Hull, Que.
Dominion Engineering Works, Limited, Montreal, Que.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

GEARS, CUT
Brown & Sharpe Mfg. Co., Providence, R. I.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Gardner & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto, Ont.
Hepburn Ltd., John T. Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

GEARS, DRESSED
Kennedy & Sons, Wm., Owen Sound, Ontario.

GEARS, FORGED
Canada Foundries & Forgings Co., Welland, Ont.

GEARS, HERRINGBONE
Hamilton Gear & Machine Co., Toronto, Ont.

GEARS, RAWHIDE (See Gears, Cut)
Hamilton Gear & Machine Co., Toronto.

GEAR, SILENT CHAIN
Gardner & Son, Robt., Montreal, Que.
Can. Link-Belt Co., Ltd., Toronto, Can.
Hans Renold of Canada, Ltd., Montreal, Quebec.

GEARS, WORM
Hamilton Gear & Machine Co., Toronto

GENERATORS, ACETYLENE
L'Air Liquide Society, Toronto, Ont.

GOGGLES, SAFETY
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto
Liquide Air Company, Toronto.

CRAB BUCKETS
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Cleveland Twist Drill Co., Cleveland, O

GREASE CUPS, PRESSED STEEL AND BRASS
Can. Winkley Co., Ltd., Windsor, Ont.

GREASES, LUBRICATING
Canadian SKF Co., Toronto, Ont.

GRINDERS, ELECTRIC
Black & Decker Mfg. Co., Ltd., Montreal, Que.

GRINDING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Norton Co., of Canada, Ltd., Hamilton

GRINDING MACHINES, ABRASIVE BELT
Norton Co. of Can. Ltd., Hamilton, Ont.

GRINDING MACHINES, AUTOMATIC
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, BENCH
Blount Co., J. G., Everett, Mass.
Geometric Tool Co., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co. of Canada, Ltd., Hamilton, Ont.
Petrie, Ltd., H. W. Toronto, Ont.
Pratt & Whitney Co. of Canada, Ltd.,

GRINDING MACHINES, CENTER
U. S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES, CUTTER AND REAMER
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Petrie Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, CYLINDRICAL
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.
Norton Co., of Canada, Ltd., Hamilton.

GRINDING MACHINES, DIE
Geometric Tool Co., New Haven, Conn.
National Acme Co., Cleveland, O.
National Machinery Co., Tiffin, Ohio.

GRINDING MACHINES, DRILL
Bellevue Industrial Furnace Co., Detroit, Mich.
Bertram & Son Co., Ltd., The John, Dundas, Ont.

GRINDING MACHINES, ELECTRIC
Independent Pneumatic Tool Co., Chicago, Ill.
Strand & Co., N. A., Chicago, Ill.

GRINDING MACHINES, FLOOR AND TOOL
Blount Co., J. G., Everett, Mass.
National Acme Co., Cleveland, Ohio.
Norton Co. of Canada, Ltd., Hamilton, Ontario.
Petrie, Ltd., H. W., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.

GRINDING MACHINES, INTERNAL
Garlock Machinery Ltd., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES PORTABLE
Strand & Co., N. A., Chicago, Ill.

GRINDING MACHINES, SNAGGING
Blount Co., J. G., Everett, Mass.
Norton Co., of Can. Ltd., Hamilton, Ont.

GRINDING MACHINES, SURFACE
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, THREAD
Pratt & Whitney Co., of Canada, Ltd.,

GRINDING MACHINERY, TOOL POST
Gisholt Machine Co., Madison, Wis.
Grenfield Tap & Die Corp., Galt, Ont.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES, UNIVERSAL
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co., of Canada, Ltd., Hamilton Ontario.
Petrie, Ltd., H. W., Toronto, Ont.

GRINDING WHEELS
Lion Grinding Wheels, Limited, Montreal, Que.
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Norton Co. of Can., Ltd., Hamilton, Ont.

GUN-BARREL MACHINERY
Steptoe Turret Machine Co., Madison, Wisconsin

HACK SAWS, POWER
Atkins & Co., Inc., E C., Indianapolis, Indiana.
Petrie, Ltd., H. W., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.

HAMMERS, CHIPPING
Cleveland Pneumatic Tool Co., Toronto, Ont.
High Speed Hammer Co., Rochester.
Independent Pneumatic Tool Co., Chicago, Ill

HAMMERS, DROP
Bertram & Son Co., Ltd., The John Dundas, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

HAMMERS, ELECTRIC
Brown, Boggs & Co., Ltd., Hamilton, Ont.

HAMMERS, PNEUMATIC
Can. Steel Foundries, Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto Ont
Independent Pneumatic Tool Co., Chicago, Ill.

HANGERS, SHAFTING
Canadian SKF Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Hamilton Gear & Machine Co., Toronto.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

HOBBING MACHINES
Shore Instrument Co., Jamaica, N.Y.

HARDENING, CASE-HARDENING AND TEMPERING
Barnes Company, Wallace, Hamilton.
Petrie, Ltd., H. W., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Cleveland Pneumatic Tool Co., Toronto Ont.

HAMMERS, POWER
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Jardine & Co., A. P., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

HOBS
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

HOISTS, ELECTRIC
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.

HOISTS, HAND
Curtis Pneumatic Machinery Co., St. Louis, Mo.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio

HOISTS, PNEUMATIC
Independent Pneumatic Tool Co., Chicago, Ill.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

HOLDERS-ON, PNEUMATIC
Cleveland Pneumatic Tool Co., Toronto Ont.
Independent Pneumatic Tool Co., Chicago, Ill.

HYDRAULIC MACHINERY
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Dominion Engineering Works, Limited Montreal, Que
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

IGNITERS, GAS ENGINE
Canada Foundries & Forgings Co., Welland, Ont.
Burke Machine Tool Co., Conneaut, O

INDICATORS, SPEED AND TEST
Brown & Sharpe Mfg Co., Providence R.I.

INSULATION
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.

IRON BARS
Steel Co. of Canada, Ltd., Hamilton, Ont.

JACKS, HYDRAULIC
Norton, A. O., Boston, Mass

JACKS, PLANER
Armstrong Bros. Tool Co., Chicago, Ill
Starrett Co., L. S., Athol, Mass.

JAPANNING AND VARNISHING OVENS
Prantford Oven & Rack Co., Brantford, Ont.

JIGS AND FIXTURES (SEE TOOL WORK)
Fisher Motor Co., Ltd., Orillia, Ont
Gisholt Machine Co., Madison, Wis

KEYSEATING MACHINES
Morton Mfg Co., Muskegon, Mich.

Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

KEYS, MACHINE
Can. Dranw Steel Co., Hamilton, Ont.
Morton Mfg. Co., Muskegon, Mich.

KNIVES, MACHINE
Atkins & Co., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

KNURL HOLDERS
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

LATHE ATTACHMENTS
Hendey Machine Co., Torrington, Conn.
Petrie, Ltd., H. W., Toronto, Ont.

LATHE TOOLS
Armstrong Bros. Tool Co. ,Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

LATHES, AUTOMATIC AND SEMI-AUTOMATIC
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, BENCH
Hardinge Bros., Inc., Chicago, Ill.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

LATHES, BORING
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, CHUCKING (SEE LATHES, HORIZONTAL TURRET, AND LATHES, VERTICAL TURRET)
Acme Machine Tool Co., Cincinnati, O.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, ENGINE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hendey Machine Co., Torrington, Conn.
Petrie, Ltd. H. W., Toronto, Ont
Rockford Lathe & Drill Co., Rockford, Illinois.

LATHES, EXTENSION AND GAP
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison Wis.
National Acme Co., Cleveland, O.
Petrie, Ltd., H. W., Toronto, Ont.
Steinle Turret Machine Co., Madison, Wis.

LATHES, PRECISION
Hardinge Bros., Chicago.

LATHES, RELIEVING
Hendey Machine Co., Torrington, Conn.

LATHE, UNIVERSAL HAND
Brown & Sharpe Mfg. Co., Providence, Rhode Island.

LATHE, SPEED AND HAND
Blount Co., J. G., Everett, Mass.

LATHES, SPINNING
Pryibil Machine Co., Torrington, Conn.

LATHES, VERTICAL TURRET
Bertram & Son, Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

LATHES, WOOD TURNING
Blount, Co., J. G., Everett, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.

LEAD PIPE
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

LEATHER FILLET
D. K. McLaren, Limited, Montreal,

LINOLEUM MILL MACHINERY
Bertrams, Ltd., Edinburgh, Scotland.

LIQUID AIR PLANTS
L'Air Liquide Society, Toronto, Ont.

LOCKERS, CLOTHES
Dennis Wire and Iron Works, London, Ont.

BUYERS' DIRECTORY

LUBRICANTS
Oakley Chemical Co., New York, N.Y.

LUBRICATING SYSTEMS
Bowser, S. F., & Co., Ltd., Toronto, Canada.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Ltd., Welland, Ont.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R. Toronto Ont.

MANGANESE STEEL
Can. Steel Foundries, Montreal, Que.

MANDRELS, EXPANDING
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MANDRELS, SOLID
Greenfield Tap & Die Corp., Galt, Ont.
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Pratt & Whitney Co., of Canada. Ltd., Dundas, Ont.

MEASURING MACHINES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MECHANICS' FINE TOOLS
Lufkin Rule Co., Windsor, Ont.

METALS, ALLOY
Canada Metal Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.

METAL WORKERS
Parker Co., Charles, Meriden, Conn.

MICROMETER CALIPERS
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Rice Lewis & Son, Ltd., Toronto, Ont.

MILLING ATTACHMENTS
Burke Machine Tool Co., Conneaut, O.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

MILLING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Burke Machine Tool Co., Conneaut, O

MILLING MACHINES, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence, R. I.
Hardinge Bros., Inc., Chicago, Ill.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

MILLING MACHINES, BENCH
Burke Machine Tool Co., Conneaut. O.
Hardinge Bros., Inc., Chicago, Ill.

MILLING MACHINES, HAND
Brown & Sharpe Mfg. Co., Providence
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MILLING MACHINES, HORIZONTAL PLANER TYPE.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Kearney & Trecker Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto.

MILLING MACHINES, PLAIN
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, O.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

MILLING MACHINES, THREAD
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MILLING MACHINES, UNIVERSAL
Brown & Sharpe Mfg. Co., Providence,
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

MILLING MACHINES, VERTICAL
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, O.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto.

MILLING TOOLS, ADJUSTABLE HOLLOW
Geometric Tool Co., New Haven, Conn.

MOTORS, ELECTRIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Roelofson Elevator Co., Galt, Ont.
Williams Machinery Co., A. R., Toronto,
Wisconsin Electric Co., Racine Wis.

NAILS AND STAPLES
Canada Metal Co., Ltd., Toronto, Ont.

NIPPLES
Canada Metal Co., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton.

NITROGEN
Carter Welding Co. Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

NUT TAPPERS
(See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
National Acme Co., Cleveland, Ohio.

NUTS, FINISHED and SEMI-FINISHED
Galt Macine Screw Co., Galt, Ont.
National Acme Co., Montreal, ue.

NUTS (Up to 4-in.)
Steel Co. of Canada, Ltd., Hamilton.

NUTS, S.A.E., PLAIN AND CASTELLATED
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

OIL FILTERING AND STORAGE SYSTEMS
Bowser, S. F., & Co., Ltd., Toronto,

OIL STORAGE ENGINEERS
Bowser, S. F., & Co., Ltd., Toronto,

OIL HOLE COVERS
Can. Whitney Co., Ltd., Windsor, Ont.

OILS, SOLUABLE
Brantford Oven & Rack Co., Brantford, Ontario.

ORNAMENTAL IRON AND WIRE WORKS
Roelofson Elevator Works, Galt, Ont.

OXYGEN
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

OXY-ACETYLENE APPARATUS
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Atlas Press Co., Kalamazoo, Mich.

PAINT SPRAYERS
Spray Engineering Co., Boston, Mass.

PAPER MILL CONVEYORS
Bertram Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd., Montreal, Que.

PATTERNS, WOOD AND METAL
Fittings, Limited, Oshawa, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.
Victoria Foundry Co., Ltd., Ottawa.

PHOSPHOR TIN
Canada Metal Co., Ltd., Toronto, Ont.

PHOTOGRAPHIC DUPLICATING MACHINES
Photostat Corp., Providence, R. I.

PIPE BENDING MACHINES
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Underwood Corp., H. R., Philadelphia, Pa.
Williams Machinery Co., A. R., Toronto.

PIPE CUTTING AND THREADING MACHINES
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Petrie, Ltd., H. W., Toronto, Ont.

PIPE
Canada Metal Co., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.

PIPE FITTINGS
Canada Metal Co., Toronto, Ont.
Fittings, Limited, Oshawa, Ont.
International Malleable Iron Co., Guelph Ont.

PIPE AND NIPPLE THREADING MACHINES
Landis Machine Co., Inc., Waynesboro, Pa.

PIPE FITTERS' TOOLS
Rice Lewis & Son, Ltd., Toronto. Ont.

PIPE THREADING DIE HEADS
Landis Machine Co., Inc., Waynesboro, Pa.

PISTON-RING MACHINES
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

PLANING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Williams Machinery Co., A. R., Toronto

PLANING MACHINES, ROTARY
Bertram & Son Co., Ltd., The John, Dundas, Ont.

PLATE ROLLS
Bertram & Son Co., Ltd., The John, Dundas, Ont.

PNEUMATIC PAINTING DEVICES
Spray Engineering Co., Boston, Mass

PNEUMATIC TOOLS
Cleveland Pneumatic Tool Co., Toronto
Independent Pneumatic Tool Co., Chicago, Ill.

POLISHING AND BUFFING MACHINES
Lion Grinding Wheels, Limited, Montreal, Que.
Blount Co., J. G. Everett, Mass.
Brown & Sharpe Mfg. Co., Providence.
Pryibil Machine Co., New York, N.Y.

PRESSED STEEL PARTS
American Pulley Co., Philadelphia, Pa.
Fisher Motor Co., Ltd., Orillia, Ont.

PRESSES, ARBOR
Atlas Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

PRESSES, DROP AND FORGING
Brown, Boggs & Co., Ltd., Hamilton.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

PRESSES, FOOT AND HAND
Brown, Boggs & Co., Ltd., Hamilton

PRESSES, HYDRAULIC
Bertram & Son Co., Ltd., The John Dunldas, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Perrin Ltd., W. R., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

PRESSES, POWER
Bliss Co., E. W., Prooklyn, N. Y.
Brown, Boggs, & Co., Ltd., Hamilton.
Hepburn Ltd., John T., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Stoll Co., Inc., D. H., Buffalo, N.Y

PRESSES, SCREW
Brown, Boggs & Co., Ltd., Hamilton.
Petrie, Ltd., H. W., Toronto, Ont.

PROFILING MACHINES
Pritt & Whitney Co., of Canada, Ltd., Dundas, Ont.

PROTRACTORS
Brown & Sharpe Mfg. Co., Providence
Lufkin Rule Co., Windsor, Ont.

PROPELLERS
Kennedy & Sons, Wm., Owen Sound Ontario.

PULLEYS, CORK INSERT
American Pulley Co., Philadelphia, Pa.

PULLEYS, METAL AND FIBRE
American Pulley Co., Philadelphia, Pa.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.
D. K. McLaren Co., Limited Montreal, Que.

PULP AND PAPER MILL EQUIPMENT
Dominion Engineering Works, Ltd., Montreal, Que.

PUMPS, HYDRAULIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Dominion Engineering Works, Ltd Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont

BUYERS' DIRECTORY

PUMPS, LUBRICANT AND OIL
Bowser, S. F., & Co., Ltd., Toronto.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Hepburn Ltd., John T., Toronto, Ont.

PUMPS, POWER
Bowser, S. F., & Co., Ltd., Toronto.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hepburn Ltd., John T., Toronto, Ont.

PUNCHES, CENTER
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

PUNCHES, HAND
Brown Boggs & Co., Ltd., Hamilton.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Jardine & Co., A. B., Hespeler, Ont.

PUNCHES, POWER
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

PUNCHING MACHINES, HORIZONTAL
Bertrams Ltd., Edinburgh, Scotland.

PYROMETERS, ELECTRIC
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Hiram Walker & Sons Metal Products Co., Walkerville, Ont.

RACKS, CUT
Hamilton Gear & Machine Co., Toronto.

RACKS, STORAGE
(See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ontario.

REAMER HOLDERS
Simonds Canada Saw Co., Montreal, Q.

REAMERS, EXPANDING
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

REAMERS, SOLID
Butterfield & Co., Inc., Rock Island, Q.
Morse Twist Drill & Machine Co., New Bedford, Mass.

REAMERS, TAPER
Brown & Sharpe Mfg. Co., Providence, R. I.
Butterfield & Co., Inc., Rock Island, Q.
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canad, Ltd., Dundas, Ont.

RECORDERS, TEMPERATURE
Taylor Instrument Co., Rochester, N. Y.

RECORDERS, TIME
Gisholt Machine Co., Rochester, N. Y.
Taylor Instrument Co., Toronto, Ont.

REGULATORS, TEMPERATURE
Taylor Instrument Co., Toronto, Ont.

RIVETS AND BURRS
Parmenter & Bulloch Co., Gananoque, Ont.
Steel Co., of Canada, Ltd., Hamilton,

RIVETS, CHAIN
Fittings, Limited, Oshawa, Ont.

RIVET-MAKING MACHINERY
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

RIVETING HAMMERS
Independent Pneumatic Tool Co., Chicago, Ill.

RIVETING MACHINES
Can. Fairbanks-Morse Ltd., Montreal Q.
High Speed Hammer Co., Rochester, N.Y.
Parmenter & Bulloch Co., Gananoque Ont.
Petrie, Ltd., H. W., Toronto, Ont.

RUDDER FRAMES, STEEL
Can. Steel Foundries, Montreal, Que.

RUBBER MILL MACHINERY
Bertram Ltd., Edinburgh, Scotland.

RULES, STEEL AND WOOD
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Windsor, Ont.

RUST PREVENTATIVES
Oakley Chemical Co., New York, N. Y.

SAND EQUIPMENT
Can. Link-Belt Co., Toronto, Ont.

SAND RAMMERS, PNEUMATIC
Cleveland Pneumatic Tool Co., Toronto.
Independent Pneumatic Tool Co., Chicago, Ill.

SAW FRAMES AND BLADES, HACK
Atkins & Co., Inc., E. C., Indianapolis.
Diamond Saw & Stamping Works, Buffalo, N. Y.
Rice Lewis & Sons, Ltd., Tornto, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWING MACHINES, POWER HACK
Atkins & Co., Inc., E. C., Indianapolis.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

SAW SHARPENING MACHINES
Atkins & Co., Inc., E. C., Indianapolis.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

SAW SHARPENING MACHINES
Atkins & Co., Inc., E. C., Indianapolis.

SAW TABLES, UNIVERSAL
Petrie, Ltd., H. W., Toronto, Ont.

SAWS, CIRCULAR METAL
Atkins & Co., Inc., E. C., Indianapolis.
Pryibil Machine Co., New York, N. Y.
Gisholt Machine Co., Madison, Wis.

SAWS, HAND
Atkins & Co., Inc., E. C., Indianapolis
Simonds Canada Saw Co., Montreal, Q.

SAWS, HOT AND COLD
Atkins & Co., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Q.

SAWS, HIGH SPEED STEEL
Atkins & Co., Inc., E.C., Indianapolis, I.
Butterfield & Co. Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWS, METAL BAND
Atkins & Co., E. C., Indianapolis, I.

SAWS, METAL CUTTING
Brown & Sharpe Mfg. Co., Providence.
Butterfield & Co., Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.
Starrett Co., L. S., Athol, Mass.

SAWS, SCREW SLOTTING
Atkins & Co., Inc., E., C., Indianapolis.
Butterfield & Co., Inc., Rock Island, Q.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canda, Ltd., Dundas, Ont.

SAWS, SCREW SLOTTING
Atkins & Co., Inc., E. C., Indianapolis.
Butterfield & Co., Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWS, WOOD
E. C. Atkins & Co, Indianapolis, Ind.

SCALES
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Lufkin Rule Co., Windsor, Ont.

SCREENS
Dominion Engineering Works, Ltd., Montreal, Que.

SCREW DRIVERS, OPTICAL, JEWELRY AND NOVELTY
Strand & Co., N. A., Chicago, Ill.

SCREW MACHINE WORK
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Montreal, Que.

SCREW MACHINERY, WOOD AND LAG
Cook Co., Asa S., Hartford, Conn.

SCREW MACHINES
Brown & Sharpe Mfg. Co., Providence, Rhode Island.

SCREW MACHINES, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.

SCREW MACHINE PRODUCTS
National Acme Co., Montreal, Que.

SCREW PLATES
Butterfield & Co., Inc., Rock Island. Que.
Jardine & Co., A. B., Hespeler, Ont.

SCREWS, CAP AND SET
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

SCREWS, SAFETY, SET
Galt Machine Screw Co., Galt, Ont.

SECOND-HAND MACHINERY
See last page of directory.
Petrie, Ltd., H. W., Toronto, Ont.

SEPARATORS, MOISTURE AND OIL
Bowser, S. F., & Co., Ltd., Toronto, Canada.

SEPARATORS, OIL AND WASTE
Bowser, S. F., & Co., Ltd., Toronto.

SHAFTS, FLEXIBLE
Strand & Co., N. A., Chicago, Ill.

SHAFTING
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
Williams Machinery Co., A. R., Toronto.

SHAPES, COLD-DRAWN SPECIAL STEEL
Union Drawn Steel Co., Hamilton, Ont.

SHAPING MACHINES
Hendey Machine Co., Torrington, Conn.
Morton Mfg. Co., Muskegon, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Williams Machinery Co., A. R. Toronto.

SHEARS HAND
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

SHEARS, POWER
Bliss Co., E. W., Brooklyn, N. Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Stoll Co., Inc., D. H., Buffalo, N. Y.
Williams Machinery Co., A. R., Toronto, Ont.

SHEARING MACHINES, ANGLE, IRON BAR AND GATE
Bertrams Ltd., Edinburgh, Scotland.

SHEET LEAD
Canada Metal Co., Ltd., Toronto, Ont.

SHEET METAL WORKING MACHINERY
Bliss Co., E. W., Brooklyn, N. Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Stoll Co., Inc., D. H, Buffalo, N.Y.

SHEETS, NICKEL, MONEL AND FIBRE
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.

SHEETS, O.P.C.R. & B. A. AND BLUE ANNEALED
Steel Co., of Canada, Ltd., Hamilton, Ont.

SIDE FRAMES, LOCOMOTIVE
Can. Steel Foundries, Montreal, Que.

SLOTTING ATTACHMENTS
Brown & Sharpe Mfg. Co., Providence, R.I.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

SLOTTING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.

SOLDERS
Canada Metal Co., Ltd., Toronto, Ont.

SPRAYING EQUIPMENT
Spray Engineering Co., Boston, Mass.

SPECIAL MACHINERY AND TOOLS
Brown Engineering Corp., Ltd., Toronto.
Gisholt Machine Co., Madison, Wis.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.
National Acme Co., Cleveland, O.

SPIKES, RAILWAY AND PRESSED
Steel Co of Canada, Ltd., Hamilton, Ont.

SPINNING LATHES
Pryibil Machine Co., P., New York City.

SPRING, MILLED
Barnes & Co., Wallace, Hamilton, Ont.

SPRINGS, SMALL SPIRAL HELICAL, COMPRESSION, EXTENSION, TORSION AND SPECIAL
Barnes Company, Wallace, Hamilton.

SPRINGS
Barnes Company, Wallace, Hamilton.
Cleveland Wire Spring Co., Clevleand, O
Steele Ltd., James, Guelph, Ont.

SPRINGS, FLAT STEEL, BRUSH HOLDER, CLOCK, SMALL FLAT SPRINGS
Barnes Company, Wallace, Hamilton.

SPROCKETS AND CHAINS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Renold Hanson of Canada, Ltd., Montreal, Que.

SQUARES
Brown & Sharpe Mfg. Co., Providence, R.I.
Lufkin Rule Co., Windsor, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

STAMPING, METAL
American Pulley Co., Philadelphia, Pa.
Barnes Company, Wallace, Hamilton.
Diamond Saw & Stamping Works, Buffalo, N. Y.
Parmenter & Bulloch Co., Gananoque, Ont.

STAMPS, STEEL
Diamond Saw & Stamping Works, Buffalo, N. Y.

STEEL CONCRETE REINFORCEMENT
Steel Co. of Canada, Ltd., Hamilton.

STEEL PLATE
British Empire Steel Co., Montreal, Que.

STEEL AND IRON BARS
Steel Co. of Canada, Ltd., Hamilton.

STEELS TOOL
British Empire Steel Co. Montreal Q.

STEEL, COLD-ROLLED STRIP
British Empire Steel Co., Montreal, Q.
Barnes Company, Wallace, Hamilton.

STEEL, CRUCIBLE, SPRING
Barnes, Company, Wallace, Hamilton.
British Empire Steel Co., Montreal, Q.

SHEETS, OPEN HEARTH STEEL
Steel Co., of Canada, Ltd., Hamilton.

STEEL, SHAFTING AND FREE CUTTING SCREW
Union Drawn Steel Co., Hamilton, Ont

STEEL, SHEET
British Empire Steel Co., Montreal, Q.
Rice Lewis & Son, Ltd., Toronto, Ont

STEEL, STAINLESS
Steel Co., of Can. Ltd., Hamilton, Ont.

STEEL STAIRS
Roelofson Elevator Works, Galt, Ont.

STEELS, ALLOY AND CARBON
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Can. Steel Foundries, Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton, Ont.

STEELS, HIGH-SPEED
Armstrong Bros. Tool Co., Chicago, Ill.
Atkins & Co., Ltd., Wm., Sheffield, England.
British Empire Steel Co., Montreal, Q.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton

STEEL TUBING, CLOSE JOINT AND WELDED
Standard Tube & Fence Co., Ltd., Woodstock, Ont.

STERN FRAMES, CAST STEEL
Can Steel Foundries, Montreal, Que.

STRAIGHTENING MACHINERY
Bertram Ltd., Edinburgh, Scotland.
Williams & Co., Ltd., J. H., Brooklyn N.Y.

STUDS
Geometric Tool Co., New Haven, Conn.
Galt Machine Screw Co., Galt, Ont.

BUYERS' DIRECTORY

SWAGING MACHINES
Atkins & Co., Inc., E. C., Indianapolis, Indiana.

SWITCHES, RAILWAY
Can. Steel Foundries, Montreal, Que.

TACHOMETERS
Bristol Co., Waterbury, Conn.

TANKS AND PUMPS, OIL
Bowser, S. F., & Co., Ltd., Toronto.

TAP HOLDERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
William L. Procunier, Chicago, Ill.

TAPER PINS
Galt Machine Screw Co., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

TAPES, MEASURING
Starrett Co., L. S., Athol, Mass.
Lufkin, Rule Co., Windsor, Ont.

TAPPING MACHINES AND ATTACHMENTS
Burke Machine Tool Co., Conneaut, O.
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Wm. L. Procunier, Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

TAPS AND DIES
Butterfield & Co., Inc., Rock Island, Q.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

TAPS, COLLAPSING
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.

TEETH, DREDGE BUCKET
Kennedy & Sons, W., Owen Sound, Ont.

THERMOMETERS
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Greenfield Tap and Die Corp., Galt, Ontario.

THREAD-CUTTING TOOLS
Butterfield & Co., Inc., Rock Island, Q.
Greenfield Tap and Die Corp., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

THREAD CUTTING MACHINES
Landis Machine Co., Inc., Waynesboro, Pa.

THREADING MACHINES
Acme Machinery Co., Cleveland, Ohio.
Geometric Tool Co., New Haven, Conn.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Williams Tool Corp., of Can. Ltd., Brantford, Ont.

THREAD LEAD TESTING MACHINES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

THREAD-ROLLING MACHINES
Bliss Co., E. W., Brooklyn, N. Y.

TIE PLATES
Steel Co. of Canada, Ltd., Hamilton.

TIME RECORDERS
International Business Machine Co., Ltd., Toronto, Ont.

TONGS
Hepburn Ltd., John T., Toronto, Ont.

TOOL CASES
Rice Lewis & Son, Ltd., Toronto, Ont.

TOOL HOLDERS
Armstrong Bros., Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Bertrams Ltd., Edinburgh, Scotland.

TOOL POSTS, LATHE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Williams & Co., Ltd., J. H., Brooklyn, N.Y.

TOOLS, SMALL
(See Machinists' Small Tools)
Armstrong Bros. Tool Co., Chicago, Ill.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Lufkin Rule Co., Windsor, Ont.
National Machine Tool Co., Racine, Wis.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S. Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A.R., Toronto.

TOOL WORK
Brown Engineering Corp., Ltd., Toronto, Ontario.

TORCHES, BLOW
Rice Lewis & Son, Ltd., Toronto, Ont.

TRACKWORK, RAILWAY
Can. Steel Foundries, Montreal, Que.

TRACKWORK, MANGANESE STEEL
Can. Steel Foundries, Montreal, Que.

TRANSMISSION MACHINERY
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound.
Petrie, Ltd., H. W., Toronto, Ont.
Renold, (Hans) of Canada, Ltd., Montreal, Que.

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Can. Link-Belt Co., Toronto, Ont.
Northern Crane Works, Walkerville, Ont.
Wright Mfg. Co., Lisbon, Ohio.

TROLLEY WHEELS
Langley & Austin, Galt, Ont.

TROWELS, PLASTERING
E. C. Atkins & Co., Indianapolis, Ind.

WRENCHES, MACHINISTS'
Armstrong Bros. Tool Co., Chicago, Ill.

TRUCKS
Can. Fairbanks-Morse Ltd., Montreal, Q.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.

TUBING, SEAMLESS STEEL, BRASS AND COPPER AND FIBRE
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

TURRET HEADS
Bertram & Son Co., Ltd., The John Dundas, Ont.

TURRET MACHINES
(See Lathes, Horizontal Turret)
Acme Machine Tool Co., Cincinnati, O.
Cook Co., Asa S., Hartford, Conn.
Gisholt Machine Co. Madison Wis.
National Acme Co. Cleveland O.
Pratt & Whitney Co. of Canada Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin

TURRETS, TOOL POST
Gisholt Machine Co. Madison, Wis.

UNIONS, PIPE
Fittings, Limited, Oshawa, Ont.

VALVES
Canada Metal Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Mon-
Dominion Engineering Works, Limited. Montreal, Que.

VISES, DRILLING MACHINE
Burke Machine Tool Co., Conneaut, Ohio.
Charles Parker Co., Meriden, Conn.
Cleveland Pneumatic Tool Co., Toronto, Ontario.
Kempsmith Mfg Co., Milwaukee, Wis.

VISES, PIPE
Charles Parker Co., Meriden, Conn.

VISES, PLANER AND SHAPER
Bertram & Son Co., Ltd., The John Dundas, Ont.
Philip Gies Foundry, Kitchener, Ont.
Hendley Machine Co., Torrington, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.

VISES, WOOD WORKERS'
Charles Parker Co., Meriden, Conn.
Parmenter & Bulloch Co., Gananoque, Ontario.

VOLTMETERS
Bristol Co., Waterbury, Conn.

WAGON LEADERS
Can. Link-Belt Co., Toronto, Ont.

WASHERS, LOCK, SPLIT AND SPRING
Barnes Company, Wallace, Hamilton.

WELDING APPARATUS, OXY-ACETYLENE
L'Air Liquide Society, Toronto, Ont.
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto, Ont.

WELDING APPARATUS
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.

WELDING, ELECTRIC, ARC, SPOT AND BUTT
International Malleable Iron Co., Guelph, Ont.

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Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.

WELDING MACHINES, ELECTRIC
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McLaren Belting Co., J. C., Montreal Que.
Steel Co. of Canada, Ltd., Hamilton.

WELDING ROD, TOBIN, MANGANESE, BRONZE AND ALUMINUM
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Liquide Air Company, Toronto, Ont.

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Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.

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Hull Iron & Steel Foundries, Hull, Que.
Kennedy & Sons, Wm., Owen Sound, Ontario.

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Kennedy & Sons, Wm. Owen Sound, Ontario.

WINCHES, STOPLOG
Kennedy & Sons, Wm., Owen Sound. Ontario.

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Barnes Company, Wallace, Hamilton.
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Dennis Wire & Iron Works, London, Ontario.
Greening Wire Co., B., Hamilton, Ont.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

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Barnes Company, Wallace, Hamilton.

WIRE, COPPER AND BRASS, FINE AND HEAVY
Steel Co., of Canada, Ltd., Hamilton, Ontario.

WIRE STRAIGHTENING AND CUTTING MACHINERY
Brown, Boggs & Co., Ltd., Hamilton, Ontario.

WIRE, WELDING
L'Air Liquide Society, Toronto, Ont.
Carter Welding Co., Ltd., Toronto, Ont
Dominion Oxygen Co., Ltd., Toronto.

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Dennis Wire & Iron Works, London, Ontario.
Greening Wire Co., B., Hamilton, Ont.

WOODWORKING MACHINERY
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Williams Machinery Co., A. R., Toronto, Ontario.

WRENCHES, DROP FORGED
Armstrong Bros. Tool Co., Chicago, Ill
Canada Foundries & Forgings Co., Welland, Ont.

When answering advertisements kindly mention Canadian Machinery

List of Directory of Dealers will be Found above Advertising Index

DIRECTORY OF DEALERS

THE Buyers' Directory of CANADIAN MACHINERY was originally intended to contain information regarding lines actually manufactured by our advertisers. We now carry the advertising of leading machinery dealers, some of whom represent scores of manufacturers in addition to being manufacturers themselves in some cases. We recommend, therefore, if our subscribers cannot find what they want in our Directory that they communicate with the dealers whose names appear herewith.

MACHINE TOOLS, ETC.

Bertram & Sons, Ltd., John, Dundas, Ont.
The Canadian Fairbanks-Morse Co., Montreal, Que.
Garlock Machinery Ltd., Toronto.
Herbert Ltd., Alfred, Toronto, Ont.
H. W. Petrie, Ltd., Toronto, Ont.
A. R. Williams Machinery Co., Toronto. Ont.
Yeates Machinery Co., London, Ont.

SHOP and FACTORY SUPPLIES

The Canadian Fairbanks-Morse Co., Montreal, Que.
Garlock Machinery Ltd., Toronto.
Herbert Ltd., Alfred, Toronto, Ont.
H. W. Petrie Ltd., Toronto, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
Yeates Machinery Co. London, Ont.

POWER EQUIPMENT, ETC.

The Canadian Fairbanks-Morse Co., Montreal, Que.
Herbert Ltd., Alfred, Toronto, Ont.
H. W. Petrie, Ltd., Toronto, Ont.

WOODWORKING MACHINERY

The Canadian Fairbanks-Morse Co., Montreal, Que.
Garlock Machinery Ltd., Toronto.
Herbert Ltd., Alfred, Toronto, Ont.
H. W. Petrie Ltd., Toronto, Ont
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Yeates Machinery Co., London Ont.

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BLACK & DECKER BENCH DRILL STAND

BENCH DRILL STAND WITHOUT DRILL

$45.00

BLACK & DECKER SPECIAL HALF INCH DRILL

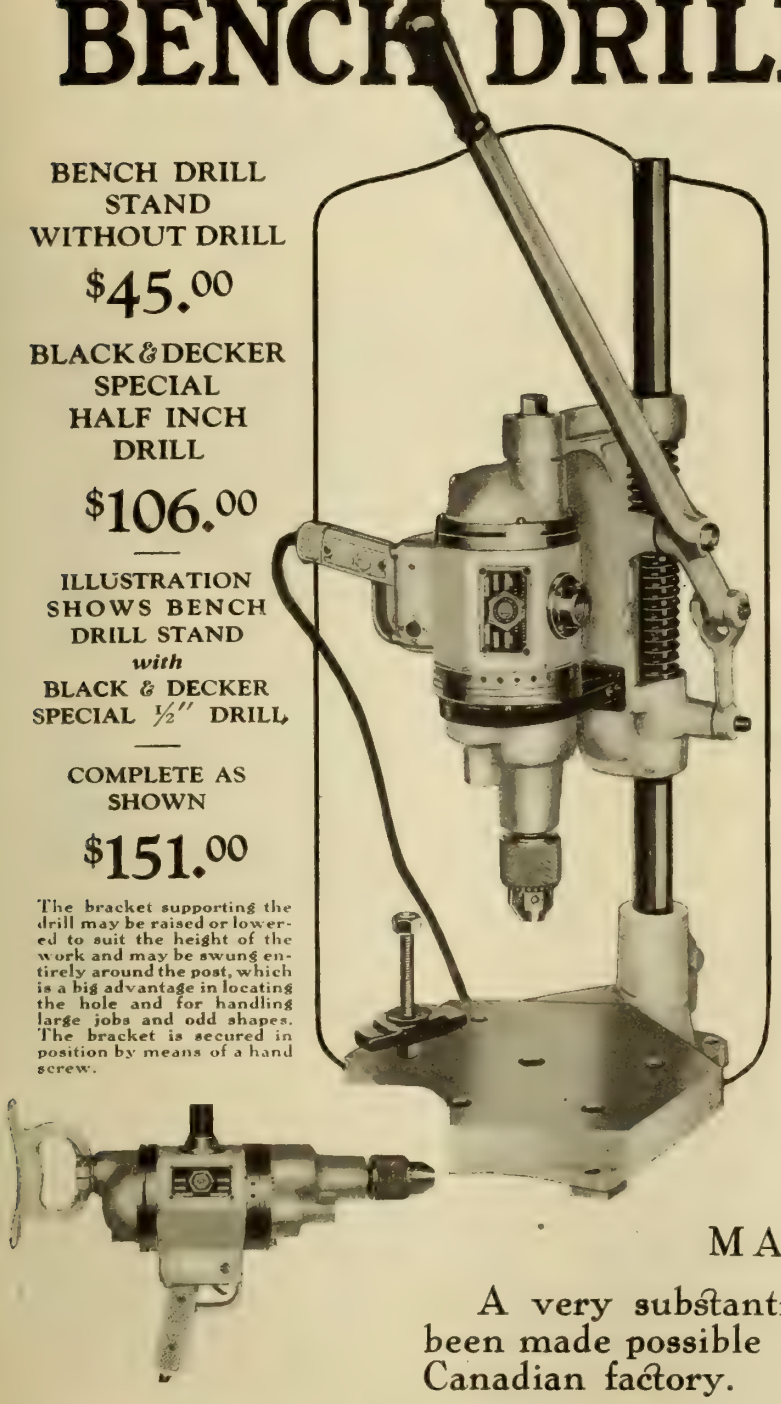
$106.00

ILLUSTRATION SHOWS BENCH DRILL STAND *with* BLACK & DECKER SPECIAL ½" DRILL,

COMPLETE AS SHOWN

$151.00

The bracket supporting the drill may be raised or lowered to suit the height of the work and may be swung entirely around the post, which is a big advantage in locating the hole and for handling large jobs and odd shapes. The bracket is secured in position by means of a hand screw.



YOU can always tell a good mechanic by his tools. He never buys inferior tools because they are cheap, if he can avoid it. But if he is a good business man as well as a good mechanic he guards against unnecessary expenditures.

In most shops a portable electric drill is absolutely indispensable and a drill press often necessary. Good mechanics everywhere are using Black & Decker Portable Electric Drills; and to make it possible for them to have the advantages of a drill press at minimum expense we have produced the Black & Decker Bench Drill Stand.

The Black & Decker Portable Electric Drill can be mounted in this stand in a few seconds and dismounted just as readily. The Stand sells for only a fraction of what it would cost to install a drill press.

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MADE IN CANADA

A very substantial reduction in prices has been made possible by the establishment of our Canadian factory.

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This is the new Black & Decker Special Half Inch Drill, which has created such a sensation in the trade by reason of the fact that it combines Black & Decker quality and an exceptionally low price.

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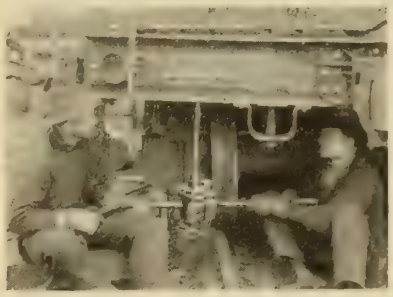
A. J. HOPKINS, Manager

Miniature catalogue will be supplied on request

DOING IT PNEUMATICALLY WITH Thor PNEUMATIC TOOLS



Thor Piston Air Drill reaming end sills on steel car

THE virtue of a pneumatic tool rests in the reputation of the Maker. *Thor* Pneumatics are good tools. Perfection is the creative standard of the specialists who make them.

DO IT PNEUMATICALLY WITH THOR

Thor No. 60 Pneumatic Riveting Hammer driving 1⅛" rivets on fore foot of ship

Thor Close Corner Pneumatic Drill at work in a tight place

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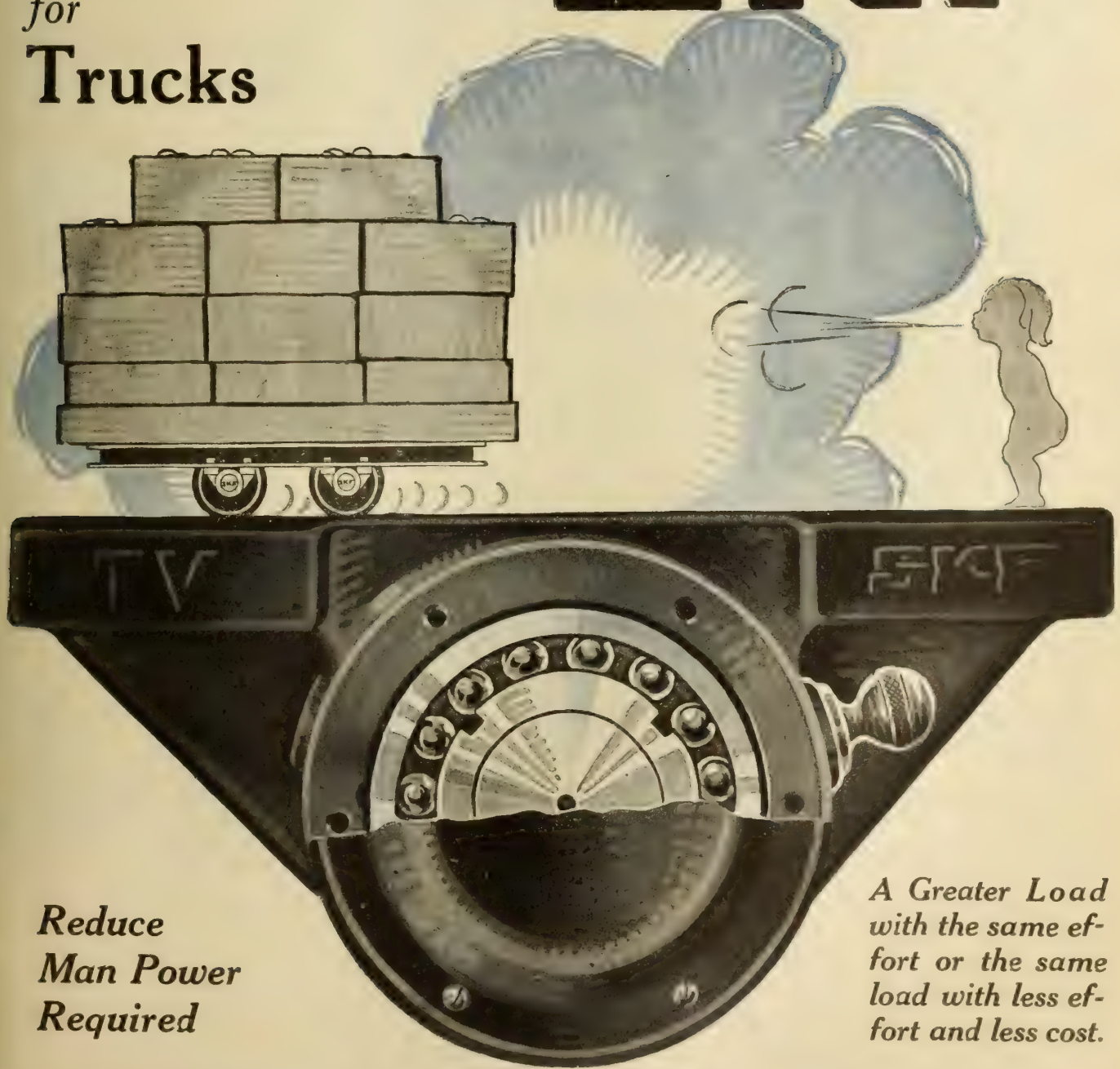
CANADIAN MACHINERY
AND MANUFACTURING NEWS

Vol. XXVIII. No. 14 | Published Weekly by the MacLean Publishing Company, Limited, Toronto, Ont. | Oct. 5, 1922 | $4.00 a Year Subscription Price

READ AND PASS TO	Check	See Page	READ AND PASS TO	Check	See Page

Ball Bearings *for* Trucks

SKF



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A Greater Load with the same effort or the same load with less effort and less cost.

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"P.M.S" BELTING

This remarkably efficient belting offers many convincing reasons why it should be adopted in your plant.

The troublesome effects of heat, cold and moisture, so often associated with the use of ordinary beltings, practically disappear where "P.M.S" is used. This reliable belting also offers better adhesion to the pulleys, even pliability and great strength. It delivers the maximum volume of the power which costs so much to develop. "P.M.S" will serve you faithfully —give it a trial.

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Laboratory Accuracy at a Toolroom Price

A TRIAL of Hoke Gages under your own conditions will convince you that our claims for these blocks are justified. You take no risk —the Pratt & Whitney guarantee is broad enough to assure satisfaction. The price permits the use of Hoke Blocks in every-day toolroom work. A reference set laid away in the safe is not earning for you what it should.

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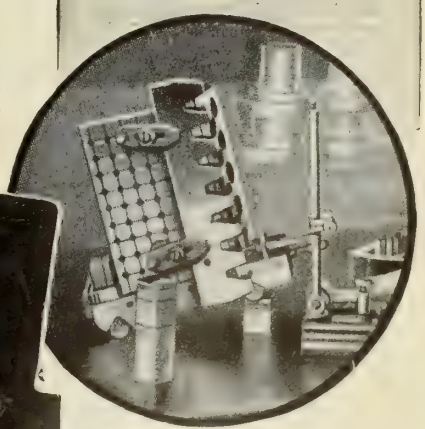

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Williams' perfectly balanced Hammers will grip the **body** of a nail, and pull it, head and all, clear through a plank. All nails are trailers to Williams' hammers.

Heads on or heads off, for drive or pull, Williams' Superior Drop-Forged Hammers are the bosses in the nail world. Good workmen want them because they fit the hand, are perfectly balanced and are good all through.

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C N C

CANADIAN NATIONAL CARBON CO. LIMITED

TORONTO - CANADA

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For prices, etc., write

Diamond State Fibre Company

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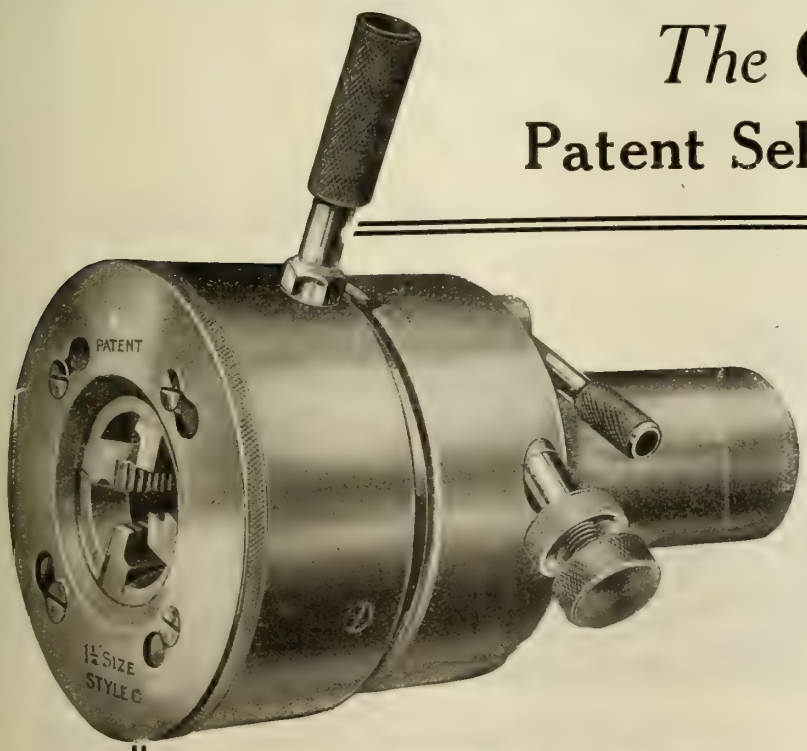

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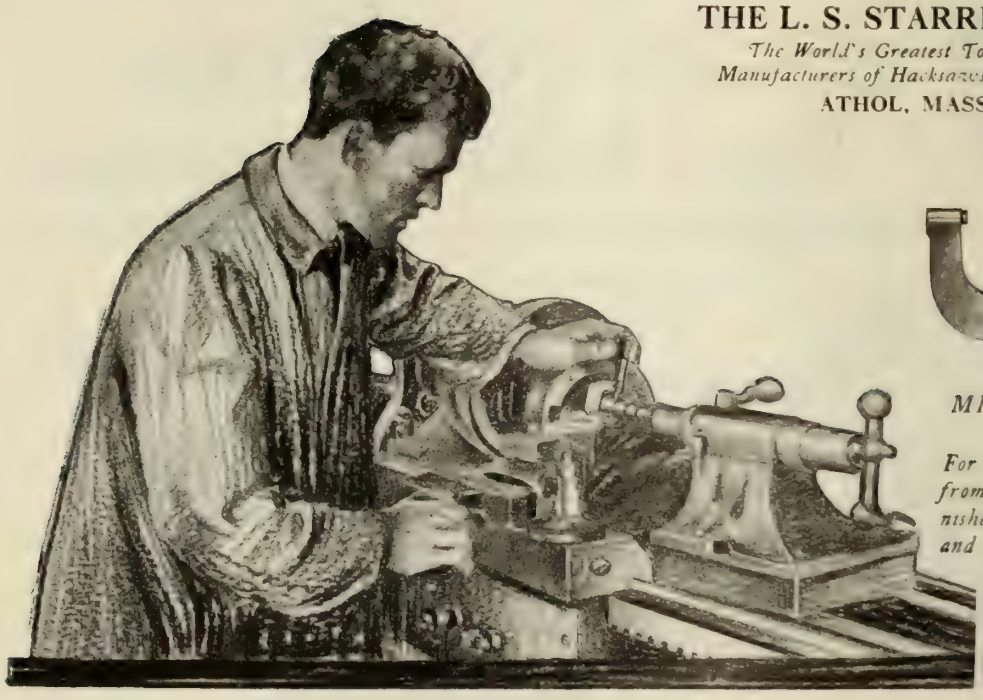
Write for Catalog No. 22"3" and the Supplement describing the new Starrett Tools.

THE L. S. STARRETT CO.
The World's Greatest Toolmakers
Manufacturers of Hacksaws Unexcelled
ATHOL, MASS.



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For measurement by thousandths from one inch to two inches. Furnished with lock nut, ratchet stop and one inch test gage.

42-439

Use Starrett Tools

A Real Money-Saving Opportunity Is Offered to You by Dominion Oxygen Service

A SCHEDULE of rock-bottom prices based on consumer's consumption.

Ample stocks of both Dominion Oxygen and Prest-O-Lite Dissolved Acetylene always ready to ship from ten centrally-located warehouses—saving freight charges.

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Modern, light-weight, safe cylinders with improved leak-proof valves.

A spirit of friendly co-operation with customers which effects economies by use of oxygen and acetylene.

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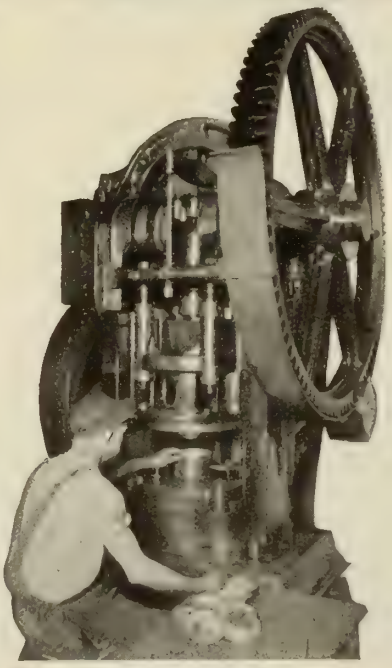
BARNES CANADIAN SPRINGS
STEEL
HAMILTON, ONTARIO
CANADA

Precision Springs

of Highest Grade Materials. Made to Your Specifications.



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In Service 37 Years

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No. 318

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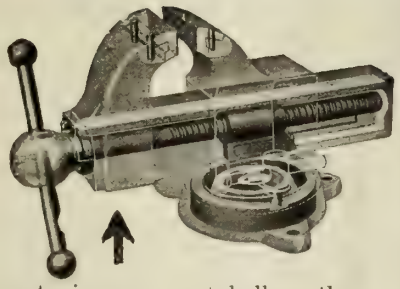
See that SOLID Under-portion?



RIGHT where most vises are cast hollow, the Parker is cast SOLID. This is made possible by placing a saddle-shaped collar on the forward end of the slide, which permits the screw to be easily removed. Parker Vises are the result of an intimate knowledge of the workman's daily problems. Seventy sizes and a style for every trade or shop.

Send for new Catalog No. 57-C.

The Charles Parker Co., *Master Vise Makers*
MERIDEN, CONN., U. S. A.

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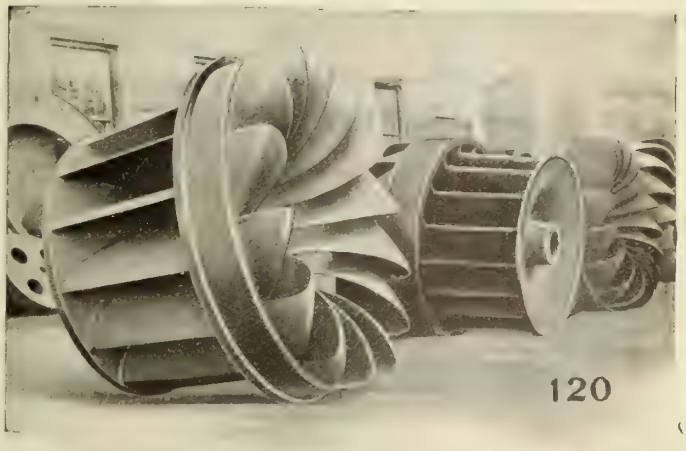
Grip Like a Grizzly

WATER POWER PLANT MACHINERY



Four 49 inch runners, part of equipment for a twin setting of a double vertical unit supplied the Seymour Power Co., of Campbellford.

The Wm. Kennedy & Sons, Limited
OWEN SOUND ONTARIO.

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M. B. Saunders, 8 Silver Street, Cobalt, Phone, Cobalt 153.
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Three Blind Holes Every Nine Seconds

With

"THE PROCUNIER" Safety Tapping Attachment

This record is regular production on cast iron gear covers. The blind holes are tapped to ⅝" deep with a ⅜" Standard Tap with "THE PROCUNIER" Safety Tapping Attachment.

Neat, compact and simple to operate, "THE PROCUNIER" Safety Tapping Attachment enables the operator to use the bottom of the hole for a stop. No danger of broken taps: directly the tap hits bottom, the Safety Friction slips.

Reversing at twice its forward speed increases production.

WILLIAM L. PROCUNIER · THE PROCUNIER LINE · CHICAGO, ILL.

Send for circulars—let us give you some further examples of "The Procunier" Tapping Service.

WILLIAM L. PROCUNIER
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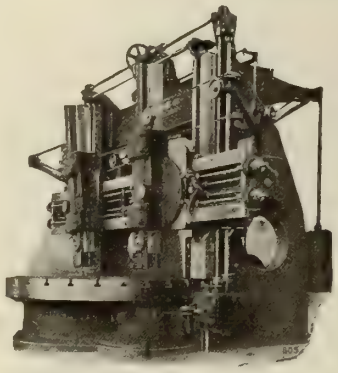
ONTARIO DISTRIBUTOR: H. A. Harrison, 220 King St. West, Toronto, Ontario

THE JOHNSON FRICTION CLUTCH

IS USED ON THE

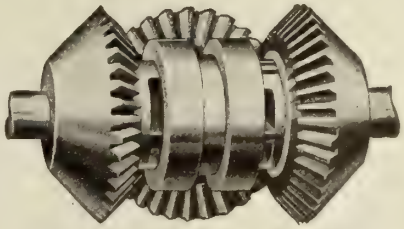
BETTS DOUBLE DRIVE BORING AND TURNING MILL



A double clutch in a nest of bevel gears in the gear feed boxes on both sides of the machine. Similar to clutch shown in cut of bevel gears, below.

Courtesy: The Betts Machine Co., Rochester, N. Y.

Your clutch problems can be readily handled in our engineering department by competent clutch engineers with years of experience.



Double Clutch in Nest of Bevel Gears
Write for "Yellow Friction Control" Catalog.

Put it up to them

THE CARLYLE JOHNSON MACHINE CO. MANCHESTER, CONN.

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TURRET LATHES
Hand Operated
For Chucking and Bar Work
AUTOMATIC TURRET LATHES
For Chucking Work
VERTICAL BORING and TURNING MILLS
UNIVERSAL TOOL GRINDERS
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REAMERS, "SOLID ADJUSTABLE"
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With Adjustable Cutters
PERIODOGRAPH
For Time Recording in Factories
Separate Catalogs on each Product
Send for the ones you want

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FOR STEAM AND ELECTRIC RAILWAYS OF ANY STANDARD SECTION

MANGANESE-STEEL SPECIAL WORK

Frogs, Diamond Crossings, Crosses, Switches, Mates and Complete Intersections to meet any traffic requirements.

Makers of Balkwill Articulated Manganese-Steel Crossings

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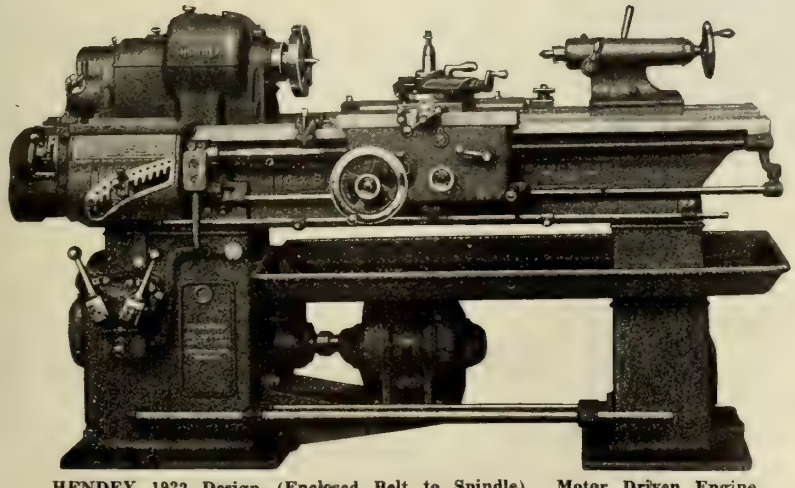
HENDEY



HENDEY 1922 Design (Enclosed Belt to Spindle). Motor Driven Engine Lathe.

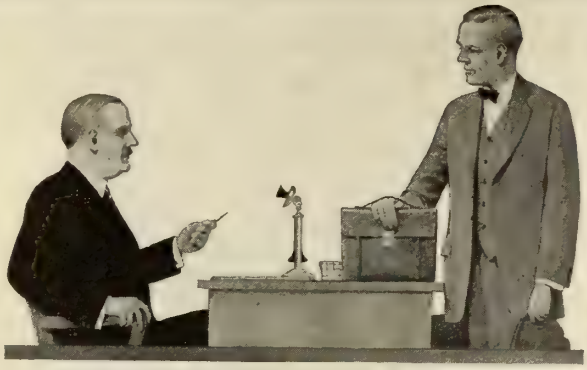
The same long life, power, rigidity, ease of operation and wide working range, characteristic of all Hendey Lathes, are exemplified in this Hendey (Motor Driven) 1922 Design.

Power is applied to spindle through a wide faced belt with pull on spindle downward; this counteracts the upward thrust of tool. There are nine speed changes to belt with speed change mechanism carried in an oil tight box mounted in cabinet leg. Lathe head is back geared and gives 18 spindle speeds. Motor is constant speed and drives a reducing gear unit, which in turn transmits power to speed gear box.

The Hendey Machine Co.

Torrington Connecticut

Canadian Agents : A. R. Williams Machinery Co., Toronto, Montreal, St. John, Halifax, Winnipeg and Vancouver; Williams & Wilson, Montreal.



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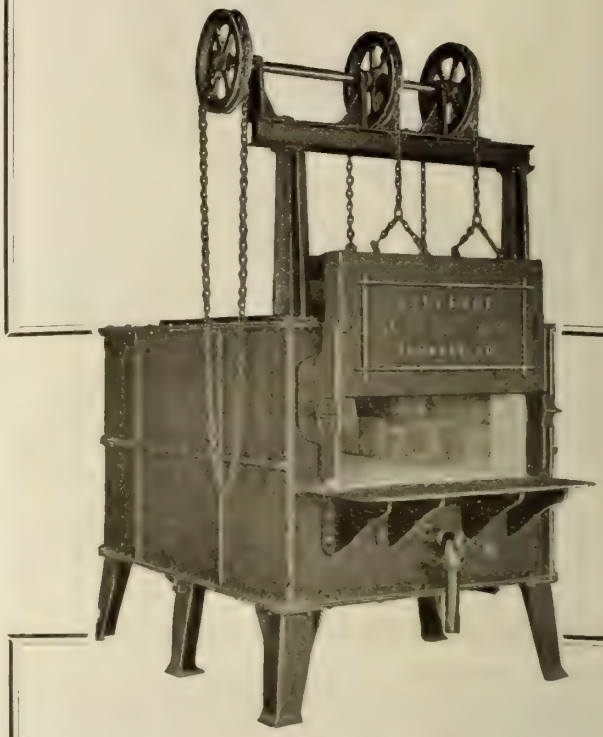
FURNACES
for every industrial use



The Solution

to your annealing and heat treating problems lies in the use of efficient economical Bellevue Furnaces.

The flame is easily controlled—attains complete combustion—heats the entire furnace quickly and uniformly—but does not come in contact with the material.

Sturdily built and reinforced, also properly lined with the highest grade heat resisting bricks—Bellevue Furnaces give excellent results.

Are you contemplating furnace installations—gas or oil burning?

We will gladly give you full information

Bellevue Industrial Furnace Co.

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DETROIT, MICH.

Representatives in Canada
CHAS. A. STRELINGER COMPANY, WINDSOR
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BROWN-BOGGS

B B

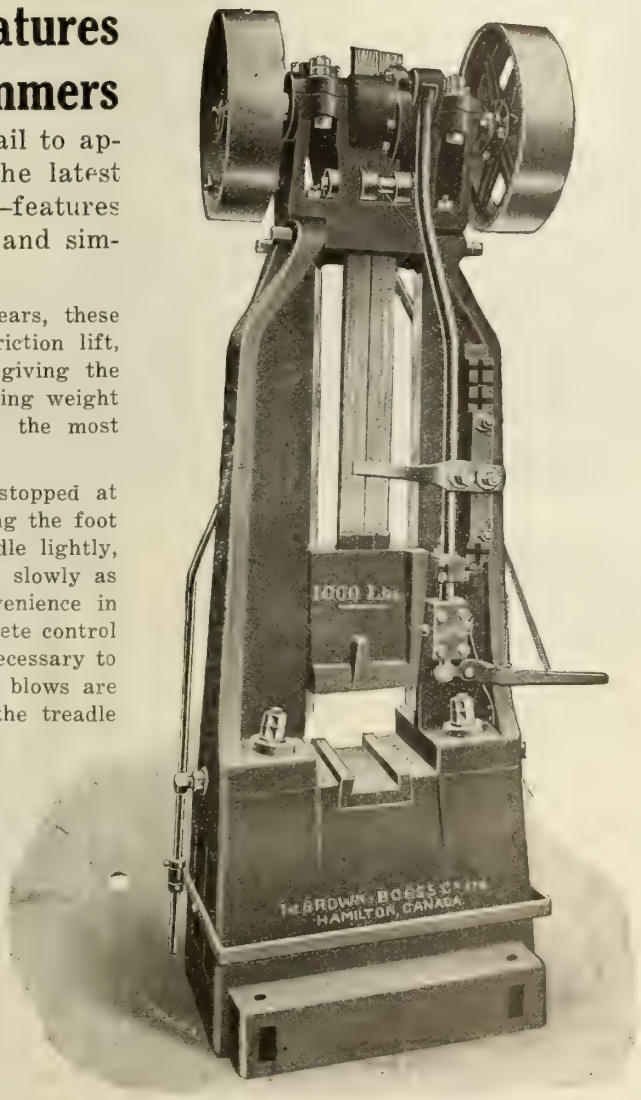
Here's Just a few Features of the "B-B" Drop Hammers

As a practical man you cannot fail to appreciate the many features of the latest type of "B-B" Drop Hammers—features that combine strength, accuracy and simplicity. Here are but a few:

In place of the old-fashioned, noisy gears, these Hammers are equipped with a roller friction lift, which, because of its effectiveness in giving the closest possible approach to the full falling weight of the hammer, is acknowledged to be the most efficient in use.

The Hammer can be almost instantly stopped at any point of the down stroke by releasing the foot treadle; or, by depressing the foot treadle lightly, the hammer may be made to descend as slowly as may be desired. This is of great convenience in setting dies and gives the operator complete control of the machine at all times. It is only necessary to keep the treadle depressed if continuous blows are wanted. If the foot is removed from the treadle as soon as the blow is struck, the hammer will return to its original position, which can be at any point desired; all that is necessary to regulate the drop of the hammer is simply to set the collar on the upright shaft at the height wanted.

Our catalogues illustrating these and other "B-B" lines such as Presses, Dies, Shears, Punches, Canners' Processing Machinery, Special Machinery, etc., will prove of interest to all practical men. Write us.



1,000 lb. Board Lift Drop Hammer

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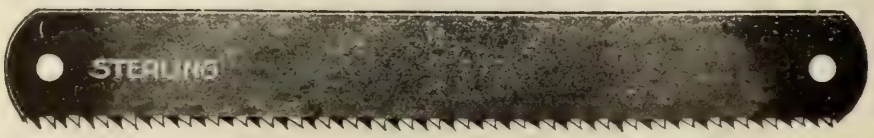
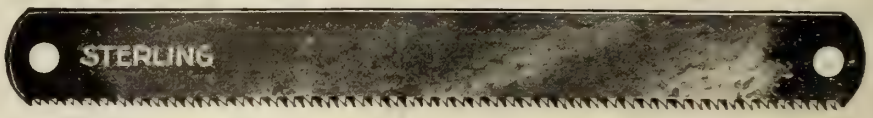


Guarantee satisfaction. A trial will convince you of their superiority.

Insist on securing the "STERLING" Brand.



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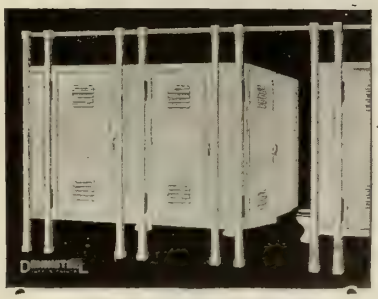

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Steel Lavatory Compartments

For Schools, Factories and Public Buildings.
"Hygienic, Non-Markable, Fireproof."

These compartments can be finished to harmonize with the most elaborate fixtures and surroundings.

"ARMCO"
Rust-Resisting Iron is used exclusively for "Dennisteel" Lavatory Compartments and Showers.

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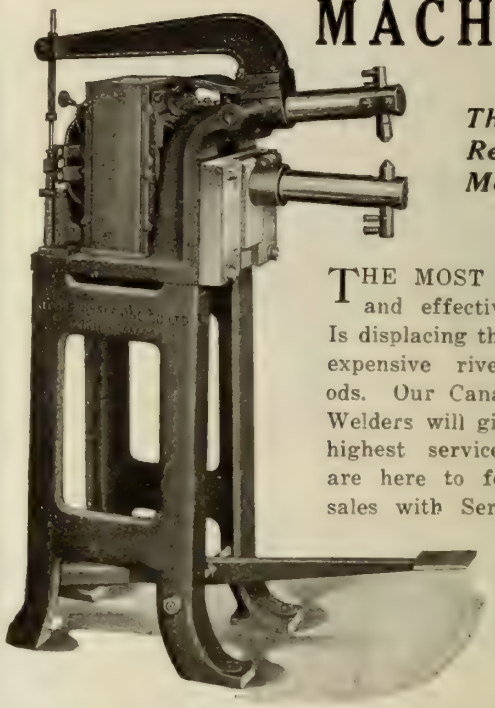

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Illustration Shows our standard Spot Welder, adaptable for all classes of Spot and Lap welding up to ⅜ in. thick

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are the
Largest Manufacturers in the world
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High Speed Silent Chains

The superiority of Morse Rocker Joint Silent Chain has never been seriously questioned.
They speed up production, cut belt expense and overtime wages.

Catalogue Free.

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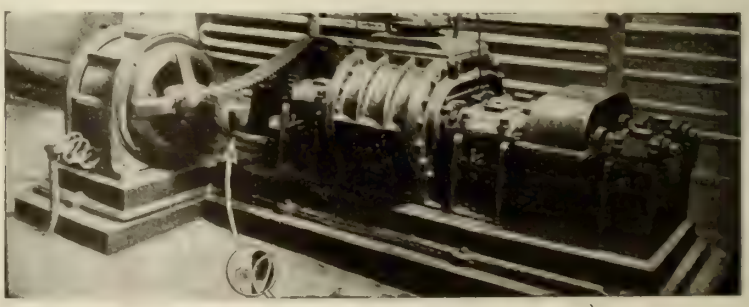

25 H.P. Morse Silent Chain to Positive Blower.

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You can put your load-moving and lifting on a surprisingly low cost basis

AN electric hoist for you—power lifting with its consequent economy in time and labor.

"Just the method we have long needed. We are moving and lifting our loads for less than we ever anticipated"—that's the consensus of opinion of the hundreds now using *LiftAbouts.*

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Incorporated in the *LiftAbout* are the same features that have made "Shepards" so well known and so widely used.

½ and 1 ton capacities for alternating or direct current.

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"Shepard" also builds electric cranes and hoists in capacities to 30 tons.

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SHEPARD
ELECTRIC CRANES & HOISTS

"CANADIAN"
HAND POWER PUNCHES AND SHEARS

All Canadian hand power punches and Shears are made with "Armor Plate" frames.

This frame construction consists of a rolled steel plate having a tensile strength 7½ times that of cast iron. This strength permits of a machine much lighter and more compact than is possible with either cast iron or cast steel.

Let us know your punching and shearing requirements. We have an "Armor Plate" machine for the service. Remember our Armor Plate line comprises power operated machines as well as hand power.

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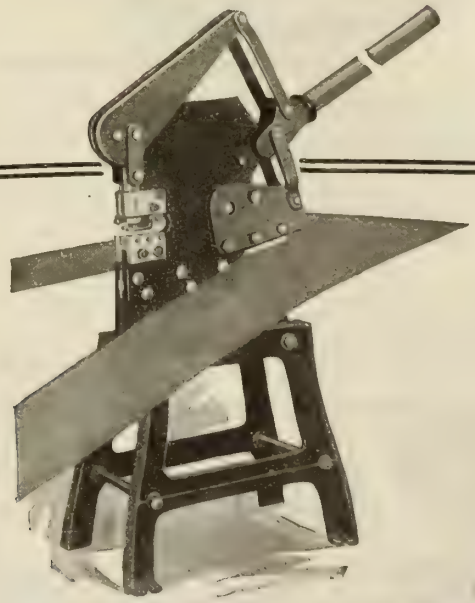

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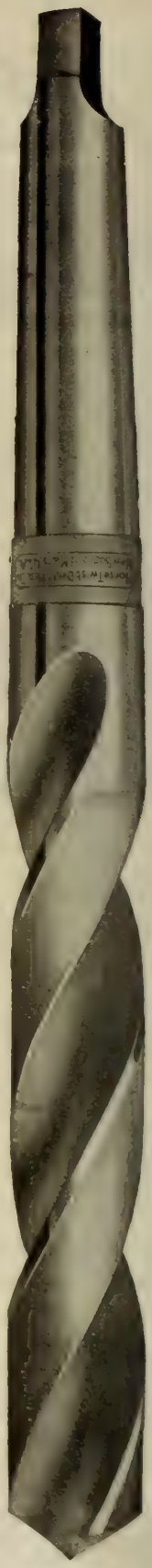
The Best High Speed Drill →

is the one that is the most economical in the long run. Try the "Morse"



Morse Twist Drill & Machine Co.
New Bedford, Mass., U.S.A.

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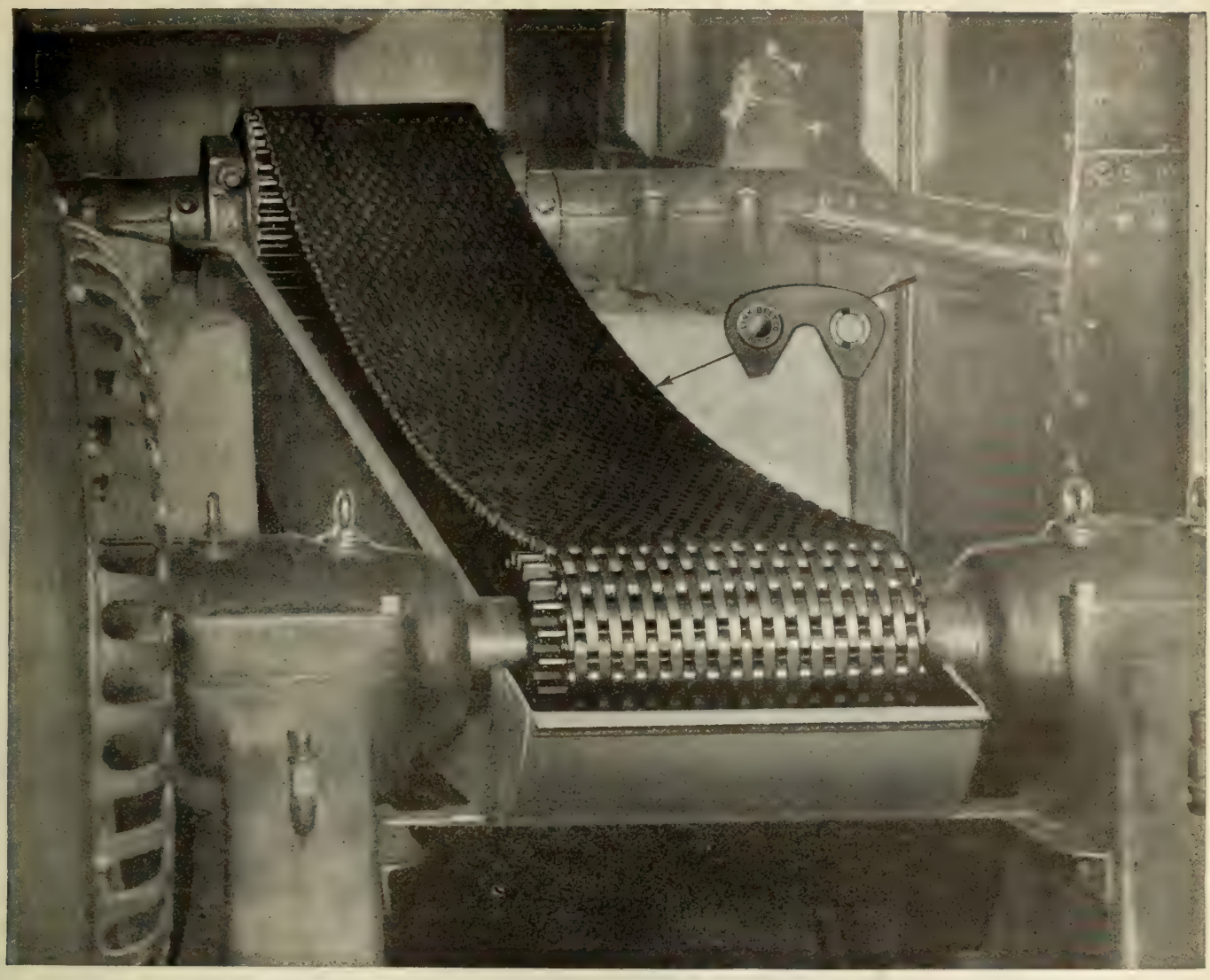

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Flexible as a Belt —
Positive as a Gear—
More Efficient than Either.

A Link-Belt Silent Chain Drive is the most positive mode of power transmission yet devised. The driving and driven shafts must revolve as one. For there is no slippage as with belts—no "play" as with gears. And there is no loss of power—no loss of time due to broken belts or gear teeth.

Chain your power to your driven machine. It's the most economical, positive and efficient method of power transmission. Our 128 page data book No. 125 tells why. Send for a copy. Ask our engineers to help you solve your power transmission problems.

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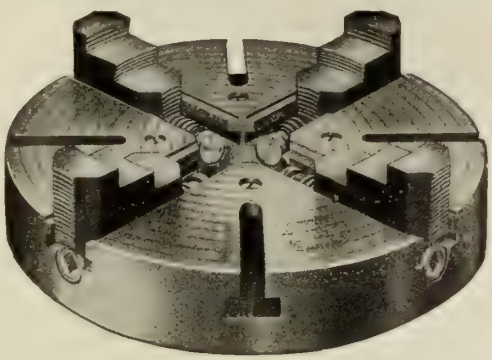
INDEPENDENT CHUCKS

are not an experiment—they have come to stay. They are a necessity with the modern machinery and high-speed steel cutting tools.



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are well designed and have all the elements of strength and durability for which they are designed. We make other types in steel also, including the Geared Scroll Chucks and the Geared Scroll Combination—all designed for heavy work and hard usage.

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Made in Canada

Hiram Walker & Sons Metal Products

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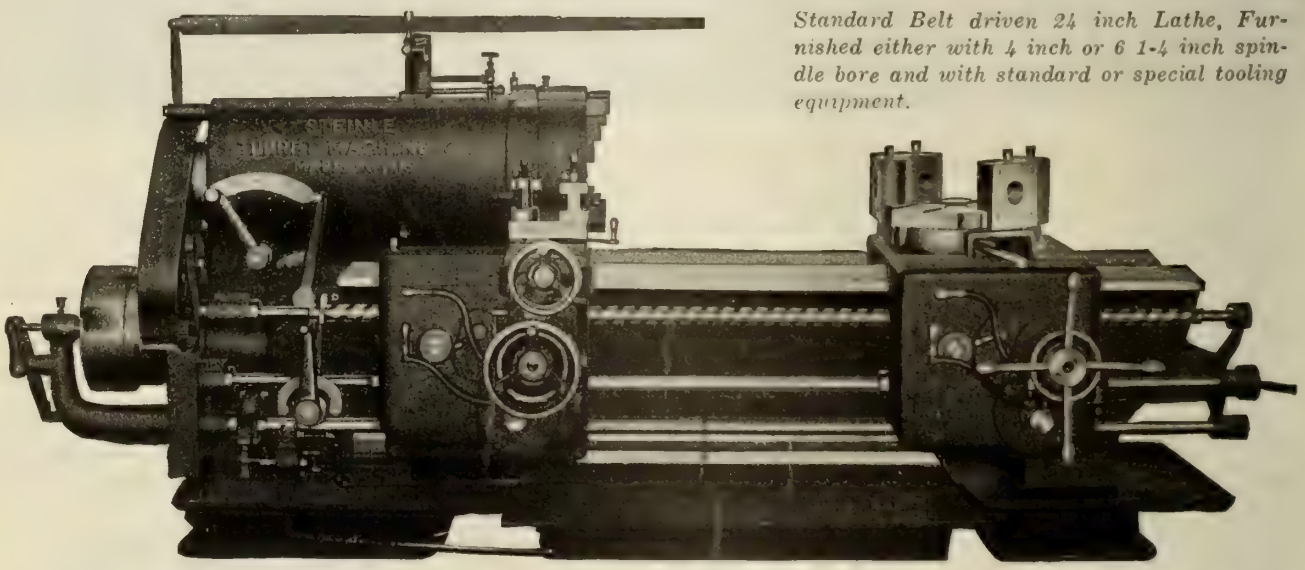

Standard Belt driven 24 inch Lathe, Furnished either with 4 inch or 6 1-4 inch spindle bore and with standard or special tooling equipment.

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Send us drawings of your work so that our Engineering Department can estimate STEINLE production, or ask to have a qualified representative call upon you to determine what work can be produced to advantage on our machines.

STEINLE TURRET MACHINE COMPANY

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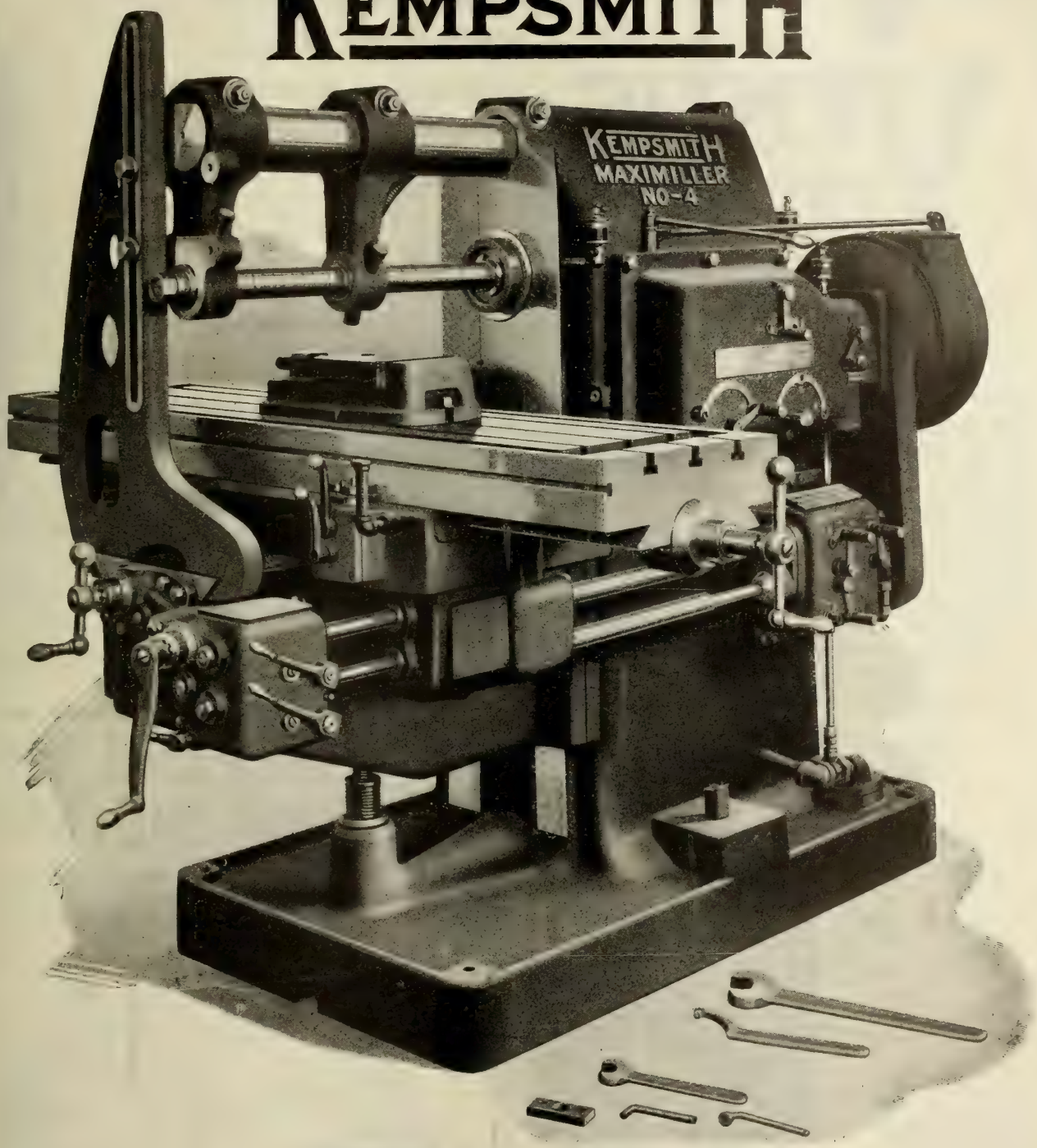

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A veritable maximum in milling machines embracing all Kempsmith patented features, permitting a maximum in production and efficiency. Write for particulars as to this machine.

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OF the same superlative quality that has made the VENUS Pencil famous; soft, gray rubber that erases *clean* without a smudge.

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RAYMOND Springs are made to order from customers' specifications — they are specially designed and "built for the job." Raymond Springs, however, cost no more than ordinary springs.

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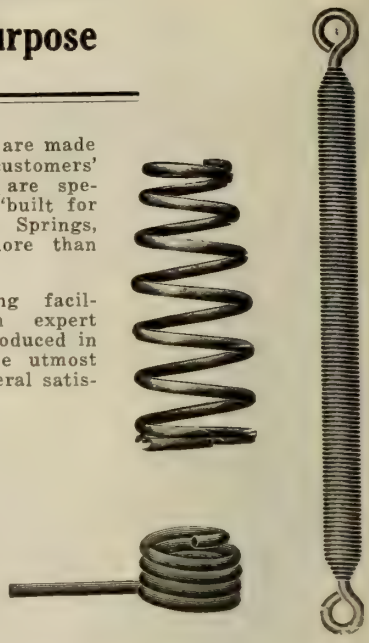

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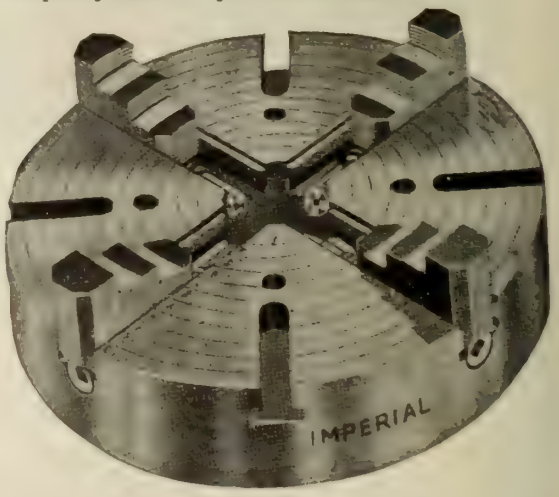
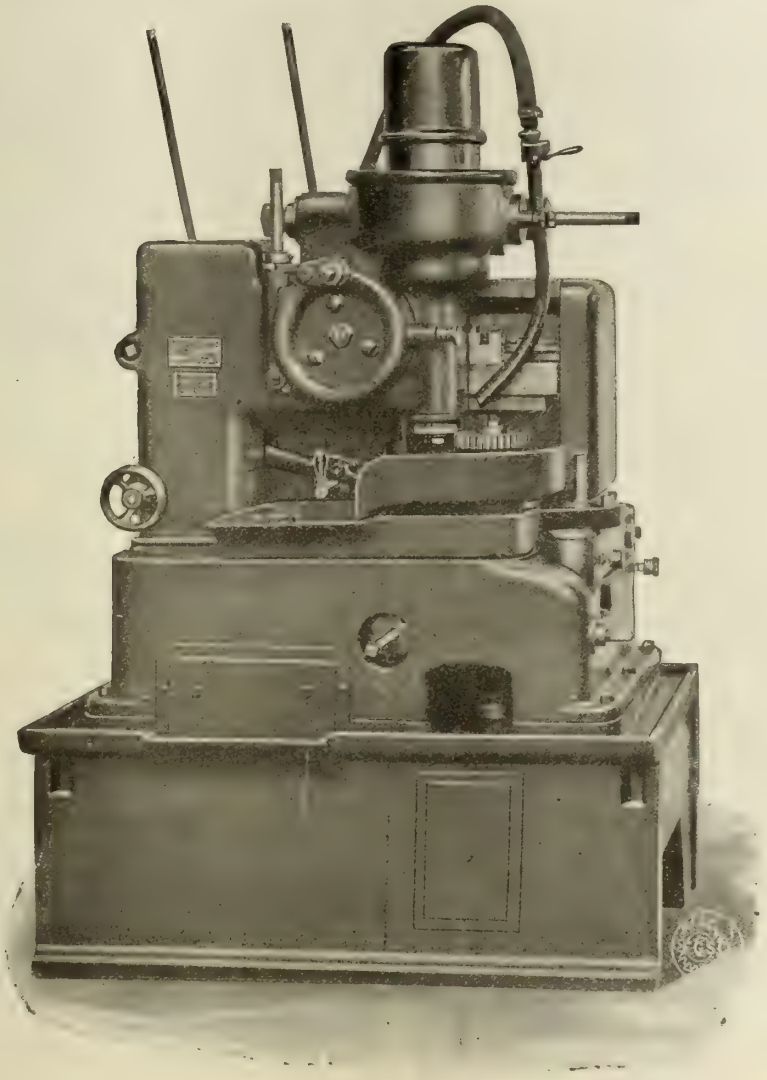
Highly Endorsed by Canada's Best Manufacturers

Sturdy long-wearing "Made-in-Canada" Chucks that are making good everywhere. Specify them in your next order.



Ker & Goodwin Machinery Co. LIMITED
BRANTFORD, Ont.

CUT GEAR COSTS
WITH THE
New Production Gear Shaper



The new production Gear Shaper, illustrated, has been designed to cut gear costs. It incorporates every feature necessary in a gear cutting machine to obtain this result, and still one of the outstanding features of the Gear Shaper principle—accuracy—has been maintained.
It is designed to cut one gear at a time and at a speed which eclipses all other methods.
All operating levers are at the front of the machine, permitting a number to be bolted together and operated as a unit, one 6 H.P. motor furnishing ample power for 10 machines
It incorporates to the fullest extent the three principal requirements of production—high speed, accuracy and simplicity of operation.
See illustrated article in all technical magazines
Send for our booklet, "A New Development in Gear Cutting," which has been prepared for the benefit of Engineers and Production Managers interested in the best gear cutting equipment available.

Write for your copy now.

THE FELLOWS GEAR SHAPER COMPANY,
SPRINGFIELD, VERMONT, U.S.A.

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The Hammer With The Human Stroke

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Heads 'em tight or loose, flush, countersunk, or finishes heads any shape desired, and at the rate of:
A rivet a second, sizes up to 3/16".
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And on special order we build machines to handle rivets up to 1½" with proportionate rapidity.
Built in eight sizes.
Besides riveting, the High Speed Riveting Hammer does all kinds of peining, swaging, upsetting, etc.
Send us sample assembly parts with rivets or sketch of your work,
and
Let us shoulder your riveting problems.
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Next time a tap breaks below the surface of a large casting, don't let some make-shift method of removing it injure the thread and waste half an hour of valuable production time. Instead—

Walton it Out in a Jiffy

And save the casting.

Special analysis steel fingers of the Walton Extractor drop into the flutes of the broken tap—and grip. Then a few turns of a wrench applied to the squared end of the Extractor backs out the buried tap.

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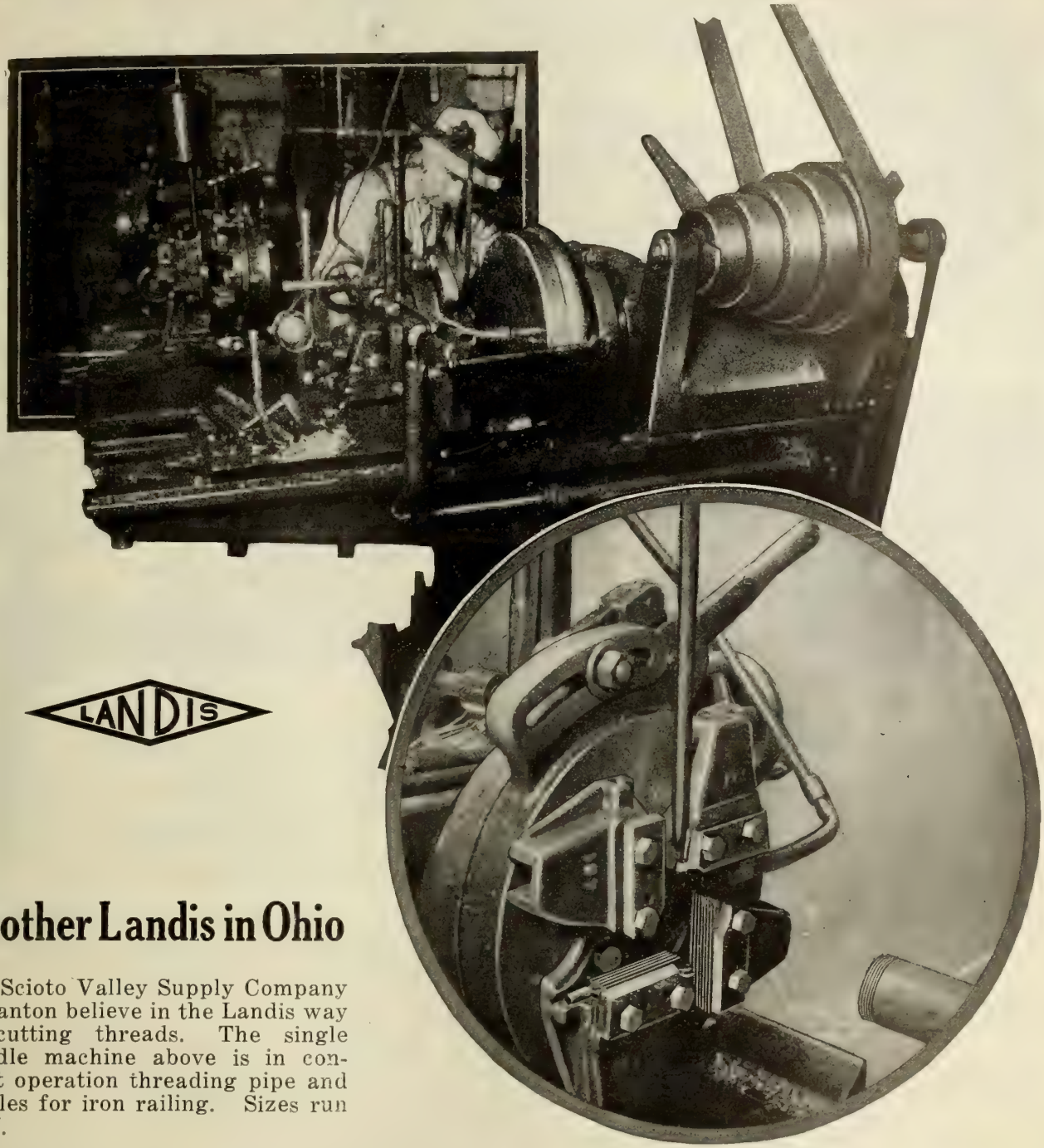

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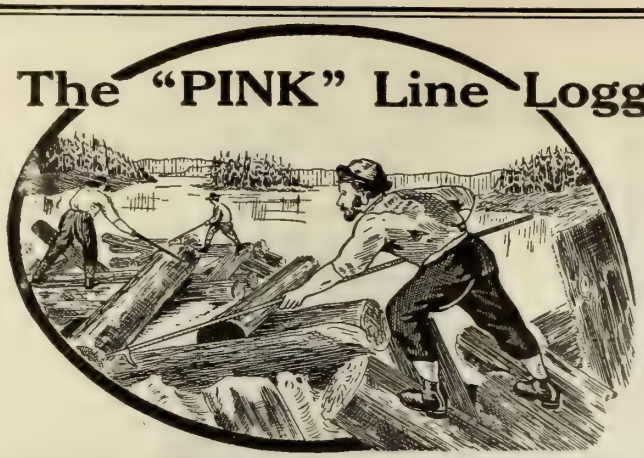

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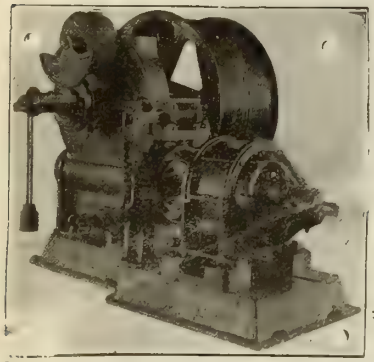

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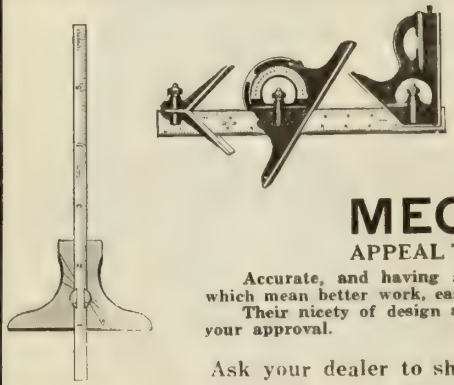

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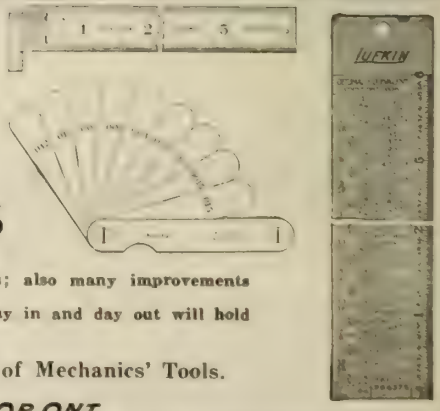

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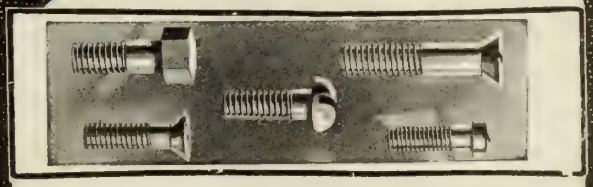

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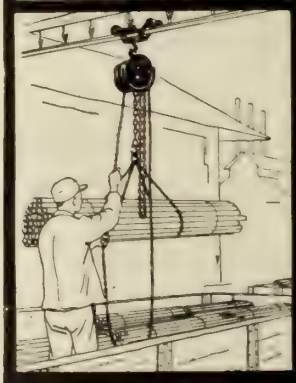

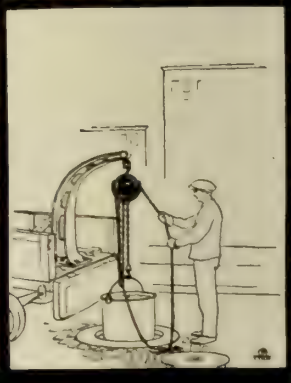

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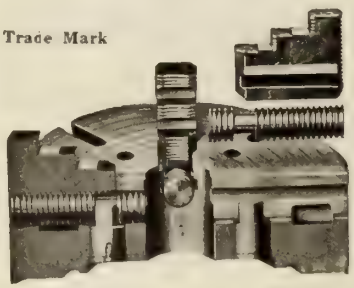

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Although the Skinner Steel Body Chuck has been in use for years, we have never known of one breaking in service. It is the heaviest, strongest Independent Chuck made.

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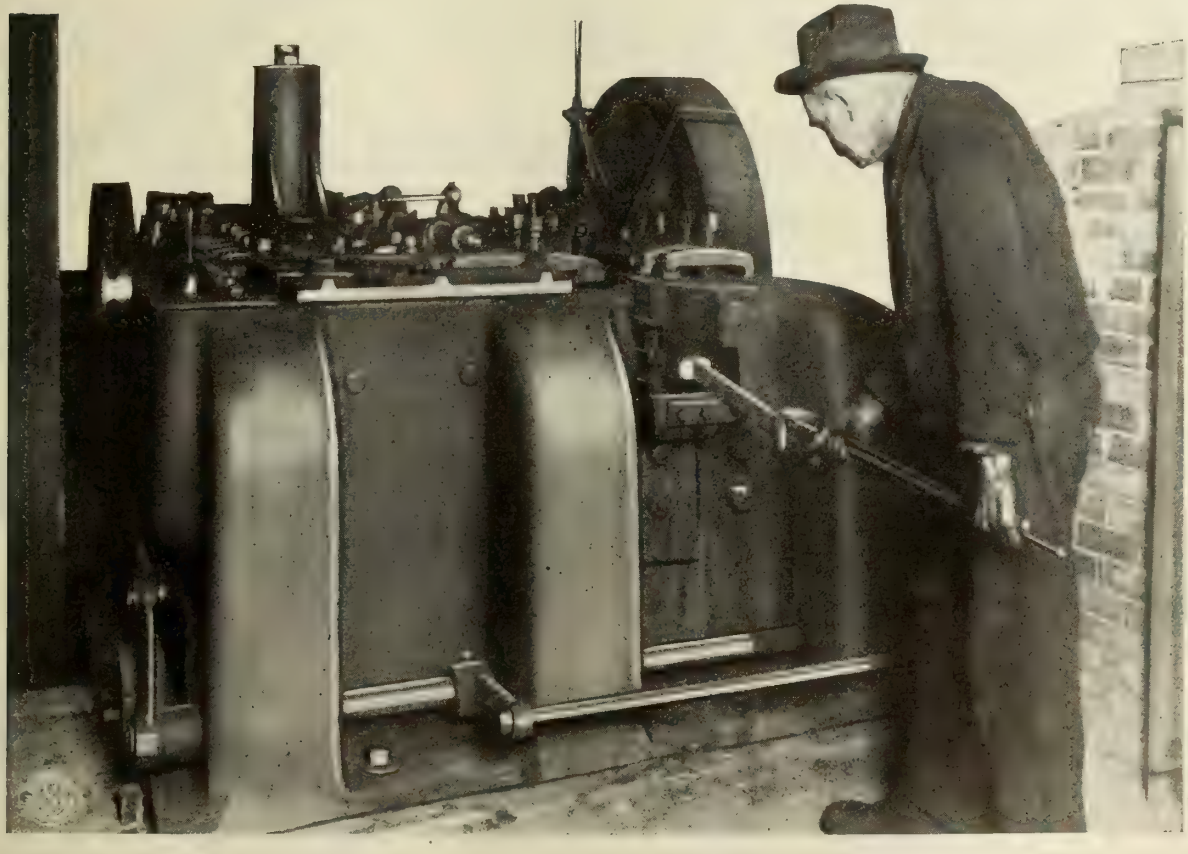
According to the costs records of a Western Pennsylvania manufacturer, the "ACME" machine in use actually saved $398.00 on its first run of a day and a half. The work in question was the making of spokes for tractor wheels besides miscellaneous contract work.



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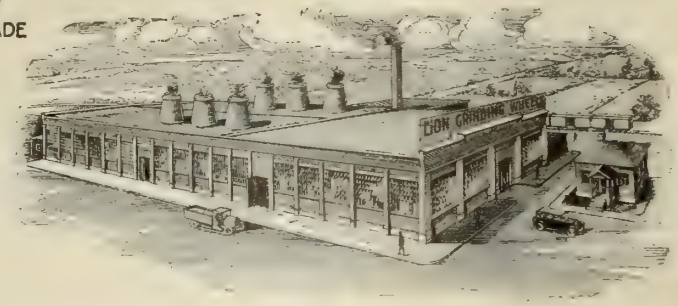

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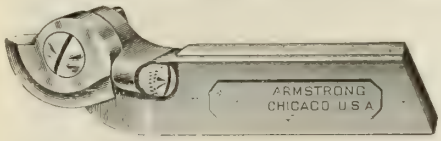

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ENSURE PERFECT WORK

A THREADING TOOL is essentially a Forming Tool and any error or inaccuracy in shape or angle in the tool point will surely be reproduced in the thread which it cuts and must result in poor fitting work. The cutters used in this Armstrong Threading Tool require grinding **on the top edge only** to sharpen, and therefore always remain true to form and of correct angle. Its use thus ensures perfect fitting threads, saves much grinding, and also dispenses entirely with forging and tempering. Furnished with either High Speed or Carbon Steel cutters.

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Double Helical Gears

for High Speed and Heavy Duty

GEAR DATA FOR YOUR NOTE BOOK
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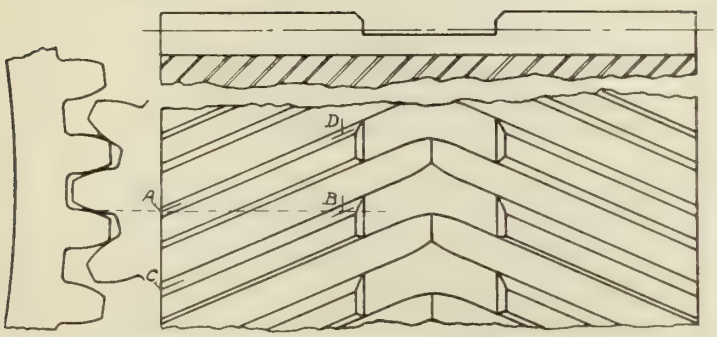

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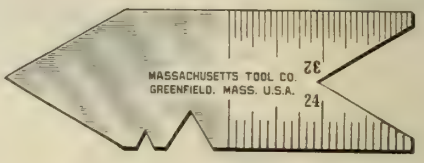

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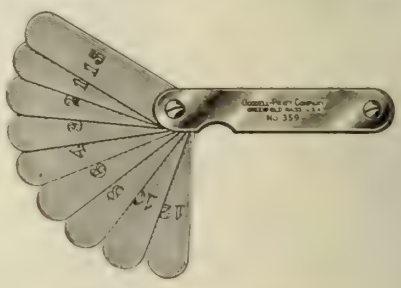
Take Center Gauges, for instance: Every Goodell-Pratt Center Gauge is made of spring tempered crucible steel, accurately ground and graduated. Each Center Gauge is lapped in the V's and tested to make sure that it is a light tight fit.

Look at Goodell-Pratt Feeder Gauges: no oversize, undersize or uneven leaves are included.



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Toolsmiths

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The American Pulley Co.
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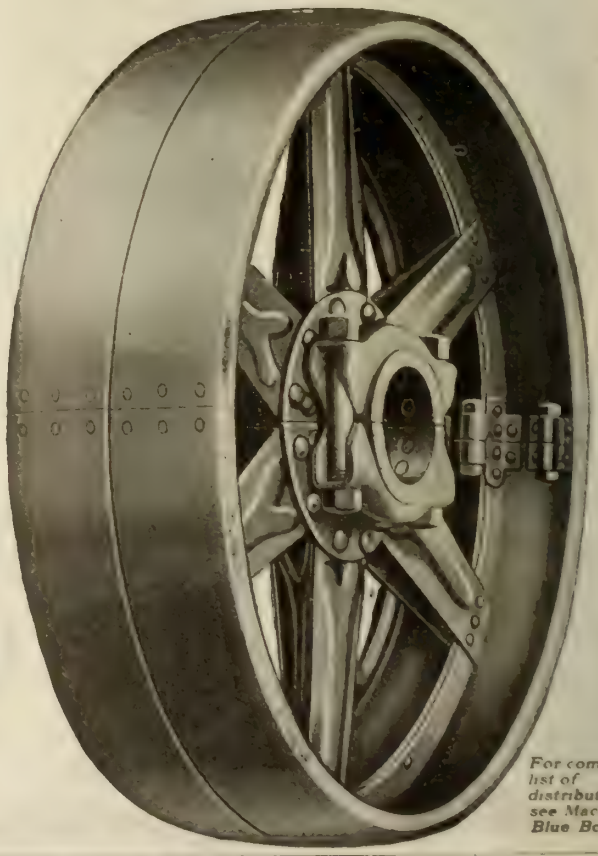

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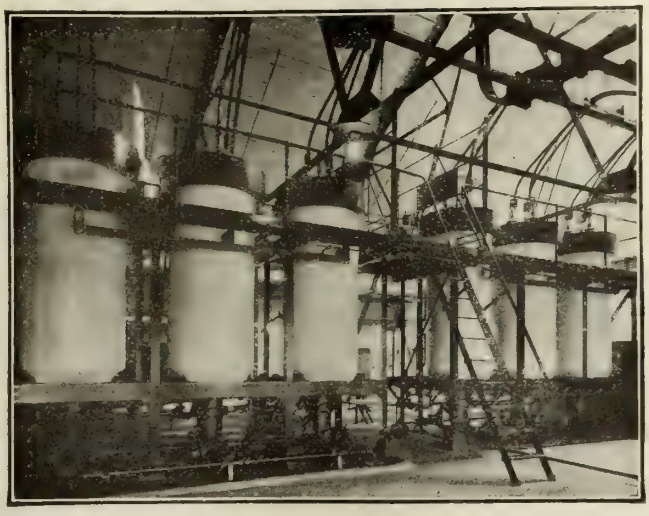

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The equipment shown in the cut was designed and built by us for the Laurentide Co., Limited, and has a capacity of 7,000 boiler horsepower. Note its compactness and simplicity. This installation has saved coal in thousands of tons, and labor in thousands of payroll hours.

We build these generators in sizes from 5 to 3,500 boiler horsepower, for pressures up to 200 lbs.; also in sizes from 5 to 75 boiler horsepower for low pressure steam heating. When desired, any of these generators may be equipped with complete automatic control.

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(M70)

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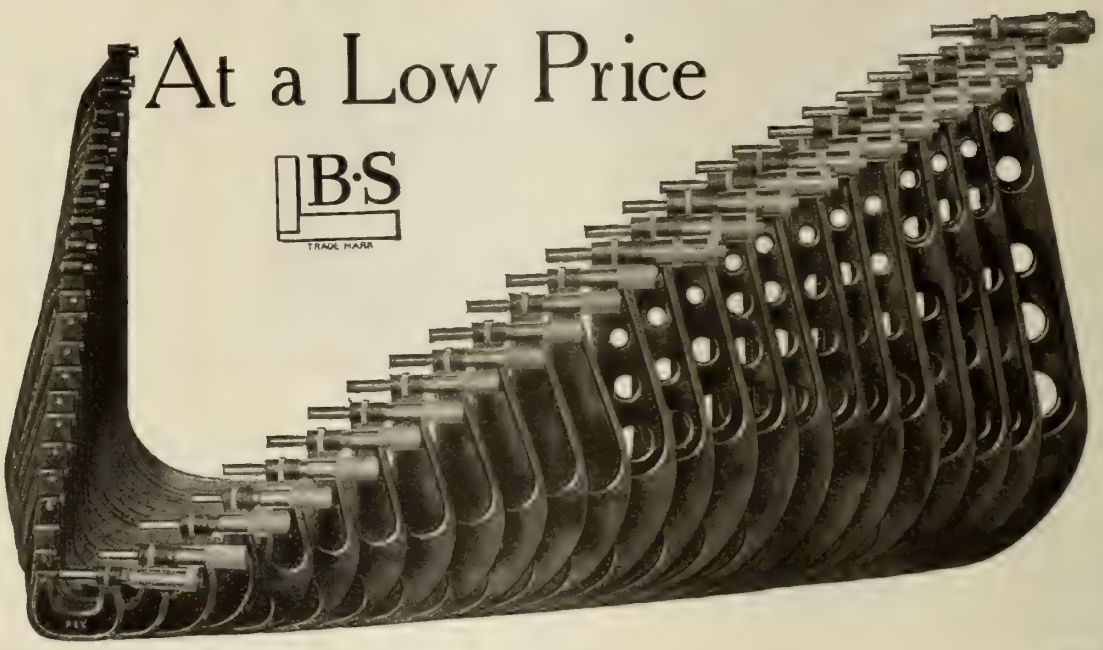

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Weeks, maybe months ago, you started looking for a set of Micrometers. You needed them then; you may need them now. A good set of Micrometers means better work and a reputation for speed and accuracy.

When you began to investigate, you found two good reasons for not buying the set you needed so badly. First of all, the high-grade tools whose accuracy met your requirements seemed a bit high-priced, and you quite properly refused to buy inferior tools. So you let the matter stand.

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CANADIAN MACHINERY
AND
MANUFACTURING NEWS

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Increasing the Efficiency of Railroad Cars

Express locomotive equipped with roller bearings and operating successfully on Swedish State railway.

By J. H. MOORE

THE QUESTION of "railway bearings" has been one of general interest among railroad executives for some time past. This question has often been asked, "Shall we stick to the regular old style bearing, or shall we install ball or roller bearings?"

Unfortunately, for the sake of progress, nothing much has been accomplished except talk by certain railways, but in other cases trials have been made with roller and ball bearings with splendid results.

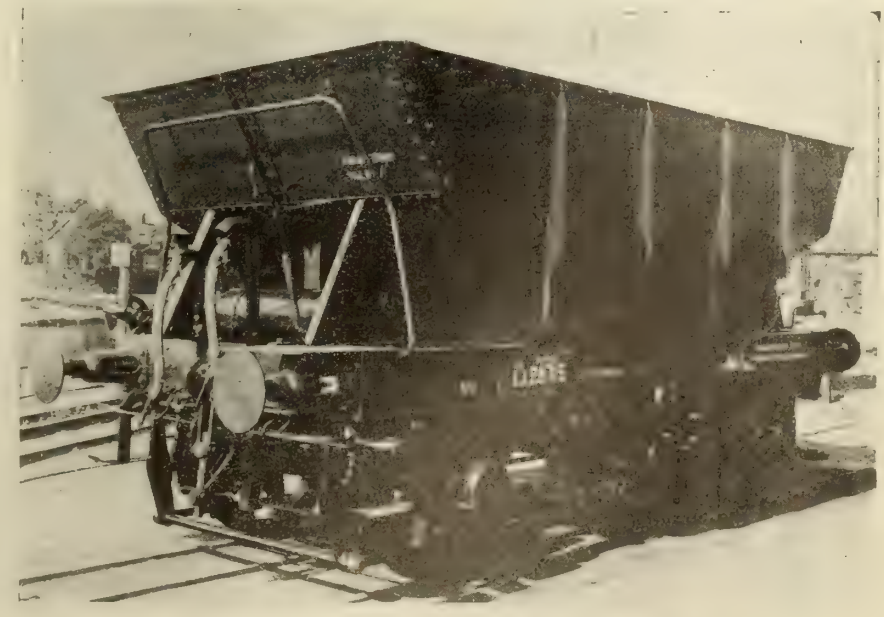
Up to the present time railway men have been cautious in condemning or upholding the use of roller bearings in place of the regular type. A few have openly stated they believed some improvement should be made, while others again have questioned the safety, durability and expense of the former type mentioned. Severe tests have been made from time to time, and now, it looks as if the doubters were soon to be silenced, because the Royal Board of Railway directors in Stockholm, Sweden, have decided to equip a large number of their cars with roller bearings. This is a very important decision, and was only arrived at after exhaustive tests, which have proved even more satisfactory than expected. In every case the applications tested have been found to fill the strictest requirements. Feeling this matter to be of vital interest to our readers we have secured details of the type of equipment to be used, also the tests made, and will take up the points in sequence.

The Tests Made

During the latter part of 1921, eight bogie cars, with altogether 32 axles in roller bearings, were put into express train service on the State railways. The journal pressure was about 5½ tons, and one spherical and one cylindrical roller bearing were used. The speed at which these cars ran was approximately 56 miles per hour while the cars covered about 124,200 miles per year. So far there have been no rejections.

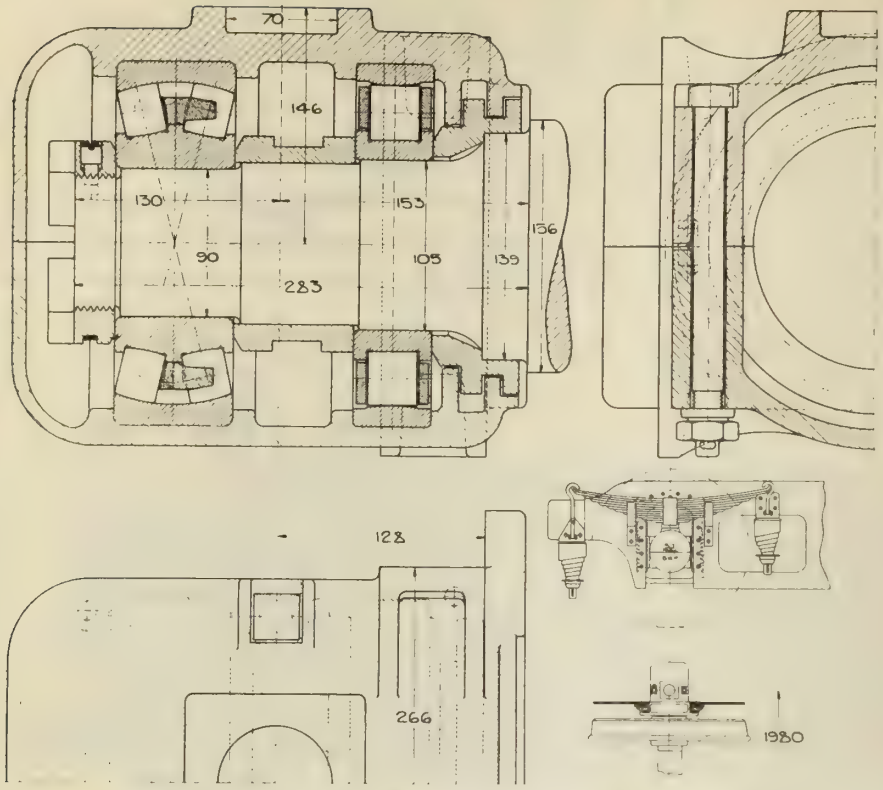
A test was also made on locomotive axles, and two of these have been running for the past two years. Each box was equipped with one spherical roller bearing, and one of the cylindrical type. The journal pressure was 6½ tons, and again there were no rejections.

Other important trials have been



Ore wagon equipped with roller bearings for Swedish State railway.

Information, photographs and drawings through the courtesy of the Canadian S.K.F. Co., Toronto. Tests mentioned were made by the parent company in Sweden, who have been making an exhaustive study of this subject for many years, and were successful in closing the important order spoken of in the article.



Sectional view showing application of roller bearing to bogie axle.

made in Sweden, the results being as follows:—Ball bearings are now in use in three bogie cars on the Bergslagarnas railway, the application being similar to that of the State railway.

On the line Gellivaare-Lulea, about 124 miles, the coal consumption for the trip with a loaded ore train consisting of 39 ball bearing wagons, and return trip with the same train but empty showed less than 10 tons. The water consumption was approximately 2,079 cub. ft. The corresponding figures for a train of only 30 cars on plain bearings were, coal consumption 10 tons, and water 2,360 cub. ft. These figures give the average for 5 round trips and show that it was possible to increase the number of wagons by about 30 per cent. with the same consumption of coal and water.

On ore traffic with electric locomotives on another line it was found that the same current consumption on the motors was registered for 30 wagons on plain bearings, as against 35 on ball bearings. In other words 17 per cent. more cars used without additional current consumption. Another coal saving test made on the Stockholm-Mjolby line, with plain and ball type of bearings showed a saving of 10 per cent. for the latter.

Two flexible axle cars equipped with two ball bearings in each box, were put into passenger train service on the Danish State Railways in 1914. The journal pressure in this case is about 5 tons, and the cars run about 186 miles per day, with a maximum speed of 56 miles per hour. Even up to present date no rejections have occurred, and the cars are still in traffic. Other trials have been made with roller bearings in Great Britain, Australia, and Czecho-Slovakia, etc., and from actual cost records it has been found that roller bearings in bogie cars usually pay for themselves in four years through the saving in coal alone.

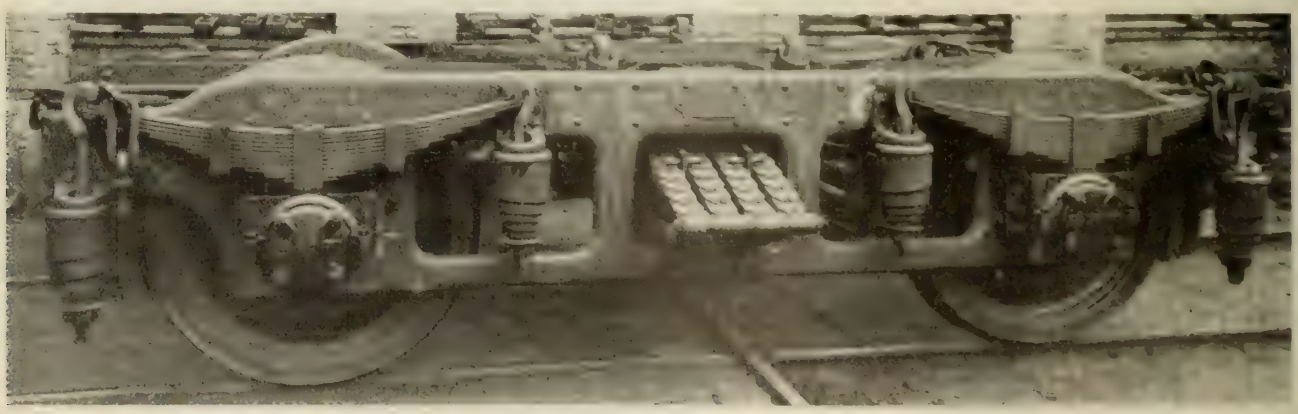
It was largely as a consequence of the favorable results attained in the trials run in Sweden that the latest decision was arrived at by the Royal Board, and 1,360 boxes, or 2,720 roller bearings for bogie cars have been ordered for the new applications. Other railways have ordered roller bearing boxes for ore wagons etc., so that the movement appears to be general in character.

The Great Eastern Railway Co., of Great Britain, have just concluded a successful series of preliminary trials with roller bearings applied to passenger trains and speaking about this subject, the engineering editor of the Manchester Guardian, has the following to say:

"It is surprising that ball or roller bearings have not been applied on an extensive scale to railway work years ago, in spite of the severe conditions of working. A long train, especially when composed of the small 10-ton wagons characteristic of British railways, with its large number of wheels and bearings, each of which takes heavy toll of the power transmitted, combining with the frequent stops and consequent heavy starting loads, is an ideal field for the application of modern anti-friction devices. It is perhaps even more surprising that the engineering industry in general has also not yet realized the enormous advantages of ball and roller bearings in eliminating friction losses, which are so serious that in many cases over 20 per cent. of the total power generated is lost.

"The textile industry, for example, is a suitable field for the application of ball bearings. In the case of the main lines of shafting equipped with ordinary plain bearings the loss of friction is 15 to 30 per cent. of the power transmitted. It would not be exaggerating to say that the installation of modern ball bearings would pay for itself in less than 12 months, whilst as regards individual machines the application of ball bearings would save something like 10 to 12 per cent. of the power required, taking an average of all the various types of machines in use in the textile industry.

"The application of ball and roller



Bogie equipped with roller bearings and used on Swedish State railways.

bearings to railway work is not, however, a new idea. Elaborate experiments, dating back to at least eight years ago, have been undertaken by the University of Illinois, U. S. A., and by several firms in this country who have specialized for many years in the manufacture of every description of anti-friction bearings. Most of these tests were carried out on goods wagons, with results so satisfactory that there is no reason why passenger vehicles should not also be fitted.

"As an indication of the high efficiency of ball and roller bearings as applied to railway conditions, the average running resistance for ordinary goods wagons at speeds up to 30 miles per hour was found to be, with the ordinary bearings 3.62 lb. per ton, whilst with modern ball bearings the figure was reduced to 2.2 lb. per ton, or, in other words, the power required to haul a running train was reduced by no less than 38 per cent. This is, however, not the only advantage. The starting up of a train requires a very heavy initial pull to overcome the standing friction, and the installation of ball and roller bearings reduces this initial frictional resistance by as much as 85-90 per cent.

Weather Conditions Overcome

"A still further advantage for railways is the fact, as determined with great accuracy in the Illinois experiments, that with ordinary common bearings the weather causes a great difference in the frictional resistance, as much as 30 per cent. between extreme summer and winter conditions, and certainly it averages 10 per cent. This difference is practically eliminated with ball and roller bearings. Ball bearings give more efficient results than the roller variety, but the latter, which can be said to save something like 14-20 per cent. of the tractive load, are more resistant to wear and tear. The stress of bearings of this description is, however, a difficult proposition, because, of course, at any given fraction of a second the strain is very severe, since the load is being carried by only a very small point of the total area.

"In fact, both ball and roller bearings must fulfil the onerous conditions of being a self-contained unit, without any loose parts and not requiring adjustment, of being able to take a radial load, combined with a very high fatigue limit, the lowest possible friction, and absence of vibration. To cope with these severe requirements the metal used is a very high grade, hard, carbon chrome steel, made from the finest Swedish iron, and in general the manufacture of such bearings has been advanced to such a degree of accuracy and organization that it can justly be termed one of the triumphs of modern engineering. It is an encouraging sign that railway companies, notoriously conservative in their ideas, should be turning at last to such modern methods, and further details of the Great Eastern experiments will be awaited with interest."

From the foregoing it will be seen that the railways in the Old Country are looking ahead, and it is stated on good authority, that if further investigations prove satisfactory, and it is fully expected they will, the whole of the Great Eastern rolling stock will be fitted with roller bearings. What Canadian roads will do in the future remains to be seen, but friction is a deadly enemy which must be overcome, and the sooner we grapple seriously with the problem, the better it will be for all concerned.

Taking Moisture From Compressed Air

Moisture is mixed with air in the form of perfectly transparent and invisible vapor, until a humidity of 100 per cent., or the point of saturation, or the dew point, is reached and this dew point is always reached in compression and transmission of air at ordinary working pressures, say six atmospheres or 75 lb. gauge. Immediately when this point is passed, the excess moisture condenses into actual water but is still mixed with air. The saturation point of air constantly varies, and is determined by its pressure and temperature, especially the latter and, at a fixed temperature, any given volume of air is saturated when it contains a certain quantity of water vapor. Now, if the absolute pressure of a certain quantity of air is, say doubled, by which the volume is reduced ½, the moisture carrying capacity is reduced the same proportion so that if the humidity of free air is 50 per cent., this humidity becomes 100 per cent. when air is compressed to two atmospheres (15 lbs. gauge) and if compressed to six atmospheres (75 lbs. gauge) the humidity becomes 300 per cent., and 200 per cent., of the air will refuse to carry water as vapor if the temperature remains constant.

As air is compressed its temperature rises rapidly and with each rise of about twenty degrees its capacity for carrying moisture is doubled. Starting with free air at sixty deg.; as it is compressed to 75 lbs. gauge, its temperature at delivery no matter how perfectly the compressor cylinder may be water jacketed, will be about 300 deg., so that in consequence of this change of temperature, the capacity of the air for moisture will have been doubled so many times that when it leaves the cylinder the real humidity will be quite low although it still carries all the moisture with which it started.

When the air is lowered in pressure, as is the case when being used for operating pneumatic tools, air rammers, or any other use where the kinetic energy is converted into work, this excess moisture will show up in the form of water and the water content will be very noticeable where the air is delivered into much lower temperature than that at the compressor. If however this compressed air is pre-cooled to a temperature not in excess of that of the point of delivery or usage, the moisture will be precipitated at the point of pre-cooling and a separator placed between the pre-cooler and point of delivery will eliminate the moisture and deliver dry air, provided the moisture removed does not in any way come in contact with the air passing through the separator.

In many cases there is sufficient cooling surface in the pipe line, which is exposed to atmospheric temperature, that it is not necessary to install after-cooler; however the following tables will enable you to determine whether or not there is sufficient cooling surface in the pipe line or if after-cooler is required the approximate size can be figured from the table showing required cooling surface for free air delivered. The following table shows the length of pipe containing one square foot of cooling surface:—

Size, External	Surface, Internal	Surface
¾ in	3.637	4.635
1 in.	2.904	3.645
1¼ in.	2.301	2.768
1½ in.	2.01	2.371
2 in.	1.608	1.848
2½ in.	1.328	1.547
3 in.	1.091	1.245
3½ in.	.955	1.077
4 in.	.849	.949
4½ in.	.764	.848
5 in.	.687	.757
6 in.	.577	.63
7 in.	501	.544
8 in.	.443	478
9 in.	.397	.427
10 in.	.355	.382

* As suggested by the United Machine and Mfg. Co.

PILFERING GOODS IN TRANSIT

Some amazing instances of pilferage of goods in transit have just come to light, says a report from the Old Country. The reports show that the thieving of goods has now become a fine art. Numerous instances have lately been reported from various parts of the world of the delivery of cases in apparently perfect condition which, when opened, were found to contain rubbish instead of valuable goods. Thefts of this kind have given rise to the suggestion that somewhere in the course of transit identical cases have been made and marked, and substituted for the original cases containing the real merchandise. Cases have arrived in such perfect condition that the only other explanation offered is that the goods ordered were never actually packed in them. That there have been numerous instances of such practices is generally believed in shipping and insurance circles. One way, it is suggested, of putting a stop to wrongdoing of the kind would be for underwriters to require their merchants to be privy to the correct packing of the goods. If it could be proved—and it would not always be an easy matter to do so—that goods were never packed, the merchants would have to bring the responsibility home to the suppliers of the merchandise.

Baldwin's Steel May Extend Tin Plate Operations

Decision on Future Plans End of October—Investment of Four Millions—Rail Strike a Chief Cause of Suspension—Problems of Building up Force—Drawback Allowed on Materials

WHILE Baldwin's Canadian Steel Corporation Limited, Toronto, are suspending operations largely as the result of transportation difficulties in securing adequate supplies of materials, it is stated that no definite plans for the future may be made known until the end of October. The president, Capt. Hugh C. Paynter, states that it may be decided to increase the capacity of their tinplate mill and make other extensions that will still further appreciate the requirements of the Canadian market.

Meantime, some regret is expressed that so large and important an industry and one for which there is so definite a field in this country should find it necessary to close out, if only for the time being. Conditions, however, should gradually right themselves, making it possible for this huge plant to resume.

In their two years' existence here the company has expended something like $4,000,000, and undoubtedly has had to contend with many of the problems that confront an infant industry. Labor conditions here differ widely from those of the Old Country where industrial heredity has made skilled men available whose families have been identified with specific callings for generations. Here, such men have to be trained. This is quite a task, for there are many classes of work in which an easier living may be made than in the production of black sheets of tin plate. There is no specialized field to draw from. The human element is a big factor in plate production and in building up a force, it is important that men appreciate the responsibilities of their departments. When this is not the case it might, for example, be a comparatively easy matter for a workman to cause a loss of upwards of $5,000 by deserting his post for some trivial cause, thereby allowing a pot of metal to burn. Absolute dependability upon the human factor is therefore essential. Some headway has been made.

Problems Being Adjusted

Press reports intimate that the cause of suspension was to a large extent due to unfulfilled promises as regards the tariff and local assessments. This is hardly the case. The company's original assessment was $2,000,000, which was subsequently reduced to $785,000. Negotiations are under way looking to a fixed assessment.

Competition with American produce is keen, and so far as tariff is concerned there is not likely to be an early revision, but the company has found itself in a better position in this respect recently by obtaining recognition of a clause in the tariff of 1908 by which a drawback of 99 per cent. is provided upon all imported materials entering into the manufacture of tinplate. This was a provision that was introduced by way of encouragement to an earlier Canadian plate industry, but which has evidently remained dormant as having no application after the cessation of the industry. Included in the materials covered in this way are rolls, classified as castings, and representing quite an item in tinplate manufacture. The drawback applies to the operations of the company since their beginning in Canada. Items entering into the production of plate sheet include crude oil, requiring one carload per day; coke, one carload per week, and large quantities of palm oil and grease, to say nothing of large metal tonnages necessary.

Running under normal conditions the plant has employed as high as 600 men. During their closing out activities they have something less than two hundred. In encouraging youths to enter the industry they have been paying to start 25 cents an hour, which is equivalent to the wage received by many skilled mechanics in the Old Country.

Requirements of the plant in electric horse power are high and the monthly bill considerable. Among those matters that would seem to call for readjustment is an item of 1660 per month for a power line which the company's operations have never called into service. The plant in some respects is self-contained and not altogether dependent upon certain municipal services.

Business men, engaged in iron and steel activities, express the hope that this important industry, so well equipped to fit in with the requirements of the market, may shortly find it possible to carry on.

Ores, Woods, Implements Needed In Hungary's Rehabilitation

HAVING suffered frightful dismemberment during the war, with all valuable assets taken away and her rolling stock given to Rumania, where much of it is rusting and rotting unused, a gigantic task has confronted Hungary in her work of rehabilitation. Materials of various kinds are urgently needed, particularly woods for furniture and kindred industries; ores, chiefly iron, and certain agricultural implements which Canada can supply.

This is the observation of Col. J. B. MacLean, president MacLean Publishing Co., Toronto, who, during a recent trip to Europe, spent three weeks in Czecho-Slovakia. Frequent few-minute chats with a number of business, financial and political leaders afforded an insight into National problems. Among those whom he thus met was one who, a few years ago, delivered an address at Toronto University, and who, for many years, occupied one of the most prominent positions in Austria-Hungary. Mainly interested in the rehabilitation of his country at the present time, he is very optimistic as to its future. Hungary, he points out, is most desirous of retaining her agricultural population and her highly trained artisans who are fairly prosperous, but there are many well-educated mechanics, teachers and professional men of whom not a few are being supported today by charity mainly contributed by British and United States friends. Many of these would go to Canadian farms, and there are thousands of hard-working women available for domestic service.

The kingdom of Hungary, which is the oldest and, previous to the war, probably the most prosperous country in Europe, had perhaps, the least sympathy of any for the war. This is shown by the fact that over one hundred thousand of their army deserted the Germans and joined the Russians, to be in turn deserted by them, and they finally joined the Canadian forces at Vladivostock and about twenty-five thousand of them were taken back to their own country via Canada.

Good work done by the Canadian Pacific Railway in the two or three years just before the war has made the people of Hungary very friendly toward this country. All who can, want to emigrate to Canada. Inducements offered by Americans are frequently met with the suggestion that they would prefer Canada. A number of generous Americans, who visit Carlsbad and other parts of Czecho-Slovakia and Hungary, have offered to pay the expenses of certain former Hungarians and several have taken advantage of this.

"I think that Hungary would be quite ready to give very reasonable terms, perhaps free trade, to Canada in implements, ores and woods in exchange for similar concessions," said Col. MacLean. "That, however will be for the industries interested to put before the sympathetic attention of Hon. Mr. Robb, Minister of Trade."

Machining the Stutz D.H. Motor Cylinder and Head

Jigs and Fixtures Used in Holding the Parts—Twelve Cylinders Milled at One Setting—Pieces Easily and Quickly Located by Means of Sliding Supports and Spring Dowels

By ROBERT MAWSON

MACHINING operations on automobile cylinders involve some interesting methods of holding the work while the milling, drilling and boring are being performed. The views here shown illustrate some of the jigs and fixtures used in accomplishing several of the more important details in machining the blocks and heads for the Stutz detachable head motor.

After the cylinders have been inspected and given the hydraulic test to ascertain if the castings are perfect, the first machining operation is performed on an Ingersoll milling machine. The table and fixtures placed on this machine will accommodate 12 cylinders at one setting. These are pushed back against stop pins and also rest on height pins so that the surfaces to be milled will be square. Clamps are then tightened onto the pieces to hold them securely in the fixtures, the design of which can be clearly seen by referring to Fig. 1. With the castings held as shown, six faces are milled at once, namely, top and bottom of the cylinder and four surfaces on the exhaust and intake side. For this work three 11-inch, two 5-inch and one 8-inch cutters are used and their type may be seen by referring to the illustrations.

Drilling Stud Holes—Crank Case Side

The next operation is drilling the holes used to fasten the cylinder to the crank case. This is performed with the jig illustrated in Fig. 3. The jig is first swung over, after it has been brought forward on the tracks A, being indexed by means of the handle operating a pin which fits into the hole B. The cylinder is then pushed into the jig, being located with stop pins at the rear and on the side; set screws are then tightened against the casting to hold it against the locating mediums. Straps at C are then fastened as shown to hold the piece securely during the machining operation. Ten 9/16 inch holes are then drilled, two of the holes being afterwards reamed, these latter holes being used in locating the cylinder in subsequent operations. The jig illustrated is the tool used for this drilling; some of the drills are not operated, but those used may be ascertained by noting the guide bushings in the jig. The tool is then swung over as described when the casting may be easily removed by loosening the straps and set screws.

Boring the Cylinder

The next operation is machining the bores to suit the pistons, and this work is performed with equipment as shown in Fig. 3. The casting is located by means of two dowels which fit into the holes previously reamed; the two wedges A are then driven under the piece and these raise it up, holding it in position in the fixture. The cylinder is bored in three separate machines, the fixtures, method of locating and holding are similar to that illustrated. The holes are bored to 4.260 inches in the first setting, 4.330 inches in the second and 4.365 inches in the third. The four holes are ground to 4.375 in a subsequent operation in order to obtain smooth and round surfaces. For the boring operations the bars are guided through the long bearings shown on the upper surface of the fixture in order to obtain parallel holes; as the casting is held and located from the base parting line surface the holes are at right angles to this surface. After the holding wedges have been removed the casting may be slid on the track B and taken out easily from the fixture.

The open ends of the bores are then chamfered with the set up shown in Fig. 4. For this operation the cylinder is moved under the tool A which, it will be observed, has a pilot end to locate it in the cylinder bores and thus enable the chamfered surface to be produced square with the milled faces and holes.

Drilling and Reaming Valve Holes

The next operation is drilling the valve guide holes and this is done in the jig shown in Fig. 5. The casting is again located with the two dowel holes previously referred to. The piece is then fastened in the jig with clamps at A, afterwards being slid along the track B until the index pin will enter a locating bushing in the base as shown. The 16 drills are guided through long bushings in the jig plate so that the holes produced will be perfectly straight and in the correct alignment and the size of the holes drilled is .745 inch. The locating pin C is then removed and the casting and jig moved along the track to a similar machine and located by means of a pin similar to C, and after substituting a correct jig plate the holes are reamed to ¾ inch.

Attention should be called to the convenience of the jigs used at this plant, the parts are easily located in them and also positively, employing the same locating medium, two dowels. And further, by means of the tracks and swinging type of tools, very little manual labor is called for on the part of the operator, merely sliding in the casting and revolving the jig to the correct position and then sliding them on the tracks under the machine. The valve chamber holes are next reamed out to 1½ inch, using a simple plate jig to guide the tool.

The holes for the studs to hold the manifolds are drilled as the next operation, and as this is a 16-valve type of engine, two intake and two exhaust for each piston, the manifolds are placed on each side of the cylinder. The jig used when drilling these stud holes is shown in Fig. 7. The casting is again located with the two dowel holes and fastened in the jig by means of four clamps as A, two on each side. The jig is then pushed under the machine by means of the tracks B until the jig plate will enter on the locating pins C, the jig and drilling plate are then in the correct location for the machining operation. Twelve 21/64 inch holes are then drilled in this side for its manifold. The jig plate is raised and the jig swung over 180 deg., being located with the index

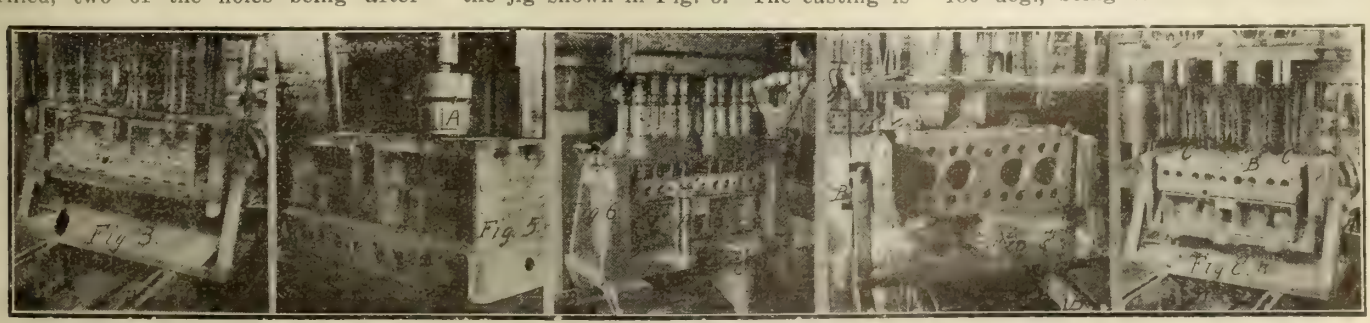


Fig. 3.—Drilling holes for crank case. Fig. 5.—Chamfering bore. Fig. 6—Drilling valve guide holes. Fig. 7—Drilling for stud holes. Fig. 8—Drilling stud holes for cylinder head.

pin and two locating bushings in the jig at the correct angle of rotation. The drilling operation is then repeated after the jig plate has been lowered into position, again determined with two more locating pins fitting in holes in the plate. A number of minor operations now follow such as tapping various holes, chamfering the valve guide holes and then the piston bores are ground to size.

The next work performed on the cylinder is with the jig shown in Fig. 7 and is that of drilling the stud holes used to hold on the head to the cylinder. The casting is located with the two dowel holes in the lower side and the revolving portion of the jig determined for position by means of the index pin A and bushing into which it fits. It will be noticed that this machine is also provided with tracks so the jig may be pushed into position with the least effort on the part of the man and in the quickest time. The jig plate B, which is used to guide the drills, is fastened into the proper position after which thirty-two 13/32 inch holes are drilled in the cylinder as shown by the half tone. A convenient medium for removing the jig plate is provided with the handles C, which are cast on the part, and is another example of the thought which has been placed in the designing of these tools and machining methods.

The casting is then given a hydraulic test of 35 lbs. pressure and if found satisfactory it is ready for inserting the studs or any other minor operations and is ready for the cylinder head.

Milling the Motor Heads

The first operation on the motor heads is milling the upper and lower surfaces. The fixture is an auxiliary attachment fastened to the main fixture used when milling the cylinder block. The head castings are placed in the fixtures, being located by means of stop screws at A, and held by the clamps B, two for each piece. Two 12-inch inserted tooth cutters are used to machine the surface C, after which the castings are reversed and the opposite face milled in a similar manner using the same cutters. By this method of employing auxiliary fixtures it is a very simple matter to change over the machine from milling the cylinder blocks to the operation on the heads. A hook bolt is provided in each fixture so that they may be placed on the machine easily, being then fastened down with bolts to the main fixtures.

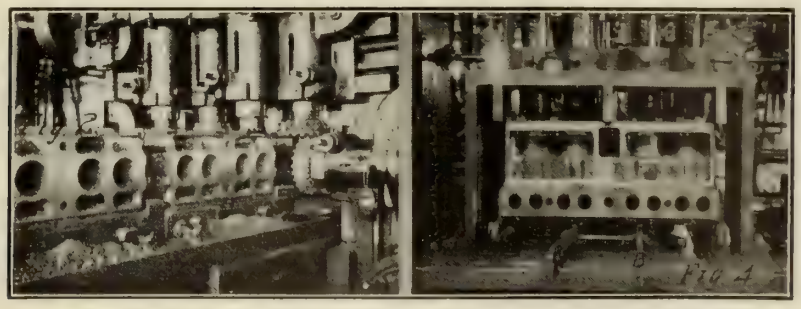


Fig. 2.—Milling twelve cylinders. Fig. 4.—Machining the bore.

Fig. 10.—Reaming for profiler. Fig. 11.—Profiling compression chamber.

The next operation is drilling the stud holes, and for this work a simple jig plate is used locating by the ends, and thirty-two 9/16 inch holes are drilled.

Profiling the Head

The casting is placed in the fixture shown in Fig. 10, which is used to ream a hole for the profiling operation. The casting is located in the sliding member of the tool by means of two dowels which fit in holes drilled in the previous jig. The casting A and sliding member are then pushed forward by means of the handle until the locating C will enter one of the position bushings placed in the movable part of the tool. The reamer D is fed down into the cored opening which is machined to 4½ inch diameter and 11/16 inch deep using a roughing and finish cutter in order to obtain the exact opening. The index pin is then withdrawn and the casting moved to the next position and the work repeated and so on until all four openings have been reamed. The result of this operation may be seen by referring to the openings at E. It will be observed that the reamer is provided with adjustable stop collars so that after these have been once correctly set all the holes machined will be similar in depth.

Fig. 11 shows the special fixture employed when profiling the compression chamber in the head. The casting is again located by means of dowels similar to the previous tool and it will be noticed that the same sliding sub-base is also employed here. Location of this sliding element is determined with the pin A which fits into locating bushings for the four positions to suit the correct locations of the machined openings. The milling cutter held and driven by the spindle is fed around to the correct outline which is determined by the guide C which the operator causes to follow the shape of the steel plate D. The shape obtained in this fixture by the method described may be seen by referring to the casting at E which shows a finished profiled chamber. It might be added that the milling machine table is locked during the profiling operation after it has been once correctly set, the four positions being determined with the locating medium described.

The spark plug holes are finally drilled, followed by the drilling of the water jacket holes. The jigs used are very simple in their construction. The head is now ready to assemble to the cylinder block and mounting in the receiving chassis.

HIGH PRICES AND BUSINESS

As representing the view that steel manufacturers entertain with reference to advanced fuel and labor costs and their effect upon general conditions in the U. S., the president of a large concern in the Pittsburgh district states:—

"It is evident that the country generally would be on a higher wage basis for some time to come. These higher costs in all lines, will, in my opinion, have a serious effect on business in two directions. First, exports will practically cease except in lines not produced in European countries. Second, the farmer will be unable to make his usual purchases on the present basis of costs even though crops are unusually good.

"The farmer cannot give four bushels of wheat for a day's wages and 12 or 15 bushels for a ton of coal and have much left to buy farm implements, automobiles and other articles requiring annually millions of tons of steel in their manufacture.

"The farmers are the largest consumers of manufactured products and their purchasing power is greatly impaired by such a situation. Evidently the price of farm products must go up or the prices of manufactured products come down before we can have the healthy basis of exchange necessary for general and permanent prosperity."

Less work at higher wages will be of little advantage to workers, says the steel maker. He adds that this "unfortunate possibility is due to the arbitrary readjustment to a normal basis in one or two important industries."

Precision grinding machines have a place in all manufacturing plants where accurate work is required.

Urge Canadians to Prepare for Trade Expansion

Commissioners From China and Scotland Describe Opportunities in Those Countries—Irish Government May Adopt Independent Policy—Showroom in Shanghai for Canadian Goods

DR. J. W. ROSS
Trade Commissioner to China

"ALMOST ANYTHING *can be sold in China. In the showroom which we are opening in China, sixty different Canadian lines will be displayed. China is an immense country and the upheavals that we hear of do not affect the reliability of those firms with whom business may be carried on."—Dr. J. W. Ross.*

"IT IS ADVISABLE *that Canadian firms be prepared to take advantage of these opportunities to trade with Ireland when they arise. Other countries are standing by, ready."—Major Gordon B. Johnson.*

MAJOR G. B. JOHNSON
Trade Commissioner to Scotland and Ireland

ADDRESSING a gathering of representatives of Canadian trade and technical newspapers recently, Dr. J. W. Ross and Major Gordon B. Johnson, Canadian trade commissioners from China and Ireland, discussed conditions and opportunities for the Canadian manufacturers in those countries.

Major Johnson pointed out that Ireland's position at the present time was one of economic dependence upon Great Britain but that the time would undoubtedly come, once internal troubles ceased and some evidence of stability returned, when there would be some national inclination toward greater independence in the matter of trade.

In 1919, ninety-one per cent. of the products of Ireland were shipped to British ports while 83% of the imports were from British sources or, in part, overseas goods transhipped through British ports by large houses in London, Liverpool or Glasgow. It was the speaker's opinion, and also that of leading men whom he had interviewed, that there was not going to be any violent change looking to trade independence from Great Britain. Through British brokers the marketing of overseas goods in Ireland is greatly facilitated. It was natural to suppose that once the Irish government became firmly established, ways and means of developing revenue would include that of entry tariff in which case direct business would result, rather than the double customs machinery necessary in trans-shipping through British houses.

Major Johnson stated that he had at least fifty enquiries for Canadian goods from Irish houses, with whom it would be a pleasure as well as safe and profitable to do business. These enquiries included such items as agricultural tools and machinery, for the south of Ireland was predominantly agricultural, asbestos fibre, aluminum ware, hardware, lead sheets and a great variety of canned goods and food stuffs. During the year 1919, Ireland's imports in iron and steel products including pipe and pipe fittings, amounted to $1,033,000.

The opinion was expressed that the action of the United States in raising her tariff barriers, would undoubtedly lead to restrictions in import trade, and to that extent would her export trade be impaired. The opportunity, therefore, was Canada's, for in this country were produced many lines similar to those in the United States, and these would find a ready demand overseas.

"WHEN Canadian Machinery and other trade and technical papers come into my office, I do not hoard them up. After I am through with them I pass them on to business firms who are most likely to be interested in Canadian affairs and in firms and products represented. In this way, quite a lot of very useful information finds distribution."—Dr. Ross, Trade Commissioner to China.

As to business conditions in Great Britain, including Scotland, there were many signs of substantial revival. The steel industry displayed renewed activity, as did the engineering field, but shipbuilding was still somewhat dormant. Naturally, this was an industry which followed, rather than preceded or paralleled, an industrial revival. As an example of conditions here earlier in the year, during the whole month of April only one small ship was turned out on the Clyde while a normal year's output was 400 ships of all kinds or eight ships per week. Since April, however, there had been some evidence of improvement.

One problem of Great Britain's trade was the unrest in Europe, and this was the explanation of a movement to establish more stable markets and to develop trade within the empire to a greater extent.

A list of imports into Scotland during 1919 showed large consumption of barley and other grains and foodstuffs such as produced in Canada.

Opportunity in China

Dr. Ross, trade commissioner for China, declared that almost anything could be sold in that country. It was a market of great potentiality, and one worth the serious attention of Canadian manufacturers. As an example he cited the fact that the last statistics showed importations from the Pacific coast of forty-two million board feet of lumber. There was a great market in China for newsprint, but it is not yet produced in Canada sufficiently light in weight to suit the trade. The Chinese required a sheet about 35 in. by 42 in. with a definite number of pounds to the ream. They do not see the advisability of purchasing a 50 lb. paper such as produced in Canada, when a 37 lb. paper such as secured in Scandinavian countries was satisfactory.

It was proposed by the Department to open showrooms in Shanghai for Canadian products and Dr. Ross stated that he proposed to have sixty Canadian lines on display there. There was a market for knitted goods, boots and shoes, silk hose, electric heaters, etc. As good roads in China were somewhat notable for their absence, the automobile trade had somewhat limited scope.

In an interview with Canadian Machinery, Dr. Ross stated that machine tool business in China was almost entirely in the hands of British firms, but that these had connections outside of Great

(Continued on page 41)

News From the Welding Field

Making the Welding Repair Shop Pay Its Way

Fluctuations in Volume of Business—Keep Man in Field Drumming Up Work—Taking on the Manufacture of Metal Specialties—Efficiency of Different Processes

ONE of the marked peculiarities of the business that comes to the door of the average welding shop is the tendency to suddenly vary in volume. One day the entire force will be on the jump from morning till evening, with part working overtime on the repair of an exceptionally heavy casting, which naturally calls for a prolonged and continuous performance of preheating and welding, and the very next day the boss finds himself puttering around the shop in search of jobs to keep the men busy. Quite naturally all repair work is wanted in a hurry, since a broken piece of machinery means a machine shop standing idle, so that there is a limit to the amount of work that can be carried over for the sake of having something for all the welders to do. Shall the welder sit down calmly when he has finished one repair and wait for something else to break? Not if he can help it. If it is a good sized shop there is probably a salesman out looking for machinery accident cases to hustle in for treatment, and if things refuse to break he investigates manufacturing processes to see if he can have parts of products sent to his shop to be assembled by welding.

Estimating on Work

A considerable volume of production welding for outside concerns has to be secured on each job in order to make the work profitable, because it requires practice to obtain sufficient speed on the work to justify making a price that will mean a saving to the manufacturer. Very often it is necessary to go to the trouble of making special jigs for holding the parts, or to the expense of having them made. Still the work is worth while if the price paid for it is enough to cover all the overhead with a slight margin of profit, for it can usually serve to keep the shop busy during the slack days.

When all other signs fail, that is when repair work inside and outside the shop falls off, and there is no demand for production work from other manufacturers, the welder still has a chance to keep busy by becoming a manufacturer himself. There is an almost unlimited number of metal specialities which can be turned out at small cost in a well-equipped welding shop, and for which a local demand can be found.

Manufacturing Possibilities

The metal can be obtained in sheets, rods, tubes, plates, etc., and cut to any desired pattern with a cutting torch, then welded together at odd moments, so that the cost of manufacturing is comparatively low. Some interesting work of this nature has been done, such as, auto axles, tanks, pans, screens, refrigeration equipment, house furnaces, depth bombs, aerial bombs, etc. The oxy-acetylene torch has scrapped many war vessels and guns. Welding equipment is indispensable to every large industrial plant for repair work, so as to enable them to quickly repair small breakdowns. The larger repairs are usually handed out to an outside shop to handle, because on large work special facilities, equipment, and organization is required.

New uses and applications of these processes are being found every day. The field offers unlimited opportunities to the workman and expert to show his initiative and skill, but let me put before you that the success of welding depends on:— The proper preparation of the work; the proper selection of process; the use of reliable equipment and supplies; the skill of the workman; the proper use of the preheating equipment before, during and after the welding; the necessary facilities to take care of the casting after heating; the necessary and proper skilled supervision of the expert.

The following is descriptive of the industry:—

Welder—The other day a big casting broke down in John Doe's Machine Works. Doe and the rest of his bunch all knew it was impossible to weld it.

Billy—Well, what became of it?

Welder—Why, they fooled me, I didn't know it was impossible to weld and they didn't tell me, so I went ahead and did the job O. K.

Where Gas Should be Used

The oxy-acetylene process is selected for bench work or the smaller castings

Extract from a paper read before a recent meeting of the Candian Welding Society by A. M. Barry, of the St. Lawrence Welding and General Engineering Works, Montreal.

Left—Manufacturing chip screens for pulp mills, by oxy-acetylene welding. ¾ x 3 in. mesh. 3-16 in. round iron rods welded at every intersection. Right—Gyratory crusher repaired by electric welding. Repairs made for ¼ the cost of new casting.

in steel and cast iron and always for the other metals such as, malleable iron, aluminum, brass, copper, platinum, tin, zinc, bronze, or bell metal, silver or gold. The oxy-acetylene and electric salesman of apparatus are constantly at war with each other on the merits of their respective apparatus, both claiming that they can do the job by their process cheaper and better than the other fellow. Experience goes to show that electric welding is selected for steel welding, principally on boiler repairs and steel tank manufacturing. In boiler repairs not because this weld is a better weld, (in fact according to my observation it is not as perfect a weld as the oxy-acetylene), but because the heat is more concentrated. While making repairs to boilers, which usually consist of building up of corroded or wasted places, building up leaky caulking edges, welding up of cracks and fire cracks; further trouble is not started by the loosening of rivets from the heat of welding which would be the case should oxy-acetylene be selected on account of the great radiation of heat during the progress of the job. By the electric welding process the heat is much more concentrated, therefore the work is nearly cold, while with oxy-acetylene process we have large sections white hot, with more metal red hot. If rivets or staybolts are in these sections we have rivets that are loose in the hole, the same arguments applying to staybolts.

Application of Thermit Welding

Principally in welding heavy sections, when broken, such as locomotive frames, steam-shovel parts, heavy frames, rolls, stone crusher parts, contractors' equipment, heavy crank shafts, shears, either in cast iron or steel, the Thermit process is adopted. Results in steel are to my mind always perfect. In cast iron a small percentage of failures and hard welds. The marine repairs by the Thermit processes usually consist of repairs to shafts, connecting rods, stern frames, rudder shoes, stem posts, rudder frames, anchors, and heavy davits. The Thermit process is also used in pipe and track welding to eliminate joints.

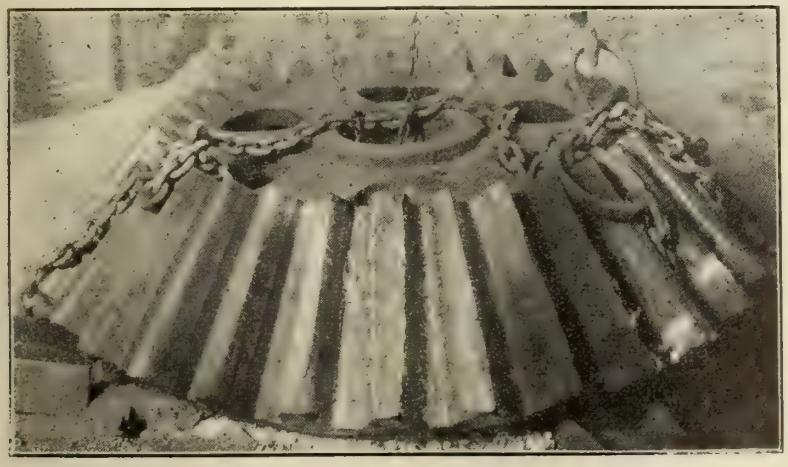
Electric welding consists of two processes, using two systems, metal electrode and carbon. The carbon is used principally in cutting steel, in welding, in building up metal where required, such as in defective steel castings. The metal electrode is also used in building up of corroded or wasted parts, welding up of cracks and fractures in boilers, tanks, and of course in the manufacturing of steel tanks, smokestacks, acid-stills, pressure vessels, vacuum tanks and equipment, also making good, worn parts in machinery, such as building up of shafting after wear to oversize, ready to be machined to full size. Electric welding of cast iron is usually done by first opening the fracture by chiselling a "V" then drilling and tapping in steel studs into the V leaving them about ⅛ in. high, then using a good Swedish iron electrode, which is generally 5/32 in. dia., filling up the "V" and heavily reinforcing when possible.

The Oxy-Acetylene Process

The oxy-acetylene process, to my mind, at least, is the only process by which all metals can be welded or any combination of metals. By its use it is possible to weld any broken part that is made of metal. Its usual application in a welding shop is to repair automobile parts, cylinders, frames, brackets, gears, shafting, (boiler tubes) crank cases, pipe and pipe fittings, intricate machinery parts (anything from artificial legs to marine boilers, from piping 40 ft. under ground to bells in church towers).

Oxy-welding is not a cheap repair process when working on small castings on account of the high cost of labor, gases, material, maintenance of equipment and unseen losses such as ends of rods, gas not accounted for, occasional idleness, defective work and the high overhead necessary. In manufacturing by oxy-acetylene the field is the same as above in electric process, with what I consider the additional advantage of the cutting of steel, which can be done by hand or machine. In flat surfaces, and heavy cuts, such as armored plates and ship plates, the oxy-graph is used, giving cuts that are smooth and accurate. By hand, ordinary cutting of plates, using a roller attachment gives good results up to 1 in. thickness

Failure and condemnation of welding is the direct result of welding equipment being placed in the hands of the unskilled and untrained workman, who with his unlimited nerve and irresponsibility undertakes, sometimes through force of circumstance, work utterly beyond the capacity of his equipment and skill. Result, a complete failure usually after considerable time and expense has been incurred taking out the broken part and replacing. This always creates a bad impression and unfortunately not the workman but the process is blamed.



Repairs made to large bevel gear, weighing approximately 6000 lbs., at plant of St. Lawrence Welding & Engineering Co., of Montreal. Repairs effected at a cost of about 1-6 that of a new gear. One new tooth built up and rim welded in three places.

URGE CANADIANS TO PREPARE

(Continued from page 39)

Britain. Manufacturing in iron and steel had to do with shipbuilding, production of cotton mill equipment, engines, etc., such industries being largely under British control.

The Chinese, Dr. Ross stated, were great readers and had their own papers, which were served with latest cables. They were quite as fully informed of happenings in the Near East as were Europe and America. One of the largest printing establishments in the world, called the Commercial Press, was owned and managed by Chinese. There were no trade or technical newspapers in China, the nearest approach to these being the Far Eastern Review, an English engineering periodical. In Shanghai there were a number of English newspapers. Every little port had its paper and there were a great many social and sporting sheets used to a certain extent for scouting or for purposes of propaganda.

Col. J. B. Maclean, who presided, pointed out that the Department of Trade and Commerce had a great amount of useful statistical information available to Canadian manufacturers if they would only take advantage of it. Under Hon. J. A. Robb the department was being developed, at last, along more businesslike lines and a broader policy was being observed in making useful information with reference to trade enquiries more easily available to manufacturers. There was, moreover, a keener sense of appreciation as to the co-operation possible through trade and technical newspapers.

During a brief discussion, it was suggested that business men returning from trips abroad might do a valuable service by broadcasting through the Department such information as they might consider valuable to business interests as a whole.

Practical Ideas From Practical Men

BALANCING A 3-FLOOR DRIVE

By W. F. Schaphorst

The vertical belt drive has been a hoodoo and perhaps always will be. About the only way such a drive can be run satisfactorily without keeping the belt too tight is by the aid of an idler,—and how some men preach against idlers! I am not opposed to idlers where they are necessary. They do not consume much power if properly designed, maintained and are kept clean. It has been shown that such idlers consume so little power that the loss is not traceable. This sketch illustrates an example where a single motor furnishes power for three floors, with no vertical belt. The principal feature of the drive is the almost perfect balance. It is laid out for a distribution of 100 horsepower to each floor, and with pulleys of equal size. The belt pull from each floor is the same. The angle between drives must be exactly 120 degrees. It is unfortunate that all three belts cannot run in the same plane, as the balance would then be perfect and there would be no thrust on the motor bearings. But with pulleys close together, and by using heavy belts, the thrust will be very small. This arrangement permits 98 per cent. efficiency (or very close to it.)

On the horizontal drive is shown an idler on the underside, which is the slack side. This idler may or may not be used, as it depends mostly upon the pulley sizes, generally the idler is placed close to the small pulley, but in this case it is used to hold up the belt and keep it from rubbing against an obstruction. The matter of balance is always worthy of consideration and perhaps it would pay to look the drivers over and correct the balance if need be. This can sometimes be done by merely shifting a bearing.

USING THE TOOLS OF ANOTHER TRADE

By D. A. Hampson

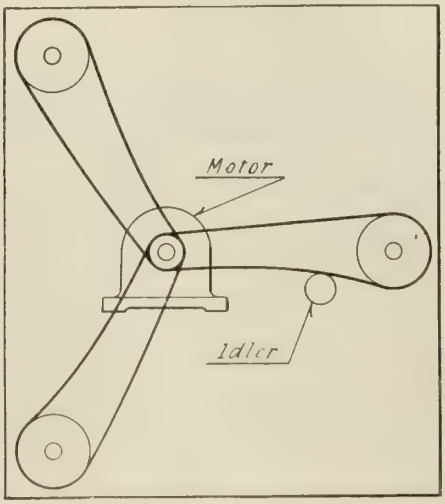
Two cases have recently come to notice where progressive machine shops adopted devices peculiar to the printing business for the purpose of securing greater efficiency in production work. They are illustrated herewith. In order to best appreciate these set-ups, it will be worth while to review the conditions under which a printer works.

A printer's "form" consists of a rectangular metal frame, or "chase," inside of which are placed the type, machine cast work, cuts, etc. This interior "matter" is squeezed against itself by means of various locking devices, the reaction of which is taken against the surrounding chase. When it is considered that even a small form, say 28 in. x 40 in., contains thousands of pieces of type and that not one of these must be so loose as to fall out when the form is lifted, the skill of the printer may be appreciated.

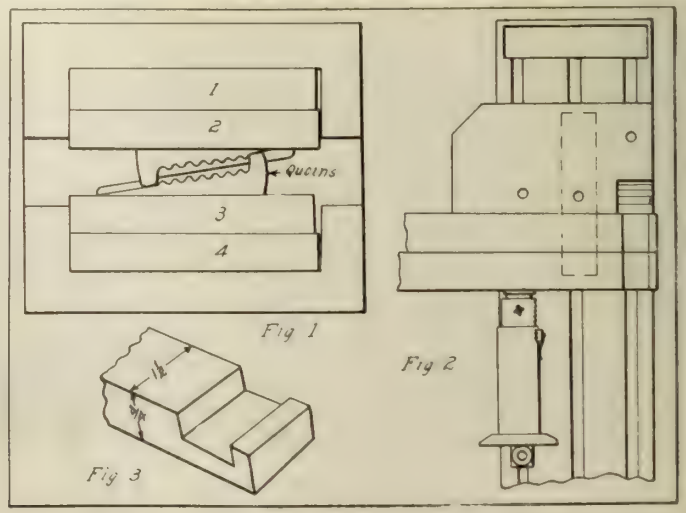
We in the machine trade would call the process of fastening the type a "clamping" process but the printer speaks of it as "locking up" and he knows the different devices used as "locks." One of the commonest locks consists of two wedge shaped pieces of steel or malleable iron called "quoins." These have teeth on their inside faces by which the opposing halves are caused to open or close using a T shaped tool with the business end shaped like a cross and this end slides the halves in opposite directions. To see a printer drop in half a dozen quoins and lock up a big form with his key in a few seconds is a lesson in speed. Long before time study came into the machine shop, the printers had their cost systems which analyzed every movement of the hands and feet in the effort to provide more efficient means of meeting the competition which is theirs.

Next to speed and results, the one thing that impresses the machinist is the fact that there is no head room on printers' work. All type is .918 in. high—that is the printing height for everything—and consequently the other parts of the form have to be much lower in order not to run any risk of printing—in practice, heights of 5/8, 11/16, and 3/4 inch are used, depending on the class of work. It must be seen that any lock only 5/8 high which can hold a big page of type and not tip it has passed the acid test of time. All parts of a form have to be kept flat because printing on a spring surface and the suction of inky rollers would soon work it loose on the press. The proven efficiency of printers' locks no doubt had much to do with their selection in the cases to follow. A positive lock, quick acting, and of little vertical height was essential.

Several thousand rough pieces of Stellite were to be ground to an exact 5/8 in. square to fit a special tool holder. The work was to be done on a Blanchard surface grinder with the well known round magnetic table. Naturally Stellite cannot be held on the face of a magnetic chuck. Fig. 1 shows a plan view of the fixture that was made up. This fixture was held on the magnetic chuck and the work pieces were to be clamped mechanically in its upper face. It was for the latter purpose that the printers' lock was used—a clamping scheme that would be quick and sensitive was required. Two of the Stellite bars were placed against the rib on each side and the quoins dropped between them. A twist of the wrist (on the quoin key) and the four pieces were held as securely as could be wished. This



Balancing a three floor drive.



Using tools of another trade.

application might well be duplicated on other work where a low clamp, accessible from the top is desired.

Fig. 2 shows a miling machine job. Drawn steel bars ¾ x 1½ are notched half way through on each end. In length, the bars run from two to six feet. The cuts have to be made very accurately, both as to depth and squareness, and to that end the bars are clamped directly to the miller table and against a low rib having its face square with the tongue that fits one of the T-slots.

Sometimes one bar is to be cut and at other times there are as many as a dozen. To keep the cost down it is necessary to have a rig that may be quickly set up, produce work whose accuracy is undoubted, and with which the parts may be handled quickly. By clamping to the table itself, and against the rib, these results are secured. A clamp reaches over from the front and holds one or two bars, as the case may be—this allows a maximum of room for the arbor and allows the table to be run back far enough at the end of the cut to make it convenient to handle the bars and clean chips out.

Making the notch at one cut and at a modern production rate creates more or less vibration and some means has to be provided to keep the bars against the rib, otherwise the cuts would be a few thousandths out of square and the bars spoiled. A printers' device is used for this purpose and seems to be the ideal thing.

In this case it is a device known as the "Slauson cylinder press lock" and was developed for locking chases on the flat beds of cylinder presses. Very often a form is made up for cylinder press work in a chase much smaller than the press bed—the lock used, therefore, must have a wide range or else a lot of filler material used, which causes the form to work up. This lock is made of two telescoping pieces of steel tubing and has two expansion adjustments—one being through teeth on the edge of the inner tube which engage a latch and the other through a cam expansion device at the end which gives a powerful squeeze through a limited range.

On this bar notching job the workman places his bars against the rib, clamps them lightly and then forces them into close contact by means of the lock. It is an absolute guarantee against working out of square. A short bolt, drawn down on the table itself and set about a foot away from the work, serves as the stop against which the lock is placed. Again, the single twist of the wrist actually locks after the tubes have been pulled through the larger increment — another twist loosens the work when the cut is finished. Those with clamping problems where the height is limited or quick action desired or where clamps must be installed in narrow spaces will do well to investigate the devices which trained men have developed for printers.

KEEPING THINGS HANDY

By Harry Moore

There is an old saying: "A place for everything and everything in its place," but like a good many of these wise saws this is much easier to say than to carry out. Machine shops are, as a rule, no less tidy than shops of other kinds, but it will hardly be denied that such ideal conditions as indicated by this maxim, are next to impossible in actual practice. Without, however, striving to attain to such an exalted state of orderliness, it is possible to make things run more smoothly by the adoption of simple methods for keeping frequently used machine shop articles in definite places. Every one has ideas as to how this should be done; one shop, for instance, keeps certain small nuts in tin cans, another strings them on a length of cord, another on wires, and so on, each with its own method which may or may not be the best for its own particular use.

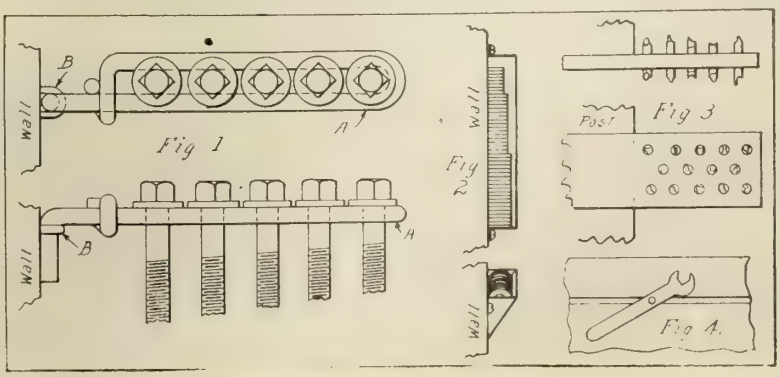
Herewith are a few simple holders used for keeping commonly used machine shop parts in handy positions. The bolt holder shown at Fig. 1 is used to keep a few bolts of varied lengths, together with nuts that fit, in a position where they can be easily removed, but where they cannot drop out or become mixed up with others. The idea of a holder of this kind is that certain bolts and nuts can be kept together with the assurance that each nut is a proper fit on the bolt upon which it is placed and that the length of each bolt is in full view. In this way much wild confusion is avoided when rush jobs come along; there is no searching for suitable bolts and neither is there the otherwise all too frequent occurrence of nuts jamming on the bolts when a set-up is being made. The only material required for this holder is a length of rod A about ⅜ in. dia. This is bent to the shape clearly shown in the drawing and when in place it swivels on a staple B driven into the wall or post, so that it can be swung out when placing or removing bolts and laid flat to the wall, out of the way, when not required.

The washer holder shown at Fig. 2 can be made in quick time out of a strip of sheet metal and when attached to the wall or any convenient place adjacent to the machine it forms quite a handy receptacle for washers of varied thicknesses such as are generally used for packing up purposes. By using a holder like this any washer selected can be removed without disturbing the others, and by placing it in an angular position as shown, the contents are always in neat order, as they naturally slide down and fill the gap made when some are removed. When fixed in place the holder forms a half vee by reason of the ends being bent to an angular shape as at A. A hole drilled at each end takes the screws used to attach the holder to the wall, post, or bench as the case might be.

The tool bit holder shown at Fig. 3 was recently noticed in a small repair shop and for simplicity it would be hard to beat. This is merely a piece of hardwood board A, drilled through at one end to take the bits, and screwed to the wall at the other. The originater of the idea had the board fixed to a post where it projected over the lathe at about his own height, so that it was entirely out of the way yet both ends of the tool bits could be clearly seen. This is a decided advantage over many kinds of toolholders where the operator is compelled to lift each tool out in order to examine the shape at the hidden end, when the kind he requires at the moment is not in view. By using hardwood and drilling the holes a size suitable to take the tool bits snugly, a good permanent tool holder is secured.

Fig. 4 shows a wrench holder. There is always one wrench which is used around a machine more or less continuously and much time and annoyance is saved if a definite place is made where it can be kept safe from wandering. The device consisted of a sawed off tee bolt tapped for a set screw. This can be placed in any handy out of the way position in the tee slot and tightened in place with the screw. By drilling a hole in some part of the wrench it can be placed over the screw head and thus be effectually prevented from rattling off the machine under vibration.

When a grinding wheel is working properly, the abrasive grain in the wheel may be considered as cutting small chips from the work, and the surface of the work as cutting or wearing away the bond of the wheel.

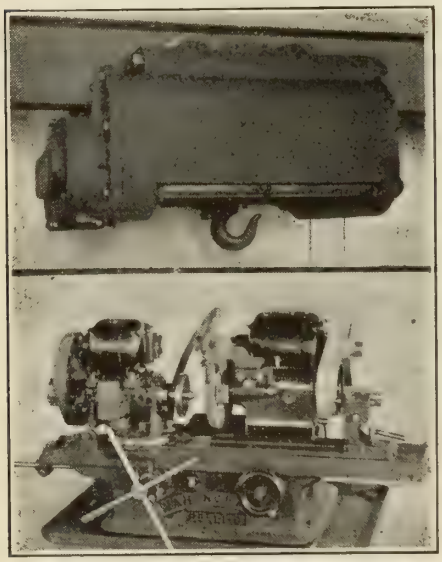


Devices for keeping things handy.

New Things in Shop Equipment

SHORT HEAD-ROOM HOIST

A special hoist for use on mono-rail systems has been placed on the market recently. Where a hoist is to be used in a room with a low ceiling, or in a room where a definite head-room must be maintained for safety sake, or where material of large size is to be lifted or transferred from one place to another, it is frequently an advantage to have a hoist that occupies small space with comparatively long lift. In the hoist here illustrated all the shafts are made of high carbon steel, heat-treated and ground to size, and fitted with roller bearings of the Hyatt high duty type. Accurately machine cut gears of forged steel are used throughout. Pinions are of high carbon steel, heat treated. The drum is of simple design and of rigid construction; grooves are accurately machined and coil the rope in a single layer. The controller is of a new type, built especially for hoist service. The motor is fully enclosed and equipped with ball bearings. The automatic mechanical lowering brake runs in an oil bath, and is provided to control the lowering speed. It is of the screw and disc type, geared to the intermediate shaft and having three discs. The automatic holding brake works on a pulley mounted on the hoisting motor shaft proper, and is asbestos lined. It is operated by a cam on the controller shaft. The circuit is broken at the upper limit of travel. Two or four-rope blocks are provided; blocks are steel yoked and carry a forged steel hook, working on a swivel. All gears operate in a bath of oil and automatically "splash lubricate" all main bearings. These hoists are made by the Standard Electric Crane and Hoist Co., Philadelphia, Pa.



Upper—Short head-room hoist.
Lower—Re-li-o tool room unit.

RE-LI-O TOOL ROOM UNIT

A small universal grinding machine of interesting design has been placed on the market recently. The work-head has a graduate swivel base with a locating pin for 30 to 45 deg., and a central lever binder. The work-head spindle has large diameter taper bearings, with take-up for wear, by means of a hardened thrust collar and a ring nut. The tail stock has cross-adjustment for off-set or alignment as required. A diamond wheel-truing tool is mounted on the inner side of the tail-stock. An adjustable limiting stop screw with lock-nut is attached to the head end of the table. The wheel head, lathe tool block and the cross slide are cast in one piece and machined as a single unit—thus insuring rigidity and freedom from chatter. Wheel spindle runs in ball bearings with ample provision for lubrication, by means of an oil reservoir cast in the wheel head. The internal grinding arbor can be mounted on the end of the regular external wheel spindle. The lathe tool-holder and its cutter are mounted at the front end of the cross slide which converts the machine into a serviceable lathe for straight or taper work. The cross-feed screw is operated by a hand-wheel with dial graduations to read in thousandths of an inch. Machine will swing 8 in. over table. Work 12 in. long can be carried between centres. Table has a travel of 10½ in. Cross feed movement 6½ in. Table has area of 36 x 6½ in. Floor space required, 38 in. x 30½ in. Weight approximately 350 lbs. These tools are made by the Van Norman Machine Tool Co., Springfield Mass.

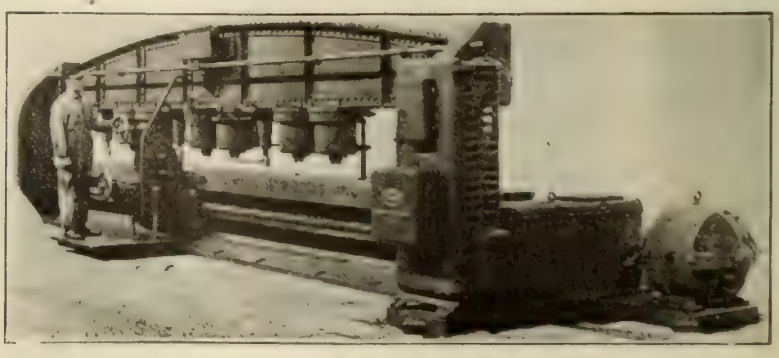
IMPROVED PLATE PLANER

An improved type of heavy plate planer has been placed on the market recently. The tool carriage is attached to the front vertical side of the bed, and is guided in same by square shears. It is bearing supports, which will permit the secured top and bottom by removable carriage to be taken from the bed at any part of its length. The bearing surfaces are provided with taper gibs for taking up wear. Two relieving tool holder slides are mounted on a standard and have simultaneous vertical adjustment by means of a screw and hand wheel, and horizontal adjustment to the standard through screw and hand wheel. Both tool slides are provided with swiveling feature to allow the planing of bevels. The drive screw is supported in a trough with an oil channel of sufficient depth to cover the full depth of the thread with oil. Roller bearings are provided to take the end thrust of the screw.

The pneumatic jacks are of the two-way type, i.e., air is admitted in the top for clamping the plate, and for unclamping the air is admitted at the bottom. The carriage is reversed automatically at any desired position by contact with stops adjustable on the shifter rod. The operator can start, stop, or reverse the carriage by manipulating this shifter rod by hand. This can be done with very little effort on the part of the operator. The main driving gears are enclosed in a box, and dip in oil. The motor is controlled by a master switch attached to the shifter rod, and an enclosed panel with forward, reverse, accelerating, and dynamic brake contactor. A push button is mounted on the right hand housing, so that the machine may be started and stopped without manipulating the shifter rod. The cutting speeds range from 20 to 40 in. per minute. These planers are manufactured by the Niles-Bement-Pond Co., New York.

GROUND-FORM GEAR CUTTERS

Ground-Form gear cutters which are ground on the tooth form, have recently been introduced to the trade. The grinding process corrects all hardening distortions, giving each tooth great accuracy of form and aligning all teeth with the hole in the cutter. As the tooth form of these cutters is accurate to very close limits, the tooth spaces of the gears cut will be correspondingly accurate. The alignment of the cutter



New design of heavy plate planer.

teeth secured by grinding makes it additionally certain that the spaces between the gear teeth will be true to form. Grinding of the tooth form also gives a positive method of controlling the form of different cutters and securing duplicates. This ability to secure duplicate cutters is of great importance to the manufacturer of gears in quantity who is seeking both accuracy and uniformity. The introduction of ground-

Ground form gear cutter.

form cutters solves a difficult problem confronting gear makers to-day—the duplication of accuracy.

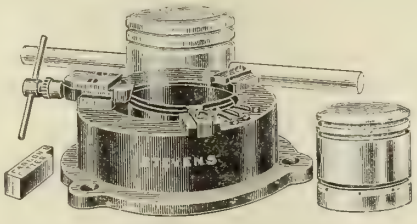
The correction of hardening distortions by grinding aligns all the teeth. This gives ground-form gear cutters a free cutting action largely due to the fact that no tooth or group of teeth does the major part of the work; each tooth does its share. The keener cutting edges formed by the conjunction of the ground surfaces of the teeth add to this freer cutting action and give the cutters a capacity for increasing production which in actual test has proved to be surprisingly great. Not only has a faster feed been used with these cutters but they have cut more gears between resharpenings. This ability of ground-form cutters to wear longer is due to several factors. As the work of cutting is evenly distributed among all the teeth, the resulting heat is not confined to any one portion of the cutter. This removes one of the commonest causes of cutter wear-localized heating. Another factor which adds to the life of these special cutters is that grinding of the form gives the teeth a positive clearance, eliminating "rubbing" of the form back of the cutting edge. These cutters are made by the Brown & Sharpe Mfg. Co., Providence, R. I.

TESTING AND RECORDING MACHINE

The illustration herewith shows a machine that has been developed for testing and recording the efficiency of pneumatic hammers. The hammer to be tested is clamped in the machine and the impact of each blow is transmitted through a column of oil to a diaphragm which communicates the vibrations to a magnifying lever, which records the blows upon paper tape operated by a recording instrument that registers the number of blows each second of time, or any number of seconds continuous run. The length of the vertical lines in the graphic record sheets give the power of the blow; the number of the vertical lines the speed. The air consumption is accurately measured by a water-displacement meter which is connected to the hammer, and registers the air used. By running a series of tests of different hammers of the same size, and selecting the record having greatest length of power line, we obtain a master record to which all tools must conform before they are shipped out. This machine eliminates the human element, substituting accuracy in place of guess work, giving dependable data on the effective work done by a hammer. This machine is manufactured by the Cleveland Pneumatic Tool Co., Cleveland, Ohio.

PISTON OIL-GROOVING TOOL

To counteract oil-pumping pistons, it has become the widespread practice to put an oil-groove on the piston and also to drill oil-return holes in the groove. The tool here shown has been designed to cut and chamfer the oil-groove in pistons and likewise to serve as a jig

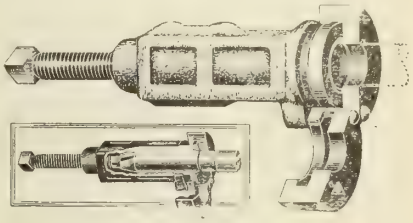


Piston oil-groove tool.

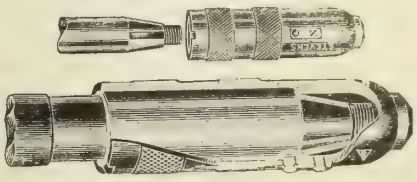
for drilling the oil-return holes. This tool chamfers the lower edge of any groove in the piston at exactly the correct angle. The cutter is made of high grade tool steel and has proper clearance to obtain a clean, smooth cut. The feed screw has a stop to prevent an accidentally deep cut. When the tool is fastened to the bench, the piston is inserted, disassembled, but when it is clamped vertically in a vise, the piston may be inserted with the connecting rod turned by passing the bar through the connecting rod bearings. Burnt carbon deposit is removed from the bottom of the ring groove by using a flat cutter in place of chamfering cutter. One of the steel jaws is designed as a jig for drilling the holes. Graduations on the face of the tool allow of uniform spacing of holes. It is claimed that the method will cure the most persistent case of oil pumping. These tools are made by Stevens and Co., New York.

PULLER AND DRIVER

It is very often a difficult task to remove an automatic drive shaft sleeve with ordinary tools. The tool here shown is claimed to make this job an easy one. It is equipped with steel jaws that completely surround the sleeve, so that any required pressure can be applied through the large steel screw without injury to either sleeve or shaft. The inside is machined to a close fit on the sleeve to prevent the tool from springing out of line or jumping off under



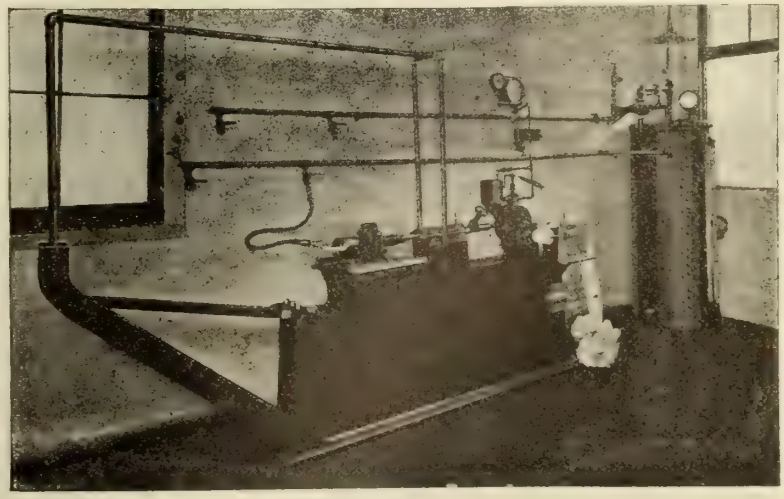
Drive shaft sleeve puller.



Drive shaft sleeve driver.

pressure. The square bosses on the sides are for securing the tool in a vise.

The driver has a novel feature, as it is provided with a "sight," consisting of a special notch and pin, which insures the proper alignment of the keyway slots as the sleeve is driven into place. The sleeve is driven with safety. These tools are the product of Stevens and Co., New York.



Testing and recording machine.

CANADIAN MACHINERY
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Canada's Export Opportunity

DURING the next two months, business men will have an opportunity to discuss export affairs with two Canadian Trade Commissioners, Dr. Ross for China, and Major Gordon B. Johnson for Scotland and Ireland. In statements which they have made it is evident that important markets await development in a larger way than heretofore by Canadian manufacturers. The opportunity seems all the more real because of the curtailment that must result in trade with the United States because of the high tariff barrier which that country is raising in protection of home industry and in more intensive development of their home market. Canadian manufacturing processes follow those of our neighbors to the south very closely, and in appreciation of export opportunities in Canada the number of branch factories here is steadily increasing. Products should, therefore, be such as to meet the requirements of a trade that may be diverted in this direction.

There is no doubt but that trade commissioners are fully aware of these conditions, and while making much valuable export information available, are further entitled to the confidence and co-operation of the manufacturer who may be in possession of facts and figures that may be broadcasted with general benefit to Canadian industry. At the same time there is much valuable material in the shape of statistics, and detailed information for exporters and importers available in the department to manufacturers. There seems to be a real opportunity for the practical application of this material.

Industry Versus Small Politics

IT IS CHARGED by a manufacturing concern in one of the larger Canadian cities that they have had some difficulty in developing a working force by the so-called paternalism of local politicians within the board of aldermen and other municipal bodies. It is pointed out that these men adopt an attitude which is almost equivalent to interference with the work of organization and that the feeling among workmen that friends at court are working in this behalf, looking to a snap on the city payroll, even if only temporary in character, tends to retard the building up of a desirable permanent staff. In short, it is evident that activity in the vote market demoralizes, in not a few cases, any influence looking toward industrial co-operation.

There are men, it is stated, who have, on busy occasions, refused to work overtime because of an attitude of independence encouraged by the promises of a ward or lodge politician. In some cases men who have been induced to work overtime, have failed to report for duty the following day and it actually developed later had applied for the easy unemployment assistance doled out by the city though still having a job available to them.

It is possible to imagine how conditions such as these might disturb the esprit de corps desirable in connection with a large industry especially when the wage rate paid by the city for common labor is considerably higher than that available in private concerns. Labor is entitled to everything to which it is legitimately entitled, but surely it is a misguided sense of public importance which causes a local politician to become a busybody to the detriment of industrial affairs. It is this kind of thing that unscrupulous ambition breeds upon. Some criticism may be directed also toward a municipal system which pays, out of public funds, a higher wage rate for ordinary labor than many taxpayers are able to obtain for harder and more intelligent work elsewhere.

Develop Canadian Ore Industry

GROWING out of the feeling of dependence, if not of helplessness that emerges from experiences in coal strikes, it would not be surprising if any movement looking to development of the country's natural resources in raw materials became more insistent. Some such feeling predominated at a recent meeting of men interested in iron ore mining and the blast furnace industry and if nothing else were wanted but statistics, there is a strong case in favor of an exclusively Canadian industry. During the past thirteen years, it was pointed out, Canada had imported iron and steel products to the value of $1,235,000,000, all of which should have been produced in Canada. For her 40,000 miles of railway, the country should produce seven million tons of steel instead of two million. If that were done, there would be one billion dollars invested in the mines and plants and thirty million tons of iron ore, coal, and limestone handled annually. The produce would be worth six hundred million dollars. Employees would receive one hundred and fifteen millions; the government, fourteen millions; railways, eight millions; municipalities, eight millions in taxes, besides about eleven millions for the use of public utilities. These statistics were emphasized as setting definitely the question of markets and of the sufficiency of ores in Canadian ranges for future demand.

The situation, however, promises no improvement until the governments see fit to assist in the mining of the ore by way of bounty or in making power available at nominal rates, or both. Existing steel companies are sympathetic, and have spent a great deal of money in investigation work on the different ranges and ore bodies and authoritative opinion emphasizes the fact that problems confronting the Canadian industry are no more serious than those which have been surmounted in the United States.

Market not so Ambitious but Prices are Firm

Mills Urge Advance Buying and Premiums Disappear—Quotations Indicate Stability But Levels Maintained—Canadian Markets Fairly Active—Reluctant to Advance Prices—Relief in Pig Iron

STEEL CO. BLOWS IN 500-TON FURNACE

AN AVERAGE advance of $9 a ton, or about one-half as much again as that of the great market movements of 1909 and 1912 has marked the movement in iron and steel during the past six months. According to Pittsburgh advices, this advance includes all steel products. Comes the inevitable reversal, probably due to increased production since the coal strike settlement, coupled with the fact that buyers are drawing upon stocks accumulated in anticipation of interrupted delivery. Car shortage is being stressed as a reason for orders, but the condition to-day shows improved deliveries on old orders, premiums for early shipment fading out, and there is some feeling that prices on placing business may have to decline. Against this, the fact must be considered that storage of products on a large scale is necessitated and this must add to costs. Basic prices are decidedly firm. Wire products have advanced. Shapes, bars and plates are very firm at $2.00 to $2.25. In Toronto markets the price is $3.25 to $3.40, and there are those who maintain that this does not represent a sufficient spread as between Pittsburgh mill and Toronto warehouse, or say, between the Hamilton basic price of $2.70 and Toronto warehouse. However, it is characteristic of the Toronto market to be quite conservative in the matter of price advances. Conditions in the past three months have necessitated an advance on bars, for example, of from 35 to 50 cents per hundred pounds. Sheet demand has been strong and here, too, advances have been frequent.

Relief in the coal situation is improving somewhat, and the Steel Company of Canada finds it now possible to blow in one of its 500-ton furnaces on basic pig. This will help reassure Ontario foundries who were running short. Toronto price for pig iron still stands at $39.30 for spot, while Montreal quotes $35 at dock for Summerlee Scotch pig. There have never been large tonnages of this available. During an acute period small quantities of this iron made its appearance in Western Ontario.

September's record in the Canadian iron and steel business was a fair record, though by no means as spectacular as might be expected as reflecting the movement in the American market. Railroads have been a strong factor there, while here, apart from the purchase by National lines, of machine tools for Eastern and Western shops, there has not been any notable buying movement. The scramble by the American lines to add to their equipment is already seen to be a trifle belated to meet present emergencies, and it is held that there is danger of a like problem developing in Canadian demand for rolling stock.

Machine tool demand is reported as showing some slight improvement in the past month's record. Shop and mill supplies have been active, and in this connection it is pointed out that the mining regions of the north are becoming an increasingly important market.

Toronto

October 4

WITH coal and rail strikes a thing of the past, the iron and steel market here is confronted by two conditions. One of these has to do with shipments from American sources which are still beset with difficulty, and the other is the time-honored law of supply and demand which always demonstrates its rigidity most positively when speculative tendencies obtain any headway. Such speculation is said to be already in evidence, reflected by the feeling that prices should shortly become easier. It is an unreasonable expectation in view of the present tendency of the market toward a very firm price attitude behind which there are statistics to prove that steel production has been conducted on a somewhat threadbare basis and that advancing wage and other costs absolutely prohibit price recessions for some months—say until the first quarter of 1923.

There are those who contend that Toronto market has itself to blame. Opposite influences are at work which contribute to instability, but which are expected, nevertheless, to promote buying. The situation may be best illustrated by the experience of a buyer who had an order up his sleeve for a fair sized order of merchant bars. With Canadian mill prices at $2.70, and Buffalo warehouse prices at $3.10, he was advised by a steel man that he would probably find that the reselling price was around $3.70, or a spread of about 60 cents over Buffalo and about $1.65 over Pittsburgh. The quotation he actually received was $3.20. He concluded that the Toronto market must be either fairly well supplied with low priced bars, or that competition was maintaining very low levels in spite of upward trends on the American markets. On the one hand there are those who contend that business does not warrant an advance; on the other there are those who declare that Toronto prices have never been in line with those of the American market and that selling has been on a basis most favorable to the buyer. At that, during the past three months, the advance in bar prices has advanced 30 to 50 cents per hundred.

Iron and Steel.—Price ranges on iron and steel bars continue at $3.25 to $3.40, with the bulk of the business being done at the first-named figure. It is claimed in some quarters that an advance is in order, but there is an undertone of reluctance. Business has been coming along steadily, but during the past week is reported to have been somewhat spotty. September, in bulk, was a fair month, but there is yet a lack of that activity which has characterized American business. Dealers declare that such a movement does not generally develop on the other side without some definite reflection here. There is confidence that it will come and in the meantime, there are dealers who declare that they will not be guilty of premature action that may discourage it. However, necessity does not stand on sentiment and the market at present may be described as halting between two influences—advancing or maintaining present levels. Certainly, there will be no declines. Sheet prices continue firm. An advance of $2 per ton on galvanized was recently announced and reflects general market trend. Here, too, the feeling seems to be that restricted markets cannot always afford to follow too closely the movements of one many times larger, and the attitude on price changes is inclined to be conservative. Current prices:

Iron bars	3 25	3 40
Steel bars	3 25	3 40
Reinforcing bars	3 25	3 40
Steel hoops		4 75
Tire Steel		3 50
Spring steel	7 00	14 00
Band steel, No. 10 gauge and 3-16 in base		3 90
Small shapes		3 50
Sheets, black, No. 28		5 50
Sheets, blue ann., No. 10		4 50
Canada plates, dull, 52 sheets		5 75
Canada plates, all bright		6 75
Galvanized Sheets, No. 28		6 75

Pig Iron Markets, so far as supply is concerned, are somewhat easier as coal becomes available. Steel Company of Canada have blown in a 500-ton furnace after an activity extending from middle of July. Spot quotations are at $39.30. Coal supplies for this production seem assured, and as the situation improves, the output will increase. Port Colborne furnaces are still out. Buffalo price is at $35. Small quantities of Scotch pig iron have made their appearance in Western Ontario, and a Galt buyer declares he bought some of this at a better price than any available from local furnaces. His purchase may have been made at a time when British pig was at a lower level than $35 dock Montreal, and when so-

called local furnaces were practically out of the market at any price. Improvement in the production of American furnaces is such that something like a war is expected in ousting foreign pig. For example, Scotch pig is quoted $30 to $33, c. i. f. Boston, and Belgian and French $26.50 to $28, c. i. f. Boston. Pennsylvania interests are quoting $35.65 delivered New England. Montreal is quoting Summerlee Scotch at $35 dock.

Scrap metal markets continue inactive, although the general undertone is declared to be good. There has been some little demand for non-ferrous materials. This may indicate that brass foundries are busy, but there has not been, recently, any work of big dimensions in this field. Dealers' average buying prices follow:

Copper, light, per 100 lbs	9 00
Copper, crucible	11 50
Copper, heavy	11 25
Copper Wire	11 25
No. 1 compositon	9 00
New brass cuttings	6 00
Red brass turnings	6 50
Yellow brass turnings	5 25
Light brass	4 50
Medium brass	6 00
Scrap zinc	3 50
Heavy lead	4 50
Tea lead	3 00
Aluminum	11 00
Boiler plate, per gross ton	9 00
Heavy melting steel	10 00
Axles (wrought iron)	20 00
Rails (scrap)	11 00
Malleable	10 00
No. 1 machine castiron	18 00
Pipe, wrought	7 00

Non-ferrous metals while recently subject to influences that make for activity, indicate no important movement on this market. London quotes tin prices as higher, in keeping with general metal lists; the copper market is firm, and New York reports large French and German business, electrolytic being quoted at 14 cents; lead markets are also showing strength; New York is quoting $6.35 to $6.40 by leading interests and $6.60 by the outsiders. Levels are high and buyers inclined to be conservative. Toronto prices:

Lake copper	17 25
Electrolytic copper	17 00
Castings, Copper	17 00
Tin	36 00
Lead	7 00
Spelter	8 50
Antimony	8 50
Aluminum	23 00

Machine tool business is spasmodic. No one week may be taken as a hint as to the record of that following. Some good sales were made last month, including lists issued by the National railways for Eastern and Western shops. One dealer reports the sale of three turret lathes. Another had reason for jubilation in a list of supplies amounting to about $2,000, which included six 3-ton chain blocks. These were for a bridge-building outfit. Business from Northern mining camps is good and compris s much heavy mill equipment and supplies. A month's business nowadays is somewhat miscellaneous in character but indicates improvement.

Toronto purchasing agents returning from Pittsburgh district expresses the opinion that the steel and iron industry may find that it has gone after high prices too vigorously in order to cover losses that occurred during end of 1921 and beginning of 1922, and that some tendency toward conservative buying may be looked for. Nevertheless, markets are decidedly firm, although deliveries are badly handicapped. The opinion is expressed that price recessions may not develop until the first quarter 1923.

Montreal

October 4

TRADING in the iron and steel lines continues to gradually increase in spite of the difficulty of getting deliveries from the mills. September figures are very satisfactory indeed, and will be, as intimated last week, at least ten per cent. in advance of the figures for August. This statement is equivalent to saying that September was the best month of the year. British pig is being marketed more freely of late, and the risk of an acute shortage is past, for the time being. Machine tools continue dull, but the supply business shows that conditions are improving. The non-ferrous metals are rather quiet and quotations steady. The scrap markets are still fairly active with quotations tending to firmness.

Iron and Steel.—Steel and iron products are moving well locally. Prices have not been changed during the week, but it is generally felt that quotations will not be advanced, as the acuteness of the strike situation has been passed, and it was this factor that was responsible for a measure of the recent advances. Merchant bars are only moving fairly well, but all other lines have shown decided improvements during the week. One jobber carried a heavy stock of plates all spring and summer, but has been able to dispose of them recently, and is having more or less difficulty in replacing them as deliveries are rather distant. British plates and sheets are being marketed largely by the local jobbers. Sheets are beginning to feel the seasonal fall movement, and all varieties are called for. Structural steel from the outside towns seems to be in good demand also. Tire steel, band steel, spring steel, sleigh shoe steel, etc., are lines that are moving well. Miscellaneous small steel products are also experiencing a heavier movement. Already the jobbers feel that October and November will set new high levels for the year. Local quotations are as follows:

Iron bars, base	3 15 to 3 25
Steel bars, base	3 15 to 3 25
Reinforcing bars, base	3 15 to 3 25
Steel hoops	4 25
Tire steel	3 25 to 3 40
Spring steel	7 00
Band steel, No. 10 gauge and 3-16" base	3 65 3 75
Small shapes	3 40
Sheets, black, No. 28	4 40
Sheets, blue ann., No. 10	4 05
Canada plates, dull, 52 sheets	5 50
Canada Plates, all bright	7 00
Galvanized Sheets, No. 28	6 50

Pig Iron.—Canadian producers are more or less definitely off the market as all local quotations have been withdrawn. Stocks of Summerlee are very low indeed, and prospects of their being replenished at an early date are remote. Carron and Middlesboro have been active. One jobber has sold over 2,500 tons in the last few weeks. Quotations on British iron are $35, car load lots on docks Montreal. The nominal quotation on Canadian iron is $40.80 on tracks Montreal. The present indication is that British iron will supply the local needs until the close of navigation. Local quotations are:

Algoma, No. 1, car lots on tracks, nominal quotation	40 80	....
Summerlee, 30-ton lots, dock	35 00	....
Carron, 30 ton lots	35 00	....
Do., 5 ton lots, ex. warehouse	42 50	....

Machine Tools and Shop Supplies.—Machine tool markets are very quiet and there is very little indication that there will be any great or permanent improvement for some time to come. Among the few sales reported it is noted that woodworking tools appear to be moving a little better than iron-working tools. Supplies continue to move well. There has been a tendency toward stiffness in quotations, which has been reflected in somewhat larger specifications in several instances.

Non-ferrous Metals.—Copper quotations have not changed during the week but reports from London indicate that tin has advanced, and in sympathy with the movement, quotations have locally advanced a half a cent a pound. Spelter also advanced a quarter of a cent, while lead sagged off a quarter of a cent. Lead has been very inactive for the past week. Quotations on antimony and aluminum remained stationary. Business has been very fair during the week. Orders have been small but they have been numerous and well scattered. Local quotations are as follows:

Lake Copper	17 75
Electrolytic Copper	17 50
Castings, Copper	17 25
Tin	36 00
Lead	7 25
Spelter	9 00
Antimony	6 75
Aluminum	22 00

Scrap Metals.—An activity is noticeable in the ferrous scrap metals owing to the scarcity of pig iron and steel. Quotations have become stiff for this reason, as they usually follow steel and pig prices. Supplies of all kinds appear to be ample to take care of the demand. The non-ferrous scrap metals are not quite so active, but an improvement has been noted in the last few weeks. Local prices follow:

Copper, light per 100 lbs.	9 00
Copper, crucible	11 50
Copper, heavy	11 25
Copper Wire	11 25
No. 1 composition	9 00
New brass cuttings	6 00
Red brass turnings	6 50
Yellow brass turnings	5 25
Light brass	4 50
Medium brass	6 00
Scrap zinc	3 50
Heavy lead	4 50
Tea lead	3 00
Aluminum	11 00
Boiler plate, per gross ton	9 00
Heavy melting steel	10 00
Axles (wrought iron)	20 00
Rails (scrap)	11 00
Malleable	10 00
No. 1 machine cast iron	20 00
Pipe, wrought	7 00
Car wheels	17 00
Steel Axles	15 00
Machine shop turnings	4 00
Stove plate	16 00
Cast boring	4 00

Pittsburgh

October 4, 1922

STEEL markets have had another of the sudden shifts that are so characteristic. For six months mills have been straining every nerve to produce the last ton possible, in order to meet, as far as possible, the urgent requests of customers for deliveries, and during almost the entire period prices were advancing. The average advance on all steel products, for forward deliveries, was about $9 a net ton, or almost one-half again as much as the advances in the great market movements of 1909 and 1912, while using early delivery prices for the comparison, the advance was considerably more than $9 a ton.

By the sudden reversal that has occurred, mill deliveries on old orders are growing more prompt, many mills are eagerly seeking business, prices for early deliveries are declining, and a feeling is growing that prices for forward deliveries are likely to decline before there is another general buying movement.

Possibly this reversal is due to the increased production of steel since the coal strike ended, but this seems hardly sufficient to explain the change fully. Production was at about 50 per cent. of capacity at the end of August and is now at between 65 and 70 per cent. While this is a great increase, the 50 per cent. rate had been only a temporary affair. The industry was running at between 70 and 75 per cent. in June, and July showed an average rate of nearly 70 per cent. Thus the real picture shows, not that there has been an increase in the past 30 days, but that there was a period of just a few weeks in which production dropped. The present rate is hardly equal to the July rate and is well below the June rate, hence it should not, itself, make a surplus of steel.

The explanation of the sudden easiness of position the steel market has acquired seems rather to be that during the coal strike buyers were anxious to get all the steel they could, fearing an interruption of deliveries by the coal shortage while now, with the coal strike ended, they content themselves with such steel as they actually need at present. Possibly they are drawing upon stocks of steel previously accumulated.

Sellers of steel are laying much emphasis upon car shortage, presumably to encourage buyers to take heavy deliveries. The car shortage is not serious, as to its present influence, but it is serious in its menace of worse conditions to come, for inclement weather, due in say a couple months, always slows down railroad operations more or less. The demands upon transportation now are a little beyond the transportation capacity and if the demand for movement continues unabated and the capacity goes down there is going to be serious trouble.

Many of the mills, perhaps the majority, have more or less car shortage. At some sheet mills product to the extent of two or three weeks of production has accumulated. At mills making other classes of material there are no accumulations or only small accumulations, equal perhaps to two or three or four days of production. The greatest difficulty of course, is with box cars, required for moving sheets, wire products and tin plate, but open top cars are more or less scarce.

The sagging tendency in prices has been exhibited only by way of delivery premiums decreasing. Basis prices, for late delivery, are in no case a particle easier. In wire products there is an advance. The American Steel & Wire Company has made an advance of $2 a ton, to 2.45c on plain wire and $2.70 on nails. Independents had been $3 above the leading interest, this representing in essence a delivery premium and they have dropped the extra dollar, so that all sellers are now on the same basis.

A somewhat similar thing has occurred in merchant steel bars. The Carnegie Steel Company recently withdrew entirely its price of $1.90, leaving it on the basis of $2.00. One large independent, which had been asking and securing $2.15 to $2.25, according to size and character of order, has come down to $2.00. One or two others are already down and other mills are merely delaying, as they have some higher priced tonnage to complete. In shapes the regular market is now $2.00, with small and undesirable orders going at $2.15 or $2.25. Plates are at $2.00 to $2.25.

The price situation in sheets is rather complicated. The American Sheet & Tin Plate Company's prices are based on $3.35 for common black, but about three weeks ago the company became sold out, so that it has no more to offer until it opens books for the first quarter of the new year. Thus $3.35 is not really an open market price at all, though some shipping orders are being placed, filling out contracts not previously specified in full. Until the past few days the independents making the largest sales were getting a $3.50 basis, and able to make shipments on new orders in from four to six weeks. Others, able to make shipment in two or three weeks, were getting a $3.75 basis, the orders of course being small. In the past few days all or most of the $3.75 mills have come down to $3.60, making it possible that henceforth the $3.50 mills will have difficulty in selling much at their price. There is a possibility, therefore, that the whole market will gradually slide back to the $3.55 price.

The very unfavorable condition that has existed in pig iron for several weeks is being relieved slightly by offerings of the Cambria Steel Company, which is now operating six blast furnaces at Johnstown and has some pig iron over and above its requirements for steel making. Cambria has sold 2,000 tons of basic iron to the Follansbee Bros. Company at $30, Johnstown, and 1,000 tons of Bessemer to a steel foundry in the Pittsburgh district, at $33.50, Johnstown. Freight to Pittsburgh is $1.77, the same as from the valleys.

The pig iron situation lately existing proved an unfortunate one. Prices asked were in the neighborhood of $35 at furnace, and experience has shown that consumers are unable to pay such a price. Even if they had been able, they could not have secured much, as little buying would simply have sent the price higher still. Offerings of Connellsville coke are extremely limited and there is little chance for additional merchant furnaces to get into blast, so that relief from the steel works, which have coke ovens of their own, is for the good of the industry as a whole, though the few merchant furnaces that are trying to operate do not like to see the steel works entering their market.

Connellsville coke is somewhat higher, being now quotable at $12 to $12.50 for furnace and $13.50 to $14.50 for foundry. There has been quite a demand from retail dealers, for household use. Until a day or two ago, odd lots could be had at $11.50. Blast furnace lots have being going right along at $12 or $12.50, with little to be had even at that.

BOOKLET

The Alemite Products Co., Belleville, Canadian subsidiary of the Bassick Mfg., Co., Chicago, manufacturers of high pressure lubricating systems, have issued a booklet on industrial lubricating facts describing the application of their equipment. The Alemite method consists in the delivery of lubricant from a compressor through a flexible conduit to a bearing through a ball-check valve fitting, which remains a permanent fixture in the part where lubrication is needed. The system, it is claimed, is a time saver in the lubrication of intricate machinery, and practically eliminates the danger factor among operatives who have this work to do.

Canada's Foreign Trade is Making a Better Showing

In the four months to July 31st, the aggregate value of Canadian imports and exports, $479,500,000, was ten millions greater than in the corresponding period of last year. And the gain was in exports. We sold abroad $27,300,000 more of domestic products, and bought $17 600,000 less of foreign goods. The balance of trade in the last four months was $7,000,000 in favor of Canada, whereas a year ago there was an adverse balance of $38,000,000.

In examining the microstructure of a sand casting, it is seen that the structure is coarse and open grained in character, and that the lines of division of the crystals are pronounced. In examining the microstructure of the forging, it is seen that the structure is fine grained, compact and uniform, and that the lines of division of crystals are absent.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Toronto price:—

Silicon, 2.25% to 2.75%	39 30
Algoma, No. 1, Montreal,	40 80
Summerlee, Scotch, Montreal dock	35 00
Summerlee, Warehouse, 5-ton	40 50
Carron, Montreal docks	35 00
Grey forge Pittsburgh	34 27
Lake Superior, charcoal, Chicago	36 15
Standard low phos., Philadelphia	38 00
Bessemer, Pittsburgh	35 77
Basic, Valley furnace	34 00

METALS

	Montreal	Toronto
Lake Copper	$17 75	$17 25
Electrolytic Copper	17 50	17 00
Castings, Copper	17 25	17 00
Tin	36 00	36 00
Spelter	9 00	8 50
Lead	7 50	7 50
Antimony	6 75	8 50
Aluminum	22 00	23 00

Prices per 100 lbs.

BILLETS

F. O. B. Pittsburgh

	Per gross ton
Bessemer billets, 4 in. x 4 in. and larger	40 00
Open hearth billets	40 00
O. H. sheet bars	40 00
Forging billets	45 00
Bessemer rods	46 50

IRON AND STEEL

Per 100 lbs. to large buyers

Iron bars, base, Toronto	$3 25	3 40
Steel bars, base, Toronto	3 25	3 40
Small shapes, base		3 50
Iron bars, base, Montreal	3 15	3 25
Steel bars, base, Montreal	3 15	3 25
Reinforcing bars, base	3 35	3 40
Steel hoops		4 50
Tire steel, base		3 50
Spring steel	7 00	14 00
Band steel No. 10 gauge and 3-16 in. base		3 90
Chequered floor plate ¼" and heavier		7 00
Bessemer rails, heavy, at mill		2 35

PITTSBURGH MILL

Steel bars	2 25
Tank plates	2 25
Structural shapes	2 25
Steel hoops	2 75 to 3 00

F. O. B. Chicago Warehouse

Steel bars	2 80
Structural shapes	2 90
Plates	2 90
Small shapes under 3-in.	2 90

PLATES

Plates 3-16 in.	$3.85	$3 60
Plates, ¼ up	3 50	3 40

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$3 70	$5 50
Sheets, blue ann., No. 10	4 70	4 50
Canada plates, dull, 52 sheets	5 50	5 75
Can. plates, all bright	7 00	6 75
Galvanized sheets, No. 28	6 75	6 75
Queen's Head, 28 B.W.G.	7 25	
Fleur de Lis, 28 B.W.G.	7 00	
Gorbal's best, No. 28		
Colborne's Grown, No. 28		
Premier	6 85	6 35
Premier 10¾ oz.	6 85	6 75
Zinc sheets	9 25	11 00

FREIGHT RATES

	Per 100 lbs. C.L.	L.C.L.
Pittsburgh to Following Points		
Montreal	52	65½
St. John, N. B.	76	96
Halifax	77½	97
Toronto	34	48½
Guelph	34	48½
London	34	48½
Windsor	31½	45½
Kingston	48½	61

Current surcharge 1 per cent.

OLD MATERIAL

Dealers' Average Buying Prices

	Montreal Per Ton	Toronto Gross
Boiler plate	$ 9 00	$ 9 00
Heavy Melting Steel	10 00	11 00
Axles (wrought iron)	20 00	16 00
Rails (scrap)	11 00	11 00
Malleable scrap	10 00	11 00
No. 1 Machine cast iron	20 00	18 00
Pipe, wrought	7 00	6 00
Car wheel	17 00	16 00
Steel axles	15 00	15 00
Mach. shop turnings	4 00	6 00
Stove plate	16 00	14 00
Cast boring	4 00	6 00
Copper, light	9 00	8 50
Copper, crucible	11 50	11 00
Copper, heavy	11 25	11 00
Copper, wire	11 25	11 00
No. 1 machine composition	9 00	9 00
New brass cuttings	6 00	6 00
Red brass turnings	6 50	6 50
Yellow brass turnings	5 25	4 85
Light brass	4 50	3 50
Medium brass	6 00	4 50
Scrap zinc	3 50	4 00
Heavy lead	4 50	4 50
Tea lead	3 00	3 00
Aluminum	11 00	11 00

COLD ROLLED STEEL

(At Warehouse)

Rounds and squares	$4 75 base
Hexagon and flats	$5 75 base

COPPER PRODUCTS

Prices per lb.

	Montreal	Toronto
Copper Bars, ½ to 2 in.	.29	.28
Brass Tube		.30
Plain sheets, 16 oz. in. 30 x 72	.30	.29
Copper sheet, tinned, 16 oz.	.37	.36
Copper sheet, planished, 16 oz. base	.42	.41
Braziers', in sheets, 6 x 4 base	.30	.29
Copper tubing, seamless		.33
Brass rod		.22

LEAD SHEETS

Roll Lot Prices

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$8 75	$ 11 50
Sheets, 3 1-2 lbs. sq. ft.	8 75	11 50
Sheets, 4 to 6 lbs. sq. ft.	8 25	10 00

Cut sheets, ¾c. per lb. extra

Cut sheets to size, 1c. per lb. extra

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	20
Brass sheets, 24 gauge and heavier base	23
Brass tubing, seamless	28

WROUGHT PIPE

Price List No. 56. August 23, 1922.

Standard Buttweld Pipe S/C

Size	Steel Blk.	Steel Galv.	Gen. Wrot. Iron Blk.	Gen. Wrot. Iron Galv.
⅛ in.	6 00	8 00	....	....
¼ in.	3 96	6 00	7 20	9 30
⅜ in.	3 96	6 00	7 20	9 30
½ in.	5 02	6 55	7 31	8 93
¾ in.	6 10	7 82	8 86	10 70
1 in.	8 50	14 22	12 58	15 30
1¼ in.	11 50	15 18	17 02	20 70
1½ in.	13 75	8 15	20 35	24 75
2 in.	18 50	24 42	27 38	33 30
2½ in.	29 25	38 61	....	....
3 in.	38 25	50 49	....	....
3½ in.	49 68	64 40	....	....
4 in.	58 86	76 30	....	....

Standard Lapweld Pipe S/C

Per 100 feet.

Below dividing line—price per foot.

Size	Steel Blk.	Steel Galv.	Gen. Wrot. Iron Blk.	Gen. Wrot. Iron Galv.
2 in.	22 20	27 75	31 08	37 00
2½ in.	32 76	41 54	46 80	56 16
3 in.	42 84	54 32	61 20	73 44
3½ in.	50 60	66 24	72 68	89 24
4 in.	59 95	78 48	86 11	105 73
4½ in.	68 58	87 63	1 04	1 24
5 in.	79 92	102 10	1 21	1 45
6 in.	1 04	1 32	1 57	1 88
7 in.	1 38	1 79	2 02	2 45
8L in.	1 45	1 88	2 13	2 58
8 in.	1 67	2 16	2 45	2 97
9 in.	2 04	2 62	2 97	3 59
10L in.	1 89	2 43	2 75	3 33
10 in.	2 43	3 13	3 54	4 28

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4-in. and under 55 per cent.

4½-in. and larger, 45 per cent.

4-in. and under running thread, 35%.

Standard couplings 4-in. and under 25%.

Do., 4½-in. and larger 5 per cent.

MALLEABLE FITTING LIST

1 in. elbow	.32	.53
2 in. elbow	1.05	1.70
1 in. tee	.43	.70
2 in. tee	1.45	2.40
1 in. coupling	.33	.53
1 in. locknut	.15	.23

Discounts to dealers—Class A, 70 per cent, Class B. and C., 60 per cent.

BOILER TUBES

Size	Lapweld Toronto	Seamless Montreal	Lapweld Montreal
1 in.	19 00		
1¼ in.	21 00		
1½ in.	20 00		
1¾ in.	23 00		
2 in.	18 00	20 00	19 00
2¼ in.	20 00	23 00	21 00
2½ in.	21 50	26 00	22 50
3 in.	27 50	32 00	28 50
3½ in.	30 50	37 00	33 00
4 in.	39 00	47 00	42 00

Prices per 100 ft., Montreal and Toronto.

BOLTS, NUTS AND SCREWS

	per Cent.
Carriage bolts, 7-16 and up	30
Carriage bolts, ⅜ in. and smaller 6 in. and shorter	40
Coach and lag screws	45
Stove bolts	72½
Wrought Washers	60
Do., corru. head	60
Machine bolts, 7-16 and over	35
Machine bolts, ⅜-in. and less	35
Blank bolts	35
Bolt ends	35
Machine screws, fl. and rd. hd., steel cut thread	37½ & 10
Machine screws, o. and fil. hd., steel cut thread	30
Machine screws, o, and fil. hd., brass cut thread	15
Standard coplings, 4-in. and under, brass cut thread	30% 30
Nuts, square, blank off net list	$1.00
Nuts, square, tapped off net list	50c.
Nuts, hex., blank off net list	50c.
Nuts, hex., tapped net list	
Copper rivets and burrs, list less	32c.
Burrs only, list plus	10%
Iron rivets and burrs	47%
Boiler rivets, base ¾ in and larger	$5.75
Structural rivets, as above	5 65
Wood screws, O. & R., bright	80
Wood screws, flat, bright	82½
Wood screws, flat brass	77½
Wood screws, O. & R., brass	75
Wood screws, flat, bronze	72½
Wood screws, O. & R., bronze	70

NAILS AND SPIKES

Wire nails, base	$3 65
Cut nails, base	4 35
Miscellaneous wire nails	72½ %

MILLED PRODUCTS

(Prices on unbroken packages)

Set screws	65
Square and hexagon head cap screws	60
Round head cap screws	20
Fillister head cap screws	35
Flat head screws	25
Button head cap screws	20
Studs	45
Semi-finished nuts up to and including 9/16 in.	70
Semi-finished nuts ⅝ to 1¼ in.	65
Semi-finished nuts 1⅜ to 2 in	35
Coupling bolts	35
Taper pins, No. 2 to No 5	65
Taper pin No. 6 and over	10
Planer bolts without fillet	10
Planer bolts with fillet	Net
Patch bolts	Plus 10%
Hollow set screws	20
Thumb screws	50
Thumb nuts	70

CARBON DRILLS AND REAMERS

	Discount.
S. S. drills, wire size	60
Can. carbon cutters	plus 10
Standard drills, all sizes	60
3-fluted drills, plus	10
Jobbers and letter sizes	60
Bit stock	50
Ratchet drills	25
S. S. drills for wood	10
Wood boring brace drills	50
Electricians' bits	30
Sockets	50
Sleeves	30
Taper pin reamers	25
Drills and countersinks	20
Bridge reamers, carbon	50
Centre reamers	Net
Taps, machine screw	50 to 60
Taps, hand, sizes up to 1"	30 to 60
Chucking reamers	20 off
Hand reamers	20
High speed drills, list	40
Can. high speed cutters	plus 10
American	plus 40

FILES AND RASPS

Globe	60/5
Vulcan	50
P. H. and Imperial	60/5
Nicholson	40
Black Diamond	40
Heller	40
Jowitts	net
J. Barton Smith, Eagle	55
McClelland, Globe	50
Delta Files	20
Disston	40
Disston	50
Great Western-American	50
Kearney & Foote, Arcade	60/5

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

PROOF COIL CHAIN

B. B. B. CHAIN

⅝ in., $16.45; 7-16 in., $14.00; ½ in., $12.95; 5-8 in., $13.15; ¾ in., $12.75; ⅞ in., $12.25; 1 in., $11.85; 1⅛ and 1¼ in., $10.55. Fire weld chain same sizes respectively are $14.00; $11.50; $10.40; $10.55; $10.15; $9.75; $9.35; and $8.25.

ELECTRIC WELD COIL CHAIN B.B.B.

⅛ in. $20.00; 3-16 in. $16.50; ¼ in. $15.50; 5-16 in. $12.70.

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	30%
Standard	30 and 10%
Cut leather lacing, No. 1	1.75
Leather in side, (Lacing)	1.50

RUBBER BELTING

Standard 36 ....28% Best grades 28%

TAPES

Chesterman Metallic, 50 ft.	$5 00
Lufkin Metallic, 603, 50 ft.	3 17
Admiral Steel Tape, 50 ft.	3 00
Admiral Steel Tape, 100 ft.	4 50
Major Jun. Steel Tape, 50 ft.	3 75
Rival Steel Tape, 50 ft.	4 00
Rival Steel Tape, 100 ft.	8 75
Reliable Jun. Steel Tape, 50 ft.	5 25

PLUMBING SUPPLIES

Plumbers' oakum, per cwt.	6 00
Solder, strictly	$0 22½
Solder, guaranteed	0 24
Soldering coppers, lb.	0 62½
White lead, pure, cwt	13 20
Red dry lead, 100-lb. kegs, per cwt.	10 75
Wood alcohol, per gal.	1 75
Whiting, plain, per 100 lbs.	3 00

ROPE AND PACKING

Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope ¾ and larger, base	0 21
British Manila rope	0 19
New Zealand hemp	0 19
Jute packing, fine	15c
Jute packing, coarse	11c

OILS AND COMPOUNDS

Castor Machine Oil, per lb.	34½
Royalite, per gal. bulk	20
Palacine	23
Machine oil, per gal.	39
Black oil, per gal. (Summer)	19
Cylinder oil, Capital	69½
Petroleum fuel oil bbls., net	10.80
Turp., single bbls., gal	1.75
Linseed oil, raw, single bbls.	1.02
Premier galsoline	34

WASTE

XXX Extra	16 Atlas 18
Peerless	21 X Empire 13
XX Grand	15 Ideal 18
Superior	20 X Press 11½
X L C R	14

Colored

Lion	12 Fancy 13½
Standard	10½ Popular 9
No. 1	13 Keen 7½

Wool Packing

Arrow	24 Anvil 16
Axle	20

Washed Wipers

Select White	18 Dark colored. 13
Mixed Colored	14

This list subject to trade discount

PLATING SUPPLIES

Polishing wheels, felt	$3 25
Polishing wheels, bull-neck	1 60
Emerey in kegs, Turkish	7½
Pumice, ground	04½
Emery glue	26
Tripoli composition	08
Crocus composition	12
Emery composition	11
Rouge, silver	60
Rouge, powder, nickel	35

Prices per lb.

ANODES

Nickel	40 to .45
Copper	.38 to 22
Zinc	.16 to .12½

PLATING CHEMICALS

Acid boracic	.20
Acid, hydrochloric	.03¾
Acid, nitric	.10¼
Acid, sulphuric	.03¾
Ammonia, aqua	.20
Ammonium, Carbonate	.15
Ammonium, chloride	.18
Ammonium, hydrosulphuret	.75
Ammonium, sulphate	.10
Arsenic, white	.18
Copper carbonate, anhy.	.26
Copper, sulphate	.08
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.14
Nickel carbonate	.32
Nickel sulphate	.14
Potassium sulphide (substitute)	.40
Silver chloride (per oz.)	.85
Silver nitrate (per oz.)	.65
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.32
Sodium hyposulphite	.08
Sodium phosphate	.10
Tin chloride	.50
Zinc chloride, C. P.	.30
Zinc sulphate	.06

Prices per lb. unless otherwise stated

Few-Minute Interviews on Business Outlook

Managers and Purchasing Agents Express View That Conditions Steadily Improve—Import Steel Tonnages Double Those of Last Year—Car Shortage Increases Costs—Machinery Demand Better

F. C. BRUNKE, United States Steel Products Co., Toronto.—"Demand for steel covering a large variety of requirements in Canadian industry still maintains a good volume. There has been no falling off in structural steel as some might expect at this time, but you must remember that September and October are two big shipping months. The year to date has made a good showing, practically double last year's record. We hope for steady improvement in deliveries. The steel industry has passed through a strenuous time during the strike period and products have piled up in Pittsburgh and other district awaiting an opportunity to ship."

E. W. Knight, Frankel Bros., Toronto.—"Conditions throughout the country so far as we come in general contact, are good. There has been quite a sound development, with no evidence of anything making for depression."

W. M. Davis, Baines and Davis, Toronto.—"While the year, so far, has not been the best in the iron and steel business, development has been steady with no indication of unhealthy conditions. It is such a growth that counts, eventually, for business under those circumstances can suffer no delusions and more easily adjusts itself to requirements."

J. F. MacKay, general manager, John Morrow Co., Ingersoll—"Conditions in Ingersoll reflect general tendencies; while there has been no marked improvement, there is a feeling that we are moving in that direction. The prospect of war is a serious matter. It looks to me as though Turkey is disposed to go the limit in taking advantage of any break, however slight, among the allies. Money is likely to tighten, and industrial development along normal peace lines delayed, but we hope the trouble finds some solution other than war."

C. R. Peckover, Peckover's Limited, Toronto.—"In spite of encouraging crop reports, there seems to be quite a conservative tendency in the iron and steel market. There is a feeling that something is holding back, but it may be characteristic of unsettled conditions through which we are passing. Indications point to steady accumulation of stocks. Toronto prices, considering those of Pittsburgh and Chicago, have maintained very reasonable levels—in fact some opinions declare that they are too reasonable to absorb diminishing spreads."

J. Kingsnorth, of Jas. P. Scott and Co., Toronto.—"While non-ferrous metal markets are quiet, brass foundries throughout the country are all busy though there is an absence of what we might call any large undertaking. Where the metal market comes into contact with building industries, business shows greater activity."

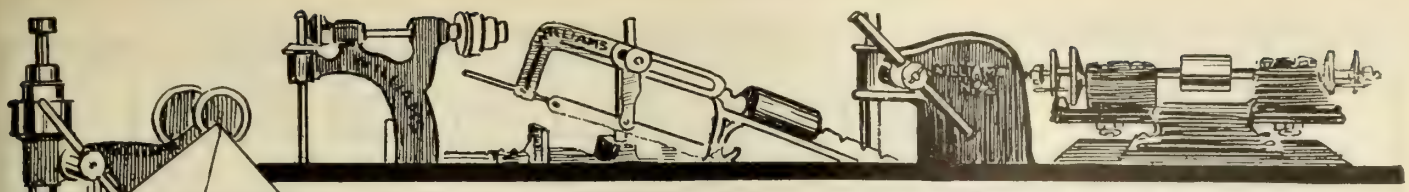
B. H. Neill, sales manager Canada Machinery Corporation, Galt.—"Industries in Galt are fairly well employed. The fact that railways have been coming into the market for machinery is a good sign. Should industry continue to improve, it would not surprise me to see still better business in woodworking machinery. Already we can see a preference developing for the latest types as being the more economical in the long run, for while manufacturing activities in general may have been below normal, there has been progress in machinery design. As to the price situation, I understand there is an upward trend evident on the United States market. Of course, owing to strong competition and the fact that raw materials over there went to low price levels, quotations on machinery had sharper reductions than elsewhere. Now that the term has come, and materials are up, prices on equipment are following and will probably continue firm for some months."

F. W. Evans, manager Canadian Fairbanks Morse, Toronto.—"Machine tools and supplies are showing improvement, although the demand is spasmodic. Our recent trip to the mines and pulp and paper industries of the north was a revelation. This market, by the way, is becoming increasingly important. All of the works visited had machine shops equipped with a view to their various requirements. Equipment and supplies of all kinds going into the north represent a very large yearly outlay. While the country's general aspect is not as flourishing as all would like, it is considerably better than has been. Although the crop is not yet marketed, there is no doubt about the demand being adequate. On many lines, the purchasing farmer will find prices that are quite as good if not better than in pre-war times. The manufacturers have learned the relation of production to low costs, and the farmer will undoubtedly reap some benefit from this."

C. S. Webber, purchasing agent, Page Hersey Tubes Limited, Toronto.—"A visit to the Pittsburgh district at the present time reveals the result of the coal and rail strikes as being more serious than we can ever imagine. My observations, among several of the more important plants, are that there seemed to be intense activity, and that immense tonnages of steel are being placed in storage owing to the car shortage. This means money and must add considerably to cost of doing business. All kinds of cars are being pressed into service; I saw some that seemed about ready to fall to pieces, but I would suppose these are used for short hauls. Prices are very firm, and the general attitude would indicate that they will be maintained for some time, although premiums for early delivery are disappearing. In my opinion there will not not be such revision of prices before the first quarter, 1923. Recent advances in pipe prices were long overdue, and the only change in sight, at the present time, is that in wrought pipe a flat discount rate, rather than a chain of discounts may be adopted. But this will apply chiefly to the Western territory. There is great activity in the steel industry in the States, with railroads doing much purchasing for track and rolling stock requirements."

Montreal:—Dominion Bridge Co. and Phoenix Bridge Co. have both tendered for the steel work of the new city hall. The lower of the two tenders was that of the Dominion Bridge Co. whose bid was $124,450. The figure asked by the Phoenix Bridge Co. was $126,655. The Dominion Bridge agreed to furnish to the city additional steel, if required, for the sum of 5 5-10 cents per pound, while the Phoenix Bridge Co. quoted 5 6-10 cents per pound. A condition of the specifications was that the work must be completed three months after the placing of the contract. Thus, if quick action is taken, the work can be completed this year.

Recent inquiries for Canadian products are reported as follows by Commercial Intelligence Branch, Department of Trade and Commerce:—No. 420—New York firm doing extensive business with Australasia and South Africa as specialists in machinery of all kinds, autos, electrical appliances and paper, would establish contact with Canadian exporters, with a view to organizing distribution. No. 418.—London firm desires to obtain agencies of Canadian makers of household utensils and domestic hardware specialties. No. 427:—Large South African firm wants to get in touch with Canadian manufacturers of galvanized piping, sheets, rails, hoops.

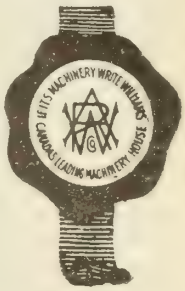


Machinery at Bargain Prices

The Williams' Monthly Machinery List is full of bargains in new and re-manufactured machinery—bargains worth your investigation. Each machine, whether new or re-manufactured, is backed by the Williams' Guarantee which means that no transaction is considered as concluded until the machine has proven satisfactory.

It will pay you to have your name on our mailing list.

Write us To-day



The A. R. Williams Machinery Co., Ltd.

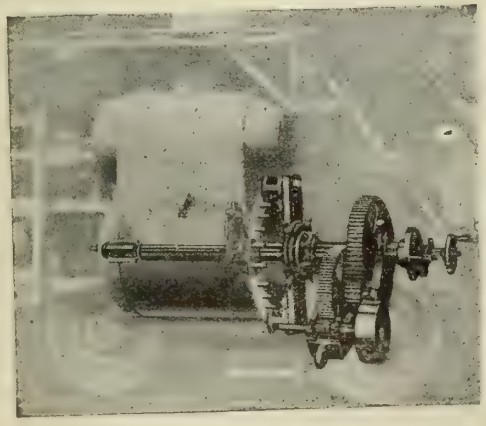
64 Front St. W. Toronto

HALIFAX ST. JOHN MONTREAL WINNIPEG VANCOUVER

If its Machinery—Write "Williams"

UNDERWOOD PORTABLE TOOLS

Figure What You'll Save On One Job Alone



THERE'S no sense in taking down your engine every time it needs boring when all that is necessary is to remove the cylinder covers and piston and take the

Underwood Portable Boring Bar for *Stationary Engines or Locomotives*

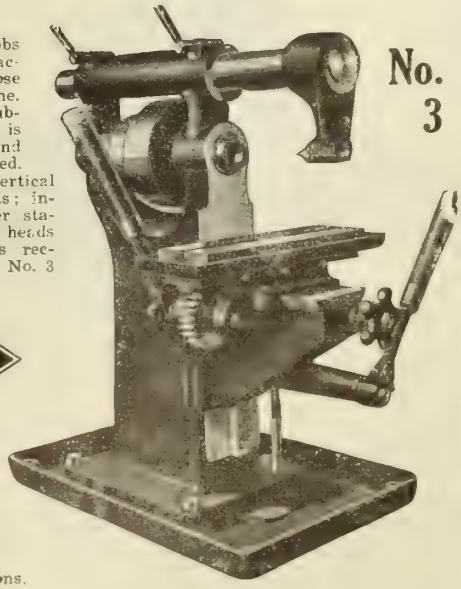
right to the job. You can appreciate what a saving of time and labor this is—just figure what it will save you on one job alone and then write for catalogue.

H.B. Underwood Corporation

1025 Hamilton St., - Philadelphia, Pa., U.S.A.

BURKE Millers

Handling big jobs with speed and accuracy is the purpose of this **little** machine. Small in size but substantially built, it is a space - saver and cost-saver combined. Slotting and vertical milling attachments; index centres — either stationary or tilting heads and other features recommend the Burke No. 3 for every shop.



No. 3

BURKE

Supplied in both Bench and Pedestal types.

PRICE BENCH TYPE $155

WITH FLOOR COLUMN $171

Write for circular and prices quotations.

THE BURKE MACHINE TOOL CO.

520 Sandusky St., Conneaut, Ohio, U.S.A.

Canadian Dealers:—H. W. Petrie, Ltd., National Machinery & Supply Co., A. R. Williams Machinery & Supply Co., Canadian Fairbanks-Morse Co., Williams & Wilson, Garlock-Walker Machinery Co., Yeates Machinery Co., Cope & Son.

If what you need is not advertised, consult our Buyers' Directory and write advertisers, listed under proper heading

News From the Industrial Field

Castrian Steamship Co., Quebec, capital $200,000 has been incorporated to engage in shipping and shipbuilding.

The International Harvester Co. recently re-opened their foundry at Hamilton, after a shut down of some months.

The general contract for the construction of a dock at Ford City, Ont., has been received by Merlo, Merlo and Ray. The cost will be about $100,000.

The Dominion Bridge Co., has been awarded the contract for fabrication of steel, roofing and skylights for a large apartment house on Bloor St., W., Toronto.

The contract for roofing and galvanized iron for the new $110,000 school board office building in Ottawa, has been awarded to W. D. Edge Co., of Ottawa.

McIntyre Bros., of Peterboro, Ont., have received the general contract for additions to the boiler room, pump house and coal bunkers for the Brinton Carpet Co. of Peterboro.

The Trussed Concrete Steel Co., of Montreal, has received a contract to supply the reinforced steel for the $200,000 school and residence for the Catholic School Commission of Montreal.

Steel Work for the new furnace building of the Abrasive Co., of Canada, to be erected on Burlington St., Hamilton, has been awarded to the Hamilton Bridge Works of Hamilton.

Signet Mfg. Co, Montreal, capital $550,000, has been incorporated to manufacture and deal in phonographs and machinery and apparatus used in their manufacture.

Lamoreux-Kelly, Limited, Montreal, capital $50,000, has been incorporated to manufacture and deal in railway, mining and general contractors' supplies and equipment.

Increased Activities are reported from the Canadian Firestone Fire and Rubber Co., of Hamilton. This plant has been gradually increasing its output and within a short time it is expected that a full staff of 500 men will be engaged.

Members of the Lake Shippers' Association are accused of discriminating against Canadian in favor of United States ports. Hon. J. A. Robb, minister of Trade and Commerce, has asked for an explanation.

George Barrett has been appointed to the position of general mechanical superintendent of Penmans Limited, Paris, Ont. Mr. Barrett has had a wide experience in a varied field of mechanics in various parts of the world.

Increase in the price of steel rails from $40 to $43, effective Oct. 1, brought out a large amount of business from the railroads. American roads came in to the extent of a million tons, and are buying material for much other equipment.

Engineering Alumni, Toronto University, will hold their fourth annual meeting and school reunion, Friday and Saturday, Oct. 27-28. The program will consist of class luncheons and dinner dance on Friday, and the annual meeting, buffet luncheon, faculty reception and football match, Queen's vs. Varsity, on Saturday.

Canadian makers of medium-sized cars will be interested in the fact that gasoline prices in Great Britain have been reduced to two shillings a gallon. In August, 1920, the price reached 94 cents. Owing to upkeep costs there have been practically no middle size cars in operation.

Toronto bankers, brokers and other business men recently visited the mining and pulp regions of northern Ontario, following upon the trip taken by Board of Trade representatives. This part of the country, of which comparatively little has been known generally, is receiving considerable attention from business and industrial interests.

Installation of chain drives by the Morse Chain Company in the Northern Central elevator at Baltimore totalled 7,000 horse power, and was not a single unit of 7,000 horsepower as a news item in these columns one week ago erroneously stated. This is one of the largest installations of chain drives in any elevator in the world.

D. A. Cameron, president of Toronto Board of Trade, addressing the Young Men's Club, stated that the curse of civilization was the inclination to look down on manual labor which if persisted in meant the downfall of the British Empire. He advised members as to the methods they should employ in private and business life, looking to greatest usefulness as citizens.

Building activities in Kitchener, Ont., to date show an increase of more than 100 per cent. over last year. The amount is $1,903,099. Galt, with a nine months' total, is slightly below last year, while Stratford reports a valuation of $660,346 on new buildings, the largest amount for fourteen years. Galt, however, reports as an indication of business improvement an increase of $37,632.23 in customs and excise revenue during the month.

Canada's fire loss in the past ten years has amounted to $250,000,000. This and the loss of over three thousand lives in that time, is the reason for the proclamation designating Oct. 2 to 9 as Fire Prevention Week. All schools, factories and theatres have been circularized with pamphlets, enumerating important facts, common causes of fires and precautions that should be taken to prevent them.

Canadian Locomotive Works, Kingston have started operations on contracts for the renewal of locomotives, manufacturing parts and making repairs. When interviewed, William Casey, general manager, stated that the work at present called for about ten per cent. of the staff, and he was not in a position to say just what would develop in the immediate future. About 75 men will be employed now. The works have been closed 14 months.

P. M. Laing, Toronto representative Jones and Glassco, engineers, has built for himself in spare time during the past year a 33-ft. schooner rigged yacht of the cruiser type. The hull is of yellow spruce, Douglas fir and oak and the craft has a sail spread of 605 feet. She is of a class that is popular with the Boston yachtsman and, up to the present time, not frequently seen in Toronto waters. Mr. Laing has made a hobby of yachts and yachting.

INDUSTRY ON UPGRADE BUSINESS MEN DECLARE

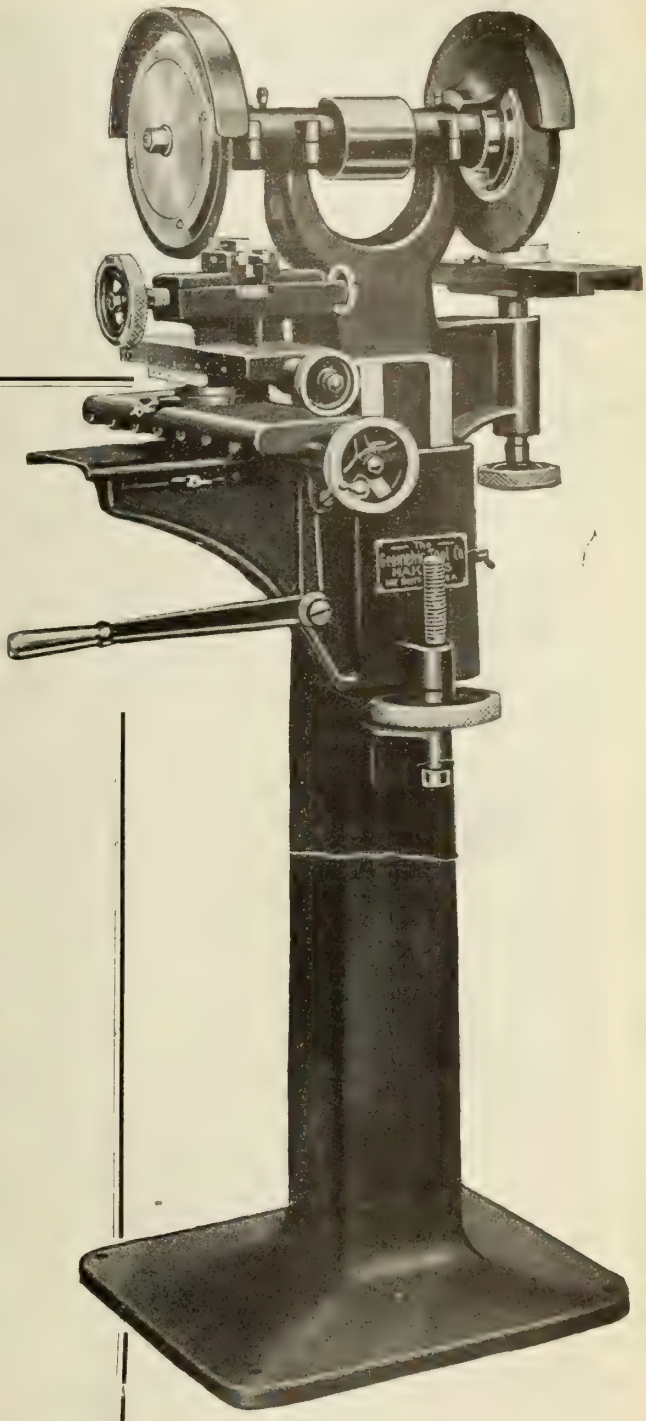
There is no question but that conditions generally are on the upgrade. During the past week Canadian Machinery has had short, informal chats with various keymen in different lines of business, and in every case reports have been encouraging.

For example, a manufacturer of motors states that they have had more enquiries lately than for some time past. A large percentage of these are developing into good-sized orders, and others looks very promising. He feels sure that those who have confidence to go after the business opening up will get it.

Mr. Newman, of the Canada Metal Co., is satisfied that things are on the mend. In fact, the improvement has been so steady and noteworthy that, in a recent editorial article, he commented as follows:—

> "We believe that there are few men today but who are interested in, and giving good thought to, the signs of the times and to business conditions and prospects generally as they appear to them, and, therefore, as

(Continued on page 56)



Sharp Chasers Cut Clean Threads

Accurate, uniform threads result only from dies which are maintained in the highest state of cutting efficiency. This means that chasers must be kept sharp, and ground uniformly.

Even if just touched up from time to time, the chasers respond splendidly, with clean threads. And with this machine—the Geometric Chaser Grinder—the matter of keeping threading tools up to scratch is a comparatively simple matter.

Various makes of chaser can be ground on this adaptable machine. The two wheels permit the easy grinding of both milled and tapped chasers. In addition, the plain wheel lends itself readily to various kinds of tool grinding.

Uniform grinding of a set of chasers is purely a mechanical matter through the use of adjustments which can be accurately set to govern the grinding of an entire set of chasers.

The Catalog describing this machine is a mine of information on chaser Grinding. Write for it.

THE GEOMETRIC TOOL COMPANY
NEW HAVEN CONNECTICUT

Williams and Wilson, Ltd., Montreal.

Canadian Agents:
The A. R. Williams Machinery Co., Ltd., Toronto, Winnipeg, St. John, N. B.

INDUSTRY ON THE UP GRADE

(Continued from page 54)

we believe conditions as we experience them in our organization are a fairly good barometer, we want to express our views to you in a few plain words.

"There is not a shadow of doubt that there is taking place all around a steady, gradual, almost imperceptible improvement and a settling down to regular consistent business activities. The pessimism that existed with many for a long time is nearly forgotten, and today everyone is looking at the present and future with every confident feeling of optimism. The talk about 'hard times' and things being 'so bad' is heard less often, if at all, and men are realizing that it's 'up to one's self' and that times and conditions are very much what one is prepared to make them. We only get out of life, or any of its interests, just exactly an equivalent to what we put into it.

"The man who is still content to sit with folded hands 'waiting for good times' is going to be left behind, but there never was a time when opportunities were better for the man who is alive and prepared to buck right in, in an aggressive and intelligent way.

"Without question, labor is steadying down, and workmen are forgetting the big money craze that seized everyone when labor and products were scarce, and today many realize that money isn't everything, and that a good, steady job under ordinary and reasonable conditions brings equally as much and perhaps more satisfaction and happiness.

"There is one lesson that we in Canada can well take to heart from some of the happenings of the past few years, viz., our dependence on outside markets for a good many of our supplies, which, with a little enterprise and patriotism on the part of many of our capitalists, manufacturers, etc., could bear quite a different aspect. We can and are well able not only to look after our own requirements but to also take our place among the exporting nations. Let us wake up in this respect and only be satisfied when we see the sign 'Made in Canada' on all the world's markets. When we begin to build up production so that we can not only take care of domestic needs but also sell to outside markets, we are indeed helping our country to take a place in the world of commerce.

"However, we are emerging from a very critical time in a more than satisfactory way and we would like every one of our readers to feel as we do—confident and assured that we have seen the worst time through and that the steady return to prosperity going on all around us is in accord with the natural cycle and working back to the law of supply and demand, which for a time was forgotten, and this improvement will be helped forward just in comparison to the way in which each one of us is prepared to put his or her best efforts into 'making Canada.'"

Mr. Mitchell, of the P. B. Yates Co., Hamilton, says that enquiries for woodworking tools of all kinds are picking up. Quite a number of shipments have been made during September and a few more men have been added to the payroll. The orders received are not centred on any one type of machine but are general in character.

Mr. Davies, secretary-treasurer of the N. Slater Co., Hamilton, says they are very busy at present and finding conditions much improved. Their galvanizing departments are working night and day, and their electrical sections are also quite rushed. They find enquiries of much better volume and look forward to still further improvement.

Truman Norton, manager of the Wallace Barnes Co., Hamilton, spring manufacturers, states that they are getting good enquiries and orders, and that business generally is picking up steadily and surely.

Mr. Norton's remarks are typical of many others who have spoken with Canadian Machinery during the past week. The steady, healthy growth is the chief feature in business improvement. All seem agreed in the statement, "We would rather see it slow but sure than sensational, because the former will last, while the sensational improvement generally leads to future disappointment."

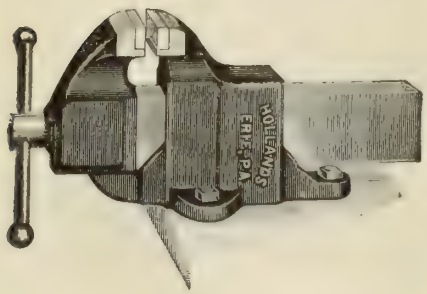
Tensile strength is the one most frequently considered. This is its ability to resist being pulled asunder.

No. 4 Press
10 to 12
tons

Write for complete information on Atlas Arbor Presses. All sizes for all purposes.

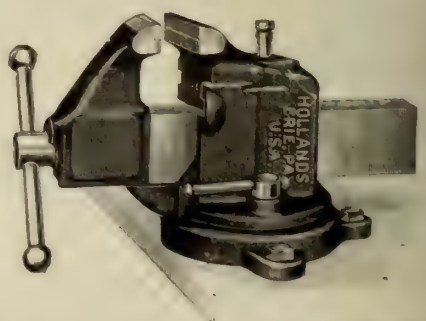
ATLAS PRESS CO
330 N. Park St.
Kalamazoo, Mich., U.S.A.
Canadian Representatives:
Chas. A. Strelinger Windsor, Ont.

HOLLANDS VISES



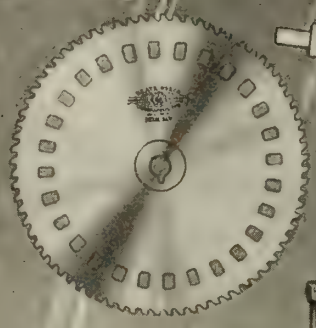
Have a record of thirty-five years of satisfactory service.

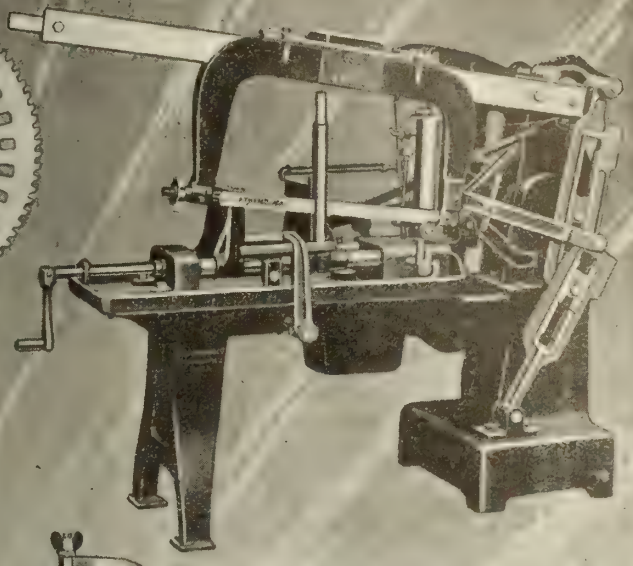
If your dealer cannot supply you, write direct for circular No. 25.



HOLLANDS MANUFACTURING CO.
Established 1887
Erie, Pa., U. S. A.

ATKINS STERLING QUALITY SAWS





O'er Land and Sea
North South East West

Atkins Sterling Quality Saws

are noted for their efficiency. Their use will increase your production.

Ask for new literature describing Atkins Kwik Kut Power Hack Saw and Metal Cutting Band Saw Machines, Circular Metal Cutting Saws, AAA Hack Saw Blades and Frames, etc.

"A Better Saw For Every Use"

Write for Catalog

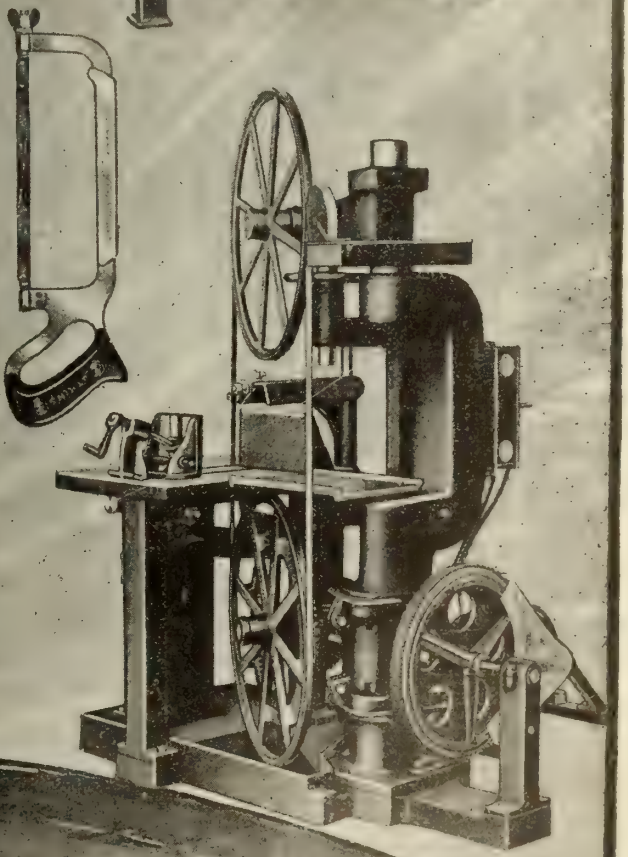
E. C. Atkins & Co.

Established 1857

"The Sterling Quality Saw People"

Factory: HAMILTON, ONT.

Branch: VANCOUVER, B. C.



ATKINS ALWAYS AHEAD

AAA

Two Important Factors in Educational Work

Business and Technical Press and Canadian National Exhibition on Common Ground—Covering Every Line of Industry—Reaching More Than Three Million Students of Industrial and Commercial Affairs

POINTS of similarity between the work of the Canadian National Exhibition and that of the Canadian National Newspapers and Periodicals Association were emphasized by Horace T. Hunter, vice-president of the latter, on the occasion of an Exhibition directors' luncheon at which the gathering was representative of the daily and weekly as well as of the business and technical press.

Importance of educational work was the common ground recognized by both Associations, the speaker declared. The great success of the Exhibition was due to the fact that the amusement side had not been allowed to dominate, and such proposed work as the new Engineering Building and the several fine structures that had recently been completed in order to facilitate representative display of national products were significant of a vision keenly appreciative of educational objective.

"The extent and influence of publications represented by our Association," said Mr. Hunter, "are indicated by the following approximate statement of circulation:—

Farm Papers	1,030,897
Magazines	1,065,307
Religious and Educational Papers	725,000
Business and Technical Newspapers	399,099
Total	3,220,303

"We know that this Exhibition is not like Topsy, 'just growed.' It has been brought to the high state of perfection it occupies to-day by the shrewd and far-seeing policies of the directors and executive officers, and by their untiring energy in carrying out these policies.

Similar Aims and Interests

"There are many points of similarity between the work of our Association and the Canadian National Exhibition. These form a strong bond of interest and sympathy between us.

"Both are national. Our subscribers in the various provinces of the Dominion are the men and women you are most anxious to bring to the Exhibition. The fact that they are readers and subscribers of our papers is the proof that they are people of intelligence, students, interested in new methods and in learning of new goods. They are the people who will travel a hundred or a thousand miles when the opportunity offers to see an exhibition such as you have developed, and I congratulate you that these people are coming in increasing numbers each year.

"The international aspect is also a common bond. You have an increasing number of visitors from foreign countries, thus creating a feeling of goodwill with these countries, and helping our manufacturers to establish connections abroad. The same reason that brings business men from United States, Great Britain, West Indies, etc., also causes them to subscribe for our publications. These foreign subscriptions have become such a big factor with some of our publications that they are now issuing Export editions.

Educational Aspect Most Important

"Then we are on common ground in educational work. I believe this Exhibition was started primarily for educational purposes and its great success is due to the fact that you have never allowed the amusement side to dominate. I believe the educational features should be given wider publicity. The individual exhibitors do a good deal in this connection but there is much to be done collectively. A few people would come to see a few exhibits of motor cars, but thousands will come when they know there will be seventy exhibitors representing probably seventy per cent. of the manufacturers who are seeking Canadian business. In our Association there is a publication for practically every line of business. These publications have told, year by year, the outstanding events of the Exhibition that would be of interest to their readers, and I think we can claim that this has been a factor in increasing interest and attendance of a very desirable class of people.

Influence of Business Press

"I would like to quote briefly from an address delivered within the past year by His Honor, the Lieutenant-Governor of Ontario, who officially opened the Exhibition this year. Addressing the Canadian National Newspapers and Periodicals Association, His Honor said:

I believe that the influence of the business press will be one of the most important factors in re-establishing business conditions in Canada on a safe and sane basis. I make a distinction between the business newspapers and the daily press because I believe that your papers—the business newspapers of Canada—exert a greater influence than the daily press because of the greater confidence your readers have in them. People read the daily newspapers to keep abreast of the general news of the day. They are interested in what is happening around them and they read to satisfy their desire for excitement or interest or entertainment. What they read in the daily newspapers to-day is forgotten to-morrow.

But this is not the case with the business newspaper. Business men need the service of these papers in the conduct of their every-day business life. I have noted that they usually have a business paper or two in their pocket when they go home Saturday night. I do not say that they read them on Sunday, that I do not know, but I do know that they study them carefully and a great number of your readers will come to their business on Monday morning with some clippings from your paper in their pockets. They will say to their associates: "This is the situation, and I can show it to you in this clipping." For that reason, gentlemen, I say that yours is the greater obligation, you are the leaders, because you are helping to build up the business fabric of the country.

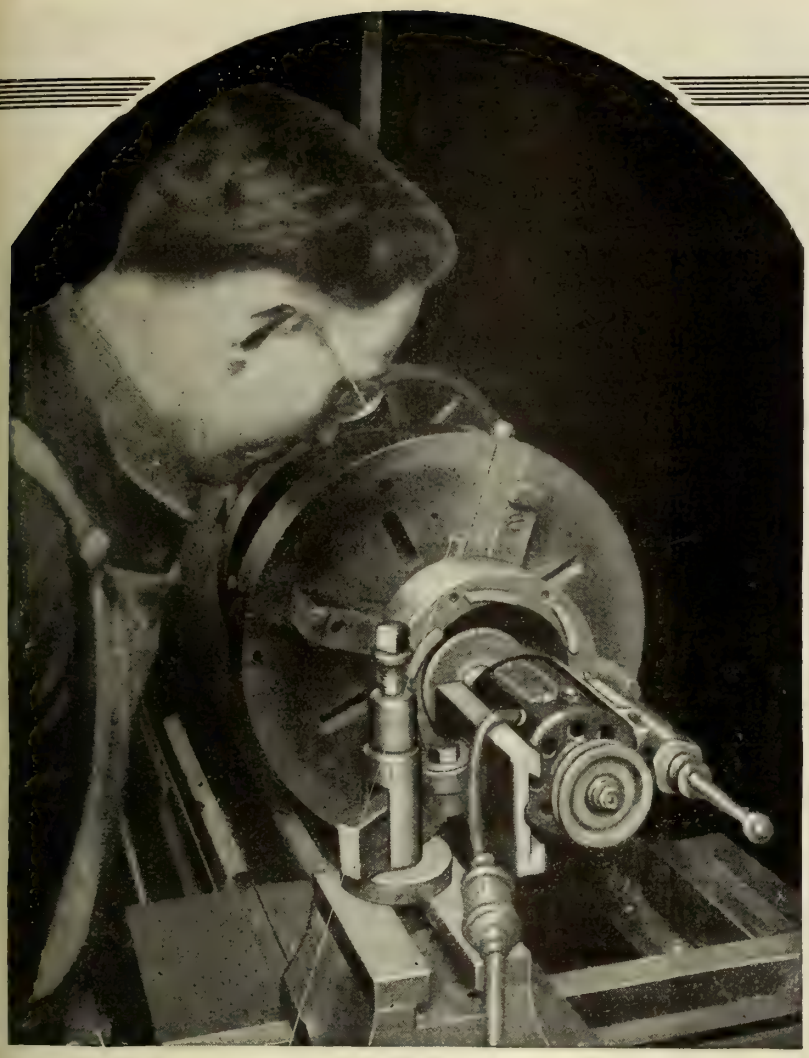
"We appreciate the honor the C. N. E. has conferred on the Press in singling out a day in their honor. In a larger sense, however, every day is 'Press Day' for some of the publishers in our association. Our publications are of such a varied nature and cover such diversified fields that in nearly every case there are one or more publications devoted to the industry that gives the day its name.

"Now, I believe the directors are interested not merely in bringing the numbers but in bringing the men and women with a stake in the country—the responsible people, the people of large buying power. To put it in newspaper language, you are interested in class in circulation rather than in the mass circulation.

"In every one of the lines mentioned above, our publications reach a large percentage of the best men and women engaged in the business, and reach them with publications that they have come to regard as their business associates.

"I believe the big development of the future for the Canadian National Exhibition is to develop the exhibits of the various industries as units.

"I can assure you the publications in our association will be very glad to cooperate with you, not only in organizing exhibitors and inducing them to guarantee the cost of the building, but in making the buildings a success after they are erected by bringing to the Exhibition the class of people these exhibitors want to reach. For, after all, the real success of an Exhibition does not consist in large buildings or elaborate exhibits but in the class of people who attend."



At the left is shown a DUMORE grinder attached to the toolpost of an engine lathe at the Geometric Tool Co., New Haven, Conn. A cam for a die lead has been just machined and the hole is being accurately ground without tearing down of the original "set up." Result—faster work at a decreased operating cost.

Thousands Now in Use

—*a tribute to* DUMORE *efficiency*

A FEW years ago the DUMORE line of high-speed grinders were new devices on the mechanical market. But to-day thousands of these better grinders have found their way into the tool rooms of the leading industries of the nation.

The many thousands of DUMORE grinders now in active service — their endorsement by the world's foremost mechanical experts — the numerous re-orders, *all* are tributes to the efficiency of DUMORE grinders more forceful than any other we know.

DUMORE grinders can meet *your* requirements for intricate grinding work as they have met the needs of over five thousand other industrial leaders. Set them up anywhere—use them for varied kinds of grinding. You'll find them equal to the task—performing swiftly, smoothly and accurately.

Be assured of correct cutting speed with a range of 10,000 to 30,000 R.P.M.—get accurate grinding to limits of .0001″—eliminate the costly need of tearing down original "set-ups." Put one or more of the DUMORE grinder family in your tool room!

Write to-day for complete information and descriptive literature—let your dealer demonstrate.

WISCONSIN ELECTRIC COMPANY

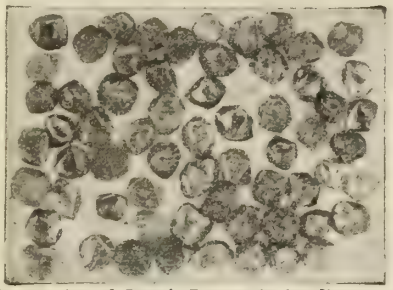
2950 SIXTEENTH STREET RACINE, WISCONSIN

DUMORE HIGH SPEED GRINDERS

If interested tear out this page and place with letters to be answered.

HINTS TO BUYERS

Diamonds and Diamond Tools for Accuracy and High Production



Sample lot of Rough Diamonds for Emery Wheel Dressing

We stock diamonds and dressing tools for all services and sizes of abrasive wheels.

Write for Catalogue and Prices.

The Canadian Desmond-Stephan Manufacturing Co., Limited

Hamilton, Ont.

FOR BEST VALUE

In Wiping Rags, Cheese Cloth and Cotton Waste **USE**

Sani-washed WIPING PRODUCTS

Manufactured and Sold by

Sanitary Wiping Products Co.

239 Richmond St. W., Toronto

COSTS LESS AND GOES FARTHER

Grease Cups

For Every Purpose

No. 249.

The No. 249 Ratchet Grease Cup for use in places of excessive vibration; cap locks every quarter turn, cannot jar loose. We also manufacture a complete line of oil cups, grease cups, spring shackle bolts and dowel pins—all types and sizes.

Write for Complete Catalogue and Prices.

CANADIAN WINKLEY COMPANY, Limited

WINDSOR, ONTARIO

Metal Workers' CRAYONS

Sawed from purest Talc; medium hard, guaranteed free from grit. Equal to best imported product but lower in price. Send for free sample.

H. H. Wood Talc Co., Mine Centre, Ont.

Head Office and Factory

Toronto 82 Richmond St. E. Montreal 131 St. Paul St., W. Winnipeg 259-261 Stanley St.

-A Small Heavy Duty Lathe -With 32 Thread Changes

THE ROCKFORD "ECONOMY"

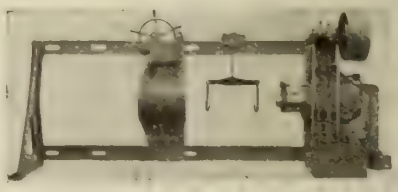
This double back geared, quick change engine lathe brings many advantages to the tool room. High grade, accurate, small in size but extremely powerful.

All gears are cut steel and covered to safe-guard the operator. A lead screw is used only for chasing. Sizes 12", 14", 18" and 22" swing. Write for circular.

ROCKFORD LATHE & DRILL CO., Rockford, Ill.

Canadian Made Presses

Let Our Service Dept. Help.

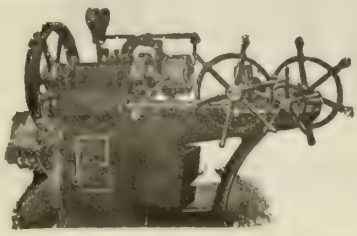


Write for Prices and Details

Hydraulic and Power Press

WILLIAM R. PERRIN, LIMITED

TORONTO, ONT.



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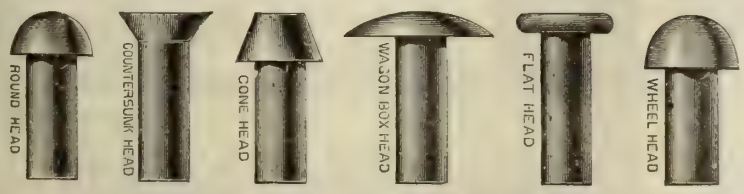

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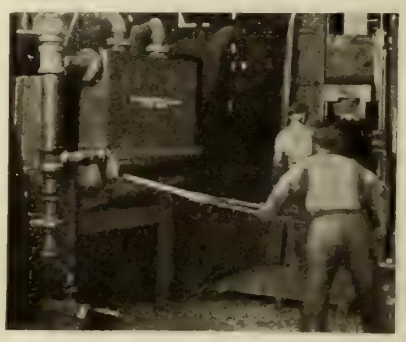

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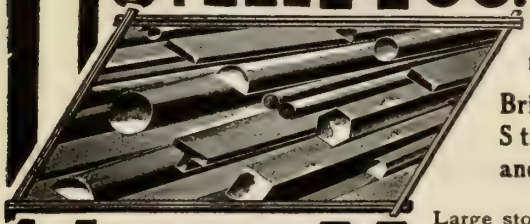

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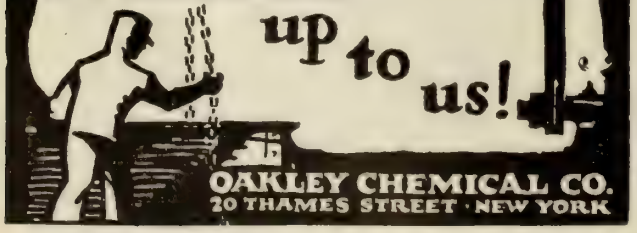

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The MacLean Publishing Co., Limited
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Yours Truly,
Brantford Brass Foundry Company.
per David Abbott

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Brown & Sharpe Mfg. Co., Providence, R. I.
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Wright Mfg. Co., Lisbon, Ohio.

BLOCKS, CHAIN (See Hoists, Hand)
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

BLOCKS, DIE
Canada Foundries & Forgings Co., Welland, Ont.

BLOCKS, PILLOW
Can. Link-Belt Co., Toronto, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

BLOWERS
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

BOLT AND NUT MACHINERY
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Montreal, Que.

BOLT AND NUT MACHINERY, Automatic
National Acme Co., Cleveland, Ohio.

BUCKET CARRIERS, Pivoted
Can. Link-Belt Co., Toronto, Ont.

BUFFERS
Pryibil Machine Co., New York, N.Y.

BUFFING OR POLISHING MACHINES (See Polishing and Buffing Machines)
Blount Co., J. G., Everett, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Pryibil Machine Co., New York, N.Y.
U. S. Electrical Tool Co., Cincinnati, O.

BUILDING MATERIALS
Bertram & Son Co., Ltd., The John Dundas, Ont.

BURNERS, OIL AND GAS
Rockwell Co., W.S., New York City.

BURRS
Steel Co. of Can. Ltd., Hamilton, Ont.

CRUSHES AND
Spray Engineering Co., Boston, Mass

CABINETS, OIL
S. F. Bowser & Co., Ltd., Toronto, Ont

CALIPERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Starrett Co., L. S., Athol, Mass.

CAMS
Canada Foundries & Forgings Co., Welland, Ont.

CAN-MAKING MACHINERY (See Sheet Metal Working Machinery)
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Bliss Co., E. W., Brooklyn, N. Y.
Smooth Mfg. Co., Jersey City, N. J.

CEMENTS, IRON CENTERING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.

CHAINS (See Sprockets and Chains)
Reynold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio

CARD CLOTHING
D. K. McLaren, Limited, Montreal

BUYERS' DIRECTORY

CLUTCHES, FRICTION
Can.-Link-Belt Co., Toronto, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.

COAL AND ASH HANDLING MACHINERY
Can.-Link Belt Co., Toronto, Ont.
Roelofson Elevator Works, Galt, Ont.

COAL-STORAGE SYSTEMS
Can. Link-Belt Co., Toronto, Ont.

COLLARS, SHAFT OR SET
Canada Foundries & Forgings Co., Welland, Ont.
Can. Link-Belt Co., Toronto, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

COLLETS
Butterfield & Co.. Inc., Rock Island, Que.
Geometric Tool Co., New Haven, Conn.
Hardinge Bros., Inc., Chicago, Ill.
Hendley Machine Co., Torrington Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

COMPOUNDS, CLEANING
Oakley Chemical Co., New York, N.Y.

COMPOUNDS—CUTTING, DRILLING, GRINDING, SCREW CUTTING
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Oakley Chemical Co., New York, N.Y.

COMPRESSORS, AIR AND GAS
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.
Spray Engineering Co., Boston, Mass.

CONES, FRICTION
Norton Co., of Can. Ltd., Hamilton, Ont.

CONNECTING RODS AND STRAPS
Canada Foundries & Forgings Co., Welland, Ont.

CONTRACT WORK
Victoria Foundry Co., Ltd., Ottawa, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

CONVEYORS AND ELEVATORS (SEE ELEVATORS)
Jones & Glassco, Montreal, Que.

COTTERS
Steel Co. of Canada, Ltd., Hamilton, Ont.

COUNTERBORES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

COUNTERS, REVOLUTION
Starrett Co., L. S., Athol, Mass.

COUNTERSHAFTS
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Johnson Machine Co., Carlyle, Man-
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

COUNTERSINKS
Butterfield & Co., Inc., Rock Island. Que.
Pratt &Whitney Co., of Canada, Ltd., Dundas, Ont.

COUPLERS, CAR AND LOCOMOTIVE
Can. Steel Foundries, Montreal, Que.

COUPLINGS
Steel Co. of Canada, Ltd., Hamilton, Ont.

COUPLINGS, PIPE
Fittings, Limited, Oshawa, Ont.

COUPLINGS, SHAFT
Can. Link-Belt Co., Toronto, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

CRANES, ELECTRIC
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can.-Link-Belt Co., Toronto, Ont.
Curtis Pneumatic Machinery Co., St. Louis, Mo.
Hepburn Ltd., John T., Toronto, Ont.
Northern Crane Works, Walkerville, Ont.
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.

CRANES, LOCOMOTIVE
Can. Link-Belt Co., Toronto, Ont.

Bertram & Son Co., td., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Northern Crane Works, Walkerville, Ont.

CRANK PIN TURNING MACHINE
Underwood Corp., H.B., Philadelphia, Pa.

CUTTERS, GEAR
Brown & Sharpe Mfg. Co., Providence. R. I.
Butterfield & Co., Inc., Rock Island, Q. Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CUTTERS, HIGH SPEED
Atkins & Co., Inc., E. C., Indianapolis.
Butterfield & Co., Inc., Rock Islaad, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jarney & Trecker Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CUTTERS, MILLING
Brown & Sharpe Mfg. Co., Providence, R. I
Butterfield & Co., Inc., Rock Island. Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.

CUTTERS, STAY BOLT
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.

CUTTING-OFF MACHINE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

CUTTING OFF MACHINES, PIPE (SEE PIPE-CUTTING AND THREADING MACHINES)
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.

CUTTING-OFF TOOLS
Armstrong Bros. Tool Co., Chicago, Ill.

CUTTING OIL FILTERS (SEE OIL FILTERING SYSTEMS
Bowser, S. F. & Co., Ltd., Toronto.

CUTTING, OXY-HYDROGEN
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

DETACHABLE CHAIN
International Malleable Iron Co., Guelph, Ont.

DIAMONDS, BLACK AND ROUGH
Can. Desmond-Stephan Mfg Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

DIAMOND TOOLS
Can. Desmond-Stephan Co., Hamilton,
Wheel Trueing Tool Co., Windsor, Ont.

DIAMOND CROSSINGS
Can. Steel Foundries, Montreal, Que.

DIAMONDS, IMPORTERS
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Co., Windsor, Ont.

DIES, SCREW AND THREAD CUTTING
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.

DIES, SHEET-METAL AND SUB-PRESS (See Tool Work)
Brown, Boggs & Co, Ltd., Hamilton, Ont.

DIES, FORGING
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

DIES, SELF-OPENING, ADJUSTABLE
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Landis Machine Co., Inc., Waynesboro,
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DIES, THREADING-OPENING
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DIVIDING HEADS
Burke Machine Tool Co., Conneaut, Ohio.
Hendey Machine Co., Torrington, Conn.
Kearney & Treacker Co., Milwaukee, Wis.
Petrie, Ltd., H. W. Toronto, Ont.

DOGS, LATHE AND MILLING MACHINE
Armstrong Bros. Tool Co., Chicago, Ill.

DRAFTING MATERIALS
American Lead Pencil Co., New York City, N.Y.

DRESSERS, GRINDING WHEEL
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ont.
Norton Co., of Can., Ltd., Hamilton.
Wheel Trueing Co., Windsor, Ont.

DRESSING TOOLS
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Co., Windsor, Ont.

DRILL HOLDERS
Armstrong Bros. Tool Co., Chicago, Ill.

DRILLING MACHINES, BENCH
Burke Machine Tool Co., Conneaut,, Ohio.
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Hardinge Bros., Inc., Chicago, Ill.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
U. S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, ELECTRIC AND HAND
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, GANG
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

DRILLING MACHINES, HEAVY DUTY
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
Rockford Drilling Machine Co., Rockford, Ill.

BORING, DRILLING AND MILLING MACHINES. (HORIZONTAL.)
Gisholt Machine Co., Madison, Wis.

DRILLING MACHINES, Multiple Spindle
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
National Acme Co., Cleveland, Ohio.

DRILLING MACHINES, Pneumatic
Cleveland Pneumatic Tool Co., Toronto. Ont.

DRILLING MACHINES, PORTABLE
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, RADIAL
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Wiliams Machinery Co., A. R., Toronto,

DRILLING MACHINES, SENSITIVE
Burke Machine Tool Co., Conneaut, O.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Williams Machinery Co., A. R., Toronto.
Wisconsin Electric Co., Racine. Wis

DRILLING MACHINES, TURRET
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wisconsin.
Williams Machinery Co., A. R., Toronto.

DRILLING MACHINES, VERTICAL
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

DRILLS, CENTRE
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DRILLS, ELECTRIC
Independent Pneumatic Tool Co., Chicago, Ill.

DRILLS, ELECTRIC
Black & Decker Mfg. Co., Ltd., Montreal, Que.

DRILLS, HIGH SPEED TWIST
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Mon treal, Que.
Cleveland Twist Drill Co., Cleveland, O
Greenfield Tap & Die Corp., Galt, Ont
Morse Twist Drill & Machine Co, New Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DRILLS, PNEUMATIC
Independent Pneumatic Tool Co., Chicago, Ill.

DRILLS, RATCHET
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont
Morse Twist Drill & Machine Co, New Bedford, Mass.

DRILLS, TWIST AND FLAT
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.

DROP FORGINGS
Steel Co. of Canada, Ltd., Hamilton

DUMB WAITERS
Roelofson Elevator Works, Galt, Ont.

DUST HANDLING EQUIPMENT
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

ELECTRIC DRILLS AND GRINDERS
Black & Decker Mfg. Co., Ltd., Montreal, Que.

ELECTRIC WELDING MACHINES
Globe Engineering Co., Ltd., Hamilton, Ont.

ELECTRICAL INSTRUMENTS
Bristol Co., Waterbury, Conn.

ELECTRICAL SUPPLIES
Atkins & Co., Inc., E. C., Indianapolis
Diamond State Fibre Co., Toronto, Ont.
U.S. Electrical Tool Co., Cincinnati, O.

ELEVATORS AND CONVEYORS
Can. Link-Belt C., Toronto, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q

ELEVATORS, FREIGHT AND PASSENGER
Roelofson Elevator Works, Galt, Ont.

EQUIPMENT, ELEVATOR SAFETY
Jones & Glassco, Montreal, Que.

EMERY WHEELS (See Grinding Wheels)
Lion Grinding Wheels, Limited, Montreal, Que.
Atkins & Co., E. C., Indianapolis, I.
Norton Co., of Canada., Ltd., Hamilton.

ENGINES, CAPSTAN
Kennedy & Sons, Wm., Owen Sound, Ont.

ENGINE LATHE MANUFACTURERS
Oliver Machinery Co., Grand Rapids, Michigan.

ENGINEERS, MECHANICAL
Dominion Engineering Works, Limited. Montreal, Que.
Gisholt Machine Co., Madison, Wis.
Hamilton Gear & Machine Co., Toronto.

EXPANDERS, TUBE
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

FANS, ELECTRIC
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

FANS, EXHAUST
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Petrie Ltd., H. W., Toronto, Ont.

FANS, VENTILATING
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

FIBRE
Diamond State Fibre Co., of Can. Ltd., Toronto, Ont.

FILES AND RASPS
Nicholson File Co., Port Hope, Ont.
Simmons Canada Saw Co., Montreal, Que.

FILLER, IRON (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J.

FIRE ESCAPES
Roelofson Elevator Co., Galt, Ont.

FITTINGS, PIPE
International Malleable Iron Co., Guelph
Fittings, Limited, Oshawa, Ont.

FLEXIBLE SHAFTS
Strand & Co., N. A., Chicago, Ill

FLUXES, WELDING
Carter Welding Co., Ltd, Toronto, Ont
Dominion Oxygen Co., Ltd, Toronto
Liquide Air Company, Toronto, Ont.

FORGING MACHINERY
Acme Machinery Co., Cleveland, Ohio
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown Boggs & Co., Ltd., Montreal
National Machinery Co., Tiffin, Ohio.
Steel Co. of Canada, Ltd., Hamilton.

BUYERS' DIRECTORY

FORGINGS, DROP
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Ltd., Toronto, Ont.

FORGINGS, HAMMER
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Hepburn Ltd., John T., Toronto, Ont

FOUNDRY EQUIPMENT
Rice Lewis & Son, Ltd., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

FOUNDRY SUPPLIES
Rice Lewis & Son, Ltd., Toronto, Ont.

FROGS, SPRING OR RIGID
Can. Steel Foundries, Montreal, Que.

FURNACES, ELECTRIC
Rockwell Co., W. S. New York City.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

FURNACES, HEAT TREATING COAL
Rockwell Co., W. S., New York City.

FURNACES, HEAT TREATING OIL AND GAS
Bellevue Industrial Furnace Co., Detroit, Michigan.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Rockwell & Co., W. S., New York, N.Y.

FURNACES TEMPERING AND ANNEALING
Bellevue Industrial Furnace Co., Detriot, Mich.
Brown & Sharpe Mfg., Co., Providence R. I.
Rockwell Co., W. S., New York City.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

FURNACES AND OVENS, ELECTRIC
Petrie, Ltd., H. W., Toronto, Ont.
Rockwell & Co., W. S., New York, N.Y.
Starrett Co., L. S., Athol, Mass.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

GAGES, MEASURING (See Tool Work)
Brown & Sharpe Mfg. Co., Providence, R. I.
Greenfield Tap & Die Corp., Galt, Ont.
Lufkin Rule Co., Windsor, Ont.
Starrett Co., L. S., Athol, Mass.

GAGES, RECORDING
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GAGES, SPECIAL MEASURING
(See Tool Work)
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GAGES, THREAD
Brown & Sharpe Mfg. Co., Providence R. I.
Starrett Co., L. S., Athol, Mass.

GALVANIZING
Fittings, Limited, Oshawa, Ont.

GAS, COAL COMPRESSED
L'Air Liquid Society, Toronto, Ont.

GAS, COMPRESSED
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

GASKETS
Diamond State Fibre Co. of Ca., Ltd., Toronto, Ont.
Smooth Mfg. Co., Jersey City, N. J.

GAUGES VACUUM AND PRESSURE
Taylor Instrument Co. Toronto, Ont.

GEAR BLANKS
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.
Dominion Engineering Works, Limited, Montreal, Que.

GEAR COUNTERS
Hart Mfg. Co., R. A., Battle Creek, Michigan.

GEAR CUTTING MACHINES
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Fellows Gear Shaper Co., Springfield, Vt.
Petrie, Ltd., H. W., Toronto, Ont.
Whiton Machine Co., D. E., New London, Conn.

GEAR TESTING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.

GEARS, CAST
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Hull Iron & Steel Foundries, Hull, Que.
Dominion Engineering Works, Limited, Montreal, Que.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

GEARS, CUT
Brown & Sharpe Mfg. Co., Providence, R. I.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Gardner & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto, Ont.
Hepburn Ltd., John T. Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

GEARS, DRESSED
Kennedy & Sons, Wm., Owen Sound, Ontario.

GEARS, FORGED
Canada Foundries & Forgings Co., Welland, Ont.

GEARS, HERRINGBONE
Hamilton Gear & Machine Co., Toronto, Ont.

GEARS, RAWHIDE (See Gears, Cut)
Hamilton Gear & Machine Co., Toronto.

GEAR, SILENT CHAIN
Gardner & Son, Robt., Montreal, Que.
Can. Link-Belt Co., Ltd., Toronto, Can.
Hans Renold of Canada, Ltd., Montreal, Quebec.

GEARS, WORM
Hamilton Gear & Machine Co., Toronto.

GENERATORS, ACETYLENE
L'Air Liquide Society, Toronto, Ont.

GOGGLES, SAFETY
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto
Liquide Air Company, Toronto.

GRAB BUCKETS
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Cleveland Twist Drill Co., Cleveland, O

GREASE CUPS, PRESSED STEEL AND BRASS
Can. Winkley Co., Ltd., Windsor, Ont.

GREASES, LUBRICATING
Canadian SKF Co., Toronto, Ont.

GRINDERS, ELECTRIC
Black & Decker Mfg. Co., Ltd., Montreal, Que.

GRINDING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Norton Co., of Canada, Ltd., Hamilton

GRINDING MACHINES, ABRASIVE BELT
Norton Co. of Can. Ltd., Hamilton, Ont.

GRINDING MACHINES, AUTOMATIC
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, BENCH
Blount Co., J. G., Everett, Mass.
Geometric Tool Co., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co. of Canada, Ltd., Hamilton, Ont.
Petrie, Ltd., H. W. Toronto, Ont.
Pratt & Whitney Co. of Canada, Ltd.

GRINDING MACHINES, CENTER
U. S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES, CUTTER AND REAMER
Brown & Sharpe Mfg Co., Providence, Rhode Island.
Petrie Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, CYLINDRICAL
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.
Norton Co., of Canada, Ltd., Hamilton.

GRINDING MACHINES, DIE
Geometric Tool Co., New Haven, Conn.
National Acme Co., Cleveland, O.
National Machinery Co., Tiffin, Ohio.

GRINDING MACHINES, DRILL
Bellevue Industrial Furnace Co., Detroit, Mich.
Bertram & Son Co., Ltd., The John, Dundas, Ont.

GRINDING MACHINES, ELECTRIC
Independent Pneumatic Tool Co., Chicago, Ill.
Strand & Co., N. A., Chicago, Ill.

GRINDING MACHINES, FLOOR AND TOOL
Blount Co., J. G., Everett, Mass.
National Acme Co., Cleveland, Ohio.
Norton Co. of Canada, Ltd., Hamilton, Ontario.
Petrie, Ltd., H. W., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.

GRINDING MACHINES, INTERNAL
Garlock Machinery Ltd., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES PORTABLE
Strand & Co., N. A., Chicago, Ill.

GRINDING MACHINES, SNAGGING
Blount Co., J. G., Everett, Mass.
Norton Co., of Can. Ltd., Hamilton, Ont.

GRINDING MACHINES, SURFACE
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, THREAD
Pratt & Whitney Co., of Canada, Ltd.,

GRINDING MACHINERY, TOOL POST
Gisholt Machine Co., Madison, Wis.
Grenfield Tap & Die Corp., Galt, Ont.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES, UNIVERSAL
Brown & Sharpe Mfg Co., Providence, Rhode Island.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co., of Canada, Ltd., Hamilton Ontario.
Petrie, Ltd., H. W., Toronto, Ont.

GRINDING WHEELS
Lion Grinding Wheels, Limited, Montreal, Que.
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Can. Fairbanks-Morse Co., Ltd., Montreal
Norton Co of Can., Ltd., Hamilton, Ont.

GUN-BARREL MACHINERY
Steinle Turret Machine Co., Madison, Wisconsin.

HACK SAWS, POWER
Atkins & Co., Inc., E C., Indianapolis, Indiana.
Petrie, Ltd., H W., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.

HAMMERS, CHIPPING
Cleveland Pneumatic Tool Co., Toronto, Ont.
High Speed Hammer Co., Rochester
Independent Pneumatic Tool Co., Chicago, Ill.

HAMMERS, DROP
Bertram & Son Co., Ltd., The John Dundas, Ont.
Pliss Co., E. W., Brooklyn, N.Y.
Brown Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

HAMMERS, ELECTRIC
Brown, Boggs & Co., Ltd., Hamilton, Ont.

HAMMERS, PNEUMATIC
Can. Steel Foundries, Montreal, Que
Cleveland Pneumatic Tool Co., Toronto Ont.
Independent Pneumatic Tool Co., Chicago, Ill.

HANGERS, SHAFTING
Canadian SKF Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Hamilton Gear & Machine Co., Toronto.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

HOBBING MACHINES
Shore Instrument Co., Jamaica, N.Y.

HARDENING, CASE-HARDENING AND TEMPERING
Barnes Company, Wallace, Hamilton.
Petrie, Ltd., H. W., Toronto, Ont.
Gisholt Machine Co., Madison, Wis
Cleveland Pneumatic Tool Co., Toronto Ont.

HAMMERS, POWER
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

HOBS
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Tap & Die Corp., Galt, Ont
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

HOISTS, ELECTRIC
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.

HOISTS, HAND
Curtis Pneumatic Machinery Co., St. Louis, Mo.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio

HOISTS, PNEUMATIC
Independent Pneumatic Tool Co., Chicago, Ill.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont

HOLDERS-ON, PNEUMATIC
Cleveland Pneumatic Tool Co., Toronto Ont.
Independent Pneumatic Tool Co., Chicago, Ill.

HYDRAULIC MACHINERY
Bertram & Son Co., Ltd., The John Dundas, Ont.
Dominion Engineering Works, Limited Montreal, Que.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

IGNITERS, GAS ENGINE
Canada Foundries & Forgings Co., Welland, Ont.
Burke Machine Tool Co., Conneaut, O

INDICATORS, SPEED AND TEST
Brown & Sharpe Mfg. Co., Providence R.I.

INSULATION
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.

IRON BARS
Steel Co. of Canada, Ltd., Hamilton Ont.

JACKS, HYDRAULIC
Norton, A. O., Boston, Mass.

JACKS, PLANER
Armstrong Bros. Tool Co., Chicago, Ill
Starrett Co., L. S., Athol, Mass.

JAPANNING AND VARNISHING OVENS
Brantford Oven & Rack Co., Brantford, Ont.

JIGS AND FIXTURES (SEE TOOL WORK)
Fisher Motor Co., Ltd., Orillia, Ont
Gisholt Machine Co., Madison, Wis

KEYSEATING MACHINES
Morton Mfg Co., Muskegon, Mich

BUYERS' DIRECTORY

Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

KEYS, MACHINE
Can. Dranw Steel Co., Hamilton, Ont.
Morton Mfg. Co., Muskegon, Mich.

KNIVES, MACHINE
Atkins & Co., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

KNURL HOLDERS
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

LATHE ATTACHMENTS
Hendey Machine Co., Torrington, Conn.
Petrie, Ltd., H. W., Toronto, Ont.

LATHE TOOLS
Armstrong Bros. Tool Co. ,Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

LATHES, AUTOMATIC AND SEMI-AUTOMATIC
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, BENCH
Hardinge Bros., Inc., Chicago, Ill.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

LATHES, BORING
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, CHUCKING (SEE LATHES, HORIZONTAL TURRET, AND LATHES, VERTICAL TURRET)
Acme Machine Tool Co., Cincinnati, O.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, ENGINE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hendey Machine Co., Torrington, Conn.
Petrie, Ltd, H. W., Toronto, Ont
Rockford Lathe & Drill Co., Rockford, Illinois.

LATHES, EXTENSION AND GAP
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison Wis.
National Acme Co., Cleveland, O.
Petrie, Ltd., H. W., Toronto, Ont.
Steinle Turret Machine Co., Madison, Wis.

LATHES, PRECISION
Hardinge Bros., Chicago.

LATHES, RELIEVING
Hendey Machine Co., Torrington, Conn.

LATHE, UNIVERSAL HAND
Brown & Sharpe Mfg. Co., Providence, Rhode Island.

LATHE, SPEED AND HAND
Blount Co., J. G., Everett, Mass.

LATHES, SPINNING
Pryibil Machine Co., Torrington, Conn.

LATHES, VERTICAL TURRET
Bertram & Son, Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

LATHES, WOOD TURNING
Blount, Co., J. G., Everett, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.

LEAD PIPE
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

LEATHER FILLET
D. K. McLaren, Limited, Montreal,

LINOLEUM MILL MACHINERY
Bertrams, Ltd., Edinburgh, Scotland.

LIQUID AIR PLANTS
L'Air Liquide Society, Toronto, Ont.

LOCKERS, CLOTHES
Dennis Wire and Iron Works, London Ont.

LUBRICANTS
Oakley Chemical Co., New York, N.Y.

LUBRICATING SYSTEMS
Bowser, S. F., & Co., Ltd., Toronto, Canada.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Ltd., Welland, Ont.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R. Toronto Ont.

MANGANESE STEEL
Can. Steel Foundries, Montreal, Que.

MANDRELS, EXPANDING
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MANDRELS, SOLID
Greenfield Tap & Die Corp., Galt, Ont.
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Pratt & Whitney Co., of Canada. Ltd., Dundas, Ont.

MEASURING MACHINES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MECHANICS' FINE TOOLS
Lufkin Rule Co., Windsor, Ont.

METALS, ALLOY
Canada Metal Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.

METAL WORKERS
Parker Co., Charles, Meriden, Conn.

MICROMETER CALIPERS
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Rice Lewis & Son, Ltd., Toronto, Ont.

MILLING ATTACHMENTS
Burke Machine Tool Co., Conneaut, O.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

MILLING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Burke Machine Tool Co., Conneaut, O.

MILLING MACHINES, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence, R. I.
Hardinge Bros., Inc., Chicago, Ill.
Pratt & Whitney Co., of Canada, Ltd. Dundas. Ont.

MILLING MACHINES, BENCH
Burke Machine Tool Co., Conneaut. O.
Hardinge Bros., Inc., Chicago, Ill.

MILLING MACHINES, HAND
Brown & Sharpe Mfg. Co., Providence
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MILLING MACHINES, HORIZONTAL PLANER TYPE.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Kearney & Trecker Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto.

MILLING MACHINES, PLAIN
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, O.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

MILLING MACHINES, THREAD
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MILLING MACHINES, UNIVERSAL
Brown & Sharpe Mfg. Co., Providence,
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

MILLING MACHINES, VERTICAL
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, O.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto.

MILLING TOOLS, ADJUSTABLE HOLLOW
Geometric Tool Co., New Haven, Conn.

MOTORS, ELECTRIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Roelofson Elevator Co., Galt, Ont.
Williams Machinery Co., A. R., Toronto,
Wisconsin Electric Co., Racine Wis.

NAILS AND STAPLES
Canada Metal Co., Ltd., Toronto, Ont.

NIPPLES
Canada Metal Co., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton,

NITROGEN
Carter Welding Co. Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

NUT TAPPERS
(See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
National Acme Co., Cleveland, Ohio.

NUTS, FINISHED and SEMI-FINISHED
Galt Macine Screw Co., Galt, Ont.
National Acme Co., Montreal, ue.

NUTS (Up to 4-in.)
Steel Co. of Canada, Ltd., Hamilton.

NUTS, S.A.E., PLAIN AND CASTELLATED
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

OIL FILTERING AND STORAGE SYSTEMS
Bowser, S. F., & Co., Ltd., Toronto,

OIL STORAGE ENGINEERS
Bowser, S. F., & Co., Ltd., Toronto,

OIL HOLE COVERS
Can. Whitney Co., Ltd., Windsor, Ont.

OILS, SOLUABLE
Brantford Oven & Rack Co., Brantford, Ontario.

ORNAMENTAL IRON AND WIRE WORKS
Roelofson Elevator Works, Galt, Ont.

OXYGEN
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

OXY-ACETYLENE APPARATUS
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Atlas Press Co., Kalamazoo, Mich.

PAINT SPRAYERS
Spray Engineering Co., Boston, Mass.

PAPER MILL CONVEYORS
Bertram Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd., Montreal, Que.

PATTERNS, WOOD AND METAL
Fittings, Limited, Oshawa, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.
Victoria Foundry Co., Ltd., Ottawa.

PHOSPHOR TIN
Canada Metal Co., Ltd., Toronto, Ont.

PHOTOGRAPHIC DUPLICATING MACHINES
Photostat Corp., Providence, R. I.

PIPE BENDING MACHINES
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Underwood Corp., H. R., Philadelphia, Pa.
Williams Machinery Co., A. R., Toronto.

PIPE CUTTING AND THREADING MACHINES
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Petrie, Ltd., H. W., Toronto, Ont.

PIPE
Canada Metal Co., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.

PIPE FITTINGS
Canada Metal Co., Toronto, Ont.
Fittings, Limited, Oshawa, Ont.
International Malleable Iron Co., Guelph Ont.

PIPE AND NIPPLE THREADING MACHINES
Landis Machine Co., Inc., Waynesboro, Pa.

PIPE FITTERS' TOOLS
Rice Lewis & Son, Ltd., Toronto. Ont.

PIPE THREADING DIE HEADS
Landis Machine Co., Inc., Waynesboro Pa.

PISTON-RING MACHINES
National Acme Co., Cleveland, Ohio
Steinle Turret Machine Co., Madison, Wis.

PLANING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Williams Machinery Co., A. R., Toronto

PLANING MACHINES, ROTARY
Bertram & Son Co., Ltd., The John, Dundas, Ont.

PLATE ROLLS
Bertram & Son Co., Ltd., The John, Dundas, Ont.

PNEUMATIC PAINTING DEVICES
Spray Engineering Co., Boston, Mass.

PNEUMATIC TOOLS
Cleveland Pneumatic Tool Co., Toronto
Independent Pneumatic Tool Co., Chicago, Ill.

POLISHING AND BUFFING MACHINES
Lion Grinding Wheels, Limited, Montreal, Que.
Blount Co., J. G. Everett, Mass.
Brown & Sharpe Mfg. Co., Providence.
Pryibil Machine Co., New York, N.Y.

PRESSED STEEL PARTS
American Pulley Co., Philadelphia, Pa.
Fisher Motor Co., Ltd., Orillia, Ont.

PRESSES, ARBOR
Atlas Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

PRESSES, DROP AND FORGING
Brown, Boggs & Co., Ltd., Hamilton.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

PRESSES, FOOT AND HAND
Brown, Boggs & Co., Ltd., Hamilton

PRESSES, HYDRAULIC
Bertram & Son Co., Ltd., The John Dunldas, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Perrin Ltd., W. R., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

PRESSES, POWER
Bliss Co., E. W., Prooklyn, N. Y.
Brown, Boggs, & Co., Ltd., Hamilton,
Hepburn Ltd., John T., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Stoll Co., Inc., D. H., Buffalo, N.Y.

PRESSES, SCREW
Brown, Boggs & Co., Ltd., Hamilton.
Petrie, Ltd., H. W., Toronto, Ont.

PROFILING MACHINES
Prtt & Whitney Co., of Canada, Ltd., Dundas, Ont.

PROTRACTORS
Brown & Sharpe Mfg. Co., Providence
Lufkin Rule Co., Windsor, Ont.

PROPELLERS
Kennedy & Sons, Wm., Owen Sound Ontario.

PULLEYS, CORK INSERT
American Pulley Co., Philadelphia, Pa.

PULLEYS, METAL AND FIBRE
American Pulley Co., Philadelphia, Pa.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.
D. K. McLaren Co., Limited Montreal, Que.

PULP AND PAPER MILL EQUIPMENT
Dominion Engineering Works, Ltd., Montreal, Que.

PUMPS, HYDRAULIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Dominion Engineering Works, Ltd. Montreal, Que.
Hepburn Ltd., John T., Toronto. Ont

BUYERS' DIRECTORY

PUMPS, LUBRICANT AND OIL
Bowser, S. F., & Co., Ltd., Toronto.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Hepburn Ltd., John T., Toronto, Ont.

PUMPS, POWER
Bowser, S. F., & Co., Ltd., Toronto.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hepburn Ltd., John T., Toronto, Ont.

PUNCHES, CENTER
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

PUNCHES, HAND
Brown Boggs & Co., Ltd., Hamilton.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Jardine & Co., A. B., Hespeler, Ont.

PUNCHES, POWER
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

PUNCHING MACHINES, HORIZONTAL
Bertram Ltd., Edinburgh, Scotland.

PYROMETERS, ELECTRIC
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Hiram Walker & Sons Metal Products Co., Walkerville, Ont.

RACKS, CUT
Hamilton Gear & Machine Co., Toronto.

RACKS, STORAGE
(See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ontario.

REAMER HOLDERS
Simonds Canada Saw Co., Montreal, Q.

REAMERS, EXPANDING
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

REAMERS, SOLID
Butterfield & Co., Inc., Rock Island, Q.
Morse Twist Drill & Machine Co., New Bedford, Mass.

REAMERS, TAPER
Brown & Sharpe Mfg. Co., Providence, R. I.
Butterfield & Co., Inc., Rock Island, Q.
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canad, Ltd., Dundas, Ont.

RECORDERS, TEMPERATURE
Taylor Instrument Co., Rochester, N. Y.

RECORDERS, TIME
Gisholt Machine Co., Rochester, N. Y.
Taylor Instrument Co., Toronto, Ont.

REGULATORS, TEMPERATURE
Taylor Instrument Co., Toronto, Ont.

RIVETS AND BURRS
Parmenter & Bulloch Co., Gananoque, Ont.
Steel Co., of Canada, Ltd., Hamilton.

RIVETS, CHAIN
Fittings, Limited, Oshawa, Ont.

RIVET-MAKING MACHINERY
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

RIVETING HAMMERS
Independent Pneumatic Tool Co., Chicago, Ill.

RIVETING MACHINES
Can. Fairbanks-Morse Ltd., Montreal, Q.
High Speed Hammer Co., Rochester, N.Y.
Parmenter & Bulloch Co., Gananoque Ont.
Petrie, Ltd., H. W., Toronto, Ont.

RUDDER FRAMES, STEEL
Can. Steel Foundries, Montreal, Que.

RUBBER MILL MACHINERY
Bertram Ltd., Edinburgh, Scotland.

RULES, STEEL AND WOOD
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Windsor, Ont.

RUST PREVENTATIVES
Oakley Chemical Co., New York, N. Y.

SAND EQUIPMENT
Can. Link-Belt Co., Toronto, Ont.

SAND RAMMERS, PNEUMATIC
Cleveland Pneumatic Tool Co., Toronto.
Independent Pneumatic Tool Co., Chicago, Ill.

SAW FRAMES AND BLADES, HACK
Atkins & Co., Inc., E. C., Indianapolis.
Diamond Saw & Stamping Works, Buffalo, N. Y.
Rice Lewis & Sons, Ltd., Tornto, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWING MACHINES, POWER HACK
Atkins & Co., Inc., E. C., Indianapolis.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

SAW SHARPENING MACHINES
Atkins & Co., Inc., E. C., Indianapolis.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

SAW SHARPENING MACHINES
Atkins & Co., Inc., E. C., Indianapolis.

SAW TABLES, UNIVERSAL
Petrie, Ltd., H. W., Toronto, Ont.

SAWS, CIRCULAR METAL
Atkins & Co., Inc., E. C., Indianapolis
Pryibil Machine Co., New York, N. Y.
Gisholt Machine Co., Madison, Wis.

SAWS, HAND
Atkins & Co., Inc., E. C., Indianapolis
Simonds Canada Saw Co., Montreal, Q.

SAWS, HOT AND COLD
Atkins & Co., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Q.

SAWS, HIGH SPEED STEEL
Atkins & Co., Inc., E.C., Indianapolis, I.
Butterfield & Co. Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWS, METAL BAND
Atkins & Co., E. C., Indianapolis, I.

SAWS, METAL CUTTING
Brown & Sharpe Mfg. Co., Providence.
Butterfield & Co., Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.
Starrett Co., L. S., Athol, Mass.

SAWS, SCREW SLOTTING
Atkins & Co., Inc., E., C., Indianapolis.
Butterfield & Co., Inc., Rock Island, Q.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canda, Ltd., Dundas, Ont.

SAWS, SCREW SLOTTING
Atkins & Co., Inc., E. C., Indianapolis.
Butterfield & Co., Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWS, WOOD
E. C. Atkins & Co., Indianapolis, Ind.

SCALES
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Lufkin Rule Co., Windsor, Ont.

SCREENS
Dominion Engineering Works, Ltd., Montreal, Que.

SCREW DRIVERS, OPTICAL, JEWELRY AND NOVELTY
Strand & Co., N. A., Chicago, Ill.

SCREW MACHINE WORK
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Montreal, Que.

SCREW MACHINERY, WOOD AND LAG
Cook Co., Asa S., Hartford, Conn.

SCREW MACHINES
Brown & Sharpe Mfg. Co., Providence, Rhode Island.

SCREW MACHINES, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.

SCREW MACHINE PRODUCTS
National Acme Co., Montreal, Que.

SCREW PLATES
Butterfield & Co., Inc., Rock Island. Que.
Jardine & Co., A. B., Hespeler, Ont.

SCREWS, CAP AND SET
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

SCREWS, SAFETY, SET
Galt Machine Screw Co., Galt, Ont.

SECOND-HAND MACHINERY
See last page of directory.
Petrie, Ltd., H. W., Toronto, Ont.

SEPARATORS, MOISTURE AND OIL
Bowser, S. F., & Co., Ltd., Toronto, Canada.

SEPARATORS, OIL AND WASTE
Bowser, S. F., & Co., Ltd., Toronto.

SHAFTS, FLEXIBLE
Strand & Co., N. A., Chicago, Ill.

SHAFTING
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
Williams Machinery Co., A. R., Toronto.

SHAPES, COLD-DRAWN SPECIAL STEEL
Union Drawn Steel Co., Hamilton, Ont.

SHAPING MACHINES
Hendey Machine Co., Torrington, Conn.
Morton Mfg. Co., Muskegon, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Williams Machinery Co., A. R. Toronto.

SHEARS HAND
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

SHEARS, POWER
Bliss Co., E. W., Brooklyn, N. Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Stoll Co., Inc., D. H., Buffalo, N. Y.
Williams Machinery Co., A. R., Toronto, Ont.

SHEARING MACHINES, ANGLE, IRON BAR AND GATE
Bertrams Ltd., Edinburgh, Scotland.

SHEET LEAD
Canada Metal Co., Ltd., Toronto, Ont.

SHEET METAL WORKING MACHINERY
Bliss Co., E. W., Brooklyn, N. Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Stoll Co., Inc., D. H. Buffalo, N.Y.

SHEETS, NICKEL, MONEL AND FIBRE
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.

SHEETS, O.P.C.R. & B. A. AND BLUE ANNEALED
Steel Co., of Canada, Ltd., Hamilton, Ont.

SIDE FRAMES, LOCOMOTIVE
Can. Steel Foundries, Montreal, Que.

SLOTTING ATTACHMENTS
Brown & Sharpe Mfg. Co., Providence, R.I.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

SLOTTING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.

SOLDERS
Canada Metal Co., Ltd., Toronto, Ont.

SPRAYING EQUIPMENT
Spray Engineering Co., Boston, Mass.

SPECIAL MACHINERY AND TOOLS
Brown Engineering Corp., Ltd., Toronto.
Gisholt Machine Co., Madison, Wis.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.
National Acme Co., Cleveland, O.

SPIKES, RAILWAY AND PRESSED
Steel Co. of Canada, Ltd., Hamilton, Ont.

SPINNING LATHES
Pryibil Machine Co., P., New York City.

SPRING, MILLED
Barnes & Co., Wallace, Hamilton, Ont.

SPRINGS, SMALL SPIRAL HELICAL, COMPRESSION, EXTENSION, TORSION AND SPECIAL
Barnes Company, Wallace, Hamilton.

SPRINGS
Barnes Company, Wallace, Hamilton.
Cleveland Wire Spring Co., Clevleand, O
Steele Ltd., James, Guelph, Ont.

SPRINGS, FLAT STEEL, BRUSH HOLDER, CLOCK, SMALL FLAT SPRINGS
Barnes Company, Wallace, Hamilton.

SPROCKETS AND CHAINS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Renold Hanson of Canada, Ltd., Montreal, Que.

SQUARES
Brown & Sharpe Mfg. Co., Providence, R.I.
Lufkin Rule Co., Windsor, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

STAMPING, METAL
American Pulley Co., Philadelphia, Pa.
Barnes Company, Wallace, Hamilton.
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Galt Machine Screw Co., Galt, Ont.

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Canada Foundries & Forgings Co., Welland, Ont.

When answering advertisements kindly mention Canadian Machinery

A Directory of Dealers will be Found above Advertising Index

DIRECTORY OF DEALERS

THE Buyers' Directory of CANADIAN MACHINERY was originally intended to contain information regarding lines actually manufactured by our advertisers. We now carry the advertising of leading machinery dealers, some of whom represent scores of manufacturers in addition to being manufacturers themselves in some cases. We recommend, therefore, if our subscribers cannot find what they want in our Directory that they communicate with the dealers whose names appear herewith.

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Garlock Machinery Ltd., Toronto.
Herbert Ltd., Alfred, Toronto, Ont.
H. W. Petrie Ltd., Toronto, Ont
A. R. Williams Machinery Co, Toronto, Ont.
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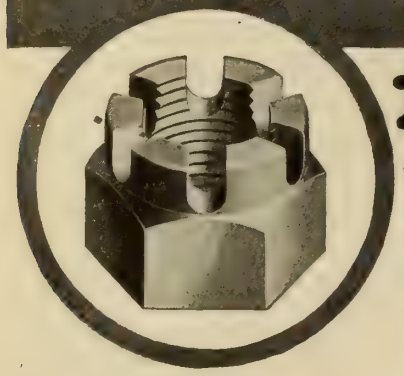

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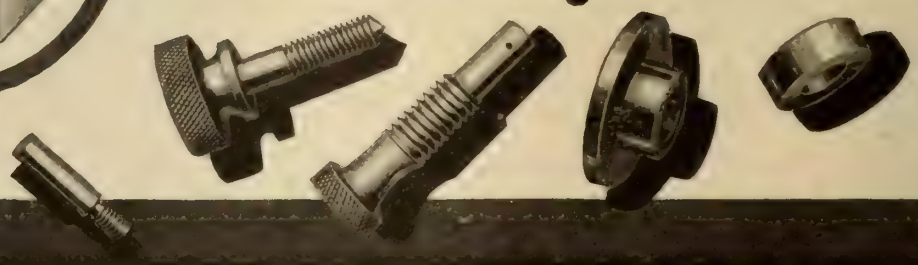

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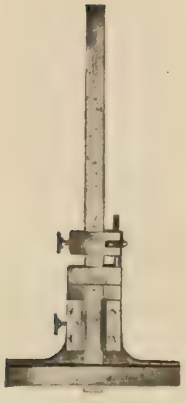

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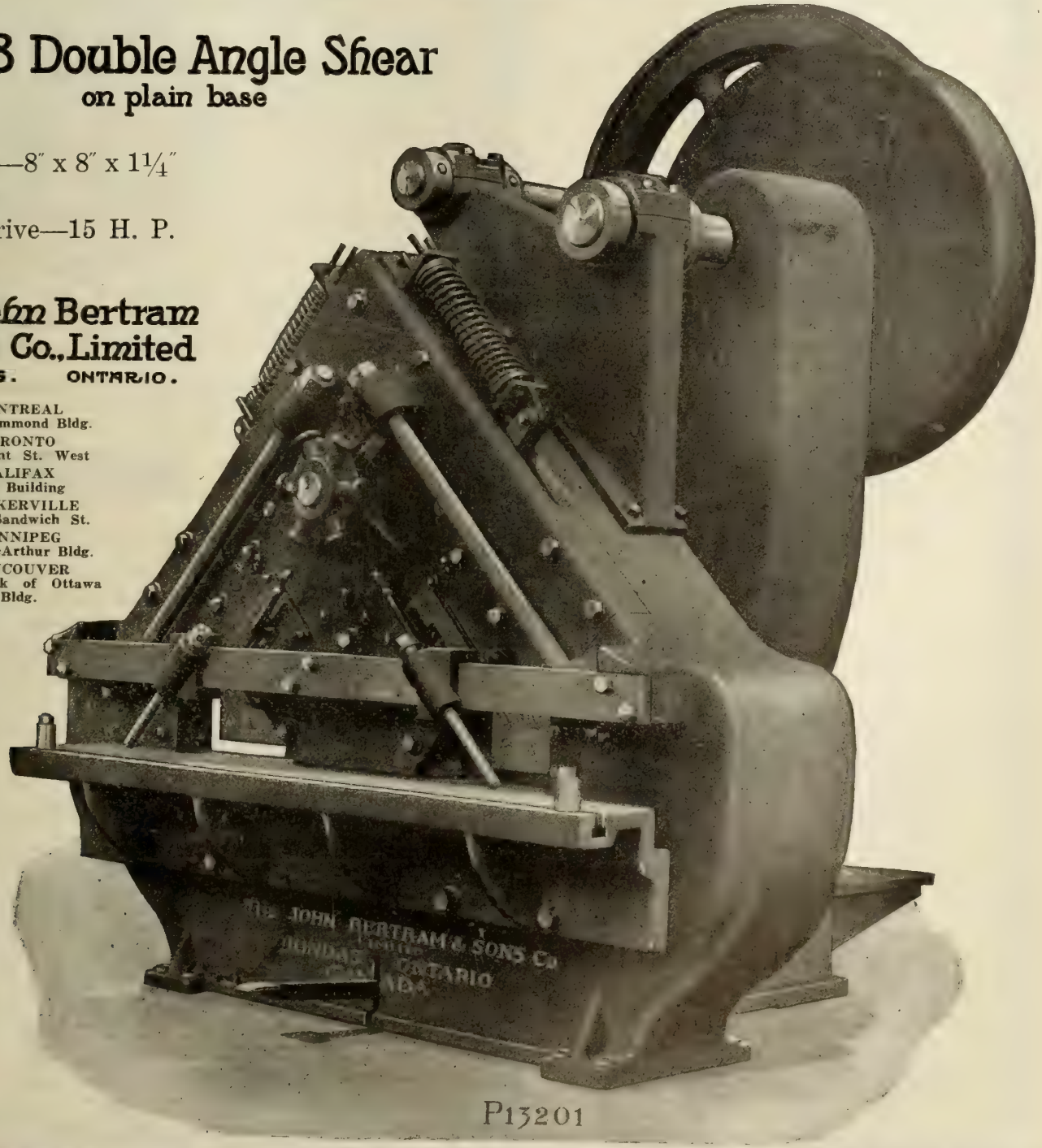

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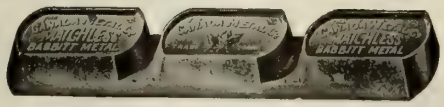

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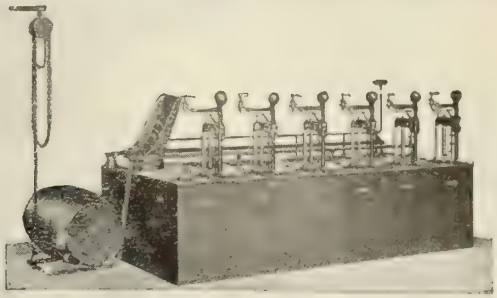

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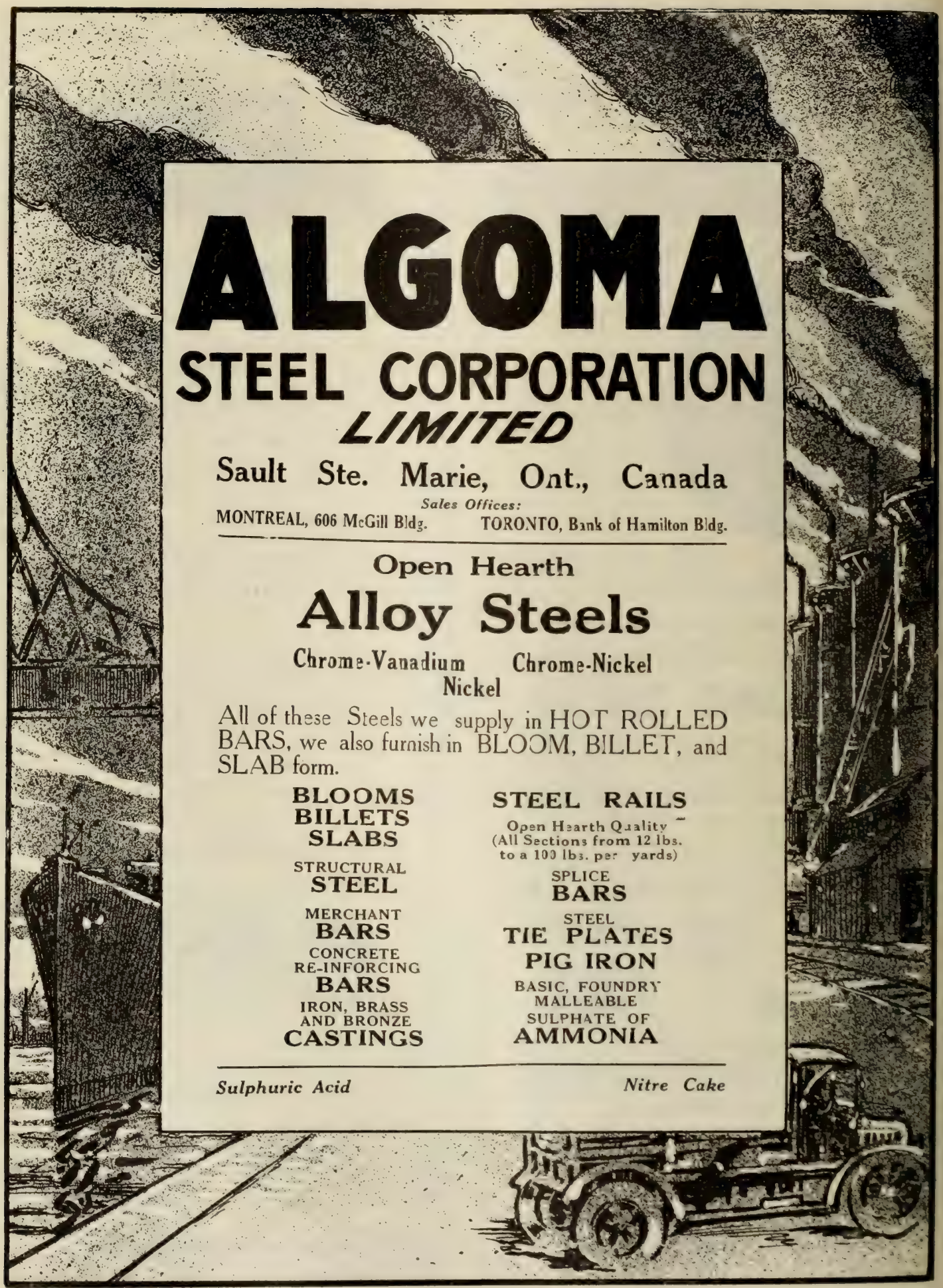

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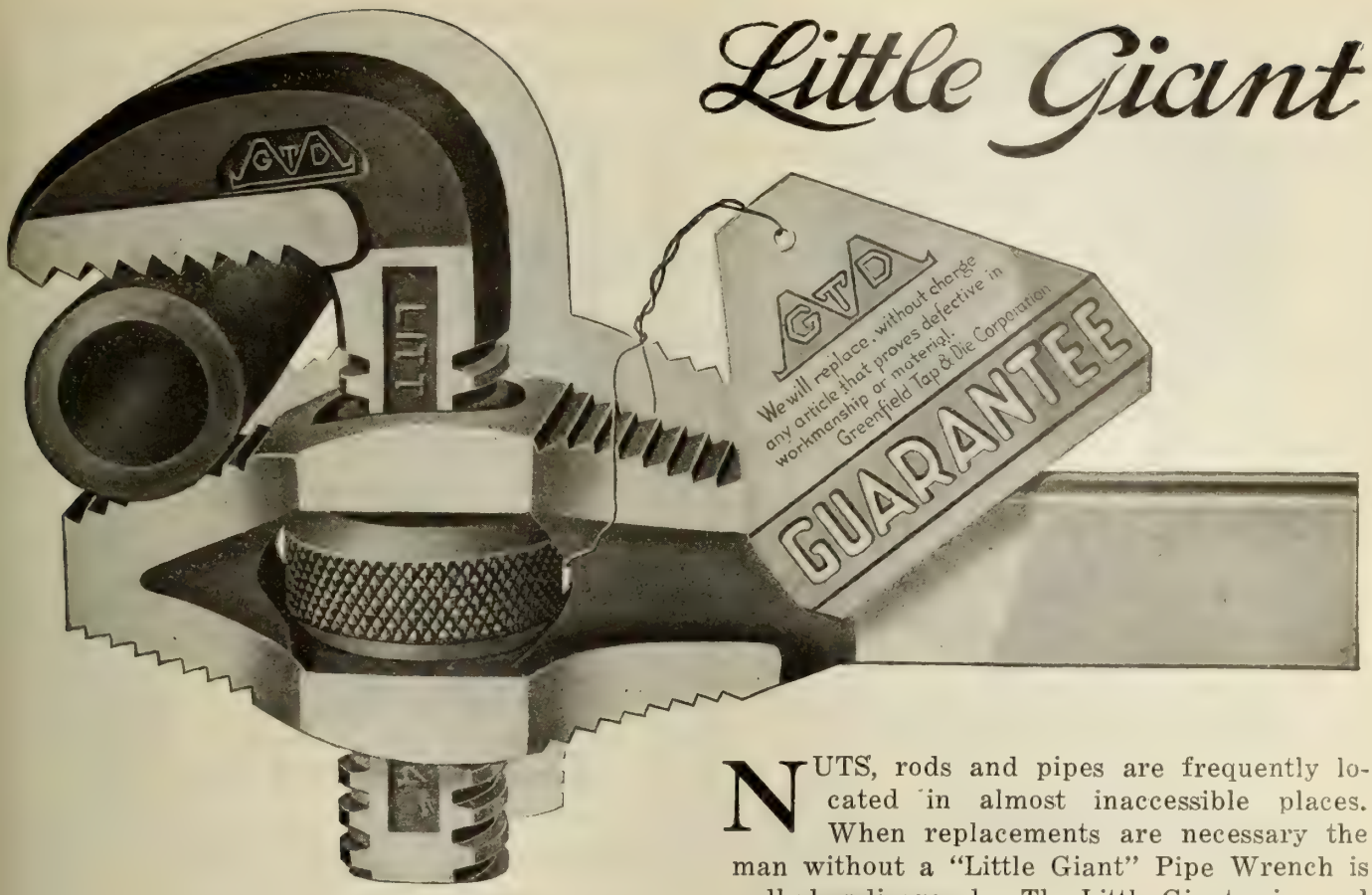
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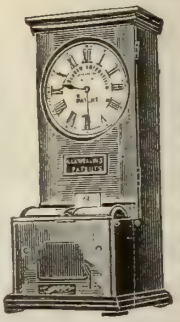

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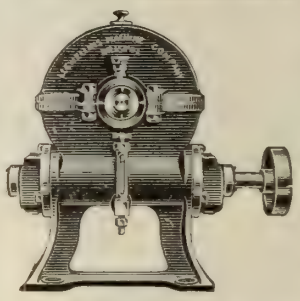

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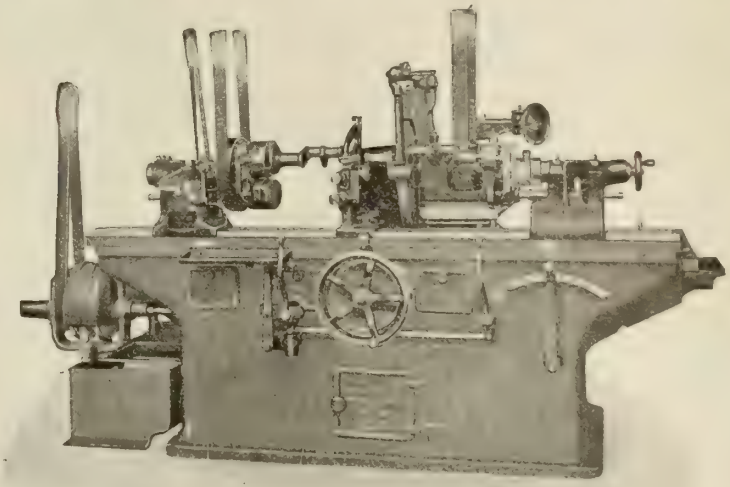

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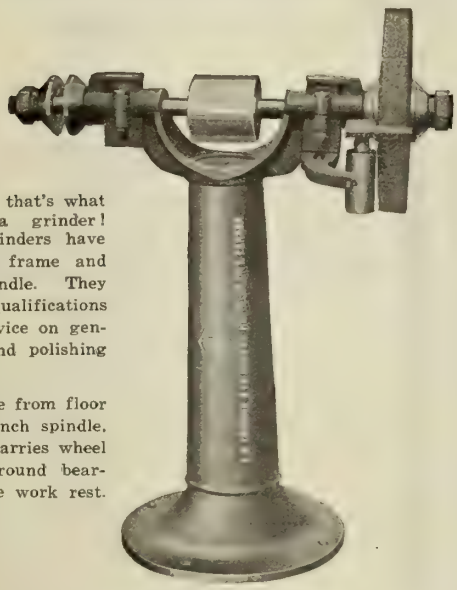

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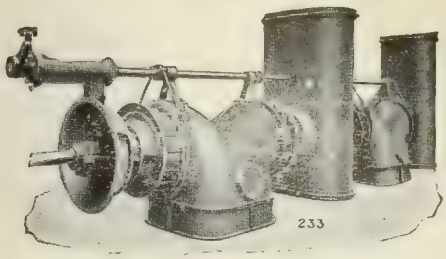

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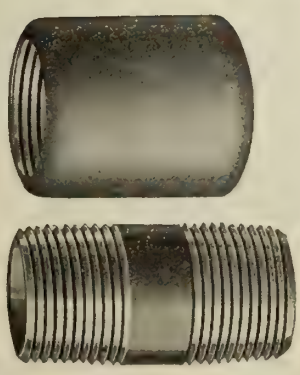

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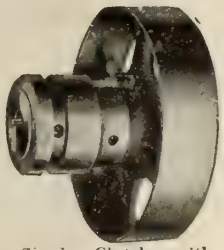
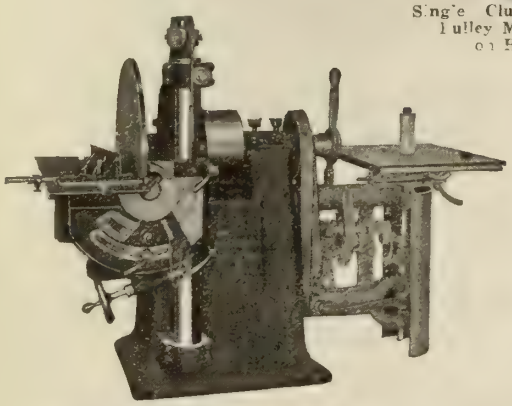


Single Clutch, with Pulley Mounted on Hub



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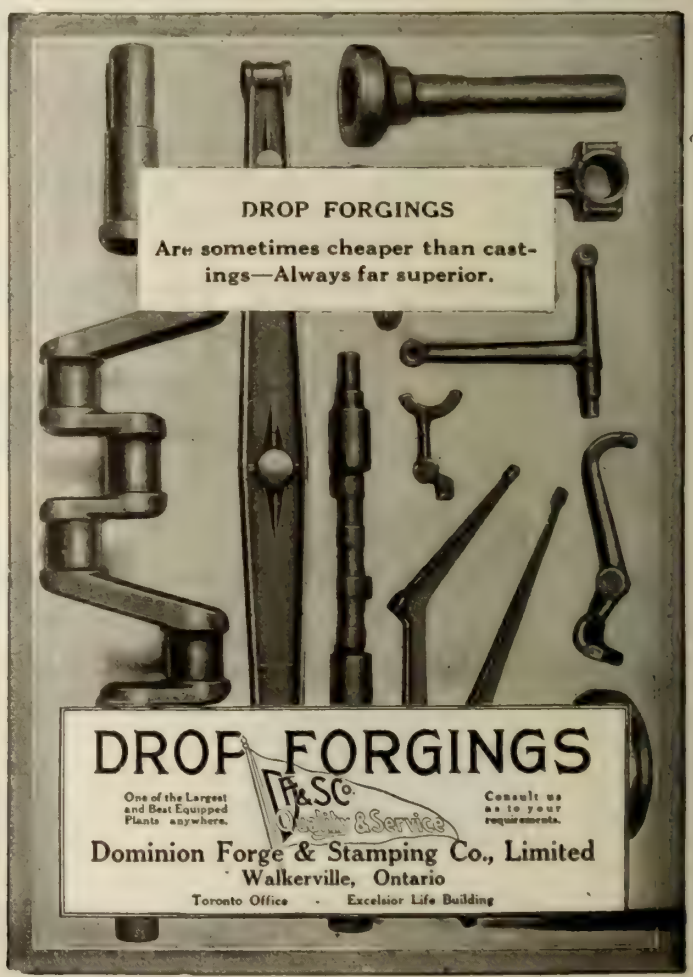
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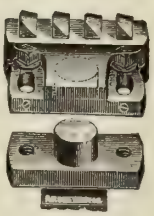

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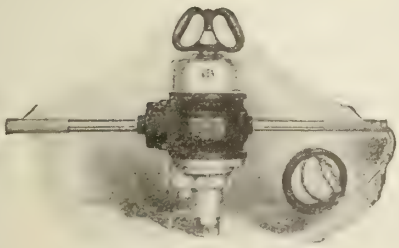

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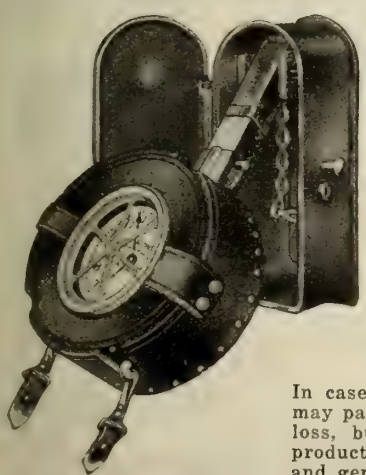

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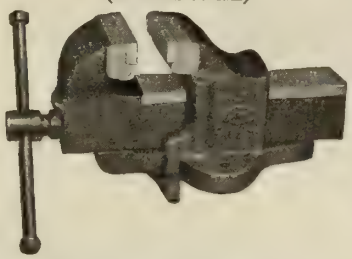

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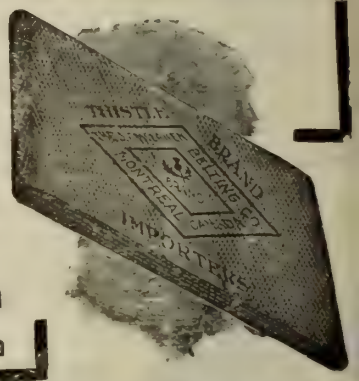

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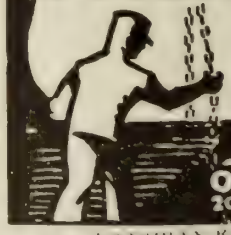

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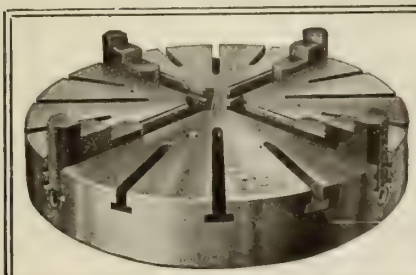

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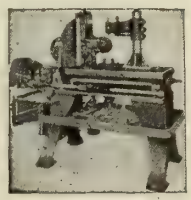

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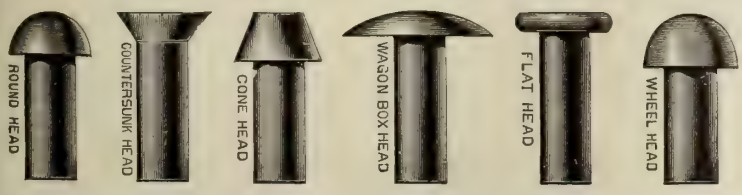

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CANADIAN MACHINERY
AND
MANUFACTURING NEWS

VOL. XXVIII, No. 15 OCTOBER 12, 1922

Producing Irregular Parts on the Turret Lathe

Experience of Others Often an Advantage—Economic Handling of Heavy Pieces—Fixtures Made to Accommodate Any Desired Shape—Special Boring Heads for Taper Work

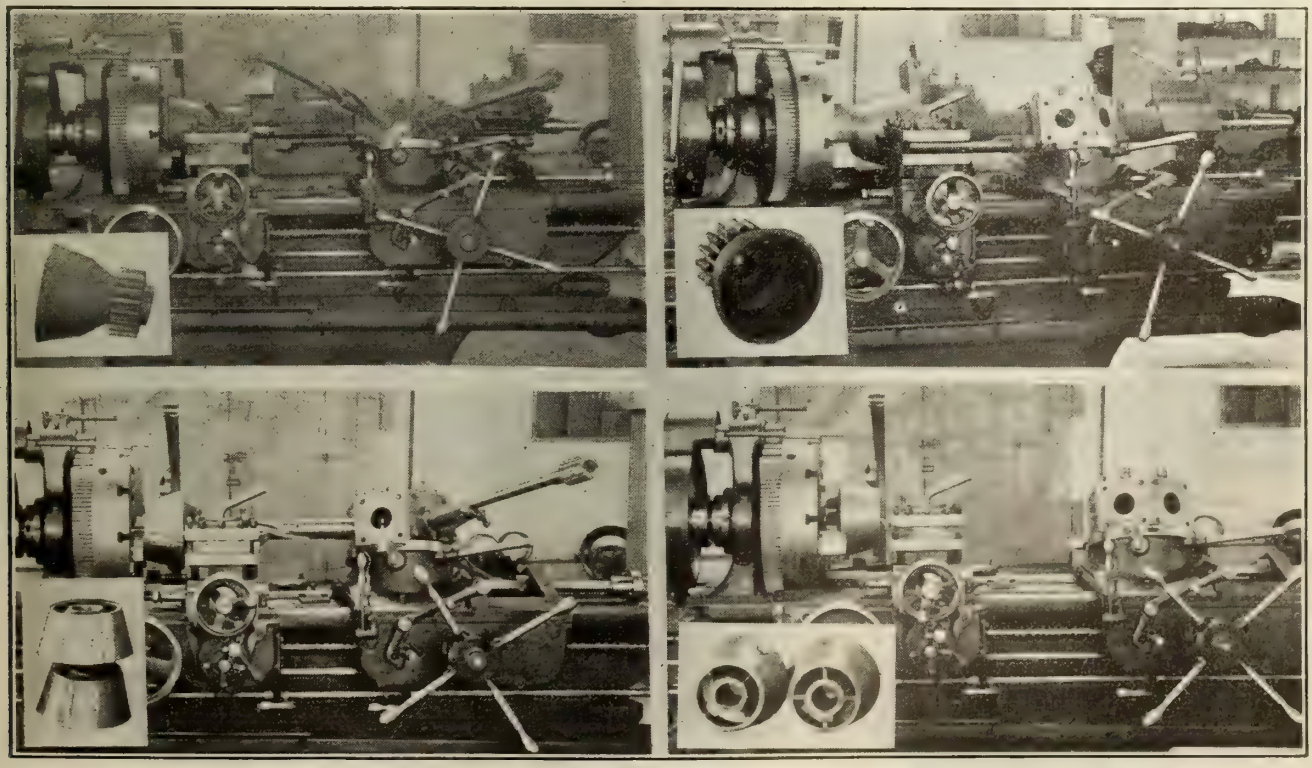
IT IS seldom that two manufacturing plants are required to solve their machining problems in exactly the same way, as production methods must necessarily vary according to the nature of the product. Nevertheless, while the experience of any one particular manufacturer cannot be taken as an absolute criterion, the degree of success that has been achieved in one plant frequently creates considerable interest in those who have similar problems to contend with, so that any records of work performed help in deciding on the most suitable class of equipment to instal to meet the requirements of modern practice in the way of quantity and quality production.

Fig. 1 illustrates a line sketch of a clutch cone gear, and an interesting piece of work satisfactorily handled on a heavy-duty turret lathe. The entire surface of the part is machined to the dimensions shown, with the exception of the second interior cone section. The work is completed in two operations. Figs. 3 and 4 show the two operations respectively while Fig. 5 illustrates the style of taper boring head used for boring this particular type of gear. It will be noted in Fig. 3 that in the first operation the clutch cone gear is held with the large conical end next to the chuck in special hard jaws bored to fit the outside tapered surface. The order of operation is very simple as on the first operation the hub is faced, the hole is rough and finish bored and reamed to size. The heavy stock on the outside of gear is (1) roughed off with tool in tool post and immediately following the (2) facing head in turret is brought up which turns and faces the gear (these two operations are done almost simultaneously). The gear is then finished turned with tools in facing head.

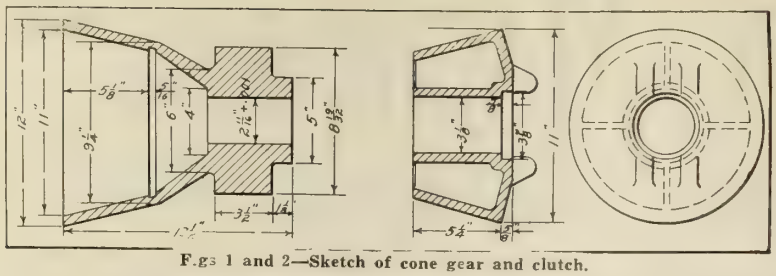
In the second operation the piece is reversed and gripped on the outside of finish gear with soft jaws bored to size. The outside tapered surface of the cone is rough and finish turned by tools in tool post, then the inside tapered surface is bored with special boring head shown in Fig. 5. The inside and outside are bored simultaneously as can be noted in Fig. 4. Both the tool post tools and turret tools are shown in action.

Sectional drawing Fig. 5 illustrates the action of the taper boring head in connection with the cone. The cone is shown in slightly different design, but the principle is the same. The taper for the friction is bored with a single

Illustrations and data through courtesy of the Gisholt Machine Co., Madison, Wis.



Figs. 3 & 4—Top: machine set up for operations on clutch cone gear. Figs. 6 & 7.—Lower: machining the clutch cone.



Figs 1 and 2—Sketch of cone gear and clutch.

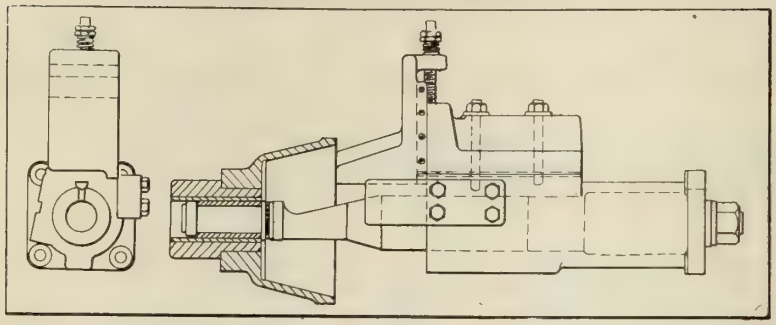


Fig. 5—Special boring head used in machining tapered cone.

point tool which is properly supported and guided to produce the correct angle. The operation is as follows: The pilot enters the bushing on which the clutch cone is centered, this insures that the friction will be concentric with the hub, a ball thrust bearing is provided at (A) and this bearing bears against the end of the bushing in the chuck, this keeps the pilot from entering further into the hole and the length and location of the taper is governed by it. As the boring head is feeding forward over the pilot, a pin resting against the angular surface (B) guides the tool in at the proper taper, the slide holding the tool being forced down by a spring as the head feeds forward.

The recess at (A) (Fig. 1) is cut with tool shown in frontside of tool post in (Fig. 4). This recess provides clearance for the tool in the taper boring head mounted in the turret (Fig. 5). The time on both these operations is 60 minutes complete.

Let us next consider the cone used on this gear just described. The piece is shown at Fig. 2 and fits into the clutch cone gear in Fig. 1. This piece is made of cast iron and is finished on the bore, counterbore, face, outside taper and small section on back face. Two settings are necessary to complete the part, and Fig. 6 and 7 illustrate both operations on this piece. In the first operation, the piece is held with special hard jaws gripping it on the inside of the small end of taper. The outside is then rough and finished turned with tools held in the tool post and at the same time the hole is roughed and finished bored and reamed with tools in the turret. The work is held by soft jaws in the second operation and is gripped on the outside of the large end of the tapered surface as shown in Fig. 7. The small end of the cone is then faced by a tool held in the tool post; this completes the operations. The total time required for both operations is 25 minutes.

Tractor Axle Arm

What at first would appear a very difficult turret lathe job is that illustrated in Fig. 8. The peculiar shape of course makes it necessary to employ special holding fixtures, but where sufficient pieces are produced the construction of such appliances is offset by the advantages in machining the parts by the multiple tool system of the turret machine.

Fig. 8 shows an irregular piece machined on a 24in. turret lathe. This arm is made of cast iron and is machined as indicated by heavy lines. There is no difficulty in finishing an irregular piece like this one provided it is held rigidly as indicated in Figs. 9 and 10. The first operation is shown in Fig. 9. The piece is first roughed and finished on the surfaces marked (A) and (B). This is done with tools held in the tool post. The time required is nine minutes.

The tool layout for the second operation is shown in Fig. 10. The work consists of boring the hole on outward end of the arm and facing the flange as well as facing the rear side of the hub at (E). The work is first placed in a special fixture which is clearly shown in Fig. 10. One: the piece is held by clamps that force the finished bottom flange against chuck plate. In addition to this, an auxiliary supporting clamp is used, thus steadying the arm near the end where it is machined. Two: flange C is then rough faced by means of tool (A) in tool post. Three: hole (D) is rough bored with cutters held in boring bar side one of the turret. Four: the hole (D) is then finished bored with cutters held in boring bar side 3 of turret. Five: hole (D) is reamed to size with a floating reamer held in side 5 of turret. Six: the face (C) is finished with tool (B) in tool post. Seven: the back of hub face (E) is then machined with tool in tool holder (C) in tool post. Total time for this operation is nine minutes.

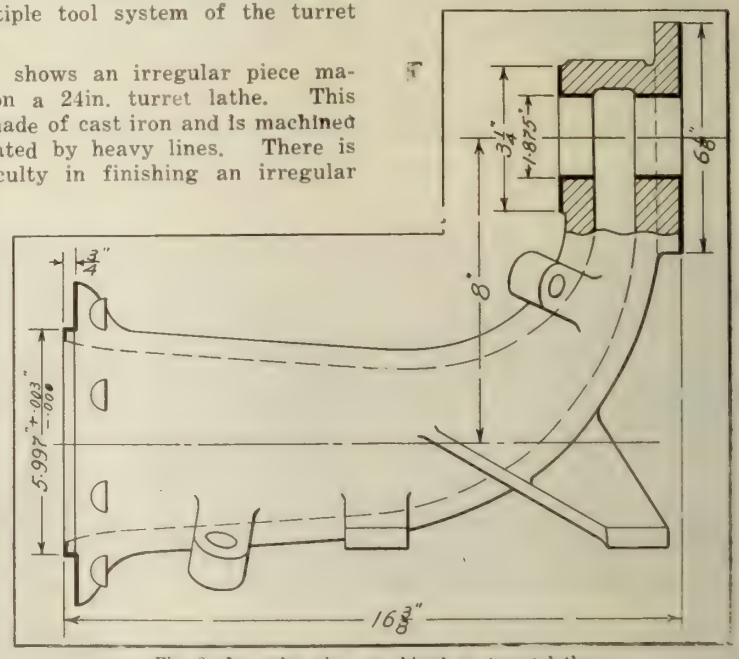


Fig. 8—Irregular piece machined on turret lathe.

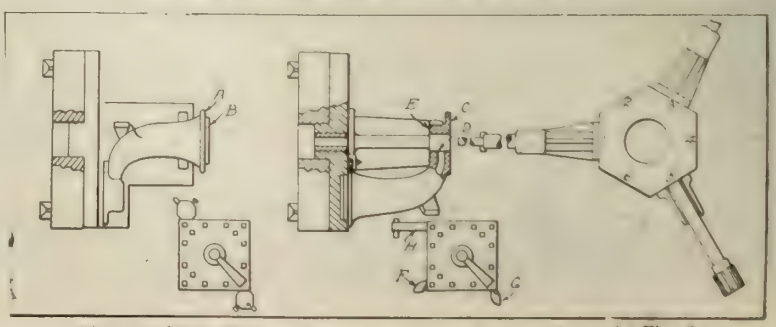


Fig. 9 and 10—First and second operation on piece shown in Fig. 8.

Some Notes on the Care of Pneumatic Equipment

Light Bodied Oil Best for High Speed Reciprocating Tools—Avoid Throwing Hammers on Sand Floors—Keep Service Lines Free of Dust—Daily Inspection Advisable

By F. A. McLEAN

LIKE all other machinery, the satisfactory operation of pneumatic tools depends to a large extent on the attention paid to their care. Pneumatic tools are high speed machines made with the same skill and attention to details that characterizes a fine watch, and in spite of the special kinds of steel and heat treatment used in their manufacture they are subject to wear in time. Especially is this true of such parts as pistons, valves, connecting rods, bearings, etc., where the wearing surfaces are necessarily limited in size and wear may be particularly destructive of economy through increasing the air consumption and shortening the useful life of the tool; but the rapidity of this wear is greatly reduced by keeping the tools clean and properly lubricated.

All manufacturers of pneumatic tools provide means for their proper lubrication. Instruction tags are usually attached to the tools when shipped, and should be kept for future reference when the tool is unpacked and put into service. Oiling and cleaning are too often delayed until the tool actually refuses to work. Tools of the reciprocating type, such as riveters, chippers, sand rammers, etc., require a high grade, light bodied oil such as the Vacuum Oil Company's Arctic Ammonia. This may be poured in at the hose connection of the tool every two or three hours when it is in continuous operation, as the air has a tendency to blow the oil out through the exhaust, or one of the small automatic oiling devices now on the market may be used, in which case the oil supply will only need replenishing once a day. Oil applied around the chisel shank in chipping and caulking hammers, will make them last longer, particularly if care is taken that all burrs or rough spots are removed from the shanks before they are put into the tool. These burrs quickly wear out the bushings which cost more than the amount saved in the cost of the chisels.

On drills of some makes such as the Thor and Little Giant, grease should be injected into the crank chamber and a light mineral oil used on pistons and valves, while in those of the Little David type this is not necessary as, due to the method of construction, the lubricant is fed from the crank chambers to the pistons, and as the crankshaft revolves all moving parts are flooded with lubricant. The best way of introducing grease into pneumatic drills, is to inject it into the dead handle by means of one of the small grease guns now on the market which have an opening in one side through which they are refilled. When drills are operated in a vertical position for any length of time, it is a good plan to invert them occasionally to ensure an even distribution of the grease to all of the working parts. Sand rammers and other tools used in dusty places obviously require more oil, and should be cleaned more often than those which are used under more favorable conditions. The moving parts of these tools are ground to very close limits, sometimes one-half thousandth of an inch or less, and may easily become clogged up with dirt if the proper precautions are not taken to guard against this. Some men unthinkingly throw their rammers or chippers on to the foundry floor at noon when the whistle blows, instead of laying them on a board or box to keep them out of the dirt.

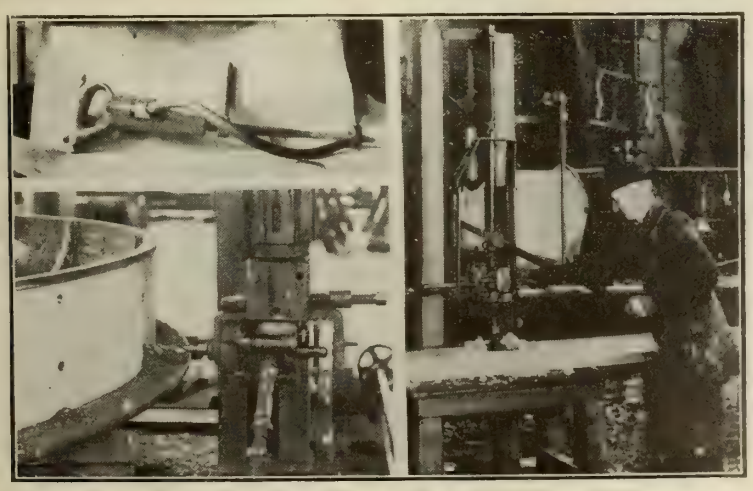
The air taken in by the compressor sometimes contains particles of dust which are blown into the tool, clogging up the parts and interfering with the proper action of the pistons and valves. For this reason a strainer should be placed over the intake of the compressor. Such a strainer is easily made by placing a box over the pipe and covering the open side of it with muslin. Heavy oils will cause the same trouble through gumming and are thus to be avoided. Where there are a small number of tools in use it is a good plan to clean them at intervals by pouring kerosene into the throttle handle that will cut the thick oil and loosen the dirt, which may then be blown out under air pressure. Moisture in the air causes the pipes to rust, and pieces of scale get into the tools unless the pipes are blown out before the tools are attached. No matter how good the hose is, it will rot in time and pieces of it are likely to get into the tools and cause the moving parts to stick. An easy way to prevent this trouble is to use a strainer in the supply line, which can be made by bolting a piece of wire netting between the two halves of a flanged pipe coupling, or a special strainer may be inserted between the tool and the hose nipples.

In Charge of One Man

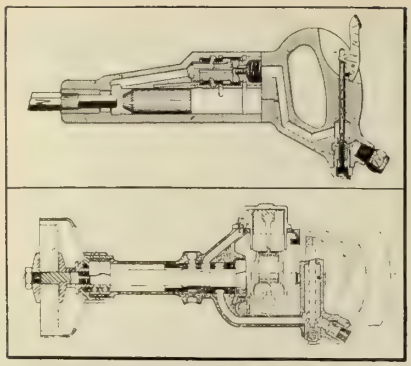
Where there are a large number of pnuematic tools in use, as in large ship yards, steel plants, etc., it is advisable to put them in charge of one man who will hang them in a tank of kerosene and gasoline in the toolroom each night in such a way that the dirt which falls out will go to the bottom of the tank. In the morning he should blow out each tool and re-lubricate it with light oil, as kerosene and gasoline while well adapted to loosening dirt, leave the wearing surfaces dry and bare. A galvanized iron box about two or three feet square and one foot deep fitted with a tight fitting cover, will make a suitable tank for this work and will hold a number of tools at one time. Immersing tools in this tank for ten minutes will often cure some of the minor troubles which sometimes occur, such as a sticking valve, etc.

Works Within Tool Capacity

It is not a good thing to apply pneumatic tools to work beyond the range of their capacity as specified by the maker, as it causes undue strain and wear and soon results in loss of power. One of the worst abuses to which a pneumatic hammer can be subjected is the substitution of pistons other than those supplied by the maker. An air hammer as it leaves the factory is properly designed and balanced for the work it has to do,



Top left—Home made drill for concrete. Lower left—Using pneumatic drill on vertical boring mill. Right—Home made drill press in wood-working shop.



Top—Sectional view of "Little David," chipping hammer. Lower—Pneumatic grinder.

as the result of a long series of costly experiments.

Avoid Short Pistons

Some would-be genius discovered that by cutting, say a four-inch standard piston down to two and one half or three inches, he could make the tool deliver a more powerful blow and for a short time increase its speed and output. Short pistons have too little metal in them to absorb the force of the blow, and the heat-treated surface is ground away. Heat treatment, as anyone can observe by examining a broken piece of treated steel, renders the metal hard, close grained and tough, to a certain depth, and grinding the piston down cuts this heat-treated surface away and exposes the soft porous centre, which soon becomes battered and chipped by the percussion of the piston on the chisel or rivet set. The broken particles cut and score the cylinder walls or become jammed and cause cracking, so that the tool is ruined in a short time.

Service Inspection

When a hammer does not appear to be standing up and the cylinders, handles and sets, or ends of chisels, are broken or chipped, the tool should be examined to see if the piston has been ground away. In some shipyards in the United States, it was at one time customary to carry out an inspection in army style while the tools were in operation as it was found that some of the men—usually unskilled labor, or foreigners—were carrying short pistons around in their pockets and substituting them for the regular pistons after having drawn their tools from the tool crib, and then putting in the proper piston before turning the tool in at quitting time. Generally where this practice is in vogue, the tools will appear battered as few of the men have the lead or copper hammers—which should be part of the kit of every pneumatic tool repair men—at hand, and are therefore forced to use other means of removing and replacing the handle. This practice also is the cause of stripped threads in the types of hammer in which the handle is screwed on to the barrel or cylinder.

While there was some excuse for shortening the pistons from the operator's point of view, due to the excessive vibration, heavy blow and slow speed of the long piston hammer of a few years ago, there is no need for it in the case of modern long stroke pneumatic hammers, in which pistons two and one half to three inches long are used, and such methods are unfair both to the firm who own the tools and to the man who made them.

Keep Tools in Order

All drills should be inspected daily to see that bolts are tight and that all moving parts of the tool are operating freely. Hammers should be inspected for loose handles, and kept properly tightened. Good operators always hold their hammers firmly against the work as they know that if the set or chisel is allowed to play in and out of the hammer it will soon result in damage to the tool. In starting to drive rivets in cold weather, especially in exposed places, it is advisable to warm the hammer slightly, as this will reduce the chances of the rivet set being broken by the blow of the piston. After a few rivets have been driven, the heat will keep the set warm enough to prevent the likelihood of this trouble occurring.

Chisel Breakage

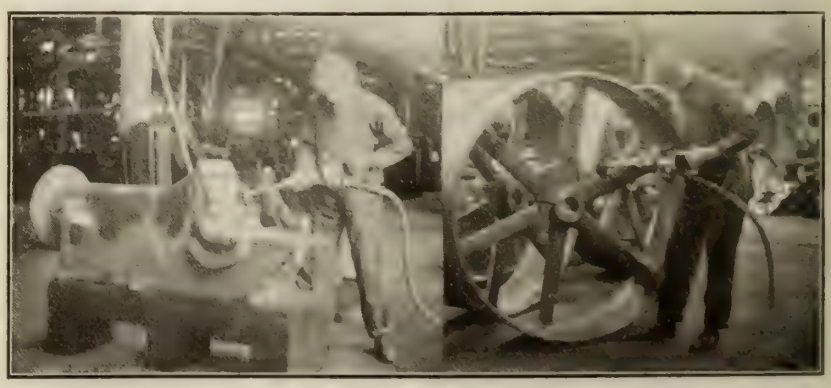
A case of abnormal chisel breakage which came to the writer's notice not long ago, was traced to the blacksmith of a large industrial plant who was in the habit of stamping his employer's initials on the shanks of the chisels when they arrived from the factory. In order to do this he had to heat the shanks, and this destroyed the heat-treating and weakened the shanks, causing a lot of trouble and annoyance to all parties concerned before the reason was discovered.

Repairing Air Tools

When repairing pneumatic tools, care should be taken to keep the parts of one tool separate from the parts of another and not have the parts of half a dozen tools all intermingled on top of a dirty work bench. A bench covered with sheet zinc or galvanized iron, is well suited for the repair of pneumatic tools. If care is not taken to get the parts into the tool from which they came out, it sometimes happens that the alignment of the tool is poor and trouble will be experienced. Pneumatic tools are as highly interchangeable as it is possible to make them, but there are always some parts which are fitted for each tool, and another reason for using care in this respect is, that hardly any two tools will wear exactly alike, and after two tools have been in service some time, parts which are a good fit in one might not be so in the other. A piece of ⅜in. hose connected at one end to the air supply line and carrying at the lower end a nozzle of the blow gun type, is a handy addition to the repair man's outfit for blowing dirt from the tools and cleaning off the bench.

Where the number of tools in use justifies it, the repair man may keep one as a standard by which to compare the hammers that are brought in to him before putting them back into service. By operating this standard against a heavy block of wood and noting how far the die penetrates, how fast the tool runs and how much vibration is set up, he is better able to judge when the tool he is putting in shape is ready for service by trying it out in the same way and noting how it measures up to his standard. In large plants where there are a number of tools in use a card index should be kept on which are entered the symbol or number of each tool, the date of its purchase, names of the men who handle it, how many times it has been overhauled, etc. Sometimes the repair man will be told that a tool is not working right when it is really low air pressure or a plugged hose which is at fault. This is easily detected by comparing the hammer with the standard and it is then a simple matter to remedy the trouble.

Lathes, planers, milling machines and other machine tools are products of fine material and skilled workmanship, but when we compare them with the pneumatic tool it is evident that the latter is a much finer piece of mechanism. Intended for portable use it must be light enough to be conveniently handled, and at the same time must be capable of delivering great power at high speed and while other machine tool equipment is used in shops or tool rooms under favorable conditions, the air tool is exposed to all weather conditions, dust, dirt, and hard knocks of all kinds; and while some of these conditions are inevitable many of them may be avoided, and it is hoped that the foregoing suggestions may be of help to the user of air tools in obtaining the best kind of service from their use.



Left—Preparing compressor casting for machinery. Right—Smoothing off large pulley spokes.

Some Useful Notes on Case Hardening Practice

Bringing About a Physical Change in the Surface Metal—Excess Carburising Should be Avoided—Careful Packing of the Treated Articles—Boxes Made to Suit the Parts

PREVIOUS to 1914 only a few of the most progressive firms in the engineering and automobile trade possessed any definite knowledge of heat treatment of metals. The result was that many firms were called upon in the early days of the war to do case-hardening who had neither the knowledge nor the equipment necessary to produce satisfactory work. The result was that a good deal of guesswork and many experiments had to be done before success was achieved.

The Ministry of Munitions, by collating what knowledge was available, brought the science of heat treatment very much to the fore. Other spheres of activities interested in heat treatment acquired much valuable information, and the following few plain facts may prove useful to the small manufacturer who has not the means at his disposal to call in the assistance of the chemist.

The case-hardening of an article is achieved by two distinct processes, says the Machine Tool Review. The first is that of changing to a required depth the chemical composition of the surface of the steel. The second process is to heat treat, to bring about a physical change in the part thus treated. Case-hardening with up-to-date equipment is now quite an easy process and readily mastered by anyone of average intelligence. The chief factors on which successful case-hardening depends are:

1.—The choice of the cement or carburising agent.

2.—The manner in which the articles are packed.

3.—The temperature reached by the article.

4.—The absence of fluctuation in temperature during carburising.

5.—The type of furnace used for the final heating process.

6.—The quality of the material used in the manufacture of the articles.

We will deal with each of these points separately.

1.—It is essential that the cement shall not carburise the articles fiercely, as is the case with compounds containing a percentage of the volatile cyanides. At the same time the requirements of modern machine shop practice demand that it shall be quicker in its action than the numerous compositions of charcoal and bone black now on the market. It must produce a carburised zone (the case) in which the carbon concentration gradually diminishes.

2.—The packing of articles in the boxes is a matter of great importance if uniform results are to be obtained; far too little attention is given to this point. As far as possible the boxes should be made to suit the article to be carburised, such as circular boxes or tubes for gear wheels and similar parts. Small pieces, such as gudgeon pins and bushes, should have tall narrow boxes, taking one row only in width and as many layers in height as the furnace will conveniently take without being too near the arch.

The luting of a box is an operation often very carelessly carried out. The best of fireclay will always crack sufficiently to allow any excess of gas generated in heating-up to escape. Therefore the more hermetically a box is luted the better. The clay should be worked until it has a silky and uniform feeling, its consistency being such that a small saucer is easily modelled with it. The boxes should not be luted until the whole furnace load is ready. When a box is ready to go in the furnace it is advisable to run a wet brush round the surface of the luting; this tends to make the shrinking of the clay uniform and the cracking fine and hairlike.

With large boxes hearth contact should be avoided. They should in some way be supported off the furnace floor, either on pipes or angle iron. This enables the hot gases to circulate entirely around the boxes.

3.—On ordinary work a temperature of 900 deg. C. is the most suitable, but with boxes of large dimensions 920 to 930 deg. C. is necessary. With circular boxes containing small gears of fine pitch and requiring an egg shell case a temperature of 920 deg. C. is best, in order to get higher carbon concentration in the case. It is impossible to get good results without a pyrometer outfit of reputed make. The thermal couple outfit is best for this class of work.

4.—Fluctuation of temperature is responsible more than any other cause for cracking or exfoliation of the cemented pieces. This is especially noticeable with coal-fired furnaces.

5.—The type of stove most suitable for the heat treatment of the cemented work is the natural draught or low pressure gas and air furnaces. It is advisable to set the burners to get a little higher than the required temperature, say, 20 deg. C. above, with the damper well open, and then gradually close the damper to effect the required reduction of temperature. The atmosphere in the furnace will then not be oxidising nor too reducing, and the work will heat up more uniformly.

The most suitable position for the thermal couple is on the centre line at the back of the furnace not more than six inches above the floor. After carburising, the boxes should be cooled as quickly as possible by standing them on two blocks of rollers and **not** stacking them close together. The work, when cold enough to handle, is brushed clean and loaded into the re-heating furnace in a suitable manner; some work may be placed in perforated trays or on wire, or any suitable rig to take a quantity. The furnace should be kept at or near 900 deg. C.; on charging, the temperature will drop; as soon as the work is red hot a steady recovery will be noted. When the temperature again reaches 900 deg. C., carefully watch the work and note when the color of the work and couple stem are alike. When this occurs the parts should be left to soak for three or four minutes, according to the size of the article, to ensure an even temperature right through. Then they are quenched in oil or water (oil for preference), and may be withdrawn from the quenching medium as soon as black; this will lessen any strains existing.

This is called "regenerating quenching," and its object is to restore the core or soft part of the material, coarsened through the long exposure at a high temperature in the carburising process, to its original structure. It also produces a more or less complete solution of the lamina of cementite, the permanence of which in the cemented or hardened zone is known to constitute one of the most important causes of brittleness.

A second quenching is now necessary to complete our object. This may be termed the "hardening quenching," and may also be considered a regenerating quenching for the steel of the carburised zone. The temperature at which this is carried out is from 760—800 deg. C., according to the weight and mass of the pieces.

It is not necessary to soak the articles any longer than sufficient to ensure that this temperature is thoroughly uniform throughout the whole of the cement zone. They may then be quenched in water and kept in until cold enough to handle. Small gears and very thin articles may be quenched in oil.

6.—Too much importance cannot be attached to the quality of the steel used for case-hardened articles. The carbon content must not exceed 0.2 per cent. A good specification for ordinary rolled case-hardening steel is:—Manganese, not over .5 to .6 per cent. Sulphur, not over 0.05 per cent. Phosphorus, not over 0.05 per cent. Carbon, from 0.16 per cent.

Machining Cylinder and Ball and Socket Bearing

Advantage of Permanently Set Tools—More Time Available for Actual Machining Operations—Unnecessary Gauging Eliminated —Increasing Output With Same Overhead

WHEN a number of tool changes are required in the machining of any particular piece of work, and the production is of sufficient volume to warrant the installation of special equipment, the problem of manufacture is largely limited to the conservation of time in setting up and handling the work. The actual cutting of the metal may be the same no matter what method is adopted but the labor involved and the elapsed time between the start and finish of the total operations may be such as to prohibit manufacture, or to do it at a relatively small profit.

The purpose of modern engineering is to utilize every available moment of time in actual production and all unnecessary time and labor eliminated or reduced to the lowest possible factor. Where interchangeability comes into the problem the constant changing of tools is almost prohibitive. The time required in resetting tools and the subsequent gauging would make standardization a very difficult proposition, where large production is required.

The heavy duty turret machine is probably the one most adaptable to a wide range of manufacturing. Its construction offers an almost unlimited number of tools to be used which can be brought into consecutive operation with the least amount of physical effort and with a great degree of accuracy. Each tool is set and adjusted individually and when once located in the exact position for its own special service can be relied on to retain that position until it is required to be removed for regrinding, and where roughing and finishing tools are used, the working period of any tool is greater than when working under constantly changing conditions.

As an example of what can be performed on a heavy-duty manufacturing turret lathe, the views herewith are shown. Fig. 1 illustrates a dimensioned sketch of a cast iron cylinder machined on a turret machine. The work consists of boring to a diameter of 5.745in. counterboring to a dia. of 5-25/32in. and 1-5/16in. deep, facing and chamfering, and turning the outside rim to 6-15/16 in. dia. The time for the complete operation on the turret lathe was 15 min., whereas, the previous time in the engine lathe was just over an hour. This gives a saving in time of about 47 min. Figured on the basis of 60c an hour labor rate and overhead of 1½, the actual cash saving comes to about $1.18.

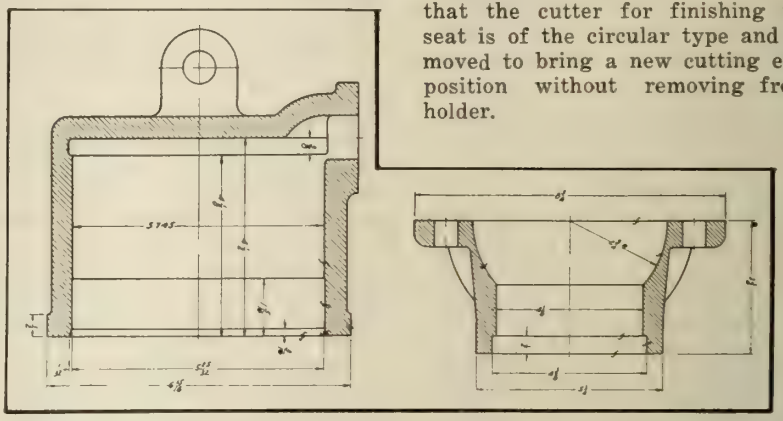


Fig. 1.—Left: cast iron cylinder, machined on turret lathe. Fig. 2.—Right: cast iron box ball and socket bearing.

A piece requiring additional tooling is shown in Fig. 2. This is a cast iron box ball and socket bearing. The machining details consist of boring to 4⅛in. dia., face of both ends to an overall length of 3¾in., recess at back to dia. of 4⅜in. and ½in. deep, turn ball socket to radius of 2¾in. This piece is completed, floor to floor, in 16 min., against the former method when 73 min. were required. At an operating cost of 60 cents an hour and 1½ overhead, the saving effected on this particular piece amounted altogether to more than $1.43.

Fig. 3 shows the machine set up to perform the operations on the piece illustrated in Fig. 2. It will be noted that the cutter for finishing the ball seat is of the circular type and may be moved to bring a new cutting edge into position without removing from the holder.

Cuts and information through courtesy of the International Machine Tool Co., Indianapolis, Ind.

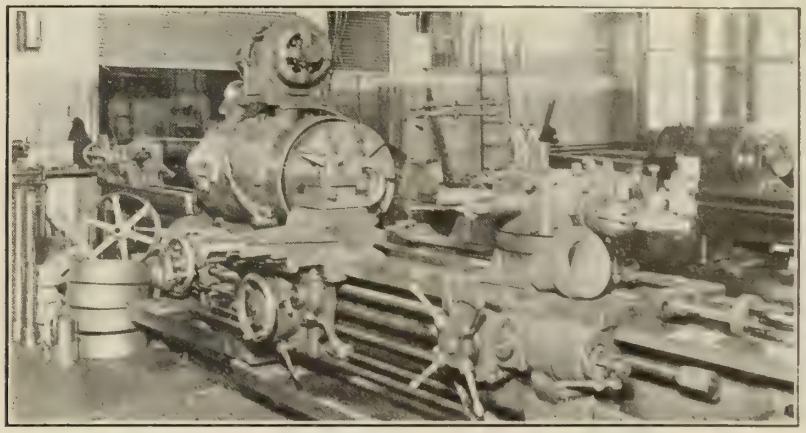


Fig. 3—Turret lathe set up to perform operation on piece shown in Fig. 2.

MOISTURE IN TURBINES

I recall that while I was a student in college I interrupted an instructor in the course of a lecture on steam turbines and asked him whether moisture in steam passing through steam turbines was as undesirable as moisture in steam for driving reciprocating engines. It is plain now that I was ahead of the times with my query. It was much like asking, at the present time, "Through what gas can a flying machine fly with greatest safety?" The professor was not to be stuck, however, for he immediately came back with the reply: "A steam turbine, Mr. Near, is not a water wheel."

We know now, from a structural standpoint, and even from the standpoint of ultimate efficiency, that moisture in steam when used for driving steam turbines is even more undesirable than in the reciprocating form of prime mover. Moisture striking the blades at the high velocity of steam is bound to cause wear and as soon as the outer crust is worn through the wear becomes quite rapid. Wear in the blading decreases efficiency. Where the water used in boiler is impure, and especially where it contains acid, the acid is liable to be carried over with the moisture particles and hasten the erosion. Sometimes solid deposits are found on the blading of turbines which have been carried over with the moisture.

With a proper reflector, illumination can usually be increased without any additional expense for current, but with a marked increase in the efficiency of the workmen, who are thereby freed from a wholly needless handicap.

Application of the Chain Drive to Machine Tools

Initial Cost Slightly Higher But Efficiency High—Slip Eliminated —Effective Operation on Short Centre Distance—Comparatively Silent in Action—Study of Various Designs

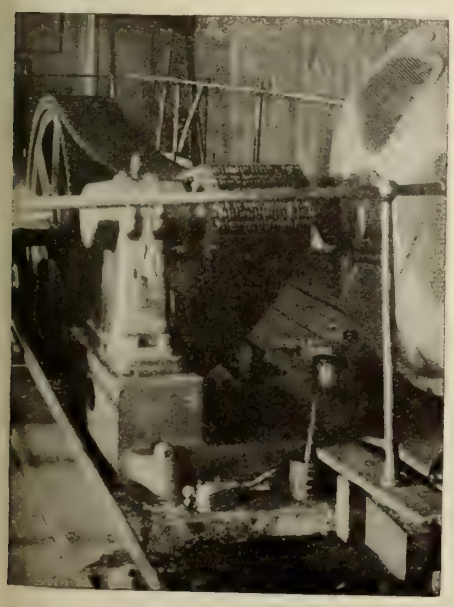
By HUBERT BENTLEY, A.M.I.M.E.

RAPID STRIDES have been made in the application of chain and sprocket wheel drives to machine tools during the past few years. In fact there are few branches of engineering in which the chain drive is not now employed. The early days of the chain drive, of course, centre around the cycle and automobile industries. When once satisfactory results had been attained in this branch of engineering, in which the conditions may be claimed to be the least favorable to the chain, fresh fields of application were sought and without doubt machine tools have proved a very fertile ground. The chain drive is today a factor to be seriously taken into account in every branch of engineering practice due to the many advantages it affords over other methods of power transmitting.

The three systems of transmitting power usually available in the modern machine shop are: (1) the belt drive, (2) the gear drive, (3) the chain drive. Both the belt drive and the gear drive in certain instances are, of course, more suitable than the chain drive, while on the other hand, the chain drive undoubtedly can show advantages over the two first named systems in many workshop applications. While the initial cost is generally higher than the belt or gear drive, the fact that the chain drive tends to improved conditions in the workshop and is, therefore, to the welfare of the worker, apart from its other advantages, should be sufficient reason for giving it serious consideration in these days.

Chain Drive Application

Undoubtedly the increased use made of electric motors for driving individual machine tools and also for the group systems of driving has been a large factor in the development of chain driving in the modern engineering works. Today the chain drive is frequently substituted for: (1) a rope or belt drive from the prime mover, engine or motor to the lineshaft, (2) for a belt drive from a line shaft to a countershaft, (3) for a belt drive from a countershaft to a machine, (4) for a gear drive in a self contained electrically driven machine tool, (5) and is now being more frequently adopted for the auxiliary drives such as feed motions, power transverses and suds pumps, etc.



Large Chain Drive Installation.

Just as in certain cases the belt or gear drive is undoubtedly correct practice, similarly with the adoption of a chain drive there is obviously hardly any necessity to consider the matter at all. On the other hand, there are many cases where the pros and cons of the different systems are carefully considered and where the various initial outlays are set against the various advantages and disadvantages accruing. As every up-to-date engineer and machine tool designer is keen to eliminate all sources of waste it is only natural that the method of transmitting power should receive careful attention. Every foot-pound of energy wasted between the prime mover and the machine is a foot-pound less available for useful work. A study of the advantages claimed for the chain drive over the belt and gear drives will now be made.

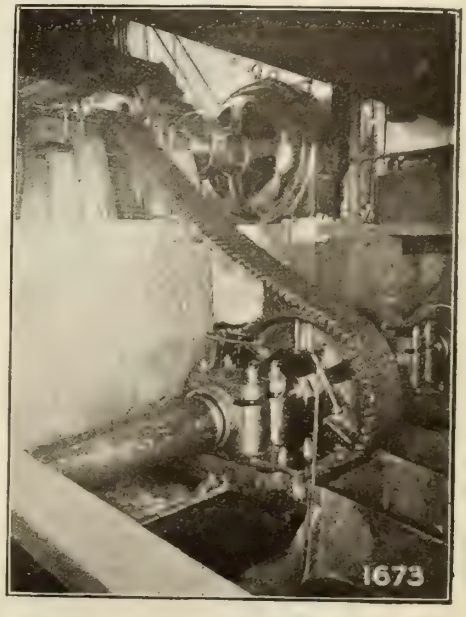
Centre Distance

For a belt drive to be efficient, there must be a long centre distance and considerable initial tension in the belt. If these conditions are not fulfilled "slip" takes place. To maintain the initial tension in the belt, constant attention must be paid to mending and adjusting the belts to remove any slackness that develops. In the chain drive, a long centre distance is unnecessary so that space can be economised. The initial tension required by the belt drive results in considerable pressure being put on the bearings with a consequent dissipation of energy in bearing friction. The chain drive being positive in action, has no tendency to slip and requires no initial tension consequently the pressure on the bearing is minimised and bearing friction and wear, due to initial tension, is eliminated. with a consequent saving of power. The "slip" in a belt is frequently claimed as a feature in favor of belt driving but it will be observed that the modern machine tool. whether arranged for belt or chain driving, is now fitted with some form of independent safety slipping clutch or pin shearing device. In works where the overhead shafting is already in existence, it will be more economical to substitute a long belt drive by means of a chain drive of similar length. While the long chain drive will give quite satisfactory results it should only be adopted where existing circumstances have to be met. A short drive, of course, effects a saving in the length of chain required and with this end in view when planning new works the countershafting for chain driving should be arranged close to the ground or even underground.

For transmitting equal horsepowers at the same speed a comparison of the space occupied in a lineshaft to countershaft, or countershaft to machine drive by pulleys and belt, and sprocket wheels and chain shows considerably in favor of the small sprocket wheels and narrow chain. The draught and danger created by wide and heavy belts and the daylight that is lost, are disadvantages of the belt drive which are greatly reduced in chain driving. to the benefit of the workmen.

Speed Reduction

The chain drive is frequently introduced to give a speed reduction which would be too large for a satisfactory belt drive and where the centre distances are too large for ordinary gearing. While possessing some of the adaptability of belts in relation to centres, chains are as positive as spur gears in their action. For this reason they are successfully employed for timed operations at fixed speeds and gear ratios such as required by various types of



Driving Large Mill Shaft.

indicators, governor drives, as used in haulage, textile and printing machinery. The positive and regular running of the chain against the "slip" of a belt or the "jar" of worn gearing ensures a better finish on the work and a regularity of output especially desirable on repetition work, due to the maintenance of feed. The cutting tool edge has a longer life with consequent saving of tool grinding and setting times. This means increased output and reduction in the power and tools consumed.

At short centre distances, the efficiency of the chain drive is maintained against the decreasing efficiency of ordinary gears due to the engagement of the chain on several teeth of the sprocket wheels giving a smooth, even turning action against the limited tooth engagement of the gear wheels, which result in wear and loss of efficiency. Frequently a gear train comprising several intermediates is displaced by a single chain drive. Under average conditions the frictional losses of a chain drive are only 2 per cent. and these do not materially increase during the life of the chain.

Silent Running

The chain drive is comparatively silent in action if run within the normal speed, and conditions of unusual heat and moisture do not affect it to the same extent as belting. Hence their frequent employment in driving oil pumps and the machinery in dyeworks, laundries and for the machinery in rolling mills and forges. Coupling with the numerous advantages stated above, the fact of the durability of the chain drive, its accessibility and simplicity of erection and that it requires little attention except for occasional lubrication, leads one to the conclusion that the chain drive can justly claim to be the most economical form of power transmission.

The two principal types of chains are: (1) the roller brush chain, (2) the inverted tooth chain. The nature of the drive and the speed at which the chain runs are the chief determining factors in the adoption of either of these types. As in the ordinary lifting chain the strength of the chain is determined by the weakest link, so it is in the driving chain. And as each link is made up of several components the failure of one of these components will determine the life of the link and the chain. Hence it will be understood that great care has to be exercised in the choice of material employed and in the gauging for accuracy and testing and inspection during construction.

The roller bush chain comprises a series of plates, rollers, bushes and rivets arranged in inner and outer links. The outer link embodies two plates and two rivets, while the inner link is made up of two plates, two bushes and two rollers.

The inverted tooth chain comprises a series of flat plates having angular projections, ground to 60 deg. angles which form the driving faces of the chain. (An angle of 75 deg. is adopted in special cases). The plates are fitted with bushes which in turn are mounted on the rivets.

Selection of a Chain

High tensile steel is employed for the plates in both these chains. They are designed to give at the weakest point a strength proportional to that of the rivets. The bearing pressure and wearing area of a rivet determines the selection of a chain for a particular job, as the life and strength of a chain depends on the area and surface condition of the rivet. Nickel steel rods are used for the manufacture of the rivets, which are hardened and ground and securely fastened to the outer links in the roller chain, as movement in the links would cause rapid wear. The bushes which are provided give a full length bearing to the rivet internally, while the external surface bears the rollers in the roller chain and the plates in the inverted tooth type of chain are held together by steel rods case hardened all over and secured to the inner links in the roller chain. The rollers which complete the inner link used in the roller bush chain are free to revolve on the bush just described. The object of the roller is to minimise friction and the consequent wear between the chain and the wheel which would otherwise occur as the chain moves on and off of the wheel teeth. A special grade of mild steel is employed for the rollers which are case hardened all over.

Tests for Hardness

Tests are made on the plates for hardness (Brinell), elastic limits, elongation, breaking load, area reduction and bursting tests at the piercings. The rivets are submitted to tests for surface hardness, impact test (Izod) for resistance to shock, shearing strain at the shoulders, measurement and microscopic examination of the core and hardened case. The bushes and rollers are tested for surface hardening and microscopically examined after case hardening. The rollers have an additional test for the crushing strains, which the roller receives when engaging the wheel teeth.

The inverted tooth chain, in which the chain lies flat on the top of the teeth like a belt, is frequently known as the "silent chain." In the roller type, the sprocket teeth project through the chain, the load being from one tooth to another as each link engages which causes the click associated with the roller chain. In the inverted tooth chain, the load is divided up on either sprocket among the full number of teeth in mesh. With the inverted tooth, as the chain elongates in pitch it assumes a greater pitch circle on the sprocket teeth, which means during the entire life of the chain each link in mesh on the sprocket teeth continues to take its full share of the load. The chain is relatively silent compared with the roller chain or spur gear.

Rocker Joint Chain

The rocker joint chain drive has an inverted tooth chain in which the joints have a non-sliding action. These are not of circular form but of a special section, and for them increased efficiency, increased durability, higher permissible speeds and less dependence on lubrication is claimed. There are two hardened steel pins of special section, one called the rocker and the other the seat pin. The former rocks or rolls on the flat surface of the seat pin when the particular section is coming into or going out of engagement with the sprocket teeth. So that there is no friction caused by sliding surfaces but simply the rocking action. When the load is on the joint, viz, while the chain section containing it is between the wheels, a broad flat bearing is presented, no load being taken on the knife edge. A parallel is sometimes drawn between the action of the ball or roller bearing and the ordinary journal bearing in comparison with the sliding joint and the rocker joint. Reducing wear to a minimum at this vital part of the chain, wear being the determining factor in the life of the chain, gives increased durability and longer life to the chain. The absence of sliding friction enables a high mechanical efficiency to be maintained with light or heavy loads while oil bath and oil-tight gear cases or other lavish lubrication is not imperative; an advantage where high speeds are employed and the lubricant is thrown off by centrifugal action. A thick grease applied to the teeth chain and wheel periodically will afford all the necessary lubrication.

Small chain wheels are usually made from mild steel blanks machined all over and having case hardened teeth. The large wheels may be of cast iron, though steel castings or stampings may be adopted if lightness is a consideration. The teeth are machine cut, the tooth shape being designed to suit the action of the chain.

To Be Continued

PIPE SUPPORT FOR MOTOR

The adaptability of individual motor drive for machine tools is well demonstrated by the conversion of a group-driven installation in an East Springfield, Mass., factory. A variety of motor mountings were necessary in fitting up this plant for its conversion from the group-drive installation, which had been used for producing rifles for war service, to individual motor drives. A Garvin No. 2 hand-screw machine, belt-driven, was connected to a 1-hp., 440-volt induction motor. The motor is mounted directly on a heavy wooden base bolted to a pipe flange at the top of the 3-inch supporting pipe which is set in the floor. The starting switch is attached to the wooden base by ¼-in by 1-in. iron straps. The arrangement carries both motor and starting switch above the machine and behind it, keeping the switch, however, within easy reach of the operator at his post in front of the machine. The motor is high enough to give a belt long enough for smooth running.

Industry Reveals Many Interesting Sidelights

How Canadians Rushed Repairs on Ocean Liner—Guelph Concern Holds Its Men—Expensive Machines Sold for Junk—Little "Hen." Thornton Now Heads C.N.R.—Growth in Auto-stamping

GUELPH'S thirty-five-year-old industry, James Steele, Limited, boasts a working force in which the so-called labor turnover is practically nil. The individual service record ranges from three to thirty-five years. One of the employees, William Gould, was with the late James Steele as a boy when the business of spring manufacturing was first established in Guelph thirty-five years ago. Mr. Gould now has charge of the upholstery spring department. Probably one explanation of staff permanency is the bonus system employed by the company. This has been in use for some years and in good times has been the means of adding materially to employees' pay envelopes at the end of each month. Although wages advanced during the war period, these have not been reduced. The company reports business to be in a fairly prosperous condition at the present time, and that the demand for springs represents a great variety of purposes. The amount of wire used during the year is from 500 to 600 tons and this includes all kinds of wire from 23/1,000, such as used in fuse plugs, to ⅜ inch, employed in machine tools. The officers of the company are the three sons of the founder, J. A. Steele, manager: H. C. Steele, secretary, and J. T. Steele, superintendent.

* * * *

IN connection with the winding up of a company manufacturing a line of steel products, the liquidator is said to have been confronted with the disposal of a number of large automatic machines that had been designed for a specific purpose and in their day had been expected to revolutionize production as it was then known in that particular branch of industry. Finally, it is said, they were turned over for $25 to an employee who had given considerable assistance during the liquidation and whose services seemed to call for some recognition. He immediately called in his favorite junk dealers and accepted the best bid of $800 for the lot or $100 per machine. It is understood that the original machine, representing much experiment, the conception of an inventive genius, cost in the neighborhood of $50,000 and that each of the other seven ranged between $15,000 and $20,000. It is stated that the machines had never actually given the service for which they were designed, but were useful up to a certain point. Nevertheless, much valuable material had entered into their construction. Like so much of the shell-making equipment that was developed during the war, they found an inglorious oblivion by way of the junk dealer.

ONE of the large liners plying between European ports and Montreal had the misfortune recently to run aground in the St. Lawrence. She was soon released and docked at one of the large docks on the river. On a Thursday evening it was found that a number of large plates were damaged and would have to be replaced. A well known firm in Montreal was called on the phone and asked to procure about twenty plates ⅞ in. thick, by twenty feet long, by six feet wide. Phone calls all over Canada and the adjoining points in the States failed to locate the plates. Friday afternoon late, definite dimensions, and the number of plates required were phoned to the steel merchants. They in turned phoned a steel mill 19 miles outside Philadelphia and over the long distance wire prevailed upon the mill to roll these plates to special order on Saturday morning. Sunday and Monday morning were occupied by submitting the steel to the two score physical and chemical tests required by Lloyds for A No. 1 classification.

Meanwhile the steamship company had, in conjunction with the steel merchants arranged with the Pennsylvania Railway System to have a car ready to load the steel and a special locomotive to pull it into Philadelphia. The steel plates constituted a full carload lot. The car of plates left the steel mill early Monday afternoon, and as soon as they reached Philadelphia, were put on a through train to New York. Here the car was handed over to the Delaware and Hudson Railway who were induced to give the car special dispatch. The car arrived in Montreal at noon on Wednesday and was handed over to the Canadian National, who were able to switch the car into the drydock siding very early Thursday morning. The old plates had been removed, and were used as templates to lay off the new plates. Drilling and punching of holes, shearing, etc., commenced at once and the plates were being rivetted on Friday.

This constitutes a record of its kind, and it was put through by Canadians. This service cost much less than express and was quite as rapid, if not more so. The estimated daily loss to the liner was $5000.00 which goes to show the urgency of the situation.

* * * *

MAJOR-General Sir Henry Worth Thornton, K. B. E., the new head of the Canadian National railroads, did not reach his present eminence in the railroad world by easy stages. He knows something about the application necessary in preliminary training, for his first experience with work, on graduating from Pennsylvania University, was in 1896 when he became a draftsman with the Pennsylvania road. Through the hard routine of engineering duties he progressed until in 1901, he took his first real executive job as superintendent of the Cleveland, Akron and Columbus railroad. Previous to going to England in 1914, he was superintendent of the Long Island Railroad and became known as a rising man in the railroad field. He confronted some prejudice when he became general manager of the Great Eastern, for in England it has always been regarded as hardly proper to import heads for institutions of long standing. Some unkind things were said directly and through the press, but Thornton accepted the proposition with courage and common sense and gradually won public confidence. This was in a year when an urgent call for big men developed in England, and while Thornton was not honored with a place on the executive committee of railroad managers to handle war traffic, the head of the Great Eastern carried on by doing his best to speed men and munitions to France. Finally, he was included in the control committee and gradually involved in a most intensive way with war transportation matters. He became director of Channel transports, and the name of Thornton became prominent where a few months previously there were those who had predicted an inglorious future. Then the King made him a Knight Commander of the Empire and, militarily, he became Major-General.

Sir Henry Worth Thornton is described as "a typical product of the American railway school. In appearance he is a big, powerful figure, something like six feet, four inches tall, weighing around 225 with level gray eyes, a close mouth and an intensive air." His experiences have brought him in contact with the long and short haul systems prevailing in America and the Old Country; he is an authority on electrification and on the application of ball bearings to rolling stock. Back in Logansport, Indiana, his old home town, thre are those who still speak of "little Hen" who wanted to be a bishop, but became a railway man instead. Opinion seems agreed that to the Canadian National lines will be the gain by reason of his concentrating on terrestrial rather than celestial methods of transport.

* * * *

THERE are certain industries which reflect or are dependent upon the development in another industry, and perhaps this is more strikingly true of motor car manufacture than of any that

(Continued on page 31)

Adapting the Engine Lathe to Quantity Production

Special Attachments to Facilitate Output—Interchangeable Tool Blocks—Individual Tool Holders Used in Groups—Adjustable Stops Assure Accuracy—Wide Range of Work

REGARDLESS of the product, every manufacturer must put in a certain amount of study to determine the most economical methods of production. The nature of the various operations that are to be performed are the governing factors in the selection of the necessary tools and machining equipment. One machine may prove ideal for one class of work but not efficient on another and it is necessary to acquire one or more machines to perform the different operations. However, if sufficient work is not available to maintain constant working of all or the majority of the machines the overhead expense is often considerable.

In selecting a machine for general purpose work it is well to choose one that has a wide range of application, one that can be used to advantage on quantity production and yet retain its simplicity for general jobbing and repair work. One of the most serviceable methods to accomplish this end has been through the use of attachments especially designed to fulfill a particular purpose. This has proven to be one of the simplest and least expensive ways of securing increased engine lathe efficiency.

Fig. 1 shows a sketch of a piece finished on the manufacturing lathe. This piece is made from .15—.25 carbon machine steel and requires two settings to complete. It will be seen from Fig. 2 that the machining is performed in two stages, the left hand view taking care of the heavy turning and the finishing accomplished as shown at the right. These two views illustrate the varied type of tool holders that may be interchanged to conform to the character of the work being performed. In the first view the single tool holder is fixed on the compound rest, while at the rear is secured a single purpose quadruple holder with the slots located at fixed distances for that particular operation, that of facing the four shoulders of the two collars. In the other view a turret tool holder is located on the front compound rest while two individual tool holders are secured on the rear rest. These may be used in any position and tools of any desired shape may be inserted. This saves a great deal of time.

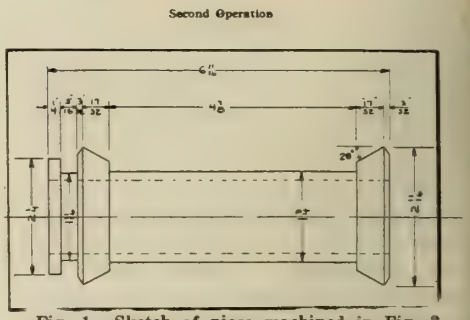


Fig. 1.—Sketch of piece machined in Fig. 2.

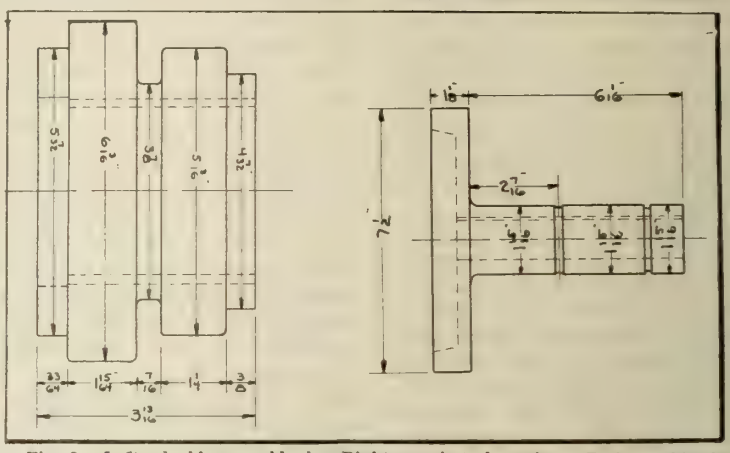


Fig. 3.—Left: double gear blank. Right: semi-steel casting. Both machined on manufacturing lathe.

The rear slide carries a plain rest coupled to the base of the cross slide. The rear rest is secured to its base by means of bolts and tee-slots which permits of adjustment to various diameters of work. The entire rear rest may be detached if desired.

Adjustable stops are provided on a bar located beneath the apron carriage for automatically tripping the power feed at any desired point. A slight pressure by hand on the hand feed wheel brings the stop bar against a fixed, solid stop, thus assuring accuracy.

In Fig. 1 the front tool turns the central portion to 1¾ in. dia. and at the finishing point the cross feed screw is reversed until the four rear tools perform their work in facing the shoulders. In the next operation the broad nose tool in the turret finishes the 2¼ in. collar on the left, at the same time making the short bevel. The second tool in turret is brought into position to finish the three recesses and then the outside bevel at right is made with third turret tool. The inside bevel of collars are turned simultaneously with rear tools.

Fig. 3 (left) shows a dimensioned sketch of a double gear blank, made of low carbon chrome nickel steel, machined on the manufacturing lathe. The turning of the main diameters is accomplished by the turret tool shown in working position. The centre groove is roughed and finished by 2nd and 3rd turret tools; facing and rear diameter turned by two rear tools. Corners are rounded by 4th turret tool. The various diameters are accurately determined by the action of the twelve stops mounted on the cross feed screw directly back of the cross feed handle. Six adjustable stops are provided for both the front and rear tools. The barrel carrying these stops is rotated by hand, bringing

Illustrations and time records through courtesy of the Lodge and Shipley Machine Tool Co., Cincinnati, Ohio.

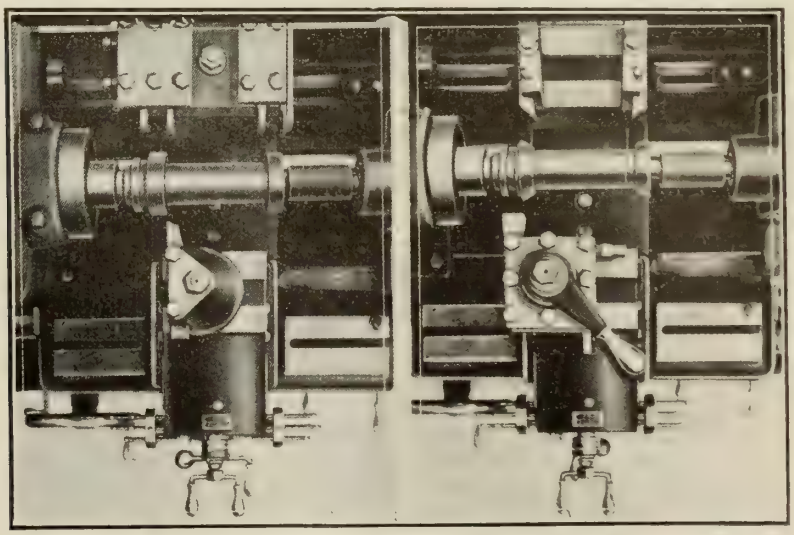


Fig. 2.—Left: roughing and facing. Right: roughing and finish recessing.

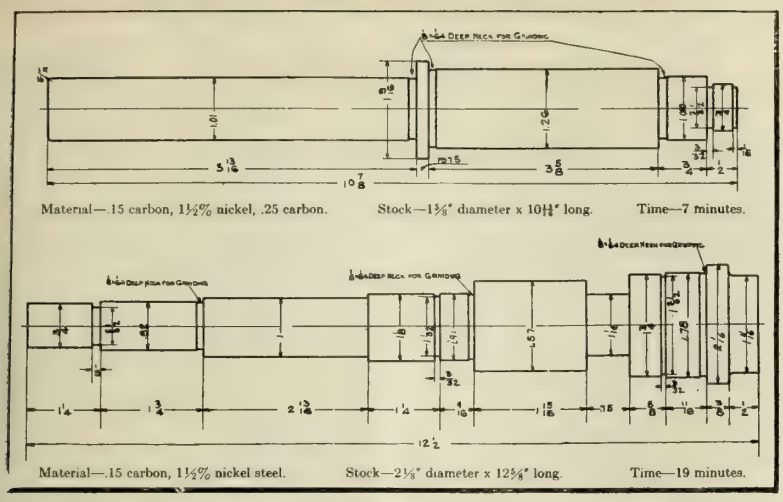

Material—.15 carbon, 1½% nickel, .25 carbon. Stock—1⅝" diameter x 10¹¹⁄₁₆" long. Time—7 minutes.
Material—.15 carbon, 1½% nickel steel. Stock—2⅛" diameter x 12⅝" long. Time—19 minutes.

Fig. 5.—Some shaft work performed on manufacturing lathe.

the respective stop screws into line for engagement. These pieces are completed in 12 min. each. It might be mentioned that the hole is bored and one end faced at a previous operation. The work here described is that done on the special arbors.

To the right of Fig. 3 is shown a semi-steel casting, turned, faced, necked, corners rounded, grooved and rough turned, and these operations may be performed on as many pieces as desired with one setting of the tools. The turning of the shank and large diameter is done with 1st turret tool; rear facing and inside taper made with the other turret tool. Facing and grooving performed with rear tools, all of whi are held in individual and adjustable tool blocks. The complete time required to finish this piece is 11 minutes. A plan view of these two jobs is illustrated in Fig. 4.

The possibilities of shaft work are shown in Fig. 5. The top view is a piece of .15—.25 carbon, 1½ per cent. nickel steel shaft made from stock 10 15/16 in. long, 1⅝ in. diameter, completed in 7 minutes. The lower is a piece of similar grade steel made from 2⅛ in. dia. stock, finished from rough in 19 minutes.

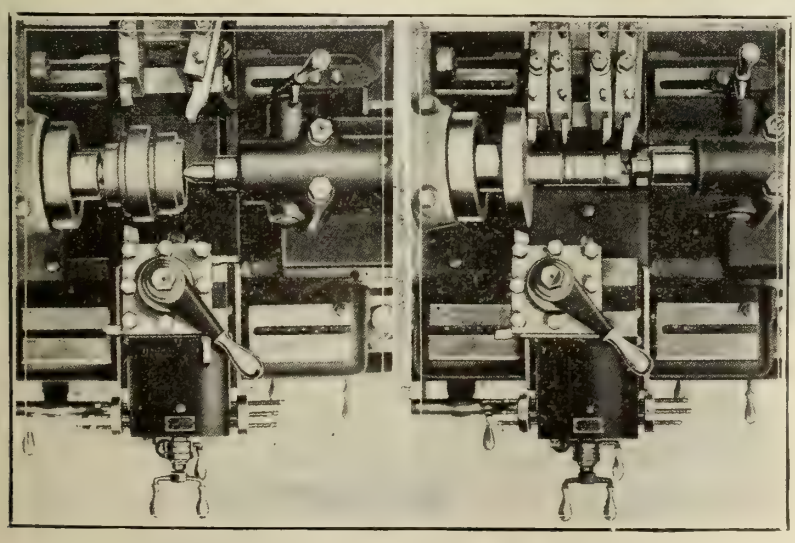


Fig. 4.—Plan view of machining on pieces shown in Fig. 3.

PAINTING MACHINERY BY THE SPRAY METHOD

A LARGE number of manufacturers throughout the country have adopted the spray gun as a method of applying fillers, paints and varnishes to their products. Their choice in this matter has been determined on account of the fact that the use of the spray gun saves them actual time and money in the matter of applying finishes to their products and it also insures uniformity of coating and quality of the product.

In a plant manufacturing oil engines the spray gun is used to great advantage for applying heavy fillers to engine castings. For this service a spray gun of the pressure type with a comparatively large nozzle opening is used for spraying filler in semi-paste form. This filler is driven into the pores of the iron by the impact and air pressure and is applied in a smooth, even way that requires very little sanding to render the surface fit to receive the second enamel coat. The enamel coat on this engine job consists of an oil proof high gloss enamel. This enamel is sprayed on with a pressure type spray gun, the spray head of which is adjustable so that either a round or flat spray can be produced. With this spray gun the operator is able to reach parts of the engine that are inaccessible to a paint brush and the time and labor saved is at least 75 per cent. less than when the hand brush was employed to do the same work.

In the washing machine industry the spray gun plays a very important part. Modern washing machine parts in a disassembled state are sprayed with a rust preventative color coat, the parts are then assembled and the completed machine is given a final coat of finishing enamel.

The manufacturer of a line of art metal cabinets is employing the spray gun in the finishing of his product. All of the cabinets and articles produced by this firm have a new metallic stippled and blended finish. This is highly ornamental. For instance, a cabinet is sprayed with a dark copper bronze with a completely hiding coat. Over this is sprayed at very low air pressure a light stipple of vermillion. Next a heavy stipple of black and then comes a light stipple of white. The finishing coat consists of a clear varnish. When the job is finished the result is a very beautiful blended metallic surface that is exclusive and different from other finishes usually found on products of this kind.

At the plant of a large manufacturer of lifting cranes all of the painting work is done with pressure type spray guns connected to paint tanks. The structural iron part of the crane as well as the cast iron and machine parts are given, first, a coat of heavy red lead, and, second, a black bitumastic coating. All of this work is done in the yard after the crane has been assembled for a test, and the saving over other methods of applying paint that this company have been able to accomplish is enormous.

One of the large manufacturers of steam engines and electric generators employs the spray gun for applying all paints and finishes to their products. The insulating paints that are used on the coils and rotor of the generators is sprayed on with a cup type spray gun. This finish consists either of shellac or special dielectric paints; on the generator castings a heavy filler is first sprayed on and when dry sanded out. Over this is sprayed a heavy coat of gray enamel. The same materials, with the exception of the insulating varnishes, are also sprayed on engine castings in this factory, and when it is necessary for this company to assume the erection of a complete power plant a spray gun equipment is always shipped out to the job and is used for applying paints to engine foundations, floors, walls, boilers, piping and buildings.

In almost every plant manufacturing machinery and where the product is to be treated with a liquid finishing material the spray gun has a distinct place and it will cut down the time and labor in getting out the work and will often save paint.

Practical Ideas From Practical Men

CALCULATING THE STIFFNESS OF SHAFTS

By F. A. Livermore, A.M.I.M.E.

Calculating the angle of twist in a shaft is not an every day requirement and, consequently, when the time arrives, we find ourselves hazy on the necessary formulas for the calculation. All goes well with the general formula until we are faced with the torsional modulus of elasticity and in the resulting answer we are doubtful as to the correctitude of the angle of twist. To avoid any confusion, I am substituting a simplified formula and a table of values from which the angle of twist can be readily obtained. First, I reiterate the old theorem:—the torsion or twisting moment is equal to the twisting force times the lever arm about which it acts.

From any mechanical handbook we can obtain the formula—

$$D = 585\ PRL\ Gd^4$$

Let

D = the twist or deflection in degrees.

R = the radius of the twisting force in inches.

L = the length between the arms of twist.

G = the torsional modulus of elasticity.

d = the diameter of shaft in inches.

P = the twisting force in pounds.

S = the shear stress in pounds per square inch.

With the degree of the angle of twist, the resulting stress created is:—

(a) $$S = \frac{DGd \times 57.3L}{2}$$

Simplified down gives $$\frac{140{,}700\ Dd}{L}$$

The problem as it is usually stated is to determine what diameter shaft will maintain the twisting moment below a certain required limit; to ascertain this we proceed as follows:—

By transposing in (a) and solving for "d" we have—

(b) $$d = \sqrt[4]{\frac{585\ PRL}{GD}}$$

Since the torsional modulus of elasticity is approximately 12,000,000 lbs. per sq. in. for steel, substituting this value in (b) it reduces to—

(c) $$d = \sqrt[4]{\frac{PRL}{20{,}500\ D}}$$

By further simplification of (c) we get—

(d) $$d = \sqrt[4]{\frac{PRL \times 0.835}{D}}$$

Since the angle of twist shall not exceed a certain value, the equation (d) can be brought to its simplest form as—

(e) $$d = K \sqrt[4]{PRL}$$

Where the value of "K" is obtained from the expression—

$$K = \sqrt[4]{\frac{1}{D}}$$

The following table by J. S. Carpenter (mechanical handbook) gives the values of "K" for corresponding values of "D"; all that is necessary is to find the nearest value of "K" and substitute for solution in the equation (e).

Tables of Values of "K"

D	K	D	K	D	K
.25	0.1180	2.50	0.0665	5.50	0.0545
.50	0.0991	3.00	0.0635	6.00	0.0534
.75	0.0896	3.50	0.0612	7.00	0.0514
1.00	0.0835	4.00	0.0591	8.00	0.0497
1.50	0.0755	4.50	0.574	9.00	0.0482
2.00	0.0703	5.00	0.0558	10.00	0.0470

So to find the angle of twist or deflection of a given shaft, the value of "K" is found from

$$K = \frac{d^4}{PRL}$$

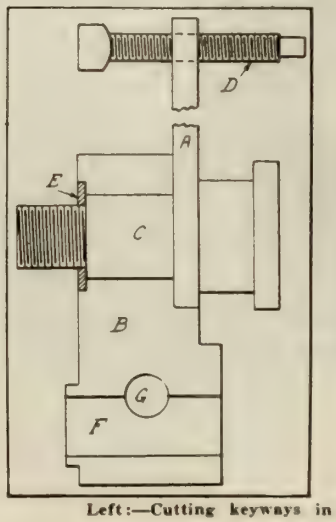
and by referring to the table a result can be obtained which is accurate enough for all practical purposes.

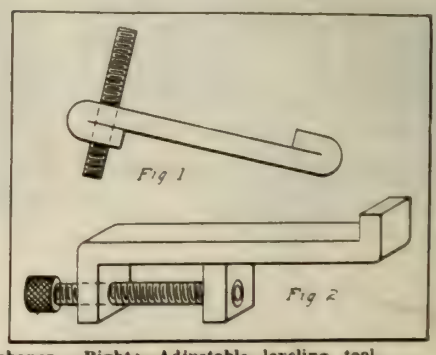
ADJUSTABLE LEVELING TOOL

By Harry Moore

The adjustable leveling tool shown here was devised to facilitate the manufacture of a large number of wedge shape blocks to be used on the ends of slides. Milled at an angle on one end only and this angle varying with different batches, it was necessary to have an adjustable feature on the tool required to hold them, in order to keep the top parallel with the surface plate and drill press table when marking off and drilling. Blocks of this kind are frequently used in the construction of built-up jigs, fixtures, etc., and perhaps the description of the tool used to hold this particular lot will be of interest to others.

Fig. 1 shows the tool as first made up: This consists merely of a piece of ¾ in. x ¼ in. stock bent over close at opposite sides on both ends. One end is tapped for a stud by means of which the angle of the tool is changed to suit the work. Although very simple to make, this holder, in some cases, was not quite satisfactory because of the projecting screw interfering with the work. A better device is shown at Fig. 2 and this was the one generally used. This also is made of ¾ in. x ¼ in. stock, both ends being bent at right angles in opposite directions. One end A is tapped for a ¼ in. knurled head screw B which carries at the end a square block C, the end of the screw being turned down and riveted over lightly for the purpose. By adjusting screw B in or out the angle of the tool can be changed to suit the work as desired. It is solid enough to hold work when being drilled with light holes in addition to being used for laying out as shown in the illustration. There are of course many ways in which this work could be done, but as a quick method for leveling up the top faces for the light operations noted this tool has proved all that could be desired.





Left:—Cutting keyways in shaper. Right:—Adjustable leveling tool.

CUTTING KEYWAYS IN SHAPER

By William Garnham

The accompanying sketch illustrates a simple but useful attachment for placing on a shaper when cutting keyways or tee-slots, or on work where it is desired to have a more rigid clamping of the tool. The special block A for supporting the tool bar is cut away at the back to receive the plate A which is firmly secured in position by means of the bolt C. The cutter bar is locked in position by the tapered pin G. The long set screw D is forced against the vertical slide, thus preventing tool chatter.

Acceleration a Factor in Cam Layouts

By John S. Watts

THE mast common form of cam is known as the heart shaped cam, designed to give the follower a uniform velocity throughout its travel. The only advantage of this type is that it is simple to layout, but it has serious disadvantages in that it is inefficient and noisy. The fault in this design of cam is that it attempts to start the follower from a state of rest to its maximum velocity instantly, I say attempts advisedly, as although the cam is made to do this very thing, the power required to do it is infinite, and is hence impossible. The actual result being that some part of the mechanism upon which the cam acts has to give or spring enough to cushion the blow and allow the mechanism to acquire velocity more or less gradually. It is only by reason of the relatively low speeds and short travels of the followers that such cams do not fail immediately. The idea that a cam can start its follower off instantly at full speed is as fallacious as would be the attempt to start a heavy train off at its full speed, from which it differs only in the weights involved, the force required being infinite in both cases. In practice the men assembling such a cam will find it working hard, and ease it off by filing the starting part of the cam surface, until the action is made bearable, but this is nothing more than a palliation of the evil, and a cam properly designed will need no such tinkering to make it work smoothly.

A later form of cam is designed to give the follower a uniform acceleration during the first half of its stroke, and a uniform deceleration during the latter half, which is a decided improvement upon the uniform velocity type, but is still short of perfection inasmuch as there is normally no valid reason, except possibly a slightly simpler layout, why the periods of acceleration and deceleration should be equal. On the other hand as the power required to accelerate a body to a given velocity, varies inversely as the time taken to acquire this velocity, it is clear that the longer we can make this period of acceleration, the lower will be the force required. Then again in the average run of cam mechanisms, the resistance against which the cam is working is much more than can be overcome by the inertia of the follower and its rods and other moving parts or in other words, the conditions are such that the follower will come to rest immediately the cam ceases to push it forward. Under these circumstances there is no advantage gained in having any deceleration period at all. The only case which requires a period of deceleration is where the roller would leave or tend to leave the cam at the end of its strike, due to the inertia of the follower parts overcoming the resistance and making a longer travel than that which the cam imposes upon it. On this point a decision can only be made after a study of the individual case.

The ideal cam is one that gives a uniform pressure against the roller throughout its working travel, it being obvious that under this condition the pressure will be the lowest possible. To gain this we must consider all the forces against which it has to work. These are, first, the resistance due to the function of the cam, for an example, in an automatic machine tool, the feeding in and out of the cutting tool, or in a gas engine, the lifting of the valves. Second, the acceleration of the moving parts of the follower, etc. Third, the friction of the moving parts.

Generally speaking the first and third forces are uniform throughout the working stroke, and cannot be reduced by any alteration in the form of the cam. The second force, that of acceleration is determined entirely by the shape of the cam, and can be made uniform, or in cases where the first force varies during the stroke, the accelerating force can be varied to be higher when the functioning force is low, and vice versa, to make the total force exerted by the cam uniform during the stroke.

To compare the difference in efficiency between the three types of cams, we will work out the force required for acceleration for each type. As said before the force required for the first type of cam, the uniform velocity type, will be infinite. For the second type, having a uniform acceleration, during the first half of the stroke, the force of acceleration is given by the formula

$$f = \frac{WV}{gT}$$

Where f = force of acceleration in pounds.
W = weight of moving parts in pounds.
V = maximum velocity in feet per second.
T = time in seconds taken to acquire the velocity V.

For purposes of comparison we will take W to be one, the stroke of the cam to be two inches, and the time taken to execute one stroke to be two seconds. As the maximum velocity is attained at one half of the stroke, the space S, travelled through in attaining the maximum velocity from rest, will be one inch, and the time taken in traversing S will be one second. The maximum velocity attained will be found by the formula,

$$V = \frac{2S}{T} = \frac{2 \times 1}{1} = 2$$

Substituting in the formula,

$$f = \frac{WV}{gT}$$

we get $f = \frac{1 \times 2}{32.2 \times 1} = \frac{2}{32.2}$

Making similar calculations for the third type, having the acceleration period last throughout the whole stroke, we get S = 2 and T = 2.

Therefore $V = \frac{2S}{T} = \frac{2 \times 2}{2} = 2$

That is, the maximum velocity is the same in both cases, but in this third type the time of acceleration T is two seconds instead of one as in the second type and the formula gives

$$f = \frac{WV}{gT} = \frac{1 \times 2}{32.2 \times 2} = \frac{1}{32.2}$$

or a force just one half of that required for the previous type of cam.

To lay out a cam for uniform acceleration rising in one half of a revolution of the cam, proceed as follows. The space travelled during succeeding units of time will be 1, 3, 5, 7, 9, etc. Referring to figure herewith, the distance ab, being the total travel of the cam roller, and using six divisions of the stroke, we have as the travel during each division 1, 3, 5, 7, 9, 11 parts of the total stroke respectively. Adding these together we get 36 parts, and dividing ab into this number of parts we draw circles through the points number 1, 4, 9, 16, 25 and 36 to meet their respective radial lines, the intersections giving the centres of the roller, and the curve can be drawn in the usual way.

If it is desired to have the velocity decrease during the latter part of the stroke, this can be done by a similar process, the deceleration period being laid off to give a travel during successive periods on the same order as the acceleration period, but reversed as 11, 9, 7, 5, 3, 1. The deceleration period being made any desired part of the stroke, as say one-sixth, to meet the particular condition.

The return stroke can be made to suit any conditions, but generally speaking with a follower returned by gravity or spring pressure a uniform velocity curve is most satisfactory. If the cam roller is actuated positively by the cam during the return stroke, the uniform acceleration curve is best with, under certain conditions as outlined before, a part of the stroke for deceleration.

CAST IRON SPLIT PULLEY

An interesting design of cast iron split pulley has recently been developed by Messrs. John Jardine of Nottingham, England. It is made in two pieces in such a way that lugs on the smaller part are forced against shoulders of the main portion by means of a heavy set screw, and giving a three-point bearing on the shaft. Small variations in shaft diameter do not affect the grip to any extent. Its construction permits of placing on shaft close to a bearing or between pulleys where difficulty would be experienced when using a spanner.

New Things in Shop Equipment

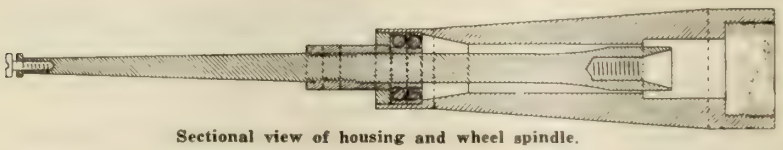
FLEXIBLE-SHAFT OUTFIT

An outfit especially intended for driving screws, as in the manufacture of radio equipment and similar apparatus, has been developed and placed on the market. It is arranged for overhead mounting but may be fixed to a bench or wall if desired. The countershaft is equipped with tight and loose pulleys, and a lever-operated belt shifter. The drive from the countershaft to the flexible shaft pulley is through a round leather belt. For high speed work the device is fitted with ball bearings. Special shafts and finder sleeves can be provided to suit the work being performed. These devices are made by the Hergi Mfg. Co., Bridgeport, Conn.

EXTENSION HOUSING AND GRINDING SPINDLE

An attachment for multi-graduated precision thread grinders, intended for deep internal grinding to a depth of 12 in. on holes 2 in. in dia. or greater, and a depth of 6 in. on ½ in. holes, has been placed on the market recently. It is particularly applicable to the operation of grinding the tapered bore in milling machine spindle; perfect concentricity of this bore promotes full service and long life of cutters especially in cases of unhardened milling machine spindles, which are subject to scoring and wear. The use of this grinder with the extension spindle speedily corrects the fault; increases efficiency and production. An untrue running cutter dulls rapidly on the few teeth that do the burden of work and soon chatters and proves unsatisfactory. Lathe spindle tapered bores also require trueing occasionally to correct errors in concentricity and alignment, obviating the necessity of trueing centres each time lathe is to be used on accurate work.

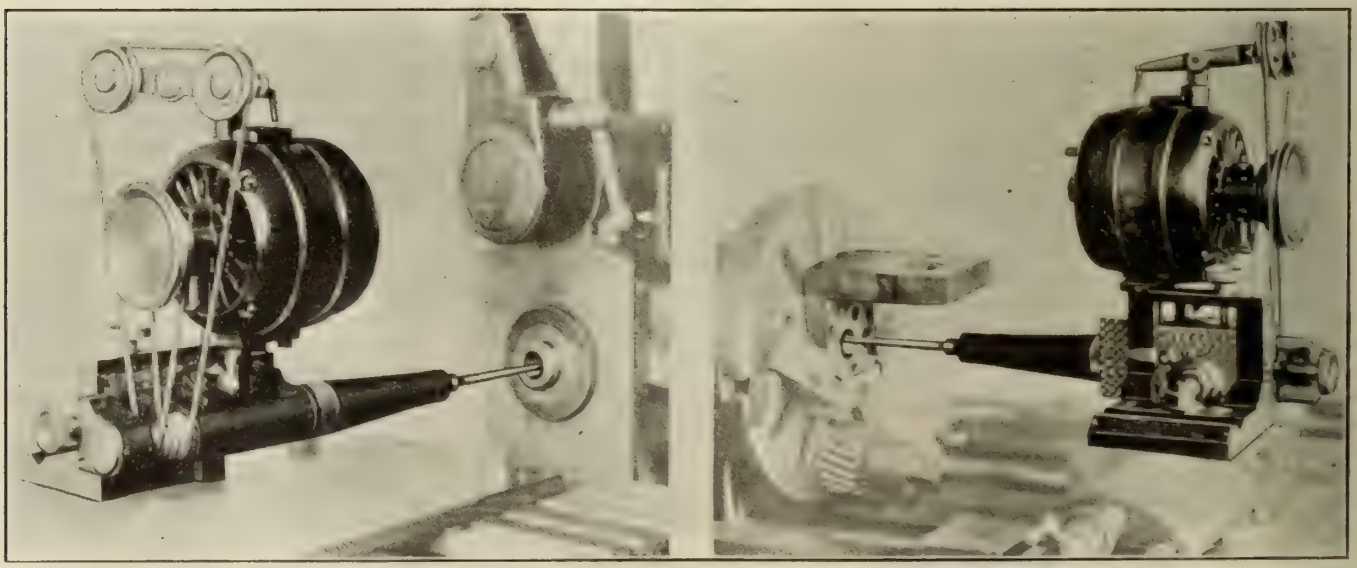
The extension spindle is particularly serviceable for grinding holes in pieces where projecting arms make it difficult to grind with short range outfits. To the right of Fig. 1, it shows the machine grinding a hole in a hardened fixtur Fig. 2 shows the line drawing of the spindle and housing. The extension housing is screwed on the projection threads on front regular spindle cap. This makes an accurate and speedy attachment. The extension spindle couples on to the regular spindle by the tapered fitting joints, and is supported at working end of radial and end thrust ball bearing at extreme end of extension housing. The great length of spindle support produces rigidity at grinding end of spindle. Simplicity, speed and accuracy of attachment to grinder together with great range of work, makes this an indispensable auxiliary attachment to every multi-graduated precision grinder. This device is manufactured by the Precision and Thread Grinder Mfg. Co., Philadelphia, Pa.



Sectional view of housing and wheel spindle.

LARGE ROLL GRINDING MACHINE

A heavy-duty cylindrical grinding machine especially built for finishing all types of hot and cold mill rolls has been placed on the market recently. The tool is self-contained and is operated by three separate motors. One motor which is directly connected to the headstock is used for driving the work; another is mounted on the grinding wheel carriage for driving the grinding wheel. The third motor is used for operating the water pump. The operator controls all of these motors by means of push buttons located in a convenient position on the operating platform. This platform is part of the grinding wheel carriage, so that the operator has a clear view of the point of contact at all times. All gears are made of chrome-nickel steel and operated in oil baths. The wheel carriage is driven by means of a worm and rack, and provision is made for a brief period of tarry at the point of reversal. Facilities are also provided for rapidly moving the wheel to and away from the work. A special feature in construction is an attachment for grinding the periphery of the roll either concave, convex, or straight, as desired. The amount of curvature is controlled by a simple system of gearing at the back of the machine. The roll supports furnished with this machine are of the two-bearing type, which allows of grinding the journal without changing the roll position; this keeps journal concentric with body of roll. These machines are built in three standard sizes, 20, 30, and 40 in. and any desired length. They are built by the Landis Tool Co., Waynesboro, Pa.



Left—Truing up tapered bore of milling machine spindle. Right—Grinding hole in angle plate with long projection.

WALL BRACKET DRILL

A light swinging drill that can be attached to a post or wall, and that is capable of operating on holes within a radius of 3½ feet of the swivel, has recently been placed on the market. The machine is particularly applicable to light drilling up to ⅜in. dia. in steel. It is belt-driven through tight and loose pulleys, the vertical shaft being connected to countershaft by means of bevel gears. The countershaft yoke can be placed in any position to conform to location of overhead drive. The spindle is equipped with ball thrust bearings and has a movement of 2½in. The spindle quill is of steel with bushed bearings and a rack cut from the solid. Two spindle speeds are provided, 500 and 1,300 r. p. m. These drills are made by the Hammond Mfg. Co., Cleveland, Ohio.

8-INCH ELECTRIC GRINDER

A small bench grinder, carrying 8in. by ¾in. wheels, and operated by a ½ h. p. motor, has been placed on the market recently. The motor operates on either direct or alternating current at voltages of either 110 or 220. Large bearings are provided for the motor shaft which operates at a no-load speed of 3,600 r. p. m. The machine is supplied complete with two abrasive wheels, two wheel guards, two adjustable tool rests, a toggle switch in the base, and 5 ft. of electric cable fitted with an attachable plug. These machines may be mounted on a pedestal if desired. Net weight about 75 lbs. They are made by Black and Decker Mfg. Co., Baltimore, Md.

PILLAR PUNCH PRESS

A small pillar punch press primarily designed for work on radiator cells has recently been developed and placed on the market. It can readily be adapted to any class of work within its capacity. The ram has a stroke of 1¼in. with a vertical adjustment of 2in. Maximum clearance between ram face and bed is 5in. the surface of the latter being 9½ by 11in. The machine is driven by means of a 3in. belt running on an 18in. flywheel with a solid web. It requires a floor space of 36 x 40in. and weighs about 700 lbs. It is made by Geo. W. Dover, Inc., Providence, R. I.

POWER SCREW PRESS

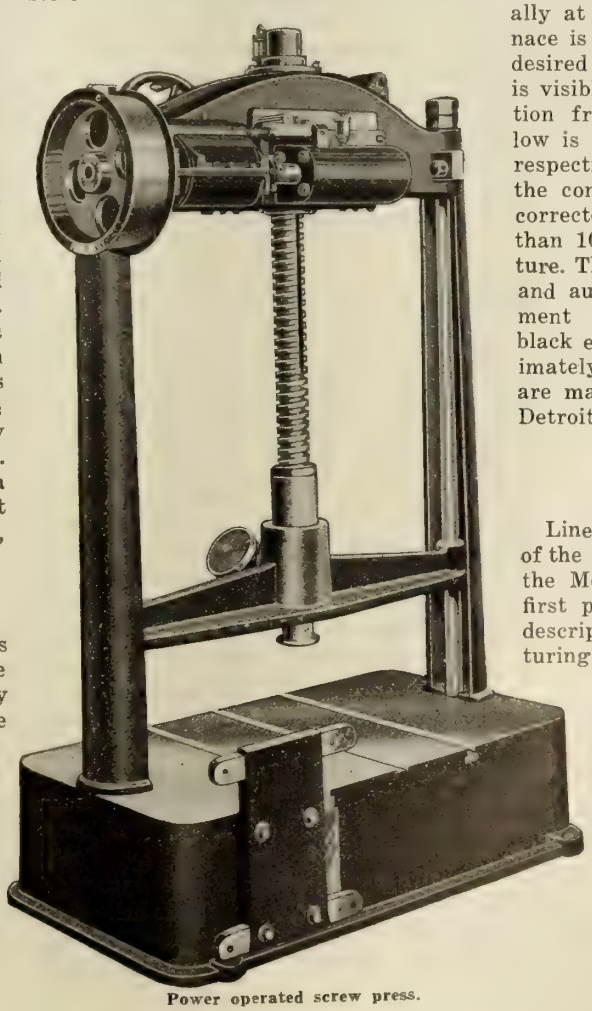
The accompanying illustration shows the cut of a screw press placed on the market recently. It is operated by means of a marine type of clutch. The engaging mechanism may be controlled either by hand-wheel shown at top of press by lever placed to suit operator. The standard size is built for 25 to 30 ton work with a ram speed of about 7 ft. per min. By changing the lead of driving worm, gear and screw, speed may be increased or decreased as desired in practically any production work, but pressure will diminish as speed is increased. Special bases or fixtures may be supplied to suit requirements and uprights of any length furnished for long work. The standard base is a perfectly planed surface with tee slots and keyways so that jigs and fixtures may be accurately fitted. A hole may be cored in the base if desired. The thrust on the screw is carried by heavy oversize S. K. F. ball thrust bearings; on worm by radial ball thrust bearings. When furnished with single thread lead screw, pressure may be held indefinitely at 25 to 30 tons. On such work the clutch is released and no power consumed. When individually driven a 5 h. p. motor operating at a speed of 1,200 r. p .m. is used. The press is 37½ in. between uprights; 32 in. clear in top position; maximum movement of ram 24 in. The screw is 1 in. pitch and 2 in. lead, 3 in. dia., and 48 in. long. The machine is 76 in. high and requires a floor space 27 in. by 48½ in. It is made by the Atlas Press Co., Kalamazoo, Mich.

CENTRELESS GRINDING MACHINE

Several changes and modifications have been made recently to this particular grinding machine. A special feature of the new design is the "drop in" attachment which makes it possible to grind either shouldered, tapered or straight work. This rest consists of a steel bar with a hardened and ground edge for supporting the work in a true horizontal position between the two grinding wheels. An extended slotted guide is located at the top of the bar, with an opening just large enough to receive the work to be ground. Side guides on the bar hold the work in the proper position between the two wheels. Adjustable stops are provided for different lengths of work, so that the grinding can be accomplished without touching the shoulder of the work.

The work rest is mounted on rollers and travels with the work. It may be drawn forward about 5 inches for insertion of the work and again moved back for grinding.

Another feature of the machine is the balanced ways and arbor for the grinding wheels, as it is essential that wheels be in fairly accurate balance. Holes are provided in the hub for the insertion of pins opposite the heavy side. Permanent balancing ways are a part of the regular equipment, these being fixed to the base of the machine. These grinders are manufactured by the Reeves Pulley Co., Columbus, Ind.



Power operated screw press.

TEMPERATURE REGULATOR

A device for automatically controlling the temperature of electric, oil or gas furnaces has been placed on the market recently. The furnace temperature can be held within a 10 deg. F. range. The control mechanism operates automatically at 30 sec. intervals. When the furnace is operating within 8 deg. F. of the desired temperature, a white signal light is visible at the top of the board. Variation from the limited range high and low is indicated by red and green lights respectively. The mechanism operates the control switch, so that the error is corrected before it has deviated more than 10 deg. from the desired temperature. The control is claimed to be positive and automatic. The case of the instrument is made of cast iron and has a black enamel finish. It weighs approximately 27 pounds. These regulators are made by the Hoskins Mfg. Co., Detroit, Mich.

CATALOGUES

Line Shafting Equipment is the title of the latest catalogue, No. 43, issued by the Medart Co. of St. Louis, Mo. The first part of the book contains a brief description of their method of manufacturing shafting, while the remainder is devoted to the listing of a wide range of products used in transmission of every character. In addition to being a catalogue, the book contains many tables and engineering data that make it very useful as a textbook.

Sale of three turret lathes by a Toronto dealer recently, is another of the many signs of improved buying tendency.

CANADIAN MACHINERY
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New Head for C. N. R.

ANNOUNCEMENT is made that Major-General Sir Henry W. Thornton, K. B. E., for eight years general manager of the Great Eastern Railway of England, has been chosen as president of Canadian National Railways. The board named to assist him is made up of representative business men whose names are not altogether familiar in railway matters, but who may bring a more practical application of actual business requirements to bear upon transportation problems in Canada. The selection suggests recognition of important sections of the country, and labor has been given consideration.

There are those who attach some political significance to the choice of board, but this is to be expected under circumstances attending practically all public appointments. One thing seems to ballast the proposition, however, and that is that the new head has a reputation based upon practical common sense, an efficiency that links up economy in operation and with unmistakable ideas as to the meaning of intensive co-operation. His task in England has brought out these characteristics and he is a man who may be expected to develop the best that is in the national system. This should mean a businesslike administration unhampered by and divorced from political influence.

Industry Has Its Risks

THAT THE man in the shop cannot always appreciate to the full what is involved in placing at his service the equipment essential to efficient production, is illustrated by the report that eight automatic machines, designed for special purchase, were recently sold for $25 and resold for junk for $800. The machines, it appears, approximated a total outlay of $150,000, the cost of the original being $50,000. Here is one instance where vast expenditure practically came to naught. This was part of the outlay necessary to launch and carry on a business. Yet it involved no responsibility on the part of the mechanics or of others employed. They were called upon to enlist only their skill in production, or in giving effect to method.

It is not by any means suggested that enterprise belongs to any one class more than another, or that one man has any more right than another to organize industrious effort in the production of goods for which there may be a ready demand, but there are those who, unthinkingly it may be, fail to appreciate the risks and responsibilities that enter into modern industry, or what vast amount of expensive experimental work may be required before an objective is reached. There are actually those who, coming from the ranks of the workingmen, have themselves experienced something of the futility of effort. Fortunately there is such a thing as success, but in many cases, it is the result of an individual application which persisted in carrying on, probably not pausing to note how small a thing is sentiment and how undependable a thing is general sympathy as encouraging factors.

Should City Pay Higher?

SHOULD municipalities buy labor at higher wage rates than private taxpaying industries are able to pay to their laborers? If so, how much? This is a question which, it is stated, will probably be a plank in the platform of economists at the next municipal election in Toronto, for it is there that the city laborer is paid 55 to 60 cents an hour, while the rate in private industry runs from 30 cents to 45 cents, and for work that is often harder and, quite as frequently, more intelligent than that performed on the city streets. Where the economists who are asking the question expect to land at the hands of the electorate is difficult to say, but at first glance they would appear to be entitled to some support from that part of the community which can never expect to appear on the city payroll or who cannot view with favor the appealing concern shown periodically for the workingman by city hall politicians.

Business men declare that the attitude of Toronto aldermen on this question seems to be hereditary or bequeathed from preceding generations of aldermen. All have had their eyes upon the workingman, while private industry has had to consider the city as a competitive factor in the labor market. It evidently makes a difference where the money comes from for no buyer of labor, whether he be alderman or not, is going to pay, as a private individual, more than the general market requires.

A prominent iron and steel concern is paying, say, thirty to thirty-five cents an hour, and would gladly pay more if they could afford it. They declare that the policy of over-liberality at the city hall has a tendency to demoralize the labor market for the immediate demand is for the same wage as that paid for city work. There are aldermen who admit that it is not the right thing, but not one has dared advocate a general change. While in other cities there is some public condemnation of over liberality in city payrolls, in Toronto approbation from a well-organized section of the community outweighs the political significance of criticism from any other section. It is not a question of the workingman's worth, or what he is entitled to. Fortunately his wages in many cases represent a higher appreciation of this service, but workingmen have a right to ask why they should be taxed to pay so much higher wages, through their representatives, than they can obtain from private industry.

Huge Tonnages Accumulate With Delivery Short

Production Speeds Up But Consumption Handicapped—Mills, However, Require Orders and Premiums Disappear—Advances in Boiler Tubes and Hoops—Good Showing in Fall Business

DECLINE PREDICTED IN PIG IRON PRICES

SOMETHING like 1,500,000 tons of steel were purchased by American railroads immediately preceding the increase in steel rails from $40 to $43 on Oct. 1. The stipulation is that the rails shall be taken out by July 1, 1923. The fact remains, however, as indicated by advices received from Pittsburgh, that the mills are still going to require orders. At present the problem has to do with shipment, as consumers want more steel than the mills can deliver. When improvement in transportation comes, with the season of lower consumption, further orders will be required.

There are conspicuous instances of accumulation due to lack of cars. The Carnegie Steel Co. has 100,000 tons of finished and semi-finished steel awaiting shipment. American Sheet and Tin Plate Co. is operating at 10 per cent. lower rate owing to shortage of supplies. Many concerns have been compelled to resort to motor trucking. Some apprehension is felt in the prospect of an early winter. In the meantime, products are piling up and costs are being swelled. This must contribute to the price stiffening that is everywhere in evidence. Unfilled tonnages for the past month will show a large increase.

On the present basis steel ingot production is at a rate of 36,000,000 tons a year, or 20 per cent. more than in 1912 and 1913, two of the biggest years before the war, while exports are smaller. Delivery premiums are disappearing, leaving the market at base prices. Already there are predictions as to the extent of declines. Bars, shapes and plates, it is said, will go to $1.75 in the next readjustment. Canadian prices range from $3.25 to $3.40, with the Hamilton mill price at $2.70. Boiler tubes are the latest to register an advance, this time it is $4 per ton, or about five per cent. on present prices. Steel hoops have also advanced slightly.

Pig iron prices, it is predicted, are due for an early decline. The prevailing spot figure for domestic pig is $39.30, which cannot compete with quotations of $36.50 and $37.75 for English and Scotch pig, on cars, at Galt, Guelph and Brantford. There is not a large quantity of import iron available, and it is likely that, with the close of St. Lawrence navigation, it may cease to be a factor on the market.

Dealers report that sales records show a falling off in small orders, but an increase in large tonnages. There is still a good demand for structural steel, but deliveries are a serious handicap. No cancellations have appeared.

Toronto

Oct. 11.

OCTOBER is displaying some indication of being a fair month in iron and steel business on Toronto markets. Buyers are evidently satisfied that nothing better in the price situation is likely to develop and recent orders, though fewer, aggregate larger tonnages. In structural steel required in bridge and building operations the record is well in advance of last year and, in spite of shipping difficulties, the demand continues. There have been no cancellations on account of slow delivery, and it would seem that problems arising in this connection have been pretty well anticipated and provision made accordingly. It is regarded as somewhat remarkable that business should maintain its strength with big buying factors, such as the railways, practically dormant, but by students of the situation this is attributed to a steady development along normal lines. If industry can hold this record without recourse to some of the larger elements, then so much the better when these again emerge from their period of seclusion. The appointment of Sir Henry Thornton as head of the C. N. R. has naturally aroused some speculation as to future buying policy. There are those who predict that the new head will take his orders from the government, while on the other hand it is declared that the country is hardly paying $50,000 a year for that kind of manager.

Pig Iron.—The situation here shows little change. Spot price is still $39.30, with supply confined largely to Algoma, producing something like 8,000 tons monthly, and to Scotch and English pig. It is stated, however, that supplies of the latter are somewhat restricted and that what quantities have accumulated represent ballast rather than full shipments. Prices on this import, however, are lower than the domestic article. In fact, as an example, buyers in Guelph report having received prices ranging from $35 to $37.50, Guelph, on this iron. This is certainly a competitive factor, and it would not be surprising to see slightly easier prices on the domestic line. The coal situation is easier and with gradual return to normal, aided materially by prevailing good weather for water shipments, the situation is bound to improve. Steel of Canada is not likely to appear for foundry business for a while. They have blown in one of their two furnaces on basic iron, but this will probably be used for steel-making purposes. No serious shortages appear to have developed among the foundries.

Iron and Steel.—Markets in this department are firm with prices ranging from $3.25 to $3.40. Hoops have advanced, and while prevailing quotations are around $4.50, it is felt by some dealers that $4.70 would better represent prevailing conditions, and in hoops, the critics observe, this price would obtain if warehouses took advantage of the spread as between mill and warehouse extras, as they do in other items such as bars. Here again is seen that lack of cohesion or agreement in the matter of prices, so characteristic of the Toronto market.

Sheets continue in good demand, but there is complaint of delayed shipments. One large concern reports the non-arrival of a big shipment of blue annealed that should have made its appearance in July. Thus quite an amount of work is being held up.

An advance of $4 per ton on boiler tubes means an increase of about five per cent. on present prices.

Local price quotations on iron and steel:—

Iron bars	3 25	3 40
Steel bars	3 25	3 40
Reinforcing bars	3 25	3 40
Steel hoops		4 75
Tire Steel		3 50
Spring steel	7 00	14 00
Band steel, No. 10 gauge and 3-16 in base		3 90
Small shapes		3 50
Sheets, black, No. 28		5 50
Sheets, blue ann., No. 10		4 50
Canada plates, dull, 52 sheets		5 75
Canada plates, all bright		6 75
Galvanized Sheets, No. 28		6 75

Scrap Metals.—Prices show a firming tendency especially on No. 1 machine but fundamentally the market shows little change, and the following average buying prices represent fairly the basis on which business is being done:—

Copper, light, per 100 lbs.	9 00
Copper, crucible	11 50
Copper, heavy	11 25
Copper Wire	11 25
No. 1 compositon	9 00
New brass cuttings	6 00
Red brass turnings	6 50
Yellow brass turnings	5 25
Light brass	4 50
Medium brass	6 00
Scrap zinc	3 50
Heavy lead	4 50
Tea lead	3 00
Aluminum	11 00
Boiler plate, per gross ton.	9 00
Heavy melting steel	10 00
Axles (wrought iron)	20 00
Rails (scrap)	11 00
Malleable	10 00
No. 1 machine castiron	18 00
Pipe, wrought	7 00

Non-Ferrous Metals.—Speaking of the copper market an authority claims that there will be little change this year

unless, of course, war develops in Europe. It will be recalled that on the outbreak of the Great War there was a considerable break in copper owing to the menace to shipping, while for the same reason tin almost doubled in price, only to resume normal levels when it was evident that the seas would remain open. In the present case there is not likely to be a menace to shipping and for that reason price fluctuations will more accurately reflect supply and demand. There is no outstanding factor in the market at present and prices are as follows:—

Lake copper	17 25
Electrolytic copper	17 00
Castings, Copper	17 00
Tin	38 50
Lead	7 00
Spelter	8 50
Antimony	8 50
Aluminum	23 00

Montreal

Oct. 11.

ALTHOUGH business on the whole continues satisfactory, it is by no means up to normal level. It is expected that from now to the close of navigation the demand for the complete range of steel products will improve and the next two months may prove very satisfactory.

Railways continue to buy only what is actually required for upkeep purposes and until they enter the market for their usual normal supplies, conditions in the steel trade will continue to be below par.

Sheet markets, in both black and galvanized, are extremely firm with indications for higher prices. This is largely due to the delay in obtaining supplies from American sources combined with a firming up of prices in the Old Country. Boiler tubes are in good demand and prices are steady. Following are prevailing prices on iron and steel:—

Iron bars, base	3 15 to	3 25
Steel bars, base	3 15 to	3 25
Reinforcing bars, base	3 15 to	3 25
Steel hoops	4 25	
Tire steel	3 25 to	3 40
Spring steel	7 00	
Band steel, No. 10 gauge and 3-16" base	3 65	3 75
Small shapes	....	3 40
Sheets, black, No. 28	....	4 40
Sheets, blue, ann., No. 10	....	4 00
Canada plates, dull, 52 sheets	....	5 50
Canada Plates, all bright	....	7 00
Galvanized Sheets, No. 28	....	6 50

Pig Iron Markets have not reflected much change in the past two or three weeks, although the general trend seems to be in the direction of more business, with a stiffening of prices. Local mills have not made any definite change within the past ten days. Algoma No. 1 foundry iron, Montreal, is now quoted at $41.65 per gross ton. Some competition has developed in English and Scotch pig which, at present, is offered at lower prices. There is a marked scarcity of import iron, however, and where consumers require quick delivery Canadian iron is being purchased. Current prices:—

Algoma, No. 1, car lots on tracks, nominal quotation	41 65	
Summerlee, 30-ton lots, dock	35 00	....
Carron, 30 ton lots	35 00	....
Do., 5 ton lots, ex. warehouse	40 50	....

Non-Ferrous Metals.—There has been little activity during the week in this department, although demand, it can be said, indicates industrial improvement. Reflecting American conditions, tin has advanced to $38.50. The coppers are stationary. Local prices:—

Lake Copper	17 75
Electrolytic Copper	17 50
Castings, Copper	17 25
Tin	36 00
Lead	7 25
Spelter	9 00
Antimony	6 75
Aluminum	22 00

Pittsburgh

October 11, 1922.

IN THE recent rail buying movement, produced by the rail mills announcing an advance in price from $40 to $43, effective October 1, and proposing to enter orders previously at the old price, considerably more than 1,000,000 tons was secured by the mills, while at the same time there was heavy buying of joints, spikes and tie plates. The total of all this business is estimated at about 1,500,000 tons. The object of the mills in making this offer was to secure winter and spring rollings, there being a stipulation that the rail should all be taken out by July 1, 1923.

At the time the offer was made, about a month ago, it did not appear particularly probable that the steel mills would stand in need of orders in the winter, and some surprise was expressed at the offer on that account. It was clear that the price advance was justified by circumstances, as the $40 price seemed somewhat low a year ago, while now, on account of heavy wage advances, the production cost is higher and, in some quarters, it was considered strange that the mills should not advance the price first and then let the orders come when they would. Now, however, all the indications are that in the not distant future the mills will need orders. For about six months, and until a fortnight or so ago, the mills were straining every nerve to produce every ton of steel possible, fuel supply being the limiting factor. Then there was a sudden shift. Now, the chief point is to get cars in which to ship the product. In general, consumers want more steel than the mills are able to ship. When transportation improves, or when the advent of winter brings about a lower rate of consumption, orders will be in demand.

Shipment Problems Serious

The car shortage is quite serious and the mills are complaining loudly. Possibly some of them are fearful lest, if shipments are delayed, their customers will not find themselves in as great need of the steel a few weeks hence. While steel production is tending to increase, the mills are more anxious to see heavier shipments than heavier production. At some plants the accumulations are growing uncomfortable and production in some departments may have to be curtailed. The most conspicuous instance of accumulation is with the Carnegie Steel Company which has 100,000 tons of finished and semi-finished steel awaiting cars. All this, of course, was made on order. The American Sheet & Tin Plate Company, which gets almost all its sheet bars from the Carnegie and Illinois steel companies, is operating at about 10 per cent. lower rate than two or three weeks, ago, on account of not receiving enough steel. A considerable tonnage has been rolled for its account and not shipped. It is motor trucking sheet bars from Duquesne to its McKeesport and Monessen works. The company has an ample sufficiency of orders and indeed its sheet obligations could not be completed by the end of this quarter even with a 100 per cent. operation. Of course, it is out of the market on sheets and will not be in again until it opens books for the first quarter of the new year. This leaves the sheet market entirely in the hands of independents, who are getting 3.50c to 3.60c for black sheets, according to delivery, etc., with 1.00c differential for galvanized sheets.

Bars and shapes are quotable at 2.00c to 2.25c and plates at 2.15c to 2.50c in the open market, according to tonnage, delivery, etc. The Steel Corporation price is understood to be 2.00c on all three products, but there is now very little buying for such deliveries as the corporation can make since it has a very large order book. In September its bookings were quite heavy in these lines, while a part of the rail business recently closed went on books in the month, and the pipe subsidiary booked an order for 100,000 tons of line pipe from Sinclair. Thus the unfilled tonnage statement is certain to show a large increase for September.

Production Recovers

Curtailment in steel production due to the coal strike reached its limit at the end of August, when the steel industry was operating at only 50 per cent. of capacity. The decrease was so sudden and the recovery has been so quick, operations being now about 70 per cent., that the loss in tonnage was small. It seems quite certain that production has not fallen below what would have occurred if the June rate had been maintained by as much as a fortnight. In other words, more steel will have been made by October 15 than would have been made by October 1 if there had been no decrease. From January 1 to June 30 the rate of steel production had been increasing continuously, except for a little backset in the first two or three weeks of April.

Production of steel ingots now may be guessed at about 36,000,000 tons a year, which is 20 per cent. more than production in 1912 and 1913, the two biggest years before the war, while exports are smaller. There is hardly the appearance of the country actually consuming steel at the proportionately greater rate. One does not need to be of a critical or pessimistic disposition to doubt whether the steel market rests upon a substan-

tial foundation to-day. If bumper crops—the most practical argument—are mentioned, the circumstance may be cited that some agricultural implement factories are working only four days a week, and then chiefly on stocks, not orders.

Prospects are that delivery premiums will have practically disappeared in a few weeks, leaving the market at basic prices, which are those of the Steel Corporation. Already there is speculation as to how far basic prices will decline in the next readjustment. They will not, of course, get down to the low point of early this year, for the double reason that costs are higher and that mills are unlikely to repeat the experiment of going to cost or below cost. It is not established that the performance did them any good. One prediction is that bars, shapes and plates will go to 1.75c. The mills will, of course, hold out for present prices as long as they can, and that may be many months.

While Connellsville coke production continues to increase, the offerings in the market are still very scant, relative to the possible demand. Many furnaces would like to blow in, but see no chance of picking up the requisite cost. Many more foundries are inquiring about coke prices than are actually buying. The market is a trifle stiffer than a week ago, furnace coke being strong at $12 to $12.50 and foundry coke strong at $13.50 to $14.

The pig iron market continues stagnant, with no clearly defined position. Very few valley furnaces have any iron to offer. Such prices as are quoted are too high for Pittsburgh delivery to meet the Cambria Steel Company, which is quoting $33 for Bessemer, $31 for basic, $32 for malleable and $32.50 for foundry, f.o.b. furnace. Freight from Johnstown to Pittsburgh is the same as from valleys to Pittsburgh, $1.77.

CANADA'S BUYING AND SELLING

Statistics show that in the matter of trade with the United States and United Kingdom, Canada buys $4 worth in the United States for every dollar spent in the U. K.; on the other hand, Canada sells more to the latter than to the States. Here are the figures:—

Imports	From U. K.	U.S.
Agric. & Veg. Prdtcs.....	25,435,111	79,122,891
Animal Products	3,177,463	34,943,067
Fibres and Textiles	60,061,893	9,374,657
Wood and Paper	2 689,944	30,998,194
Iron and Products	10,382,131	105,012,416
Non-Ferrous Metals	2,708,338	27,839,331
Non-Metallic Minerals	7,019,456	95,167,496
Chemical Products	3,433,708	18,821,299
Miscellaneous	9,153,061	34,395,189
Total	124,061,105	495,674.500

Exports	To U. K.	To U. S.
Agric. & Veg. Products..	211,843,271	42,614,100
Animal Products	5,260,832	51,354,835
Fibres and Textiles	1,172,400	2,879,030
Wood and Paper	18.903.734	161.951.231
Iron and Products	6,346,975	5,584,540
Non-Ferrous Metals	6,428.125	16,932,864
Non-Metallic Min.	587,321	14,517,980
Chemical Pdts.	1,326,120	6.402,374
Miscel.	1,355,140	9,335,603
Total	313,223,918	311,572,557

An Infant Industry Building Helps Belleville's Expansion

CITIZENS of Belleville, in the early part of 1920, re-organized their board of trade and formed a chamber of commerce. Since then a great many difficult situations have arisen, many of which hampered the proper functioning of that body. The various units, however, have been working very smoothly for the last twelve or eighteen months, with the result that remarkable progress has been made, particularly from an industrial standpoint. The methods employed to accomplish these ends are rather unique, but since they have achieved success the theory behind them must be sound.

Such names as the Board of Trade and Chamber of Commerce suggest purely business organizations, but in Belleville the commercial side is only one of many lines of activity. The chamber first took an inventory of the assets of the city from the point of view of industrial expansion and at the same time looked into any drawbacks that were evident. From the point of view of shipping facilities the city has its advantages, as the three transcontinental lines pass through and there is an excellent harbor on the Bay of Quinte, which connects directly with Lake Ontario. The chamber then undertook to obtain factory sites. Simultaneously with these lines of activity other commodities were working along lines that were not generally accepted as falling in the spheres of activity of such an organization. These committees endeavored to make Belleville a city that would be attractive, all eyesores about the town were removed, citizens were encouraged to beautify their residences and places of business. Sporting activities were encouraged, social gatherings invited and a community spirit fostered.

The membership of the chamber was enlarged until nearly four hundred were enrolled. These included even the proprietors of the most humble business ventures, those young men destined to be the future business men.

A number of the most successful business men of the city organized the Belleville Industrial Corporation, Ltd., with a capital of $500,000.00, with the sole object of assisting in the development of the city and district. New industries are not encouraged to locate here and experiment with Belleville money, but in cases of worthy enterprises, already established and needing new capital for legitimate expansion, assistance is given. The industrial corporation takes existing structures and converts them into factory buildings, erects workmen's homes and purchases and holds available factory sites. The corporation purchased one large building and located a number of infant industries there. It was called an industrial incubator.

The city does not provide free sites does not give exemption from taxation, and does not offer cash bonuses or other unusual concessions. The policy of the chamber of commerce is to actively search out firms that contemplate locating in Canada. The advantages of the city are pointed out, and representatives are invited to inspect the city.

The result of this policy is that eleven new industries have chosen Belleville as their location in the last eighteen months. These firms are:—

National Castings Ltd., electric steel and iron castings; Natural Tread Shoes Ltd., footwear; Belleville Electric and Stamping, Ltd., electric appliances; American Optical Co., spectacles and optical goods; Bassick Alemite Corpn., Alemite lubrication systems, furniture, hardware, automobile accessories, etc.; International Burr Co., metal burrs; Asbestos Pulp Co., talc and talcum powder; Rubber Crepe Products Co., bathing shoes and rubber goods; Ashley Sweater Co., sweaters and knitted goods; Tiger Tire Co., tires, tubes and rubber goods; A. S. Richardson Co., display fixtures.

INDUSTRY REVEALS SIDELIGHTS

(Continued from page 21)

has had marked prosperity during the past few years. Serving the requirements of a limited market, the industry is in it infancy as compared with its status in the United States, yet it has given encouragement to many others, until to-day there are certain plants in which much expensive equipment has been installed and where enterprise has had elaborate scope. One of the most outstanding of these is the auto-stamping department of the Pedlar People in Oshawa. It was in 1915 that they became actively associated with the auto industry, by installing equipment to turn out stampings of sheet metal for bodies. It was natural that they should extend in this way, for they were manufacturing metal shingles, siding, ornamental ceilings and other similar products. It was predicted that it couldn't be done—at least not in Canada. But given the dies and the machinery and the engineering skill the proposition didn't seem to be impossible. Moreover there was a market to be retained in Oshawa where the McLaughlins were making cars. That the undertaking was successful is evident from the extent of that branch of the Pedlar plant to-day, where one wing of a new factory built two years ago, is occupied by auto-stamping machinery of all kinds. The floor space is 360 feet by 83 feet with a forty foot mezzanine. F. Reesor, the engineer, states that seven years ago a 2,000 run for one set of dies was considered a pretty fair record, while to-day a 25,000 or 30,000 run is a mere trifle. Such has the demand for motor cars grown. Here, too, is an instance of that industrial relativity which contributes so much to better business.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Toronto price:—

Silicon, 2.25% to 2.75%	39 30
Algoma, No. 1, Montreal	41 65
Summerlee, Scotch, Montreal dock	35 00
Summerlee, Warehouse, 5-ton	40 50
Carron, Montreal docks	35 00
Grey forge Pittsburgh	34 27
Lake Superior, charcoal. Chicago	36 15
Standard low phos., Philadelphia	38 00
Bessemer, Pittsburgh	35 77
Basic, Valley furnace	33 50

METALS

	Montreal	Toronto
Lake Copper	$17 75	$17 25
Electrolytic Copper	17 50	17 00
Castings, Copper	17 25	17 00
Tin	38 50	36 00
Spelter	9 00	8 50
Lead	7 00	7 50
Antimony	7 00	8 50
Aluminum	22 00	23 00

Prices per 100 lbs.

BILLETS

F. O. B. Pittsburgh

	Per gross ton
Bessemer billets, 4 in. x 4 in. and larger	40 00
Open hearth billets	40 00
O. H. sheet bars	40 00
Forging billets	45 00
Bessemer rods	46 50

IRON AND STEEL

Per 100 lbs. to large buyers

Iron bars, base, Toronto	$3 25	3 40
Steel bars, base, Toronto	3 25	3 40
Small shapes, base		3 50
Iron bars, base, Montreal	3 15	3 25
Steel bars, base, Montreal	3 15	3 25
Reinforcing bars, base	3 35	3 40
Steel hoops		4 50
Tire steel, base		3 50
Spring steel	7 00	14 00
Band steel, No. 10 gauge and 3-16 in. base		3 90
Chequered floor plate ¼" and heavier	6 25	7 00
Chequered plates ¼-in. and heavier, sunken diamond		5 40
Bessemer rails, heavy, at mill		2 35

PITTSBURGH MILL

Steel bars	2 25
Tank plates	2 25
Structural shapes	2 25
Steel hoops	2 90 to 3 25

F. O. B. Chicago Warehouse

Steel bars	2 80
Structural shapes	2 90
Plates	2 90
Small shapes under 3-in.	2 90

PLATES

Plates 3-16 in.	$3.85	$3 60
Plates, ¼ up	3 50	3 40

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$4 75	$5 50
Sheets blue ann., No. 10	4 50	4 50
Canada plates, dull, 52 sheets	5 25	5 75
Can. plates, all bright	6 50	6 75
Galvanized sheets, No. 28	6 75	6 75
Queen's Head, 28 B.W.G.	7 25	
Fleur de Lis, 28 B.W.G.	7 00	
Gorbal's best, No. 28, U. S. G.	6 10	
Colborne's Grown, No. 28		
Premier	6 85	6 35
Premier 10¾ oz.	6 85	6 75
Zinc sheets	9 50	11 00

FREIGHT RATES

	Per 100 lbs. C.L.	L.C.L.
Pittsburgh to Following Points		
Montreal	52	65½
St. John, N. B.	76	96
Halifax	77½	97
Toronto	34	48½
Guelph	34	48½
London	34	48½
Windsor	31½	45½
Kingston	48½	61

Current surcharge 1 per cent.

OLD MATERIAL

Dealers' Average Buying Prices

	Montreal Per Ton	Toronto Gross
Boiler plate	$ 9 00	$ 9 00
Heavy Melting Steel	10 00	11 00
Axles (wrought iron)	20 00	16 00
Rails (scrap)	11 00	11 00
Malleable scrap	10 00	11 00
No. 1 Machine cast iron	20 00	18 00
Pipe, wrought	7 00	6 00
Car wheel	17 00	16 00
Steel axles	15 00	15 00
Mach. shop turnings	4 00	6 00
Stove plate	16 00	14 00
Cast boring	4 00	6 00
Copper, light	9 00	8 50
Copper, crucible	11 50	11 00
Copper, heavy	11 25	11 00
Copper, wire	11 25	11 00
No. 1 machine composition	9 00	9 00
New brass cuttings	6 00	6 00
Red brass turnings	6 50	6 50
Yellow brass turnings	5 25	4 85
Light brass	4 50	3 50
Medium brass	6 00	4 50
Scrap zinc	3 50	4 00
Heavy lead	4 50	4 50
Tea lead	3 00	3 00
Aluminum	11 00	11 00

COLD ROLLED STEEL

(At Warehouse)

Rounds and squares	$4 75 base
Hexagon and flats	$5 75 base

COPPER PRODUCTS

Prices per lb.

	Montreal	Toronto
Copper Bars, ½ to 2 in.	.29	.28
Brass Tube		.30
Plain sheets, 16 oz. in. 30 x 72	.30	.29
Copper sheet, tinned, 16 oz.	.37	.36
Copper sheet, planished, 16 oz. base	.42	.41
Braziers', in sheets, 6 x 4 base	.30	.29
Copper tubing, seamless		.33
Brass rod		.22

LEAD SHEETS

Roll Lot Prices

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$9 25	$11 50
Sheets, 3½ lbs. sq. ft.	9 00	11 50
Sheets, 4 to 6 lbs. sq. ft.	8 75	10 00

Cut sheets, ¾c. per lb. extra

Cut sheets to size, 1c. per lb. extra

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	20
Brass sheets, 24 gauge and heavier base	23
Brass tubing, seamless	28

WROUGHT PIPE

Price List No. 56. August 23, 1922.

Standard Buttweld Pipe S/C

Size	Steel Blk.	Steel Galv.	Gen. Wrot. Iron Blk.	Gen. Wrot. Iron Galv.
⅛ in.	6 00	8 00	....	....
¼ in.	3 96	6 00	7 20	9 30
⅜ in.	3 96	6 00	7 20	9 30
½ in.	5 02	6 55	7 31	8 93
¾ in.	6 10	7 82	8 86	10 70
1 in.	8 50	14 22	12 58	15 30
1¼ in.	11 50	15 18	17 02	20 70
1½ in.	13 75	8 15	20 35	24 75
2 in.	18 50	24 42	27 38	33 30
2½ in.	29 25	38 61	....	....
3 in.	38 25	50 49	....	....
3½ in.	49 68	64 40	....	....
4 in.	58 86	76 30	....	....

Standard Lapweld Pipe S/C

Per 100 feet.

Below dividing line—price per foot.

Size	Steel Blk.	Steel Galv.	Gen. Wrot. Iron Blk.	Gen. Wrot. Iron Galv.
2 in.	22 20	27 75	31 08	37 00
2½ in.	32 76	41 54	46 80	56 16
3 in.	42 84	54 32	61 20	73 44
3½ in.	50 60	66 24	72 68	89 24
4 in.	59 95	78 48	86 11	105 73
4½ in.	68 58	87 63	1 04	1 24
5 in.	79 92	102 10	1 21	1 45
6 in.	1 04	1 32	1 57	1 88
7 in.	1 38	1 79	2 02	2 45
8L in.	1 45	1 88	2 13	2 58
8 in.	1 67	2 16	2 45	2 97
9 in.	2 04	2 62	2 97	3 59
10L in.	1 89	2 43	2 75	3 33
10 in.	2 43	3 13	3 54	4 28

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4-in. and under 55 per cent.

4½-in. and larger, 45 per cent.

4-in. and under running thread, 35%.

Standard couplings 4-in. and under 25%.

Do., 4½-in. and larger 5 per cent.

MALLEABLE FITTING LIST

1 in. elbow	.32	.53
2 in. elbow	1.05	1.70
1 in. tee	.43	.70
2 in. tee	1.45	2.40
1 in. coupling	.33	.53
1 in. locknut	.15	.23

Discount to dealers—10 per cent.

BOILER TUBES

Size	Lapweld Toronto	Seamless Montreal	Lapweld Montreal
1 in.		19 00	
1¼ in.		23 00	
1½ in.		23 00	
1¾ in.		23 00	
2 in.	18 00	20 00	19 00
2¼ in.	20 00	23 00	21 50
2½ in.	21 50	26 00	22 50
3 in.	27 50	32 00	28 50
3½ in.	30 50	37 00	33 00
4 in.	39 00	47 00	42 00

Prices per 100 ft., Montreal and Toron

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, 7-16 and up	30
Carriage bolts, ⅜ in. and smaller 6 in. and shorter	40
Coach and lag screws	45
Stove bolts	72½
Wrought Washers	60
Do., corru. head	60
Machine bolts, 7-16 and over	35
Machine bolts, ⅜-in. and less	35
Blank bolts	35
Bolt ends	35
Machine screws, fl. and rd. hd., steel cut thread	37½ & 10
Machine screws, o. and fil. hd., steel cut thread	30
Machine screws, o, and fil. hd., brass cut thread	15
Standard couplings, 4-in. and under, brass cut thread	30% 30
Nuts, square, blank off net list	$1.00
Nuts, square, tapped off net list	50c.
Nuts, hex., blank off net list	50c.
Nuts, hex., tapped net list	
Copper rivets and burrs, list less	32c.
Burrs only, list plus	10%
Iron rivets and burrs	47%
Boiler rivets, base ¾ in and larger	$5.75
Structural rivets, as above	5 65
Wood screws, O. & R., bright	80
Wood screws, flat, bright	82½
Wood screws, flat brass	77½
Wood screws, O. & R., brass	75
Wood screws, flat, bronze	72½
Wood screws, O. & R., bronze	70

NAILS AND SPIKES

Wire nails, base	$3 65
Cut nails, base	4 35
Miscellaneous wire nails	72½%

MILLED PRODUCTS

(Prices on unbroken packages)

Set screws	65
Square and hexagon head cap screws	60
Round head cap screws	20
Fillister head cap screws	35
Flat head screws	25
Button head cap screws	20
Studs	45
Semi-finished nuts up to and including 9/16 in.	70
Semi-finished nuts ⅝ to 1¼ in.	65
Semi-finished nuts 1⅜ to 2 in	35
Coupling bolts	35
Taper pins, No. 2 to No 5	65
Taper pin No. 6 and over	10
Planer bolts without fillet	10
Planer bolts with fillet	Net
Patch bolts	Plus 10%
Hollow set screws	20
Thumb screws	50
Thumb nuts	70

CARBON DRILLS AND REAMERS

	Discount.
S. S. drills, wire size	60
Can. carbon cutters	plus 10
Standard drills, all sizes	60
3-fluted drills, plus	10
Jobbers and letter sizes	60
Bit stock	50
Ratchet drills	25
S. S. drills for wood	10
Wood boring brace drills	50
Electricians' bits	30
Sockets	50
Sleeves	30
Taper pin reamers	25
Drills and countersinks	20
Bridge reamers, carbon	50
Centre reamers	Net
Taps, machine screw	50 to 60
Taps, hand, sizes up to 1"	30 to 60
Chucking reamers	20 off
Hand reamers	20
High speed drills, list	40
Can. high speed cutters	plus 10
American	plus 40

FILES AND RASPS

Globe	60/5
Vulcan	50
P. H. and Imperial	60/5
Nicholson	40
Black Diamond	40
Heller	40
Jowitts	net
J. Barton Smith, Eagle	55
McClelland, Globe	50
Delta Files	20
Disston	40
Disston	50
Great Western-American	50
Kearney & Foote, Arcade	60/5

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

PROOF COIL CHAIN

B. B. B. CHAIN

⅜ in., $16.45; 7-16 in., $14.00; ½ in., $12.95; 5-8 in., $13.15; ¾ in., $12.75; ⅞ in., $12.25; 1 in., $11.85; 1⅛ and 1¼ in., $10.55. Fire weld chain same sizes respectively are $14.00; $11.50; $10.40; $10.55; $10.15; $9.75; $9.35; and $8.25.

ELECTRIC WELD COIL CHAIN B.B.B.

⅛ in. $20.00; 3-16 in. $16 50; ¼ in. $15.50; 5-16 in. $12.70.

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	30%
Standard	30 and 10%
Cut leather lacing, No. 1	1.75
Leather in side, (Lacing)	1.50

RUBBER BELTING

Standard 36 28% Best grades 28%

TAPES

Chesterman Metallic, 50 ft.	$5 00
Lufkin Metallic, 603, 50 ft.	3 17
Admiral Steel Tape, 50 ft.	3 00
Admiral Steel Tape, 100 ft.	4 50
Major Jun. Steel Tape, 50 ft.	3 75
Rival Steel Tape, 50 ft.	4 00
Rival Steel Tape, 100 ft.	8 75
Reliable Jun. Steel Tape, 50 ft.	5 25

PLUMBING SUPPLIES

Plumbers' oakum, per cwt.	6 00
Solder, strictly	$0 22½
Solder, guaranteed	0 24
Soldering coppers, lb.	0 62½
White lead, pure, cwt	13 20
Red dry lead, 100-lb. kegs, per cwt.	10 75
Wood alcohol, per gal.	1 75
Whiting, plain, per 100 lbs.	3 00

ROPE AND PACKING

Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope ¾ and larger, base	0 21
British Manila rope	0 19
New Zealand hemp	0 19
Jute packing, fine	15c
Jute packing, coarse	11c

OILS AND COMPOUNDS

Castor Machine Oil, per lb.	34½
Royalite, per gal. bulk	20
Palacine	23
Machine oil, per gal.	39
Black oil, per gal. (Summer)	19
Cylinder oil, Capital	69½
Petroleum fuel oil bbls., net	10.80
Turp., single bbls., gal	1.75
Linseed oil, raw, single bbls.	1.02
Premier galsoline	34
Fuel oil, bbls., gal.	11 80

WASTE

XXX Extra	16	Atlas	18
Peerless	21	X Empire	13
XX Grand	15	Ideal	18
Superior	20	X Press	11½
X L C R	14		

Colored

Lion	12	Fancy	13½
Standard	10½	Popular	9
No. 1	13	Keen	7½

Wool Packing

Arrow	24	Anvil	16
Axle	20		

Washed Wipers

Select White 18 Dark colored. 13
Mixed Colored 14

This list subject to trade discount

PLATING SUPPLIES

Polishing wheels, felt	$3 25
Polishing wheels, bull-neck	1 60
Emerey in kegs, Turkish	7½
Pumice, ground	04½
Emery glue	26
Tripoli composition	08
Crocus composition	12
Emery composition	11
Rouge, silver	60
Rouge, powder, nickel	35

Prices per lb.

ANODES

Nickel	40 to .45
Copper	38 to 22
Zinc	16 to .12½

PLATING CHEMICALS

Acid boracic	.20
Acid, hydrochloric	.03¾
Acid, nitric	.10¼
Acid, sulphuric	.03¾
Ammonia, aqua	.20
Ammonium, Carbonate	.15
Ammonium, chloride	.18
Ammonium, hydrosulphuret	.75
Ammonium, sulphate	.10
Arsenic, white	.18
Copper carbonate, anhy.	.26
Copper, sulphate	.08
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.14
Nickel carbonate	.32
Nickel sulphate	.14
Potassium sulphide (substitute)	.40
Silver chloride (per oz.)	.85
Silver nitrate (per oz.)	.65
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.32
Sodium hyposulphite	.08
Sodium phosphate	.10
Tin chloride	.50
Zinc chloride, C. P.	.30
Zinc sulphate	.06

Prices per lb. unless otherwise stated

News From the Industrial Field

Belleville Chamber of Commerce is putting on a "made-in-Belleville" exhibition, in the Armories, Oct 24 to 28.

James McEwan, an inspector with the John Bertram & Sons Co., Dundas, and who had been an employee of that concern since 1868, is dead.

Belleville.—Patterson Construction Co., this city, have purchased a ¾-yard steam shovel for use in the T. & N. O. Railway contract on which they are working at Fabre, P. Q.

Construction of the new technical school and collegiate institute in Guelph is going forward. It is expected that it will be ready for occupation with the second term of 1923.

William and Edwin Taylor have leased a foundry building in Galt, which they have equipped with wood planer, circular saw and buzz-planer, purchased from Preston Woodworking Machinery Co. They will operate under the name of Taylor Brothers in conjunction with building contractors.

Montreal.—In the year 1921 a total of 1,081 charters were granted new companies commencing operations in Canada, the whole representing a capitalization of $824,000,000. This year, during the first six months, new corporations have approximated $20,000,000 a week, and it would seem as if 1922 was going to create a record in this regard.

Montreal.—A despatch from London says that it is understood that a representative of the North Eastern Marine Engineering Company, Wallsend-on-Tyne, is about to go to Canada with a view to the establishment of a branch factory for the manufacture of marine engineering material in Eastern Canada.

Belleville, Ont.—Marsh Engineering Works have been able to dispose of a fair number of steam hoists, boilers, etc., this season. The firm has not been working to capacity but the sales are practically double what they were in 1921. Business is falling off, as it generally does at this season. Inquiries are coming in freely and prospects for next season are good.

Belleville, Ont.—Wm. Seward, president and manager of the Tiger Tire & Rubber Co., states that the sales of his firm were over half a million dollars for their year ending Sept. 30th. A chain of branches and dealers from Halifax to Vancouver has been completed. Since January 17th last till Sept. 30th a double shift has been employed. The night shift was only off one week when on Oct. 9th it was put on again to assist in overtaking orders. The factory may be enlarged.

Ottawa.—An influx of experienced agriculturists from Holland to Canada is likely, according to J. C. C. Sandberg, who is visiting Ottawa representing the government of Holland, which proposes a scheme of assisted emigration of farmers and agricultural laborers and their families. Sandberg is making a tour of Canada to investigate the possibility of settling the surplus of Dutch farmers.

Vancouver, B. C.—Based on returns from 532 firms, statistics concerning the lumber industry in British Columbia, show that the payroll for the past year amounted to $18,180,962. The average number of wage-earners was about 14,500. During May, June and July the number of men working was approximately 15,400, whereas during December, January and February not more than ten to twelve thousand men were employed.

Montreal.—Three world's records for unloading and loading grain have been broken at the port of Montreal during the last ten days. In one day 1,569,393 bushels of grain were loaded for sea, while 800,000 bushels were unloaded. This gives a total of 2 369,393 bushels moved in one day. Another world's record was broken for speed in unloading a vessel. A steamer arrived in port at 5.30 a. m., was berthed at 7 o'clock, delivery of grain was commenced at 8 o'clock and the vessel put out to sea the same evening with 242,000 bushels of grain in her hold.

Montreal.—Between thirty and forty thousand dollars are spent daily by United States tourists in Montreal, or approximately six million dollars for the six months period from May to October, according to the Secretary of the Automobile Club of Canada. For the province, he further states, the sum would be about $15,000,000, as Quebec and other points attract large numbers. In the principal hotels of Montreal, it is estimated 75 per cent. of the guests this last summer were from the United States.

Belleville, Ont.—Work on the new Coleman ward school is progressing satisfactorily. The local contractors, Thos. Manly and Son, expect to have the structure enclosed before the snow flies. The estimated cost of the building is $109,000. The school is to be equipped with an up-to-date heating and ventilating system. Four electric motors are being installed to drive the ventilating fans. A Keewatin boiler will furnish the steam. The building is of steel and brick construction, with steel sash and other materials that make it as nearly fireproof as possible.

Glace Bay, Nova Scotia.—With all its collieries working, the output of the Dominion Coal Company's mines is rapidly approaching normal. The average output of the mines is 14,000 tons a day, and officials of the company expect to reach this figure in a short time.

Ottawa.—About thirty-four per cent. of the automobiles now being used in India are made in Canada, according to a report from H. A Chisholm. Owing to the British preferential tariff Canada is rapidly becoming the centre for the export of motor vehicles, and each year sees new companies from the United States establishing plants in Canada to take care of their export business.

Edmonton.—Coal production in the Drumheller fields has amounted to 6,825 tons daily and will shortly be increased to between 8,000 and 9,000 tons. All the coal camps in Alberta and Eastern British Columbia are now working, and much of the product is being shipped to Saskatchewan and Manitoba. It is expected ample coal will be mined to meet all the requirements of Western Canada. The longest distance that Alberta coal has been shipped was recorded here when a local colliery forwarded a carload of egg coal to Levis, Que.

Toronto.—Gold production in Ontario for the first half of 1922 shows a marked increase over a similar period last year, and gives promise of an output exceeding $20,000,000 for the full year, as compared with $14,624,085 in 1921, according to returns received by the Ontario Department of Mines. Silver production also shows a corresponding increase over the corresponding period in 1920. The northern camps are becoming an important market for mining machinery and other heavy mill equipment.

Ottawa.—The preliminary estimate of the Bureau of Statistics of the total wheat yield of Canada for 1922 is 388,733,000 including fall and spring wheat, from 22,630,900 acres, or 17.25 bushels per acre, as against the 1921 estimate of 300,858,100 bushels from 23,261,224 acres, or 13.10 bushels per acre. Other grain yields for the whole of Canada, with last year's figures in brackets, are as follows: oats 558,358,000 (426,232 900) barley 76,395.500 (59,709,100); rye 49,601,800 (21,455,260); flaxseed 5,296,000 (4,111,800). The figures for 1922 represent the following forecast of total yields in bushels or tons: peas 2.945.000; beans 976 000; buckwheat 7,825,000; mixed grain 30,255.000; corn for husking 14,909.000; potatoes 102,686,000; turnips, etc., 80,796,000; fodder corn 5,635,000 tons; sugar beets 246 000 tons.

It's the Service that Counts
We carry the largest stock in Canada of new and re-manufactured machinery and supplies. This, combined with our long experience and our intimate connections with manufacturers in Canada, United States and Great Britain, enables us to offer you a service that is unique. No matter what you need in machinery, we either have it or will get it for you quickly at an advantageous price.
Our regular monthly machinery list is full of bargains? Shall we put you on our mailing list?
The A. R. Williams Machinery Co. Ltd.
64 Front St. W., Toronto
HALIFAX ST. JOHN MONTREAL WINNIPEG VANCOUVER
If its Machinery-Write "Williams"

Railway shopmen at Montreal have re-opened their wage issue with Canadian roads.

Acheson Graphite Co., Niagara Falls, Ont., are increasing the capacity of their plant to take care of enlarged export business. They are now replacing a 700 K. W. tranformer with one of 2,000 K. W. capacity.

Ford Motor Co., of Canada had net earnings of over five millions last year, equal to 71½ per cent. on the seven millions of stock outstanding. The company produced 45,000 cars and 1,192 tractors in the year which compares with 46.832 cars and 3.062 tractors in the preceding year. Receipts from sales were $8,563,219 below 1921, due largely to lower selling prices.

Belleville.—A. W. Robertson Co., have purchased the interests of the Quinlan Robertson Co., Montreal, in Huntington Township, fifteen miles north of Belleville, consisting of several hundred acres of pure lacustrine gravel. A railway siding is being built to the hill and workmen's cottages built. A dam is being thrown across a nearby stream from which it is proposed to develop power. Gravel handling appliances are being installed.

Guelph has a notable instance of family concentration in industry. The Callander foundry is operated by Alex. Callander, and his five sons, Malcolm, David, H. D., W. L., J. S., and E. J. Siefred. They report that business has been fairly good during the past Summer, particularly on good work for the building industry

Belleville, Ont.—F. B. Foley, manager of the Fruit Machinery Co., states that his firm has had a particularly successful season in their regular line of fruit and canning machinery. The contract work offering has been small and not of an attractive nature. The company expects to declare its regular dividend of ten per cent.

Quebec, Que.—There has been considerable activity in the pulp and paper industry in Canada lately. Michigan interests are negotiating with Kingston, Ont., with the view of building there a pulp and paper mill. The Premier Paper and Power Co., of Hartville, N. S., is about to instal a standard newsprint machine with a capacity of 15,000 tons a year. The average daily production of the Abitibi Power and Paper Co.'s plant during August was 462 tons, and on the 29th of the month it reached as high as 494 tons. The groundwood pulp mill of the Backus Brooks Company, near Kenora, Ont., is also well under way. Work has started on the new 13,000,000 plant of the Wigwam Pulp and Paper Company, at Elko, British Columbia.

Belleville Hardware and Lock Mfg. Co. state that the past season has been the best one in building trades for several years. Most jobbers allowed their stocks to get very low, and early in the year buying commenced. It has continued right up to the present time. Indications at this time are that 1923 will see even better records. Jobbers already are arranging for stocks to meet business expected to develop early in 1923.

Belleville.—F. A. Daniels, manager of the foundry of the National Castings Ltd., states that their new Moore rapid electromelt electric furnace of 500 pounds capacity, made by the Pittsburg Electric Furnace Co., has been delayed in transit, and it will be about two weeks before same is installed. This furnace will melt 1,400 pounds at one heat and can take off a heat every seventy-five minutes after it has been warmed up.

That Scotch and English pig iron, during the recent coal and rail strikes, was shipped into Western Ontario from Montreal at advantageous rates, is evident from quotations received by many of the foundries. One Guelph concern reports a price of $36.50, Guelph, for English pig, while another plant had an offer of Scotch pig iron at $37.75. This was the Guelph figure quoted by a Montreal firm at a time when the nominal Toronto price on domestic pig iron was $37.75.

Calgary Riverside Iron Works will establish branch works at Blairmore, Alta.

Vancouver, B. C.—Seaman Paper Mill Company of Chicago is planning to erect a large pulp and paper plant here. Power will be secured from Bridge River.

Bell Telephone Co.'s new East End exchange in Toronto will cost $175,000. P. H. Secord & Son Construction Co., Brantford, have the contract, which calls for completion in five months.

Fort William.—The new paper mill under construction at the Mission is ready for installation of machinery. It is expected that the plant will be ready for manufacturing by the first of the new year.

Waterville, N. S.—A pre-cooling plant of unique design is being installed in connection with the fruit storage warehouse by the Department of Agriculture. It consists of an ice tank with capacity of three tons, air ducts, gasoline engine and large insulated fan with capacity of 4,000 feet per minute. Air is forced through the ice tank in such a way as to ensure continuous circulation and even temperature.

Kingston.—With the opening of the locomotive works, there is ground for hope that orders for new locomotives are not improbable. It is pointed out that the Canadian railways are much in the position of the American railways—that is, that they have not been buying locomotives for some years and that they must therefore be in greater need of the new motive power than ever. Striking evidence of this, on the American side, is found in the announcement that the Baldwin Locomotive Co. has just secured some new large orders while the American Locomotive Co. has now orders on hand to the total value of $50,000,000. Hence the confident feeling that the "lightning will strike" in Canada also and that the railway companies will soon put in substantial orders for new locomotives.

Belleville.—Local officials of the Grand Trunk yard announce that some interesting tests have recently been made near Brockville. What is believed to be the heaviest train ever hauled over the grade just east of Brockville was taken out on Oct. 4th. The tests were made by the dynamo meter car of the eastern lines. The Mikado type locomotive No. 579 hauled 78 cars, 75 of them loaded with grain and heavy freight, over this grade, the total load being 5,054 tons. A further test was made on the 5th inst. when locomotive No. 685 of the superheated type, hauled 57 loaded cars and three empties over this grade, the total load aggregating 3,998 tons. These tests being conducted by the dynamo meter car are considered most satisfactory. The tests are for the purpose of ascertaining the draw-bar pull and at the same time registering the speed at which the train is travelling. Longer trains have been hauled over the grade but in the opinion of railroad men none of greater tonnage.

SIR HENRY THORNTON NEW HEAD OF C. N. R.

Major-General Sir Henry W. Thornton, K. B. E., is to head Canada's National Railway Board. For eight years he has been general manager of the Great Eastern Railway of England. He is a naturalized Britisher and a native of the United States. His salary is to be $50,000 a year. There is no doubt that a successful executive for the post will be worth such a salary.

SIR HENRY WORTH THORNTON
New Head of Canadian National Railways.

As to the board named to assist him, one hope will immediately stand out, and that is that the board was picked for something else than satisfying all parts of the country geographically. Two vice-presidents are to be picked from the present operatives of the roads and W. D. Robb and Mr. Hungerford are likely to be the ones chosen by the board.

Richard P. Gough, vice-president of the Sellers-Gough Company, furriers, Toronto.

Ernest R. Decary, notary and ex-president of the Montreal Civic Commission.

James Stewart, Winnipeg, prominent grain dealer, and ex-chairman of the Canada Wheat Board of 1919.

John H. Sinclair, K. C., of New Glasgow, N. S., who sat in the House of Commons for a number of years as Liberal member, first for Guysboro and subsequently for Antigonish and Guysboro, N. S.

Frederick G. Dawson, of Prince Rupert, B. C., wholesale grocer.

Tom Moore, president of the Trades and Labor Congress of Canada, as representative of labor.

Graham A. Bell, Deputy Minister of Railways and Canals, representing the Dominion Government, and

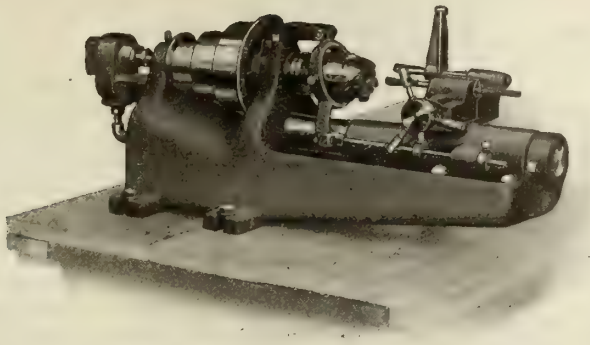
Gerard G. Ruel, who has been general counsel of the Canadian Northern Railway and is to be general counsel for the whole Canadian National System.

MARKET FOR CANADIAN EDGE TOOLS

That Canadian manufacturers of edge tools able to meet competition in the Dominion ought to be able to establish a trade in Argentine Republic is the report of B. S. Webb, trade commissioner. He states that this is proved by the fact that Canadian made picks, forks, hammers, shovels, and axes have been sold there, some of them without interruption, for the past ten years. One Canadian factory has sold edge tools there, year in year out, to the value of $50,000 per annum, the line comprising hammers, axes, picks, and rolled forks. That the trade will be finally profitable is reasonably sure, but it cannot be expected to prove lucrative at the commencement. A glance at the list of foreign manufacturers whose local representatives are and have been for many years actively canvassing the trade will be sufficient to suggest that the competition to be met is decidedly keen, and a feature of the market which must constantly be borne in mind is the fact that consumers there attach exceptional importance to the question of a trade mark, making it a long and uphill task to place an unknown make of tools on the market in the face of the competition to be met from the manufacturers whose trade marks are already well known amongst consumers. Importers as a class are not at all interested in pushing an unknown mark as, rightly or wrongly, they consider their mission is to supply the trade with the goods it asks for. The importer himself may admit that a certain article is of superior quality and cheaper than another for which a demand exists, but will still maintain the attitude that it is easier to give the customer what he asks for than to educate him up to the recognition of the merits of an unknown article. On the other hand, once a make of tools is well placed on the market, steady trade will result, but from the foregoing it is quite clear that tools cannot be sold there in a desultory manner: the manufacturer makes exceptional efforts to get his goods on the market and he either definitely succeeds or definitely fails, there being no half measure. Quotations should always be in Canadian money.

Comparison of the trade of Australia with that of Canada during the past two fiscal years shows that in 1920-21, Canada's trade was $2,450,587,001; Australia's, $1,434 945,282. In 1921-22, Canada's trade was $1,501,731 341; Australia's, $1,113,003,743—a very material falling off in the past year.

With the exception of his eyes, a workman's hands are his most valuable possessions. Stopping a machine before cleaning it, and using a brush or stick for removing accumulated waste material, will greatly help to reduce the number of accidents to hands and fingers.



Geometric Bench Threading Machine

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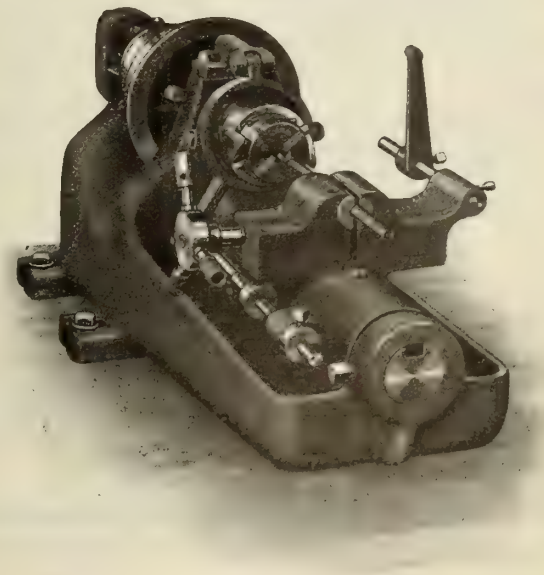
Sturdy
Complete

Right in the Lead

ANOTHER GEOMETRIC LEADER

Brings Down Production Costs

The Geometric Bench Threading Machine is a wonder on small threaded work. It weighs but 90 pounds and takes bench space of only 9½″ x 29 inches. The 5-16″ Geometric Rotary Die Head with which the machine is fitted cuts threads of standard and finer pitch on diameters of 1-16″ to 5-16″ inclusive. The machine is arranged for bolting to a bench, or it may be mounted on a separate pedestal for floor use.



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NEW HAVEN **CONNECTICUT**

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SIMONDS
HACK SAW
BLADES

Hack Saw Machines equipped with Simonds Blades produce more work at a minimum of expense. These blades cut rapidly, hold their cutting edge longer and do not shell teeth.

They are made of special steel and heat treated by an exclusively Simonds method to bring out the utmost in cutting efficiency and lasting qualities.

Write for catalog and prices.

SIMONDS
Canada Saw Co.
LIMITED
"The Saw Makers"
MONTREAL - QUEBEC

St. John, N.B. Vancouver, B.C.

Dent's-Griffiths, makers of fine silk gloves, have started operations with 50 hands in their new plant, St. Catharines.

In the Made-in-Belleville exhibition which will be opened by the Lieutenant-Governor, Oct. 24, some seventy firms will be represented. Those engaged in iron and steel or allied industries are: National Castings, castings and metal goods; Belleville Electric and Stampings, electric appliances; Steel Company of Canada, horseshoes and iron and steel products; Marsh Engineering Works, hoists, boilers and special machinery; Weed Harvester Co., harvesting machinery; Belleville Sash and Door Co., wood products; Brown, Sword & Co., wood products; American Optical Co., spectacles and optical goods; Bassick Optical Co., Alenite lubrication system, furniture, hardware and auto accessories; International Burr Co., metal burrs; Asbestos Pulp Co., talc and talcum powder; Belleville Hardware and Lock Co., locks and builders' hardware; Canada Cement Co., cement and cement products; Elliott Woodworking Machine Co., woodworking machines, electric washers, school desks; The Greenleaf Co., castings, ironware and other products; Quinte Battery Service Co., storage batteries and ignition systems; Consolidated Distilleries, industrial alcohol and other products; G. T. R. shops, locomotive models, drawings and parts of engines; Springer Lock Mfg. Co., locks and builders' hardware; Tiger Tire Co., tires, tubes and rubber goods.

One of the most common as well as serious evils of lighting installations is glare. Any brightness, whether from a light-source or from reflected light within the field of vision, and of such a character as to cause annoyance, discomfort, interference with vision, or eye fatigue, is glare.

"Maple Leaf"
BRAND
Stitched Cotton Duck Belting

More Power
At Less Cost

This is possible if you use ONLY "Maple Leaf" stitched cotton duck belting. It has a positive gripping surface which hugs the pulley. Costs less than leather, rubber or balata.
Once you use "Maple Leaf" belting you specify it always for it is the NO TROUBLE belting which helps production. Write us for samples.

Dominion Belting Co. Ltd.
Hamilton, Canada
Quebec Branch: 51 Duluth Bldg., Montreal

GENERAL BUSINESS IMPROVES SLOWLY

"That business is on the up-grade," seems to be the general consensus of opinion among leading manufacturers in Galt. A few firms report no improvement during the last two months, but these are in the minority, and are making lines which cannot help but be slow to pick up. For example, L. W. Smith, manager of the Greenfield Tap & Die Corporation, told Canadian Machinery that business is much improved in their lines, and that on one particular article alone, they are about two months behind on delivery. Enquiries are better, and from present outlook, October should show quite a bit of improvement over September. As last month was ahead of August, the improvement seems to be sure and steady.

Mr. Jansen, of the Galt Machine Screw Company, also states that September was a better month for them than August. He describes the improvement as slight but steady, and says that the demand is of a general nature, no one line being affected more than another.

Mr. Elliott, of Elliott and Whitehall, says that the small orders are better, but on large work, conditions are still somewhat quiet. He expects, however, that October will show a decided improvement over September. When commenting upon enquiries he mentioned that the best way to get business was not to sit down and wait for enquiries, but to go out and hustle for the orders.

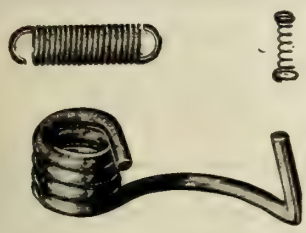
J. H. Cowan, secretary-treasurer of the Cowan Co., and W. L. Cowan, plant superintendent of the same firm, told Canadian Machinery that following the Toronto Exhibition, business picked up slightly, and has been improving slowly but steadily since then. Both these gentlemen do not look for any sensational improvement, but hope that the present upward trend will continue.

A HUNDRED-INCH SLIDE RULE

Every engineer is reputed to carry a slide rule and to use it a hundred times a day for every conceivable kind of calculation. The ordinary pocket slide rule is, however, not accurate except within rather wide limits; and when a finer margin of error is desired it is necessary to employ a rule of larger dimensions. A British firm has recently brought out a slide rule in which the scale is 100in. long and can therefore be relied upon to yield results in multiplication and division with an error of less than one in one thousand. The scale is arranged in twenty parallel lines, each about five inches long; and the whole thing is arranged so that the rule can be operated with one hand while the other holds the pen for recording results.

PRECISION SPRINGS

SPECIAL TORSION AND SMALL WIRE SPRINGS



THE WALLACE BARNES CO. LIMITED
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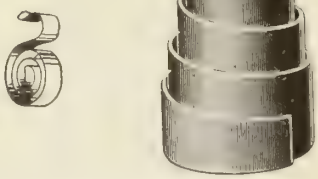
BARNES CANADIAN SPRINGS
STEEL
HAMILTON, ONTARIO
CANADA

FLAT AND FLAT COIL SPRINGS OF ALL DESCRIPTIONS

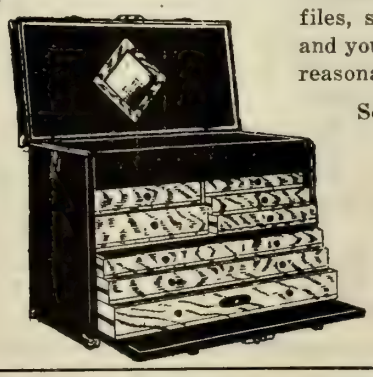


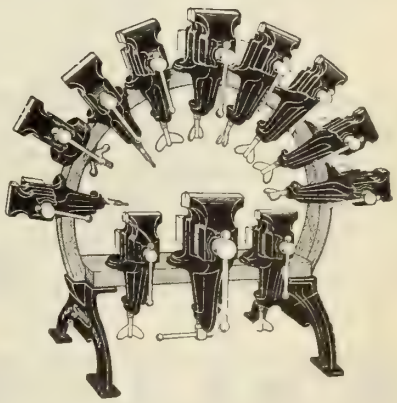
'RICE LEWIS' NEWS

Machine Shop Supplies

When in need of Machine Shop Supplies of any nature we can serve you. You will find us well stocked with high-grade tools, only those with an established reputation being carried. We have a full line of calipers, vises, wrenches, tool boxes, hack saws, files, scales, steel tapes, etc., etc., and you will always find our prices reasonable.

Send us your enquiries.





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HANNA

—the name of a service supplying approximately 1,000,000 tons of pig iron annually in all required grades to the merchant iron trade.

M.A. HANNA & CO.

Buffalo Cleveland Cincinnati
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New York
Toronto

If what you need is not advertised, consult our Buyers' Directory and write advertisers listed under proper heading.

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Two cents a word, including "Canadian Machinery" box numbers; minimum charge is $1.00 per insertion for 50 words or less, set in 6-pt. type. Each figure counts as a word. Display ads., or ads. set in border, are at the card rates.

PATENTS

THE OLD ESTABLISHED FIRM. PATENTS everywhere. Head Office, Royal Bank Bldg., Toronto. Ottawa Office, 5 Elgin St. Offices throughout Canada.—Booklet free.
FETHERSTONHAUGH & CO.

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We have a complete Belknap Equipment for sale. This equipment is still in use in our Subscription Department and is in excellent working order. We have placed an attractive price on this outfit, and would advise manufacturers or merchants having a mailing list to let us tell you how it will save you money. We will give a guarantee as to the proper working condition of this equipment.

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"OVENS"

Japanning and Varnishing Ovens heated by Gas, Electricity, Steam or Coal, Kernchen and Apex Siphonage Ventilators, Bakers' Ovens, trucks, casters, etc. Write for Booklet.

BRANTFORD OVEN & RACK CO.
Brantford, Canada

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Air Pressure Tanks, Air Receivers, Steel Plate Tanks, Pneumatic Tanks, Tote Boxes, Shop Barrels, Steel Factory Equipment, Smoke Stacks, Gasoline Tanks.
Write For New Catalogue

THE STEEL TROUGH & MACHINE CO. LTD.
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Or General Foreman open for engagement. Ten years' executive experience. Efficient and up-to-date methods used (under local conditions) to get quality and quantity production. For further information and references, etc., Apply to
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We make a complete line of Bench and Floor Grinding Machines, equipped with Patented Adjustable Guards and Tool Rests, and Special Mounting Means. We also design and manufacture special machinery for any purpose. Let us have your enquiries.

SUMBLING MACHINERY Company Ltd.
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Light and Medium-Bench and Floor Repetition Castings; Capacity 15 tons per day.
Expert Metal and Wood Pattern Work. Our advice and estimates will save you money.
Semi-finishing operations on Lathe or Grill on Castings supplied if required.
ASK US.
THE KATIE FOUNDRY, GALT, ONT.

WELDING APPARATUS

We have just taken over the Smith Invention's complete line of Welding and Cutting apparatus with a full line of miscellaneous welding supplies.

Write us for full particulars.
THE ACME WELDING CO.,
118 McNab St. N., Hamilton, Canada.

WANTED

SCRAP ENDS
STEEL PLATES 9, 10, 11 Gauge

Carloads or less. Suitable for making Iron Washers.

The Graham Nail Works
Toronto

PATTERNS

TORONTO PATTERN WORKS, 65 JARVIS Street, Toronto. Patterns in wood and metal for all kinds of machinery. (ctfm)

BRANTFORD PATTERN WORKS ARE PREpared to make up patterns of any kind—including marine works—to sketches, blue prints or sample castings. Prompt, efficient service. Bell 'Phone 631; Machine 'Phone 733. Brantford Pattern Works, 49 George St., Brantford, Ont. (ctfm)

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MANAGER OF FOUNDRY MACHINE SHOPS desires a larger opportunity. Age 45. Can personally run office, foundry and machines. Practical training as draughtsman, pattern maker and machinist. Can handle iron, brass and aluminum. References the best. Box 816. Canadian Machinery.

FOREMAN WANTED

WANTED — FOREMAN FOR PLATE SHOP equipped with Hydraulic Machines, employing 30 men, Winnipeg. Apply Box No. 814.

PATENT NOTICE

TO ALL WHOM IT MAY CONCERN:
Be it known that CHARLES PRACHE, of Paris, France, is willing to license any Canadian manufacturers under his Canadian Patent No. 203,025, for EVAPORATOR.
Further information may be had by applying direct to me, or to Messrs. Marion & Marion, 364, University Street, Montreal.

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BERTRAMS LIMITED
SCIENNES EDINBURGH

VICTORIA Special Machinery
DESIGNS PATTERNS
CASTINGS FORGINGS
Send for Catalogue
Victoria Foundry Co., Limited, Ottawa, Canada

"CUSHMAN" CHUCKS 1862
Building *for the Future*
On the Experience of the Past
THE CUSHMAN CHUCK CO.

The "Incomparable"
That New Steel Chuck
Style 214
HARTFORD, CONN., U.S.A.

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UNIVERSAL GRINDING MACHINES
THE THOMPSON GRINDER CO.
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OF QUALITY SINCE 1873.
SMITH'S FALLS MALLEABLE CASTINGS LTD
SMITH'S FALLS, ONTARIO.

Where To Buy Your CASTINGS

The Brown-Boggs Co., Limited
HAMILTON, ONT.
Grey Iron.

Fisher Motor Co., Limited.
ORILLIA, ONT.
Die Castings.

Sully Brass Foundry, Limited
618 Brock Ave., TORONTO, ONT.
Brass, Bronze, Copper and Aluminum.

Canadian Rumley Co., Limited
Queen West and Abell Streets,
TORONTO, ONT.
Grey Iron.

Galt Malleable Iron Co., Ltd.
GALT, ONT.
Malleable.

S. Vessot & Company
JOLIETTE, QUE.,
Grey Iron, Brass and Aluminum.

Miller Bros. & Sons, Limited,
120 Dalhousie St., MONTREAL.
Grey Iron, Semi-Steel Castings up to 10 tons.

Can. Mead-Morrison Co., Ltd.,
MONTREAL, P.Q. WELLAND, ONT.
Grey Iron Machinery Castings.

Hugh Park Foundry Co., Ltd.,
OSHAWA, ONT.
Grey Iron, Patterns, Etc.

Hull Iron & Steel Foundries Ltd.
HULL, CANADA.
Steel, Manganese, Chrome.

John T. Hepburn, Limited
TORONTO, ONT.
Grey Iron.

Imperial Foundry Company
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Phone Junc. 7935.
Grey Iron Castings.

Can. Hanson & VanWinkle Co.
LIMITED
TORONTO, ONT.
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Tallman Brass & Metal, Ltd.
HAMILTON, CANADA
Brass, Bronze, Manganese Bronze, Aluminum.

Dom. Foundries & Steel, Ltd.
HAMILTON, CANADA.
Steel Castings all sizes.

Manitoba Steel Foundries, Ltd.
Office Winnipeg. Works Selkirk, Man.
Steel Castings up to 5,000 lbs.

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BRANTFORD, ONT.
Aluminum, Brass, Bronze, Specialty.

The Katie Foundry
GALT, ONT.
Grey Iron, Semi-Steel, Brass, Aluminum.

William Kennedy & Sons, Ltd.
OWEN SOUND, ONT.
Steel, Malleable and Heavy Grey Iron.
See Advertisement Page 7

Machinery & Foundries, Ltd.
BROCKVILLE, ONT.
Light and Medium Grey Iron.

A. F. McCulloch
OSHAWA, ONT.
Brass, Alum. Castings—Wood, Metal Patterns.

Corbet Foundry & Machine Co. Ltd.
OWEN SOUND, ONT.
Grey Iron, Brass.

Fittings Limited,
OSHAWA, ONT.
Malleable, Grey Iron, Brass, Aluminum.

W. W. Wells
370 Victoria Street, TORONTO, ONT.
Nickel and Monel Metal.

The Robert Mitchell Co., Ltd.
64 Belair Ave., MONTREAL.
Light Grey Iron.

Canadian Steel Foundries, Ltd.
MONTREAL, QUE.
Steel and Ferro-Alloy.

Langley & Austin,
GALT, ONT.
Copper, Bronze, Brass and Aluminum.

Maxwells, Limited
ST. MARYS, ONT.
Light Grey Iron, Tinning same a specialty.

The Eureka Planter Co., Ltd.,
WOODSTOCK, ONT.
Specialty Light Grey Iron.

Lindsay Foundry and Pattern Works, Limited
Victoria Avenue. LINDSAY. ONT.
Grey Iron and Semi-Steel to 75 tons.

Dominion Engineering Works, Limited
MONTREAL, QUE.
Grey Iron and Semi-Steel to 75 tons.

Smith's Falls Malleable Castings, Limited
SMITH'S FALLS, ONT.
Malleable.

Aluminum Last & Metal Co.,
KITCHENER, ONT.
Aluminum, Brass, Bronze and Special Alloys.

International Malleable Iron Company, Limited
GUELPH, ONT.
Malleable.

Getting The Business
You Can Do Likewise
A Few Panels For Sale
APPLY
Canadian Machinery & Mfg. News
143 University Avenue,
TORONTO, CAN.

BRANTFORD BRASS FOUNDRY COMPANY
BRANTFORD, ONTARIO

June 27th., 1922.

The MacLean Publishing Co., Limited.
Toronto, Ont.

Gentlemen;-

We wish to inform you that we have had quite satisfactory results from our advertisement in Canadian Machinery and Manufacturing News, which runs under the classified heading " Where to Buy your Castings ".

Yours Truly,
Brantford Brass Foundry Company.
per David Abbott

If what you need is not advertised, consult our Buyers' Directory and write advertisers listed under proper heading.

Canadian Machinery BUYERS DIRECTORY

If what you want is not here, write us, and we will tell you where to get it. Let us suggest that you consult also the advertisers' index— last page of book, after having secured advertisers' names from this directory. The information you desire may be found in the advertising pages. This department is maintained for the benefit and convenience of our readers. The insertion of our advertisers' names undr proper headings is gladly undertaken, but does not become part of an advertising contract.

ABRASIVE DISCS
Lion Grinding Wheels, Limited, Montreal, Que.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John, London, S.E., Eng.

ABRASIVE MATERIALS
Lion Grinding Wheels, Limited, Montreal, Que.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John, London, S.E., Eng.

ACETYLENE, DISSOLVED
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Toronto.
Liquide Air Company, Toronto.

AIR DRILLS,
Independent Pneumatic Tool Co., Chicago, Ill.

AIR HAMMERS,
Independent Pneumatic Tool Co., Chicago, Ill.

AIR HOISTS,
Independent Pneumatic Tool Co., Chicago, Ill.

AIR HOSE
Independent Pneumatic Tool Co., Chicago, Ill.

AIR COUPLINGS
Independent Pneumatic Tool Co., Chicago, Ill.

AIR TOOLS
Independent Pneumatic Tool Co., Chicago, Ill.

ANCHOR BELTS
Steel Co. of Can. Ltd., Hamilton, Ont

ANGLE BARS
Steel Co. of Can. Ltd., Hamilton, Ont.

ANVILS
Aikins & Co., Inc., E.C., Indianapolis, I.
Petrie, Ltd., H. W., Toronto, Ont.

ANCHOR BOLTS
Steel Co. of Can., Ltd., Hamilton, Ont.

ANGULAR HOLE DRILLING TOOL
Globe Engineering Co., Ltd., Hamilton, Ont.

ARBORS
Atkins & Co., Inc., E. C., Indianapolis,
Brown & Sharpe Mfg.Co., Providence,R.I.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.

BELLS, BRASS, BRONZE and STEEL
Canada Foundries & Forgings Co., Welland, Ont.
Canadian SKF Co., Toronto, Ont.

BARS, BORING
Armstrong Bros. Tool Co., Chicago, Ill.
Bertram & Son Co., td., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

BARS, BORING, PORTABLE
Underwood Corp., H. B., Philadelphia.

BARS, STEEL
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
British Empire Steel Corporation, Montreal, Que.

BEARINGS, BALL
Canadian SKF Co., Toronto, Ont.

BEARINGS, ROLLER
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

BELT CEMENT
D. K. McLaren, Limited, Montreal,
McLaren Belting Co., J. C., Montreal, Que.

BELT DRESSINGS AND FILLERS
Dom. Belting Co., Ltd., Hamilton, Ont.
D. K. McLaren, Limited, Montreal,

BELT FASTENERS
Bristol Company, Waterbury, Conn.
D. K. McLaren, Limited, Montreal,
McLaren Belting Co., J.C., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

BELT HOOKS
Bristol Co., Waterbury, Conn.
D. K. McLaren, Limited, Montreal,

BELT LACING
Bristol Company, Waterbury, Conn.
D. K. McLaren, Limited, Montreal,
McLaren Belting Co., J. C., Montreal,

BELT LACING, STEEL
Bristol Company, Waterbury, Conn.

BELT LACING MACHINES
D. K. McLaren, Limited, Montreal,
McLaren Belting Co., J. C., Montreal, Que.
Petrie, Ltd., H. W., Toronto. Ont.

BELTING, CHAIN
Can. Link-Belt Co., Toronto, Ont.
Fittings, Limited, Oshawa, Ont.
Jones & Glassco, Montreal, Que.
Renold (Hans) of Canada, Ltd., Montreal, Que.

BELTING, FABRIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Dom. Belting Co., Ltd., Hamilton, Ont.
D. K. McLaren, Limited, Montreal,
McLaren Belting Co., J. C., Montreal, Que.

BELTING, LEATHER
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Can. Fairbanks-Morse Ltd., Montreal, Q.
D. K. McLaren, Limited, Montreal,
McLaren Belting Co., J. C., Montreal, Que.
Smith Belting Co., Toronto, Ont.

BOLTS AND NUTS
British Empire Steel Corporation, Montreal, Que.
Fittings, Limited, Oshawa, Ont.
National Acme Co., Montreal, Que
Petrie, Ltd., H. W., Toronto, Ont

BOLT THREADING DIE HEADS
Landis Machine Co., Inc., Waynesboro, Pa.

BOLTS, TRACK
Steel Co. of Canada, Ltd., Hamilton, Ont.

BORING and TURNING MILLS, Vertical
Bertram & Sons Co., Ltd., The John Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

BORING, DRILLING and MILLING MACHINES, Horizontal.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
Herbert, Limited, Alfred, Toronto, Ont.
Landis Tool Co., Waynesboro, Pa.
Vertical
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
McDougall Co., Ltd., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont
Rockford Drilling Machine Co., Rockford,

BORING TOOLS
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.

CASTINGS, ALUMINUM, BRASS, BRONZE, COPPER, DIE-MOLDED, FERRO-ALLOY, IRON, SEMI-STEEL, STEEL.
See "Where to buy your castings" Section. Page number may be found by turning to Advertisers' Index.

CHAINS, DRIVING
Can. Link-Belt Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont
Jones & Glassco, Montreal, Que.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

CHASERS
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, a.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CHUCKING MACHINES
Acme Machine Tool Co., Cincinnati, O
Brown & Sharpe Mfg. Co., Providence, R. I.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

CHUCKS, DRILL AND TAP
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canadian SKF Co., Toronto, Ont.
Cushman Chuck Co., Hartford, Conn
Geometric Tool Co., New Haven, Conn.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg., New Britain, Conn.

CHUCKS, LATHE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Cushman Chuck Co., Hartford, Conn.
Geometric Tool Co., New Haven, Conn.
Gisholt Machine Co., Madison, Wis.
Herbert, Limited, Alfred, Toronto, Ont.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pryibil Machine Co., New York, N.Y.
Skinner Chuck Co., New Britain, Conn
Union Mfg. Co., New Britain, Conn.

CHUCKS, MAGNETIC
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CHUCKS, PLANER
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cushman Chuck Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

CHUCKS, TAPPING
William L. Procunier, Chicago, Ill.

CHUCKS, VERTICAL BORING MILL
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

CLAMPS, MACHINISTS'
Brown & Sharpe Mfg. Co., Providence,
Starrett Co., L. S., Athol, Mass.

CLEANERS, METAL, WASTE, GENERAL
Oakley Chemical Co., New York, N. Y.

CLOCKS
Chicago Watchman's Clock Co., Chicago.
Hardinge Bros., Limited, Toronto, Ont.

CLOCKS, TIME
Gisholt Machine Co., Madison, Wis.

CLOCKS, WATCHMEN'S
Chicago Watchman's Clock Co., Chicago, Ill.
Hardinge Bros., Limited, Toronto, Ont.

For list of Dealers see the last page of This Buyers Directory

BELTS, ABRASIVE
Oakey & Sons, Ltd., John, London, S.E., Eng.

BENDING MACHINES, POWER
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bertrams Ltd., Edinburgh, Scotland.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

BILLETS, BLOOMS and SLABS
Steel Co., of Can. Ltd., Hamilton, Ont.

BLAST GATES
Rockwell & Co., W. S., New York, N.Y.

BLOCKS
Wright Mfg. Co., Lisbon, Ohio.

BLOCKS, CHAIN (See Hoists, Hand)
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

BLOCKS, DIE
Canada Foundries & Forgings Co., Welland, Ont.

BLOCKS, PILLOW
Can. Link-Belt Co., Toronto, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

BLOWERS
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

BOLT AND NUT MACHINERY
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Montreal, Que.

BOLT AND NUT MACHINERY, Automatic
National Acme Co., Cleveland, Ohio.

BUCKET CARRIERS, Pivoted
Can. Link-Belt Co., Toronto, Ont.

BUFFERS
Pryibil Machine Co., New York, N.Y.

BUFFING OR POLISHING MACHINES (See Polishing and Buffing Machines)
Blount Co., J. G., Everett, Mass.
Herbert, Limited, Alfred, Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pryibil Machine Co., New York, N.Y.
U. S. Electrical Tool Co., Cincinnati, O.

BUILDING MATERIALS
Bertram & Son Co., Ltd., The John Dundas, Ont.

BURNERS, OIL AND GAS
Rockwell Co., W.S., New York City.

BURRS
Steel Co. of Can. Ltd., Hamilton, Ont.

BRUSHES, AIR
Spray Engineering Co., Boston, Mass.

CABINETS, OIL
S. F. Bowser & Co., Ltd., Toronto, Ont

CALIPERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Starrett Co., L. S., Athol, Mass.

CAMS
Canada Foundries & Forgings Co., Welland, Ont.

CAN-MAKING MACHINERY
(See Sheet Metal Working Machinery)
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Bliss Co., E. W., Brooklyn, N. Y.
Smooth Mfg. Co., Jersey City, N. J.

CEMENTS, IRON CENTERING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.

CHAINS (See Sprockets and Chains)
Reynold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

CARD CLOTHING
D. K. McLaren, Limited, Montreal,

BUYERS' DIRECTORY

CLUTCHES, FRICTION
Can.-Link-Belt Co., Toronto, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.

COAL AND ASH HANDLING MACHINERY
Can.-Link Belt Co., Toronto, Ont.
Roelofson Elevator Works, Galt, Ont.

COAL-STORAGE SYSTEMS
Can. Link-Belt Co., Toronto, Ont.

COLLARS, SHAFT OR SET
Canada Foundries & Forgings Co., Welland, Ont.
Can. Link-Belt Co., Toronto, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

COLLETS
Butterfield & Co., Inc., Rock Island, Que.
Geometric Tool Co., New Haven, Conn.
Hardinge Bros., Inc., Chicago, Ill.
Hendley Machine Co., Torrington Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

COMPOUNDS, CLEANING
Oakley Chemical Co., New York, N.Y.

COMPOUNDS—CUTTING, DRILLING, GRINDING, SCREW CUTTING
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Oakley Chemical Co., New York, N.Y.

COMPRESSORS, AIR AND GAS
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.
Spray Engineering Co., Boston, Mass.

CONES, FRICTION
Norton Co., of Can. Ltd., Hamilton, Ont.

CONNECTING RODS AND STRAPS
Canada Foundries & Forgings Co., Welland, Ont.

CONTRACT WORK
Victoria Foundry Co., Ltd., Ottawa, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

CONVEYORS AND ELEVATORS (SEE ELEVATORS)
Jones & Glassco, Montreal, Que.

COTTERS
Steel Co. of Canada, Ltd., Hamilton, Ont.

COUNTERBORES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

COUNTERS, REVOLUTION
Starrett Co., L. S., Athol, Mass.

COUNTERSHAFTS
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Johnson Machine Co., Carlyle, Man-
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

COUNTERSINKS
Butterfield & Co., Inc., Rock Island, Que.
Pratt &Whitney Co., of Canada, Ltd., Dundas, Ont.

COUPLERS, CAR AND LOCOMOTIVE
Can. Steel Foundries, Montreal, Que.

COUPLINGS
Steel Co. of Canada, Ltd., Hamilton, Ont.

COUPLINGS, PIPE
Fittings, Limited, Oshawa, Ont.

COUPLINGS, SHAFT
Can. Link-Belt Co., Toronto, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

CRANES, ELECTRIC
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can.-Link-Belt Co., Toronto, Ont.
Curtis Pneumatic Machinery Co., St. Louis, Mo.
Hepburn Ltd., John T., Toronto, Ont.
Northern Crane Works, Walkerville, Ont.
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.

CRANES, LOCOMOTIVE
Can. Link-Belt Co., Toronto, Ont.

Bertram & Son Co., td., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Northern Crane Works, Walkerville, Ont.

CRANK PIN TURNING MACHINE
Underwood Corp., H.B., Philadelphia, Pa.

CUTTERS, GEAR
Brown & Sharpe Mfg. Co., Providence, R. I.
Butterfield & Co., Inc., Rock Island, Q. Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CUTTERS, HIGH SPEED
Atkins & Co., Inc., E. C., Indianapolis.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CUTTERS, MILLING
Brown & Sharpe Mfg. Co., Providence, R. I.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.

CUTTERS, STAY BOLT
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.

CUTTING-OFF MACHINE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

CUTTING OFF MACHINES, PIPE (SEE PIPE-CUTTING AND THREADING MACHINES)
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.

CUTTING-OFF TOOLS
Armstrong Bros. Tool Co., Chicago, Ill.

CUTTING OIL FILTERS (SEE OIL FILTERING SYSTEMS
Bowser, S. F. & Co., Ltd., Toronto.

CUTTING, OXY-HYDROGEN
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

DETACHABLE CHAIN
International Malleable Iron Co., Guelph, Ont.

DIAMONDS, BLACK AND ROUGH
Can. Desmond-Stephan Mfg Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

DIAMOND TOOLS
Can. Desmond-Stephan Co., Hamilton,
Wheel Trueing Tool Co., Windsor, Ont.

DIAMOND CROSSINGS
Can. Steel Foundries, Montreal, Que.

DIAMONDS, IMPORTERS
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Co., Windsor, Ont.

DIES, SCREW AND THREAD CUTTING
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.

DIES, SHEET-METAL AND SUB-PRESS (See Tool Work)
Brown, Boggs & Co., Ltd., Hamilton, Ont.

DIES, FORGING
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

DIES, SELF-OPENING, ADJUSTABLE
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Landis Machine Co., Inc., Waynesboro,
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DIES, THREADING-OPENING
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DIVIDING HEADS
Burke Machine Tool Co., Conneaut, Ohio.
Hendey Machine Co., Torrington, Conn.
Kearney & Treacker Co., Milwaukee, Wis.
Petrie, Ltd., H. W. Toronto, Ont.

DOGS, LATHE AND MILLING MACHINE
Armstrong Bros. Tool Co., Chicago, Ill.

DRAFTING MATERIALS
American Lead Pencil Co., New York City, N.Y.

DRESSERS, GRINDING WHEEL
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ont.
Norton Co., of Can., Ltd., Hamilton.
Wheel Trueing Co., Windsor, Ont.

DRESSING TOOLS
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Co., Windsor, Ont.

DRILL HOLDERS
Armstrong Bros. Tool Co., Chicago, Ill.

DRILLING MACHINES, BENCH
Burke Machine Tool Co., Conneaut,, Ohio.
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Hardinge Bros., Inc., Chicago, Ill.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, ELECTRIC AND HAND
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, GANG
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

DRILLING MACHINES, HEAVY DUTY
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
Herbert, Limited, Alfred, Toronto, Ont.
Rockford Drilling Machine Co., Rockford, Ill.

BORING, DRILLING AND MILLING MACHINES, (HORIZONTAL.)
Gisholt Machine Co., Madison, Wis.
Herbert, Limited, Alfred, Toronto, Ont.

DRILLING MACHINES, Multiple Spindle
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
National Acme Co., Cleveland, Ohio.

DRILLING MACHINES, Pneumatic
Cleveland Pneumatic Tool Co., Toronto. Ont.

DRILLING MACHINES, PORTABLE
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, RADIAL
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Herbert, Limited, Alfred, Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto,

DRILLING MACHINES, SENSITIVE
Burke Machine Tool Co., Conneaut, O.
Herbert, Limited, Alfred, Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Williams Machinery Co., A. R., Toronto.
Wisconsin Electric Co., Racine, Wis

DRILLING MACHINES, TURRET
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wisconsin
Williams Machinery Co., A. R., Toronto.

DRILLING MACHINES, VERTICAL
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Herbert, Limited, Alfred, Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

DRILLS, CENTRE
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DRILLS, ELECTRIC
Independent Pneumatic Tool Co., Chicago, Ill.
U. S. Electrical Tool Co., Cincinnati, Ohio.

DRILLS, ELECTRIC
Black & Decker Mfg. Co., Ltd., Montreal, Que.

DRILLS, HIGH SPEED TWIST
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Cleveland Twist Drill Co., Cleveland, O.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DRILLS, PNEUMATIC
Independent Pneumatic Tool Co., Chicago, Ill.

DRILLS, RATCHET
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

DRILLS, TWIST AND FLAT
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.

DROP FORGINGS
Steel Co of Canada, Ltd., Hamilton.

DUMB WAITERS
Roelofson Elevator Works, Galt, Ont.

DUST HANDLING EQUIPMENT
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

ELECTRIC DRILLS AND GRINDERS
Black & Decker Mfg. Co., Ltd., Montreal, Que.
U. S. Electrical Tool Co., Cincinnati, Ohio.

ELECTRIC WELDING MACHINES
Globe Engineering Co., Ltd., Hamilton, Ont.

ELECTRICAL INSTRUMENTS
Bristol Co., Waterbury, Conn.

ELECTRICAL SUPPLIES
Atkins & Co., Inc., E. C., Indianapolis.
Diamond State Fibre Co., Toronto. Ont.

ELECTRIC TOOLS
U. S. Electrical Tool Co., Cincinnati, Ohio.

ELEVATORS AND CONVEYORS
Can. Link-Belt C., Toronto, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.

ELEVATORS, FREIGHT AND PASSENGER
Roelofson Elevator Works, Galt, Ont.

EQUIPMENT, ELEVATOR SAFETY
Jones & Glassco, Montreal, Que.

EMERY WHEELS (See Grinding Wheels)
Lion Grinding Wheels, Limited, Montreal, Que.
Atkins & Co., E. C., Indianapolis, I.
Norton Co., of Canada., Ltd., Hamilton.

ENGINES, CAPSTAN
Kennedy & Sons, Wm., Owen Sound, Ont.

ENGINE LATHE MANUFACTURERS
Oliver Machinery Co., Grand Rapids, Michigan.

ENGINEERS, MECHANICAL
Dominion Engineering Works, Limited, Montreal, Que.
Gisholt Machine Co., Madison, Wis.
Hamilton Gear & Machine Co., Toronto,

EXPANDERS, TUBE
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

FANS, ELECTRIC
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

FANS, EXHAUST
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Petrie Ltd., H. W., Toronto, Ont.

FANS, VENTILATING
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

FIBRE
Diamond State Fibre Co., of Can. Ltd., Toronto, Ont.

FILES AND RASPS
Nicholson File Co., Port Hope, Ont.
Simmons Canada Saw Co., Montreal, Que.

FILLER, IRON (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J.

FIRE ESCAPES
Roelofson Elevator Co., Galt, Ont.

FITTINGS, PIPE
International Malleable Iron Co., Guelph.
Fittings, Limited, Oshawa, Ont.

FLEXIBLE SHAFTS
Strand & Co., N. A., Chicago, Ill

FLUXES, WELDING
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd, Toronto
Liquide Air Company, Toronto, Ont.

FORGING MACHINERY
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown Boggs & Co., Ltd., Montreal.
National Machinery Co., Tiffin, Ohio.
Steel Co. of Canada, Ltd., Hamilton.

BUYERS' DIRECTORY

FORGINGS, DROP
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Ltd., Toronto, Ont.

FORGINGS, HAMMER
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Hepburn Ltd., John T., Toronto, Ont.

FOUNDRY EQUIPMENT
Rice Lewis & Son, Ltd., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

FOUNDRY SUPPLIES
Rice Lewis & Son, Ltd., Toronto, Ont.

FROGS, SPRING OR RIGID
Can. Steel Foundries, Montreal, Que.

FURNACES, ELECTRIC
Rockwell Co., W. S. New York City.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

FURNACES, HEAT TREATING COAL
Rockwell Co., W. S., New York City.

FURNACES, HEAT TREATING OIL AND GAS
Bellevue Industrial Furnace Co., Detroit, Michigan.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Rockwell & Co., W. S., New York, N.Y.

FURNACES TEMPERING AND ANNEALING
Bellevue Industrial Furnace Co., Detriot, Mich.
Brown & Sharpe Mfg., Co., Providence R. I.
Rockwell Co., W. S., New York City.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

FURNACES AND OVENS, ELECTRIC
Petrie, Ltd., H. W., Toronto, Ont.
Rockwell & Co., W. S., New York, N.Y.
Starrett Co., L. S., Athol, Mass.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

GAGES, MEASURING (See Tool Work)
Brown & Sharpe Mfg. Co., Providence, R. I.
Greenfield Tap & Die Corp., Galt, Ont.
Lufkin Rule Co., Windsor, Ont.
Starrett Co., L. S., Athol, Mass.

GAGES, RECORDING
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GAGES, SPECIAL MEASURING
(See Tool Work)
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GAGES, THREAD
Brown & Sharpe Mfg. Co., Providence R. I.
Herbert, Limited, Alfred, Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

GALVANIZING
Fittings, Limited, Oshawa, Ont.

GAS, COAL COMPRESSED
L'Air Liquid Society, Toronto, Ont.

GAS, COMPRESSED
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

GASKETS
Diamond State Fibre Co. of Ca., Ltd., Toronto, Ont.
Smooth Mfg. Co., Jersey City, N. J.

GAUGES VACUUM AND PRESSURE
Taylor Instrument Co. Toronto, Ont.

GEAR BLANKS
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.
Dominion Engineering Works, Limited, Montreal, Que.

GEAR COUNTERS
Hart Mfg. Co., R. A., Battle Creek, Michigan.

GEAR CUTTING MACHINES
Bertram & Sons Co Ltd The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Fellows Gear Shaper Co., Springfield, Vt.
Petrie, Ltd., H. W., Toronto, Ont.
Whiton Machine Co., D. E., New London, Conn.

GEAR TESTING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.

GEARS, CAST
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Hull Iron & Steel Foundries, Hull, Que.
Dominion Engineering Works, Limited, Montreal, Que.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

GEARS, CUT
Brown & Sharpe Mfg. Co., Providence, R. I.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Gardner & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto, Ont.
Hepburn Ltd., John T. Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

GEARS, DRESSED
Kennedy & Sons, Wm., Owen Sound, Ontario.

GEARS, FORGED
Canada Foundries & Forgings Co., Welland, Ont.

GEARS, HERRINGBONE
Hamilton Gear & Machine Co., Toronto, Ont.

GEARS, RAWHIDE (See Gears, Cut)
Hamilton Gear & Machine Co., Toronto.

GEAR, SILENT CHAIN
Gardner & Son, Robt., Montreal, Que.
Can. Link-Belt Co., Ltd., Toronto, Can.
Hans Renold of Canada, Ltd., Montreal, Quebec.

GEARS, WORM
Hamilton Gear & Machine Co., Toronto.

GENERATORS, ACETYLENE
L'Air Liquide Society, Toronto, Ont.

GOGGLES, SAFETY
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

GRAB BUCKETS
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Cleveland Twist Drill Co., Cleveland, O.

GREASE CUPS, PRESSED STEEL AND BRASS
Can. Winkley Co., Ltd., Windsor, Ont.

GREASES, LUBRICATING
Canadian SKF Co., Toronto, Ont.

GRINDERS, ELECTRIC
Black & Decker Mfg. Co., Ltd., Montreal, Que.
U. S. Electrical Tool Co., Cincinnati, Ohio.

GRINDING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Norton Co., of Canada, Ltd., Hamilton.

GRINDING MACHINES, ABRASIVE BELT
Norton Co. of Can. Ltd., Hamilton, Ont.

GRINDING MACHINES, AUTOMATIC
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, BENCH
Blount Co., J. G., Everett, Mass.
Geometric Tool Co., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co. of Canada, Ltd., Hamilton, Ont.
Petrie, Ltd., H. W. Toronto, Ont.
Pratt & Whitney Co of Canada, Ltd.,

GRINDING MACHINES, CENTER
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES, CUTTER AND REAMER
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Petrie Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, CYLINDRICAL
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.
Norton Co., of Canada, Ltd., Hamilton.

GRINDING MACHINES, DIE
Geometric Tool Co., New Haven, Conn.
National Acme Co., Cleveland, O.
National Machinery Co., Tiffin, Ohio.

GRINDING MACHINES, DRILL
Bellevue Industrial Furnace Co., Detroit, Mich.
Bertram & Son Co., Ltd., The John, Dundas, Ont.

GRINDING MACHINES, ELECTRIC
Independent Pneumatic Tool Co., Chicago, Ill.
Strand & Co., N. A., Chicago, Ill.

GRINDING MACHINES, FLOOR AND TOOL
Blount Co., J. G., Everett, Mass.
Herbert, Limited, Alfred, Toronto, Ont.
National Acme Co., Cleveland, Ohio.
Norton Co. of Canada, Ltd., Hamilton, Ontario.
Petrie, Ltd., H. W., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.

GRINDING MACHINES, INTERNAL
Garlock Machinery Ltd., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES PORTABLE
Strand & Co., N. A., Chicago, Ill.

GRINDING MACHINES, SNAGGING
Blount Co., J. G., Everett, Mass.
Norton Co., of Can. Ltd., Hamilton, Ont
U. S. Electrical Tool Co., Cincinnati, Ohio.

GRINDING MACHINES, SURFACE
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, THREAD
Pratt & Whitney Co., of Canada, Ltd.,

GRINDING MACHINERY, TOOL POST
Gisholt Machine Co., Madison, Wis.
Grenfield Tap & Die Corp., Galt, Ont.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES, UNIVERSAL
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Herbert, Limited, Alfred, Toronto, Ont.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co., of Canada, Ltd., Hamilton Ontario.
Petrie, Ltd., H. W., Toronto, Ont.

GRINDING WHEELS
Lion Grinding Wheels, Limited, Montreal, Que.
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Norton Co. of Can., Ltd., Hamilton, Ont.

GUN-BARREL MACHINERY
Steinle Turret Machine Co., Madison, Wisconsin.

HACK SAWS, POWER
Atkins & Co., Inc., E.C., Indianapolis, Indiana.
Petrie, Ltd., H. W., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que
Starrett Co., L. S., Athol, Mass.

HAMMERS, CHIPPING
Cleveland Pneumatic Tool Co., Toronto, Ont.
High Speed Hammer Co., Rochester.
Independent Pneumatic Tool Co., Chicago, Ill

HAMMERS, DROP
Bertram & Son Co., Ltd., The John Dundas, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

HAMMERS, ELECTRIC
Brown, Boggs & Co., Ltd., Hamilton, Ont.

HAMMERS, PNEUMATIC
Can. Steel Foundries, Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto Ont.
Independent Pneumatic Tool Co., Chicago, Ill.

HANGERS, SHAFTING
Canadian SKF Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Hamilton Gear & Machine Co., Toronto.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

HOBBING MACHINES
Shore Instrument Co., Jamaica, N.Y.

HARDENING, CASE-HARDENING AND TEMPERING
Barnes Company, Wallace, Hamilton.
Petrie, Ltd., H. W., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Cleveland Pneumatic Tool Co., Toronto Ont.

HAMMERS, POWER
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

HOBS
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

HOISTS, ELECTRIC
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.

HOISTS, HAND
Curtis Pneumatic Machinery Co., St. Louis, Mo.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio

HOISTS, PNEUMATIC
Independent Pneumatic Tool Co., Chicago, Ill.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont

HOLDERS-ON, PNEUMATIC
Cleveland Pneumatic Tool Co., Toronto Ont.
Independent Pneumatic Tool Co., Chicago, Ill.

HYDRAULIC MACHINERY
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

IGNITERS, GAS ENGINE
Canada Foundries & Forgings Co., Welland, Ont.
Burke Machine Tool Co., Conneaut, O

INDICATORS, SPEED AND TEST
Brown & Sharpe Mfg. Co., Providence, R.I.

INSULATION
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.

IRON BARS
Steel Co. of Canada, Ltd., Hamilton, Ont.

JACKS, HYDRAULIC
Norton, A. O., Boston, Mass.

JACKS, PLANER
Armstrong Bros. Tool Co., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

JAPANNING AND VARNISHING OVENS
Brantford Oven & Rack Co., Brantford, Ont.

JIGS AND FIXTURES (SEE TOOL WORK)
Fisher Motor Co., Ltd., Orillia, Ont.
Gisholt Machine Co., Madison, Wis.

KEYSEATING MACHINES
Morton Mfg. Co., Muskegon, Mich.

BUYERS' DIRECTORY

Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

KEYS, MACHINE
Can. Drauw Steel Co., Hamilton, Ont.
Morton Mfg. Co., Muskegon, Mich.

KNIVES, MACHINE
Atkins & Co., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

KNURL HOLDERS
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

LATHE ATTACHMENTS
Hendey Machine Co., Torrington, Conn.
Petrie, Ltd., H. W., Toronto, Ont.

LATHE TOOLS
Armstrong Bros. Tool Co. ,Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

LATHES, AUTOMATIC AND SEMI-AUTOMATIC
Gisholt Machine Co., Madison, Wis.
Herbert, Limited, Alfred, Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, BENCH
Hardinge Bros., Inc., Chicago, Ill.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

LATHES, BORING
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, CHUCKING (SEE LATHES, HORIZONTAL TURRET, AND LATHES, VERTICAL TURRET)
Acme Machine Tool Co., Cincinnati, O.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
Herbert, Limited, Alfred, Toronto, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, ENGINE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hendey Machine Co., Torrington, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Petrie, Ltd, H. W., Toronto, Ont
Rockford Lathe & Drill Co., Rockford, Illinois.

LATHES, EXTENSION AND GAP
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison Wis.
Herbert, Limited, Alfred, Toronto, Ont.
National Acme Co., Cleveland, O.
Petrie, Ltd., H. W., Toronto, Ont.
Steinle Turret Machine Co., Madison, Wis.

LATHES, PRECISION
Hardinge Bros., Chicago.

LATHES, RELIEVING
Hendey Machine Co., Torrington, Conn.

LATHE, UNIVERSAL HAND
Brown & Sharpe Mfg. Co., Providence, Rhode Island.

LATHE, SPEED AND HAND
Plount Co., J. G., Everett, Mass.

LATHES, SPINNING
Pryibil Machine Co., Torrington, Conn.

LATHES, VERTICAL TURRET
Bertram & Son, Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

LATHES, WOOD TURNING
Blount, Co., J. G., Everett, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.

LEAD PIPE
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

LEATHER FILLET
D. K. McLaren, Limited, Montreal,

LINOLEUM MILL MACHINERY
Bertrams, Ltd., Edinburgh, Scotland.

LIQUID AIR PLANTS
L'Air Liquide Society, Toronto, Ont.

LOCKERS, CLOTHES
Dennis Wire and Iron Works, London, Ont.

LUBRICANTS
Oakley Chemical Co., New York, N.Y.

LUBRICATING SYSTEMS
Bowser, S. F., & Co., Ltd., Toronto, Canada.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Ltd., Welland, Ont.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R. Toronto Ont.

MANGANESE STEEL
Can. Steel Foundries, Montreal, Que.

MANDRELS, EXPANDING
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MANDRELS, SOLID
Greenfield Tap & Die Corp., Galt, Ont.
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Pratt & Whitney Co., of Canada. Ltd., Dundas, Ont.

MEASURING MACHINES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MECHANICS' FINE TOOLS
Lufkin Rule Co., Windsor, Ont.

METALS, ALLOY
Canada Metal Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.

METAL WORKERS
Parker Co., Charles, Meriden, Conn.

MICROMETER CALIPERS
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Rice Lewis & Son, Ltd., Toronto, Ont.

MILLING ATTACHMENTS
Burke Machine Tool Co., Conneaut, O.
Hendey Machine Co., Torrington, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

MILLING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Burke Machine Tool Co., Conneaut, O.

MILLING MACHINES, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence, R. I.
Hardinge Bros., Inc., Chicago, Ill.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

MILLING MACHINES, BENCH
Burke Machine Tool Co., Conneaut, O.
Hardinge Bros., Inc., Chicago, Ill.

MILLING MACHINES, HAND
Brown & Sharpe Mfg. Co., Providence
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MILLING MACHINES, HORIZONTAL PLANER TYPE.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Kearney & Trecker Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto.

MILLING MACHINES, PLAIN
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, O.
Hendey Machine Co., Torrington, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

MILLING MACHINES, THREAD
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MILLING MACHINES, UNIVERSAL
Brown & Sharpe Mfg. Co., Providence,
Hendey Machine Co., Torrington, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

MILLING MACHINES, VERTICAL
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, O.
Herbert, Limited, Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto.

MILLING TOOLS, ADJUSTABLE HOLLOW
Geometric Tool Co., New Haven, Conn.

MOTORS, ELECTRIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Roelofson Elevator Co., Galt, Ont.
Williams Machinery Co., A. R., Toronto,
Wisconsin Electric Co., Racine Wis.

NAILS AND STAPLES
Canada Metal Co., Ltd., Toronto, Ont.

NIPPLES
Canada Metal Co., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton,

NITROGEN
Carter Welding Co. Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

NUT TAPPERS (See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
National Acme Co., Cleveland, Ohio.

NUTS, FINISHED and SEMI-FINISHED
Galt Macine Screw Co., Galt, Ont.
National Acme Co., Montreal, ue.

NUTS (Up to 4-in.)
Steel Co. of Canada, Ltd., Hamilton.

NUTS, S.A.E., PLAIN AND CASTELLATED
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

OIL FILTERING AND STORAGE SYSTEMS
Bowser, S. F., & Co., Ltd., Toronto,

OIL STORAGE ENGINEERS
Bowser, S. F., & Co., Ltd., Toronto,

OIL HOLE COVERS
Can. Whitney Co., Ltd., Windsor, Ont.

OILS, SOLUABLE
Brantford Oven & Rack Co., Brantford, Ontario.

ORNAMENTAL IRON AND WIRE WORKS
Roelofson Elevator Works, Galt, Ont.

OXYGEN
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

OXY-ACETYLENE APPARATUS
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Atlas Press Co., Kalamazoo, Mich.

PAINT SPRAYERS
Spray Engineering Co., Boston, Mass.

PAPER MILL CONVEYORS
Bertram Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd., Montreal, Que.

PATTERNS, WOOD AND METAL
Fittings, Limited, Oshawa, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.
Victoria Foundry Co., Ltd., Ottawa.

PHOSPHOR TIN
Canada Metal Co., Ltd., Toronto, Ont.

PHOTOGRAPHIC DUPLICATING MACHINES
Photostat Corp., Providence, R. I.

PIPE BENDING MACHINES
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Underwood Corp., H. R., Philadelphia, Pa.
Williams Machinery Co., A. R., Toronto.

PIPE CUTTING AND THREADING MACHINES
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Petrie, Ltd., H. W., Toronto, Ont.

PIPE
Canada Metal Co., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.

PIPE FITTINGS
Canada Metal Co., Toronto, Ont.
Fittings, Limited, Oshawa, Ont.
International Malleable Iron Co., Guelph Ont.

PIPE AND NIPPLE THREADING MACHINES
Landis Machine Co., Inc., Waynesboro, Pa.

PIPE FITTERS' TOOLS
Rice Lewis & Son, Ltd., Toronto, Ont.

PIPE THREADING DIE HEADS
Landis Machine Co., Inc., Waynesboro, Pa.

PISTON-RING MACHINES
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

PLANING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Williams Machinery Co., A. R., Toronto.

PLANING MACHINES, ROTARY
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Herbert, Limited, Alfred, Toronto, Ont.

PLATE ROLLS
Bertram & Son Co., Ltd., The John, Dundas, Ont.

PNEUMATIC PAINTING DEVICES
Spray Engineering Co., Boston, Mass.

PNEUMATIC TOOLS
Cleveland Pneumatic Tool Co., Toronto.
Independent Pneumatic Tool Co., Chicago, Ill.

POLISHING AND BUFFING MACHINES
Lion Grinding Wheels, Limited, Montreal, Que.
Blount Co., J. G. Everett, Mass.
Brown & Sharpe Mfg. Co., Providence.
Pryibil Machine Co., New York, N.Y.

PRESSED STEEL PARTS
American Pulley Co., Philadelphia, Pa.
Fisher Motor Co., Ltd., Orillia, Ont.

PRESSES, ARBOR
Atlas Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

PRESSES, DROP AND FORGING
Brown, Boggs & Co., Ltd., Hamilton.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

PRESSES, FOOT AND HAND
Brown, Boggs & Co., Ltd., Hamilton.

PRESSES, HYDRAULIC
Bertram & Son Co., Ltd., The John, Dunldas, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Perrin Ltd., W. B., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

PRESSES, POWER
Bliss Co., E. W., Prooklyn, N. Y.
Brown, Boggs, & Co., Ltd., Hamilton.
Hepburn Ltd., John T., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Stoll Co., Inc., D. H., Buffalo, N.Y.

PRESSES, SCREW
Brown, Boggs & Co., Ltd., Hamilton.
Petrie, Ltd., H. W., Toronto, Ont.

PROFILING MACHINES
Prtt & Whitney Co., of Canada, Ltd., Dundas, Ont.

PROTRACTORS
Brown & Sharpe Mfg. Co., Providence.
Lufkin Rule Co., Windsor, Ont.

PROPELLERS
Kennedy & Sons, Wm., Owen Sound, Ontario.

PULLEYS, CORK INSERT
American Pulley Co., Philadelphia, Pa.

PULLEYS, METAL AND FIBRE
American Pulley Co., Philadelphia, Pa.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.
D. K. McLaren Co., Limited Montreal, Que.

PULP AND PAPER MILL EQUIPMENT
Dominion Engineering Works, Ltd., Montreal, Que.

PUMPS, HYDRAULIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Dominion Engineering Works, Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont

BUYERS' DIRECTORY

PUMPS, LUBRICANT AND OIL
Bowser, S. F., & Co., Ltd., Toronto.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Hepburn Ltd., John T., Toronto, Ont.

PUMPS, POWER
Bowser, S. F., & Co., Ltd., Toronto.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hepburn Ltd., John T., Toronto, Ont.

PUNCHES, CENTER
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

PUNCHES, HAND
Brown Boggs & Co., Ltd., Hamilton.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Jardine & Co., A. B., Hespeler, Ont.

PUNCHES, POWER
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

PUNCHING MACHINES, HORIZONTAL
Bertram Ltd., Edinburgh, Scotland.

PYROMETERS, ELECTRIC
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Hiram Walker & Sons Metal Products Co., Walkerville, Ont.

RACKS, CUT
Hamilton Gear & Machine Co., Toronto.

RACKS, STORAGE
(See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ontario.

REAMER HOLDERS
Simonds Canada Saw Co., Montreal, Q.

REAMERS, EXPANDING
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

REAMERS, SOLID
Butterfield & Co., Inc., Rock Island, Q.
Morse Twist Drill & Machine Co., New Bedford, Mass.

REAMERS, TAPER
Brown & Sharpe Mfg. Co., Providence, R. I.
Butterfield & Co., Inc., Rock Island, Q.
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canad, Ltd., Dundas, Ont.

RECORDERS, TEMPERATURE
Taylor Instrument Co., Rochester, N. Y.

RECORDERS, TIME
Gisholt Machine Co., Rochester, N. Y.
Taylor Instrument Co., Toronto, Ont.

REGULATORS, TEMPERATURE
Taylor Instrument Co., Toronto, Ont.

RIVETS AND BURRS
Parmenter & Bulloch Co., Gananoque, Ont.
Steel Co., of Canada, Ltd., Hamilton,

RIVETS, CHAIN
Pittings, Limited, Oshawa, Ont.

RIVET-MAKING MACHINERY
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

RIVETING HAMMERS
Independent Pneumatic Tool Co., Chicago, Ill.

RIVETING MACHINES
Can. Fairbanks-Morse Ltd., Montreal Q.
High Speed Hammer Co., Rochester, N.Y.
Parmenter & Bulloch Co., Gananoque Ont.
Petrie, Ltd., H. W., Toronto, Ont.

RUDDER FRAMES, STEEL
Can. Steel Foundries, Montreal, Que.

RUBBER MILL MACHINERY
Bertram Ltd., Edinburgh, Scotland.

RULES, STEEL AND WOOD
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Windsor, Ont.

RUST PREVENTATIVES
Oakley Chemical Co., New York, N. Y.

SAND EQUIPMENT
Can. Link-Belt Co., Toronto, Ont.

SAND RAMMERS, PNEUMATIC
Cleveland Pneumatic Tool Co., Toronto.
Independent Pneumatic Tool Co., Chicago, Ill.

SAW FRAMES AND BLADES, HACK
Atkins & Co., Inc., E. C., Indianapolis.
Diamond Saw & Stamping Works, Buffalo, N. Y.
Rice Lewis & Sons, Ltd., Tornto, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWING MACHINES, POWER HACK
Atkins & Co., Inc., E. C., Indianapolis.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

SAW SHARPENING MACHINES
Atkins & Co., Inc., E. C., Indianapolis.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

SAW SHARPENING MACHINES
Atkins & Co., Inc., E. C., Indianapolis.

SAW TABLES, UNIVERSAL
Petrie, Ltd., H. W., Toronto, Ont.

SAWS, CIRCULAR METAL
Atkins & Co., Inc., E. C., Indianapolis
Pryibil Machine Co., New York, N. Y.
Gisholt Machine Co., Madison, Wis.

SAWS, HAND
Atkins & Co., Inc., E. C., Indianapolis
Simonds Canada Saw Co., Montreal, Q.

SAWS, HOT AND COLD
Atkins & Co., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Q.

SAWS, HIGH SPEED STEEL
Atkins & Co., Inc., E.C., Indianapolis, I.
Butterfield & Co. Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWS, METAL BAND
Atkins & Co., E. C., Indianapolis, I.

SAWS, METAL CUTTING
Brown & Sharpe Mfg. Co., Providence,
Butterfield & Co., Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.
Starrett Co., L. S., Athol, Mass.

SAWS, SCREW SLOTTING
Atkins & Co., Inc., E., C., Indianapolis.
Butterfield & Co., Inc., Rock Island, Q.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canda, Ltd., Dundas, Ont.

SAWS, SCREW SLOTTING
Atkins & Co., Inc., E. C., Indianapolis.
Butterfield & Co., Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWS, WOOD
E. C. Atkins & Co., Indianapolis, Ind.

SCALES
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Lufkin Rule Co., Windsor, Ont.

SCREENS
Dominion Engineering Works, Ltd., Montreal, Que.

SCREW DRIVERS, OPTICAL, JEWELRY AND NOVELTY
Strand & Co., N. A., Chicago, Ill.

SCREW MACHINE WORK
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Montreal, Que.

SCREW MACHINERY, WOOD AND LAG
Cook Co., Asa S., Hartford, Conn.

SCREW MACHINES
Brown & Sharpe Mfg. Co., Providence, Rhode Island.

SCREW MACHINES, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.

SCREW MACHINE PRODUCTS
National Acme Co., Montreal, Que.

SCREW PLATES
Butterfield & Co., Inc., Rock Island. Que.
Jardine & Co., A. B., Hespeler, Ont.

SCREWS, CAP AND SET
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

SCREWS, SAFETY, SET
Galt Machine Screw Co., Galt, Ont.

SECOND-HAND MACHINERY
See last page of directory.
Petrie, Ltd., H. W., Toronto, Ont.

SEPARATORS, MOISTURE AND OIL
Bowser, S. F., & Co., Ltd., Toronto, Canada.

SEPARATORS, OIL AND WASTE
Bowser, S. F., & Co., Ltd., Toronto.

SHAFTS, FLEXIBLE
Strand & Co., N. A., Chicago, Ill.

SHAFTING
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
Williams Machinery Co., A. R., Toronto.

SHAPES, COLD-DRAWN SPECIAL STEEL
Union Drawn Steel Co., Hamilton, Ont.

SHAPING MACHINES
Hendey Machine Co., Torrington, Conn.
Morton Mfg. Co., Muskegon, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Williams Machinery Co., A. R. Toronto.

SHEARS HAND
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

SHEARS, POWER
Bliss Co., E. W., Brooklyn, N. Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Stoll Co., Inc., D. H., Buffalo, N. Y.
Williams Machinery Co., A. R., Toronto, Ont.

SHEARING MACHINES, ANGLE, IRON BAR AND GATE
Bertrams Ltd., Edinburgh, Scotland.

SHEET LEAD
Canada Metal Co., Ltd., Toronto, Ont.

SHEET METAL WORKING MACHINERY
Bliss Co., E. W., Brooklyn, N. Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Stoll Co., Inc., D. H. Buffalo, N.Y.

SHEETS, NICKEL, MONEL AND FIBRE
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.

SHEETS, O.P.C.R. & B. A. AND BLUE ANNEALED
Steel Co., of Canada, Ltd., Hamilton, Ont.

SIDE FRAMES, LOCOMOTIVE
Can. Steel Foundries, Montreal, Que.

SLOTTING ATTACHMENTS
Brown & Sharpe Mfg. Co., Providence, R.I.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

SLOTTING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.

SOLDERS
Canada Metal Co., Ltd., Toronto, Ont.

SPRAYING EQUIPMENT
Spray Engineering Co., Boston, Mass.

SPECIAL MACHINERY AND TOOLS
Brown Engineering Corp., Ltd., Toronto.
Gisholt Machine Co., Madison, Wis.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.
National Acme Co., Cleveland, O.

SPIKES, RAILWAY AND PRESSED
Steel Co of Canada, Ltd., Hamilton, Ont.

SPINNING LATHES
Pryibil Machine Co., P., New York City.

SPRING, MILLED
Barnes & Co., Wallace, Hamilton, Ont.

SPRINGS, SMALL SPIRAL HELICAL, COMPRESSION, EXTENSION, TORSION AND SPECIAL
Barnes Company, Wallace, Hamilton.

SPRINGS
Barnes Company, Wallace, Hamilton.
Cleveland Wire Spring Co., Clevleand, O.
Steele Ltd., James, Guelph, Ont.

SPRINGS, FLAT STEEL, BRUSH HOLDER, CLOCK, SMALL FLAT SPRINGS
Barnes Company, Wallace, Hamilton.

SPROCKETS AND CHAINS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Renold Hanson of Canada, Ltd., Montreal, Que.

SQUARES
Brown & Sharpe Mfg. Co., Providence, R.I.
Lufkin Rule Co., Windsor, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

STAMPING, METAL
American Pulley Co., Philadelphia, Pa.
Barnes Company, Wallace, Hamilton.
Diamond Saw & Stamping Works, Buffalo, N. Y.
Parmenter & Bulloch Co., Gananoque, Ont.

STAMPS, STEEL
Diamond Saw & Stamping Works, Buffalo, N. Y.

STEEL CONCRETE REINFORCEMENT
Steel Co. of Canada, Ltd., Hamilton.

STEEL PLATE
British Empire Steel Co., Montreal, Que.

STEEL AND IRON BARS
Steel Co. of Canada, Ltd., Hamilton.

STEELS TOOL
British Empire Steel Co. Montreal Q.

STEEL, COLD-ROLLED STRIP
British Empire Steel Co., Montreal, Q.
Barnes Company, Wallace, Hamilton.

STEEL, CRUCIBLE, SPRING
Barnes, Company, Wallace, Hamilton.
British Empire Steel Co., Montreal, Q.

SHEETS, OPEN HEARTH STEEL
Steel Co., of Canada, Ltd., Hamilton

STEEL, SHAFTING AND FREE CUTTING SCREW
Union Drawn Steel Co., Hamilton, Ont.

STEEL, SHEET
British Empire Steel Co., Montreal, Q.
Rice Lewis & Son, Ltd., Toronto, Ont.

STEEL, STAINLESS
Steel Co., of Can. Ltd., Hamilton, Ont.

STEEL STAIRS
Roelofson Elevator Works, Galt, Ont.

STEELS, ALLOY AND CARBON
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Can. Steel Foundries, Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton, Ont.

STEELS, HIGH-SPEED
Armstrong Bros. Tool Co., Chicago, Ill.
Atkins & Co., Ltd., Wm., Sheffield, England.
British Empire Steel Co., Montreal, Q.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton.

STEEL TUBING, CLOSE JOINT AND WELDED
Standard Tube & Fence Co., Ltd., Woodstock, Ont.

STERN FRAMES, CAST STEEL
Can. Steel Foundries, Montreal, Que.

STRAIGHTENING MACHINERY
Bertram Ltd., Edinburgh, Scotland.
Williams & Co., Ltd., J. H., Brooklyn, N.Y.

STUDS
Geometric Tool Co., New Haven, Conn.
Galt Machine Screw Co., Galt Ont.

BUYERS' DIRECTORY

SWAGING MACHINES
Atkins & Co., Inc., E. C., Indianapolis, Indiana.

SWITCHES, RAILWAY
Can. Steel Foundries, Montreal, Que.

TACHOMETERS
Bristol Co., Waterbury, Conn.

TANKS AND PUMPS, OIL
Bowser, S. F., & Co., Ltd., Toronto.

TAP HOLDERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
William L. Procunier, Chicago, Ill.

TAPER PINS
Galt Machine Screw Co., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

TAPES, MEASURING
Starrett Co., L. S., Athol, Mass.
Lufkin, Rule Co., Windsor, Ont.

TAPPING MACHINES AND ATTACHMENTS
Burke Machine Tool Co., Conneaut, O.
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Wm. L. Procunier, Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

TAPS AND DIES
Butterfield & Co., Inc., Rock Island, Q.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Herbert, Limited, Alfred, Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

TAPS, COLLAPSING
Geometric Tool Co., New Haven, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.

TEETH, DREDGE BUCKET
Kennedy & Sons, W., Owen Sound, Ont.

THERMOMETERS
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Greenfield Tap and Die Corp., Galt, Ontario.

THREAD-CUTTING TOOLS
Butterfield & Co., Inc., Rock Island, Q.
Greenfield Tap and Die Corp., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

THREAD CUTTING MACHINES
Landis Machine Co., Inc., Waynesboro, Pa.

THREADING MACHINES
Acme Machinery Co., Cleveland, Ohio.
Geometric Tool Co., New Haven, Conn.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Williams Tool Corp., of Can. Ltd., Brantford, Ont.

THREAD LEAD TESTING MACHINES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

THREAD-ROLLING MACHINES
Bliss Co., E. W., Brooklyn, N. Y.

TIE PLATES
Steel Co. of Canada, Ltd., Hamilton.

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International Business Machine Co., Ltd., Toronto, Ont.

TONGS
Hepburn Ltd., John T., Toronto, Ont.

TOOL CASES
Rice Lewis & Son, Ltd., Toronto, Ont.

TOOL HOLDERS
Armstrong Bros., Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Bertrams Ltd., Edinburgh, Scotland.

TOOL POSTS, LATHE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Williams & Co., Ltd., J. H., Brooklyn, N.Y.

TOOLS, SMALL
(See Machinists' Small Tools)
Armstrong Bros. Tool Co., Chicago, Ill.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Lufkin Rule Co., Windsor, Ont.
National Machine Tool Co., Racine, Wis.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S. Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A.R., Toronto.

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TORCHES, BLOW
Rice Lewis & Son, Ltd., Toronto, Ont.

TRACKWORK, RAILWAY
Can. Steel Foundries, Montreal, Que.

TRACKWORK, MANGANESE STEEL
Can. Steel Foundries, Montreal, Que.

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Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound.
Petrie, Ltd., H. W., Toronto, Ont.
Renold, (Hans) of Canada, Ltd., Montreal, Que.

TROLLEYS AND TRAMWAYS
Can. Link-Belt Co., Toronto, Ont.
Northern Crane Works, Walkerville, Ont.
Wright Mfg. Co., Lisbon, Ohio.

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Langley & Austin, Galt, Ont.

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Armstrong Bros. Tool Co., Chicago, Ill.

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Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.

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Bertram & Son Co., Ltd., The John Dundas, Ont.

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(See Lathes, Horizontal Turret)
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Gisholt Machine Co. Madison Wis.
Herbert, Limited, Alfred, Toronto, Ont.
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Steinle Turret Machine Co., Madison, Wisconsin.

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Gisholt Machine Co. Madison, Wis.

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Fittings, Limited, Oshawa, Ont.

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Dominion Engineering Works, Limited, Montreal, Que.

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Cleveland Pneumatic Tool Co., Toronto, Ontario.
Kempsmith Mfg Co., Milwaukee, Wis.

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VISES, PLANER AND SHAPER
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L'Air Liquide Society, Toronto, Ont.
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Dominion Oxygen Co., Ltd., Toronto, Ont.

WELDING APPARATUS
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Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.

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Kennedy & Sons, Wm. Owen Sound, Ontario.

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Dennis Wire & Iron Works, London, Ontario.
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Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

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WIRE, COPPER AND BRASS, FINE AND HEAVY
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WIRE STRAIGHTENING AND CUTTING MACHINERY
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Williams Machinery Co., A. R., Toronto, Ontario.

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Canada Foundries & Forgings Co., Welland, Ont.

When answering advertisements kindly mention Canadian Machinery

A Directory of Dealers will be Found above Advertising Index

DIRECTORY OF DEALERS

THE Buyers' Directory of CANADIAN MACHINERY was originally intended to contain information regarding lines actually manufactured by our advertisers. We now carry the advertising of leading machinery dealers, some of whom represent scores of manufacturers in addition to being manufacturers themselves in some cases. We recommend, therefore, if our subscribers cannot find what they want in our Directory that they communicate with the dealers whose names appear herewith.

MACHINE TOOLS, ETC.

Bertram & Sons, Ltd., John, Dundas, Ont.
The Canadian Fairbanks-Morse Co., Montreal, Que.
Garlock Machinery Ltd., Toronto.
Herbert Ltd., Alfred, Toronto, Ont.

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WOODWORKING MACHINERY

The Canadian Fairbanks-Morse Co., Montreal, Que.
Garlock Machinery Ltd., Toronto.
Herbert Ltd., Alfred, Toronto, Ont.

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Do you always strike pay dirt when you invest? Have you always had a safe, sure income from every dollar you have put into securities?
Few people there are who have not made at least one poor investment. Many have made many poor investments.
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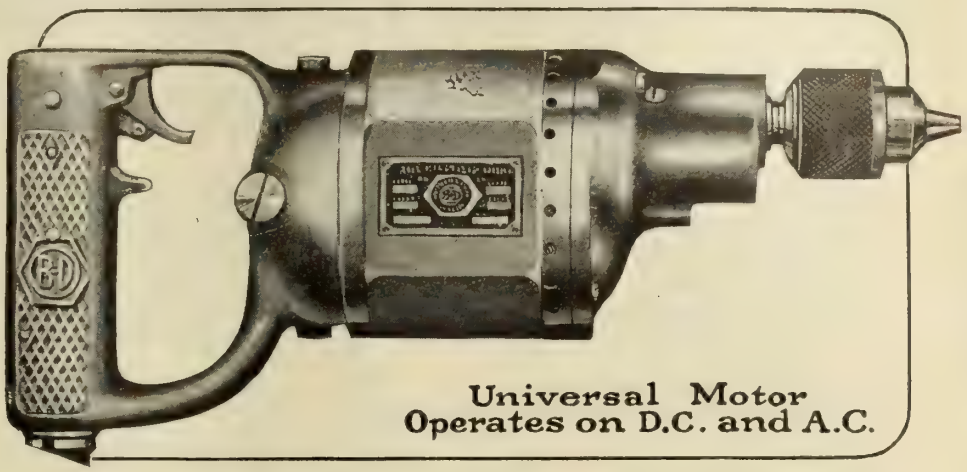
BLACK & DECKER QUARTER-INCH DRILL

"With the Pistol Grip and Trigger Switch"

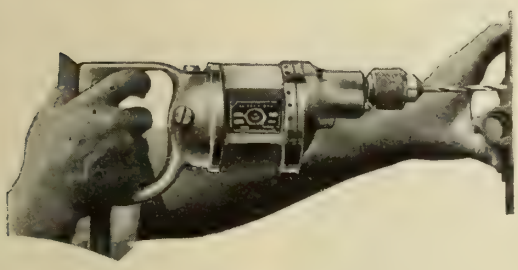
$49.00

Weight 5 lbs.

1922 Model
1922 Price



Universal Motor
Operates on D.C. and A.C.



Standard Black and Decker Portable Electric Drill, *"With the Pistol Grip and Trigger Switch."*

In design and construction the same as the larger sizes. Powerful, durable, comfortable to handle and perfectly controlled. Nothing in the way of ability or durability has been sacrificed to obtain this light weight. Particularly adapted for close corner drilling.

Very accessible. All bearings removable and renewable. By removing four screws, complete switch mechanism, motor commutator, field leads and cable terminals may be uncovered. Armature bearing is carried in a spider integral with motor case, consequently drill may be inspected or commutator cleaned while machine is running.

Brushes may be quickly and easily renewed from outside of motor case. Flexible cable is attached to screw terminals on the switch block so that cable may be renewed when necessary quickly and easily without soldering any joints.

SPECIFICATIONS

HOUSING—Aluminum alloy (No sheet metal is used)

MOTOR—Constructed and insulated the same as the larger Black & Decker Drills. Universal. Operates on direct or alternating current.

AIR COOLED—

GEARING—Double reduction stub tooth gears, cut from chrome nickel steel, heat treated (The toughest, longest wearing gears engineers have been able to design.)

NOTE—No brass gears are used in any Black & Decker tools.

CONTROL—*"The Pistol Grip and Trigger Switch."*

CHUCK—Three jaw chuck for straight shank drill bits up to ¼ inch.

FLEXIBLE CORD—Special light weight rubber covered duplex electric cable, fitted with separable attachment plug.

NO LOAD SPEED—1600 R. P. M.

NET WEIGHT—5 pounds.

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Montreal, P. Q.
A. J. HOPKINS, Manager

Miniature catalogue will be supplied on request.

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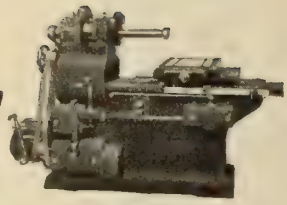
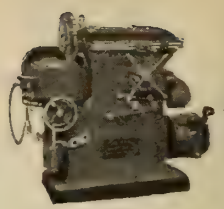
HEALD

AND BE SURE



Cylinder Grinder



Surface Grinder

A Machine for every Internal and Surface Grinding Requirement

Machines especially designed and adaptable to one particular class of grinding work are greatly in demand to-day. The efficient manager recognizes the folly of purchasing anything that is not exactly suited for the job.

For instance, on large, short work without question a simple hand feed machine is far more productive and less expensive to buy and maintain than a valuable automatic. While, on the other hand, long work and where the utmost precision is demanded it is absolutely necessary to use a machine with an automatic feed for the table.

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The success of the Heald Company in the grinding field is largely due to the fact that they have a complete line of internal and surface grinders which enables them to handle each and every condition to the best advantage of their customers.

Possibly you have work on which there is a bit of doubt in regard to the method of holding, production time, wheel speed, proper machine, etc. If so, send us samples or prints and our Engineering Service Department will give you full data.

Let's get together on that grinding job to-day

The Extensive Heald Line Covers Your Needs

Style No. 80. Automatic Internal Grinding Machine for small, long work.

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Style No. 50. Cylinder Grinding Machine for a great variety of large, awkward-shaped work.

Style No. 20. Surface Grinding Machine for single work. Has 8 in. capacity.

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Style No. 25. Surface Grinding Machine. Has automatic feed for chucking work. Ideal for piston rings, collars, ball races, etc.

The Heald Machine Company

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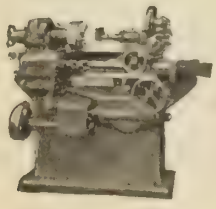


Internal Auto Feed

Small Internal

Internal Hand Feed

CANADIAN MACHINERY
MANUFACTURING NEWS

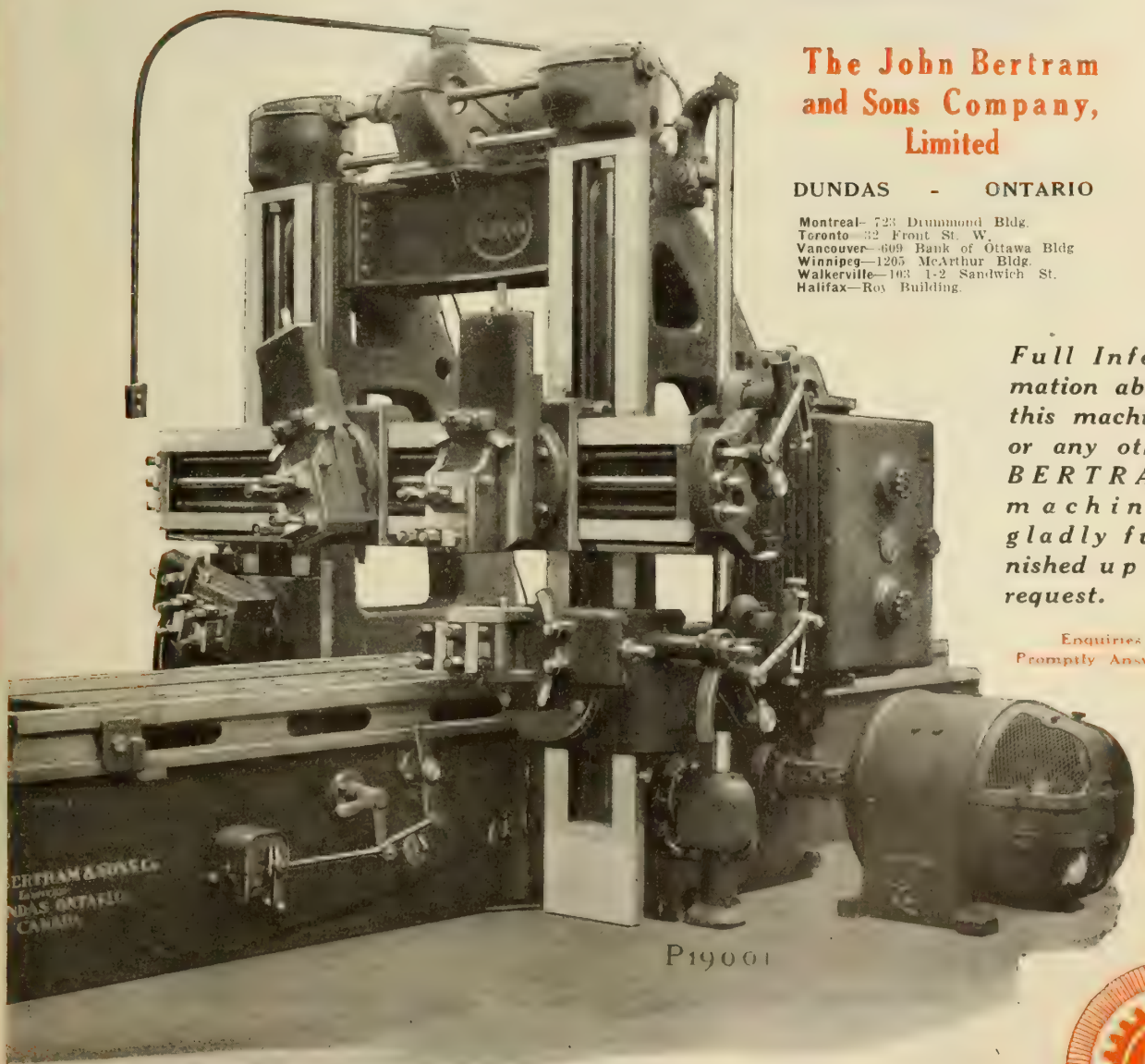
Vol. XXVIII. No. 16 | Published Weekly by the MacLean Publishing Company, Limited, Toronto, Ont. | Oct. 19, 1922 | $4.00 a Year Subscription Price

READ AND PASS TO	Check	See Page	READ AND PASS TO	Check	See Page

J.R.&S.Co.

42" X 42" SPECIAL PLANER

Two heads on cross rail --- Two side heads --- Equipped with Reversing Motor Drive--- Steel gears and rack.



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Full Information about this machine, or any other BERTRAM machine, gladly furnished upon request.

Enquiries Promptly Answered

J.R.&S.Co.

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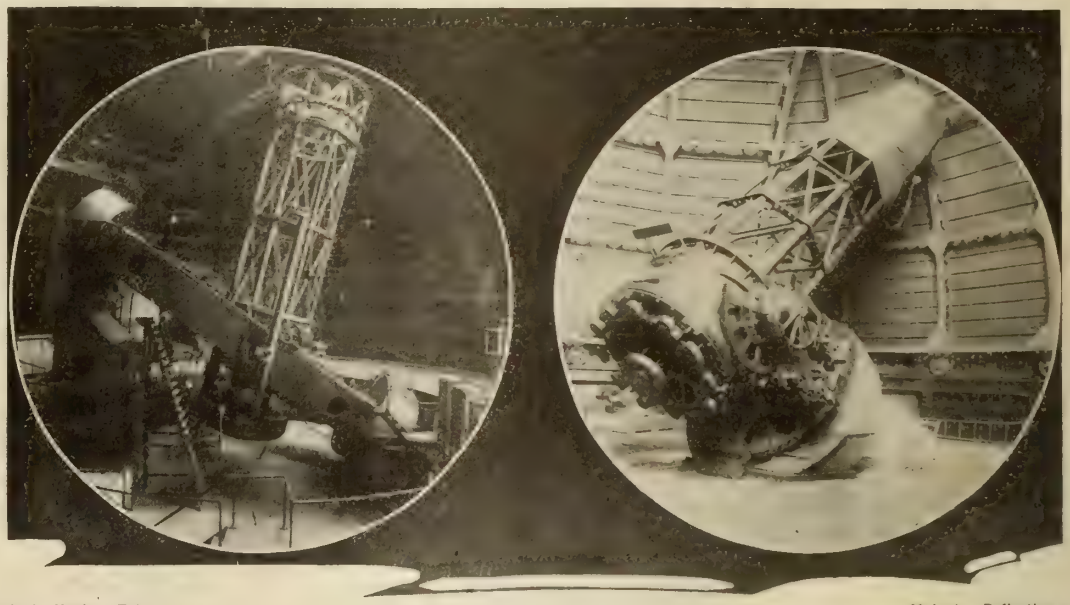

100-inch Hooker Telescope with Cassegrain spectrograph.

60-inch Reflecting Telescope from the west.

The World's Largest Telescope

—*Weight 650 Tons*—Ball Bearing Equipped

Only 50 H.P.—divided between 40 small motors—is required to operate the great 100-inch telescope of the Mount Wilson Observatory—the largest in the world.

The massive 550-ton dome, mounted on 23 ball-bearing equipped trucks, responds to the traction of two small 7½ H.P. motors. Altogether, over 200 **SKF** marked ball-bearings support the dome and the telescope's 100 tons of moving parts.

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The fact that ball bearings are very accurate, practically frictionless and show no appreciable wear, contributes much towards maintaining the delica e movement and ease of adjustment so essential where millions of miles are measured by a mere fraction of an inch.

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CANADIAN **SKF** COMPANY, LIMITED

TORONTO - MONTREAL

Races displaced to show DEEP-GROOVE bearing carrying maximum end thrust in a forward direction.

Races displaced to show THE SAME bearing carrying maximum thrust in reverse direction.

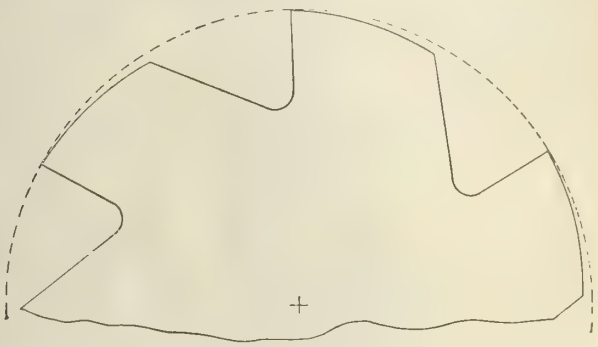
PRATT & WHITNEY

Reamers

With Eccentric Relief

THE cut below shows our patent eccentric relief which is an exclusive Pratt & Whitney feature. Eccentrically relieved Reamers, as made by us, have the distinguishing advantage that they can be sharpened by grinding on the face of each flute, thus retaining a true working size for a much longer period than is otherwise possible.

Pratt & Whitney Reamers are the only reamers having this eccentric relief, which should not be confused with the so-called "Eccentric tooth," which is nothing more than unequal spacing and adds nothing to the life of the tool.



--a stronger tooth--a smoother hole
--no chatter--maintained size

All P. & W. Adjustable Reamers have **eccentric** relief, can be set to size without regrinding and can be made to **face the bottom of a hole.**

In order to set these reamers, it is only necessary to loosen the shoes and run back the nuts. The blades can then be pushed back and the shoes tightened slightly. Then, upon coming up with the adjusting nut, the diameter will gradually decrease until the desired size is obtained. Lock-nut and shoes are now firmly tightened and the reamer is ready for use. Quick, positive and convenient.

Be Sure They Are Stamped Pratt & Whitney

These reamers are made with 12 different sizes of bodies, giving an adjustment from .020 to .060 in., according to the diameter. Shell, hand or chucking reamers with the same number of body have interchangeable nuts, shoes, screws and wrenches. Shell and chucking reamers with the same number of body have interchangeable blades also.

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By reason of the magnitude of the operations of our constituent companies, combined with a balanced, highly efficient organization, we are in a unique position to serve the needs of the industries of the world—and of Canada in particular.

—ALL within the empire

If Interested tear out this page and place with letters to be answered

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& Company Limited.

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EXCAVATORS

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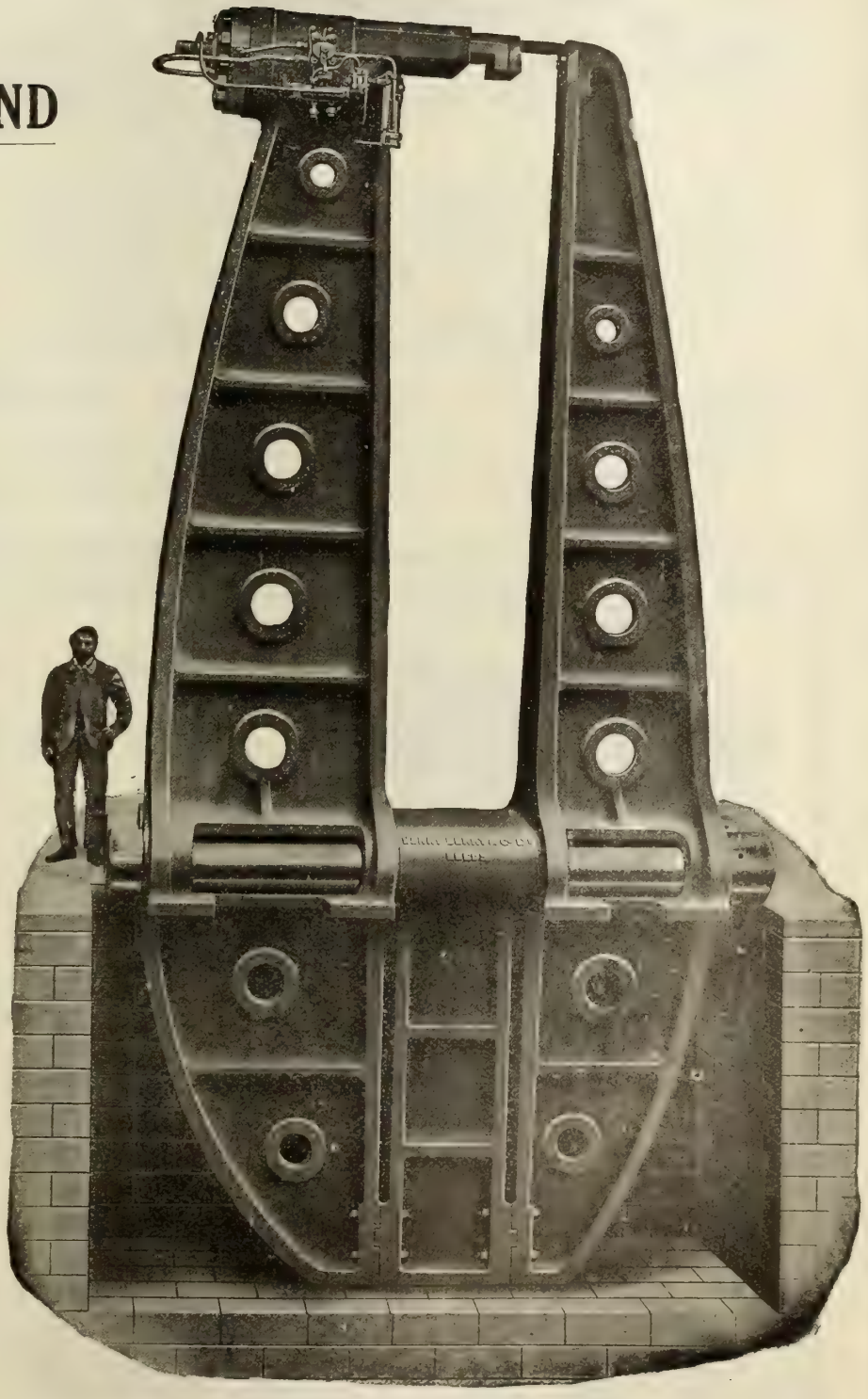
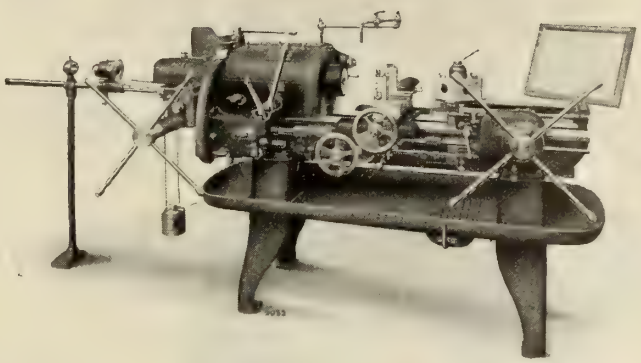
PLANT for STEELWORKS and RAILWAY SHOPS



17'6" gap Fixed Hydraulic Rivetting Machine

3 Powers—33, 67 and 100 Tons.

ECONOMICAL on the Small Quantities Too



THE No. 4 Herbert Capstan or Universal Turret Lathe illustrated presents a rapid production, exceedingly versatile machine. It will handle bar work in the draw in chuck up to 1⅝″ x 10″ long. The swing is 13″ over the bed. The cross saddle is provided with a positive leader chasing mechanism. The range of standard tools available from Toronto stock enables an exceedingly large percentage of brass and steel work to be done without special toolmaking.

The words turret lathe and quantity with many are synonymous. This is a mistake. Quantity is a relative term. On some work six is a quantity which will pay handsomely. We would appreciate an opportunity of investigating your work and reporting to you fully as to the possibilities of savings by the introduction of turret lathes.

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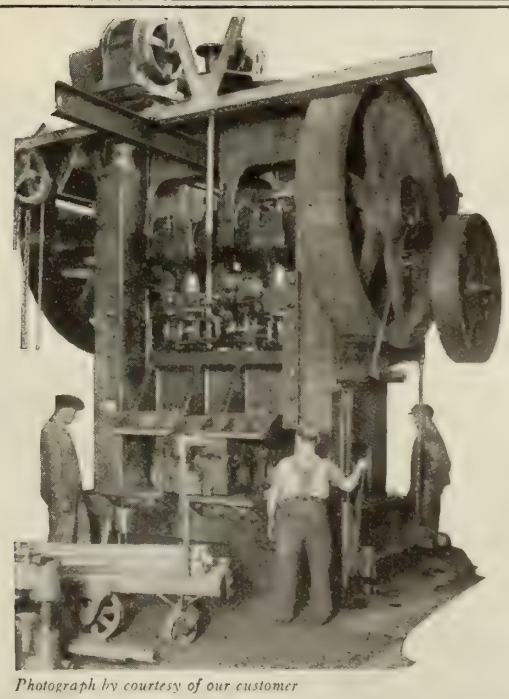


Photograph by courtesy of our customer

Double-Crank Presses

BLISS

IN THE PICTURE is shown a BLISS No. 12 Double Crank Press perforating at one time rivet holes in two tractor side frames. The rivetting of the angle iron and frame is done with BLISS Rivetting Presses.

BLISS Double Crank Presses, combining accuracy, durability and convenience, are built in over one hundred and fifty types and sizes. Weights range from 3000 to 600,000 lbs. They are particularly adapted for heavy stamping, punching, cutting, piercing, and trimming. There is a size to economically meet every requirement. BLISS on your machinery is more than a name, it's a guarantee.

Bliss for Machinery

E. W. BLISS CO. MAIN OFFICE AND WORKS **BROOKLYN, N. Y., U. S. A.**

SALES OFFICES DETROIT Dime Bank Bldg. CLEVELAND Cleveland Discount Bldg. CHICAGO Peoples Gas Bldg. PITTSBURGH Oliver Bldg. ST. LOUIS Boatmen's Bank Bldg. BUFFALO Marine Bank Bldg. CINCINNATI Union Trust Bldg. NEW HAVEN Second Nat'l Bank Bldg.

American Factories: BROOKLYN, N.Y. HASTINGS, MICH. CLEVELAND, OHIO. SALEM, OHIO.

FOREIGN SALES OFFICES AND FACTORIES:

ENGLAND, Pocock St., Blackfriars Rd., S. E., London ITALY, 345 Via Nizza, Turin FRANCE, 54 Blvd. Victor-Hugo, St. Ouen, Paris

No. 319

If Interested tear out this page and place with letters to be answered

A Finish Fight

This Advertisement is one of a series based on actual occurrences

THE smaller crab, more aggressive, had all the best of the battle. The larger one was handicapped because he had only one fighting claw.

How strikingly this battle sums up the story of a recent experience of our own in a large machine shop. It was a question of which should survive, old methods —or new.

The job was to remove machine oil from brass tubes before japanning. The old method of cleaning with caustic was slow and gave frequent trouble.

Resident Canadian Representatives:
Mr. C. Burgin, Montreal,
Mr. C. P. Murphy, Toronto

New methods were instituted and Oakite Platers' Cleaner went at the work aggressively, like the young crab, and took hold with all its claws. It cleaned the work perfectly, ***3 times faster*** than caustic. The tubes were made absolutely clean before japanning, a condition never before possible when caustic was used. A considerable saving in money resulted from the elimination of rejects—and naturally O.P.C. won the battle.

Wouldn't you like to clean your work ***3 times faster*** and cut out rejects in your shop? Let us stage a competitive test in your plant between Oakite materials and whatever you are using. Under our liberal guarantee we will ship you enough Oakite materials for a 30-day trial. If we can't clean your work faster, better and for less money, it won't cost you a cent.

That's fair, isn't it? May we ask one of our experienced Service Men to call to arrange the details with you? Write us.

OAKITE

MANUFACTURED BY OAKLEY CHEMICAL CO. 44 THAMES ST. NEWYORK

There's a RAYMOND For Every Purpose

No matter what your Spring requirements — no matter how unusual they may be—you can confidently leave it to our engineers to design a Spring that will function to your entire satisfaction. A staff of experts, together with unique heat-treating and testing facilities, make this possible. We guarantee both material and workmanship.

If you have Spring problems, consult us.

Raymond Mfg. Co., Ltd.
Corry, Pa., U.S.A.

For Making Perfect Screw-Thread Joints

SMOOTH-ON
ELASTIC CEMENT NO. 3

A screw-thread joint made with Smooth-On Elastic Cement No. 3, will not leak, because the Smooth-On expands in metallizing and so closes up any defective places which otherwise would cause leaks; yet, the joint may be taken apart when desired.

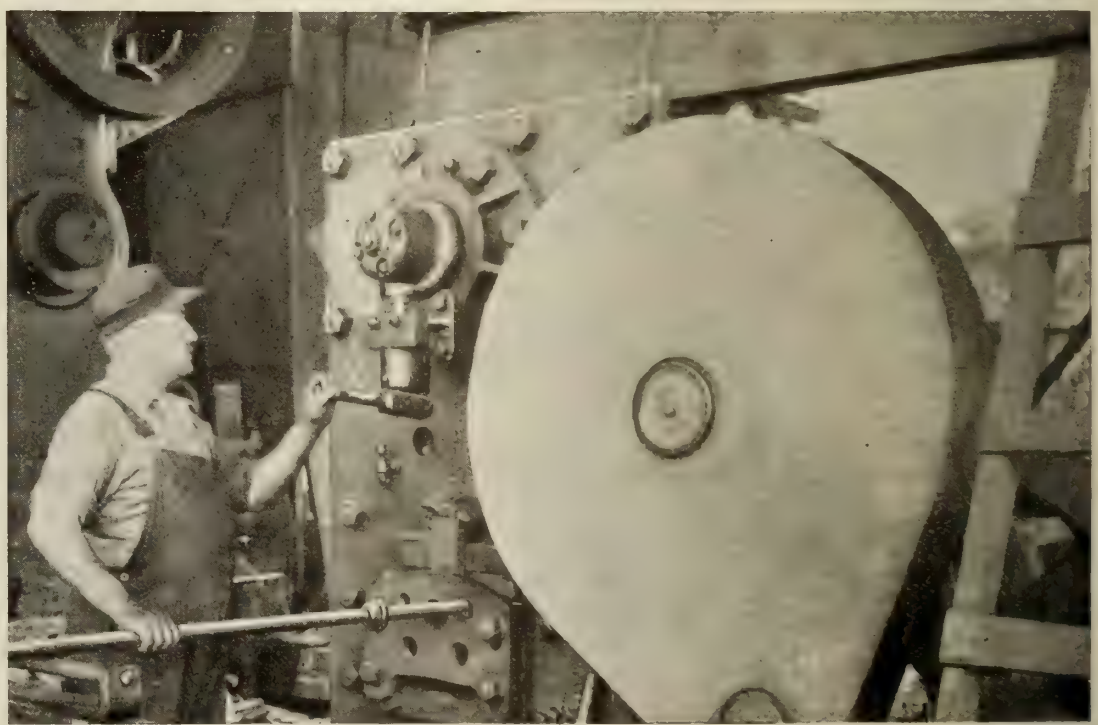
Smooth-On Elastic Cement, No. 3, is sold ready for use in paste form. It is applied to the screw-threads with a brush. Especially useful for high pressure steam or water joints, for ammonia joints, for coating flanged joint faces and for coating gaskets.

Send for our NEW Smooth-On Instruction Book No. 19. It illustrates and describes how to make perfect screw-thread joints and hundreds of other repairs. You will marvel at its contents. The book is **FREE.**

Smooth-On Elastic Cement No. 3 comes in 5 lb., 10 lb., and 25 lb. tins. Also in larger sizes.

SMOOTH - ON MFG. CO.
DEPT. 9K.
570 - 574 COMMUNIPAW AVE. JERSEY CITY, N.J., U.S.A.
Sole Agents in Canada: Canadian Asbestos Co., Montreal, Que.

Sixteen Drop Hammers Kept Busy by this Machine



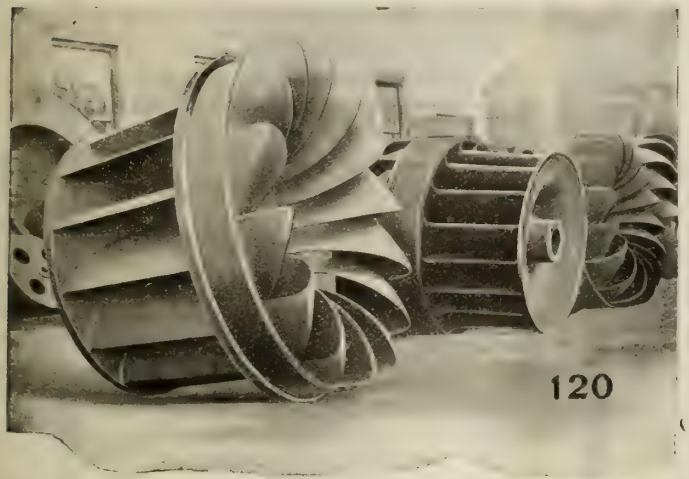
This Bar Cutter, less than one-half the weight of a cast iron machine of the same capacity, has 7½ times the strength, and cuts all the stock for the 16 busy drop hammers in operation at the Pittsburgh Knife and Forge Company, Corapolis, Pa.

Small size, light weight, unusual power, great strength is the story in a nutshell of the Armor Plate Construction which makes Canadian Punches, Shears and Bar Cutters such efficient and economical machines. **Dept. No. 16 will send you valuable information.**

Canadian Blower & Forge Company, Limited, Kitchener, Ont.

If interested tear out this page and place with letters to be answered.

WATER POWER PLANT MACHINERY



Four 49 inch runners, part of equipment for a twin setting of a double vertical unit supplied the Seymour Power Co., of Campbellford.

The Wm. Kennedy & Sons, Limited
OWEN SOUND ONTARIO.

DISTRICT REPRESENTATIVES:
M. B. Saunders, 8 Silver Street, Cobalt, Phone, Cobalt 153.
L. A. Mitchell, 1091A Bathurst St., Toronto, 'Phone Hillcrest 2014.
H. C. Kennedy, 364 University St., Montreal, Phone Uptown, 5396.

KENNEDY

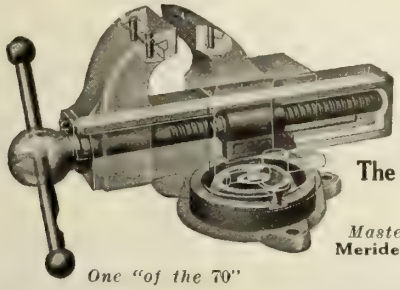
PARKER VISES

They "Grip Like a Grizzly."

Made *by* Good Workmen *for* Good Workmen

The makers of Parker Vises, themselves skilled craftsmen, appreciate the importance of good tools.

That is why they have built into Parker Vises special features of extra strength and convenience not found in any other vise.



One "of the 70"

SEND FOR NEW CATALOG NO. 57-C

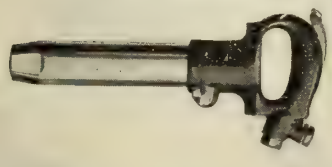
The Charles Parker Co.
Master Vise Makers,
Meriden, Conn., U.S.A.

Cleveland Foundry Sand Rammers

For Floor, Flask and Bench Ramming

For speed, power, economy and general efficiency Cleveland Rammers have no equal. The men like them as they have no recoil and when running lift and sustain their own weight. Try one and note their resilient action on the work.

CLEVELAND CHIPPERS AND PORTABLE AIR GRINDERS ARE "IDEAL" FOR FOUNDRY CLEANING ROOM



Enclosed Handle Chipper. Sizes, 1½", 2", 3" or 4" stroke. We furnish pistol grip style with outside or inside latch in same sizes. They have high speed, no recoil and are dust-proof. Just the tool for the foundry.

No. 7G Air Grinder. Weight, 12 lbs.; 4,600 R.P.M.; 4-in. or 6-in. emery wheel. No. 8G. The same only a little heavier. Weight, 21 lbs.; 3,600 R.P.M. Has 8-in. wheel guard. Can be fitted with snap or twist handle if preferred.

IN STOCK—Riveters, Chippers, Air Drills, Corner Drills, Compound Drills, Rammers, Grinders, Foundry Blow Guns, Bowes Air Hose Couplings, Cleco Pressure-Seated Air Valves, etc.

Ask for Bulletins Nos. 51, 52, 78G.

ADDRESS ALL INQUIRIES TO:

CLEVELAND PNEUMATIC TOOL CO. OF CANADA, LIMITED

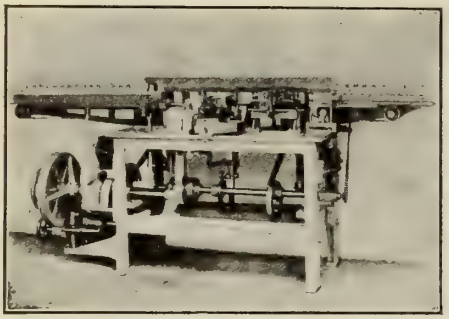
84 CHESTNUT STREET, TORONTO, ONT. 337 CRAIG ST. W., MONTREAL, QUE.

THE JOHNSON FRICTION CLUTCH

as used on the

WEEKS AUTOMATIC LABELER

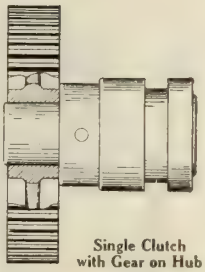
For Oval, Round and Square Bottles



The No. 2 single Johnson Friction is located on the drive shaft direct from ¼ h. p. motor. Clutch is adjusted to drive the machine but will slip when bottle is caught which prevents breakage.

Courtesy: F. W. Horstmann Co., Irvington, N. J.

There is only one clutch that can readily be made to meet so many varied conditions — the Johnson Friction Clutch. A product of great merit. Built in nine sizes from ¼ to 20 h.p. Can be run at high speed without vibration.



Single Clutch with Gear on Hub

Write for "Yellow Friction Control" Catalog.

THE CARLYLE JOHNSON MACHINE CO. MANCHESTER, CONN.

GISHOLT

LABOR SAVING EQUIPMENT

TURRET LATHES
Hand Operated
For Chucking and Bar Work
AUTOMATIC TURRET LATHES
For Chucking Work
VERTICAL BORING and TURNING MILLS
UNIVERSAL TOOL GRINDERS
HORIZONTAL BORING and DRILLING MACHINES
CYLINDER GRINDERS
TOOL-POST TOOL HOLDERS
REAMERS, "SOLID ADJUSTABLE"
Shell and Chucking
BORING BARS
With Adjustable Cutters
PERIODOGRAPH
For Time Recording in Factories
Separate Catalogs on each Product
Send for the ones you want

GISHOLT MACHINE CO.

1207 E. Washington Avenue

Madison, Wisconsin, U. S. A.

MADE IN CANADA

MADE IN CANADA

WILLIAMS' SUPERIOR

DROP-FORGED

WRENCHES

Over 40 Standard Patterns in 1000 Sizes

J. H. WILLIAMS & CO., Limited

"The Wrench People"

45 Thorold Road, St. Catharines, Ont.

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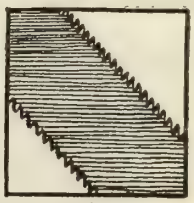
No, thanks— I've sworn off on 'freaks'—

"I used to be easy meat for freaks and 'all-around, general purpose' things. Got so I'd try *anything*, as long as it was different. Trick spoons and plugs that were guaranteed to do everything short of causing the fish to jump into the boat. I had 'em by the score but the fish they hooked could be counted on my fingers.

"Funny shaped putters that were supposed to remove the human element on the green—actually I got to experimenting so much that my game was all but ruined before I came back to earth and threw out the lot.

"And it was the same story with hack saws. I remember one we tried out that had two cutting edges—the theory was that it would last twice as long as the others. When we put it to work, however, the upper edge was so dulled by friction as it passed through the cut that it was impossible to make even *one* cut with the blade turned. Others were not quite so bad, but I'm through experimenting with 'freaks'! It's too expensive with labor and overhead so high.



"Look in my tool room today and you'll find Starrett blades only, in the hack saw section. They represent the very best experience in hack saw manufacture and I *know* they're reliable. And I'd have saved money if I had quit experimenting earlier."

Send for Catalog No. 22"3" and the Supplement showing the newest Starrett Tools

THE L. S. STARRETT CO.

The World's Greatest Toolmakers
Manufacturers of Hacksaws Unexcelled
ATHOL, MASS.

Write for "Hack Saws and their Use" a handy reference book on the least understood tool in the shop. Sent free on request.

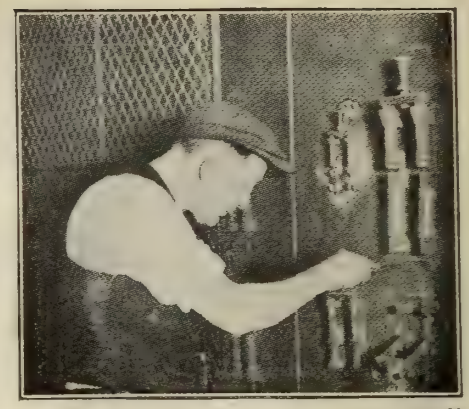
42-445

Use Starrett Hacksaws

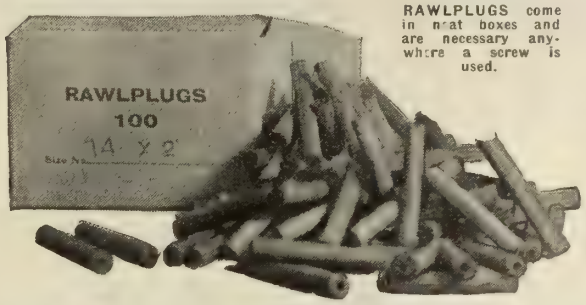
RAWLPLUGS

Hold Screws in any Material

The Greatest Idea in Years. Machine Shops, Builders, Contractors, Electricians and all other trades find RAWLPLUGS indispensable. No skilled handling required. Can be used in either hard or soft materials and will hold firmly under all conditions. They are low in cost and save time.



Can be placed in Brick or Cement Wall



RAWLPLUGS come in neat boxes and are necessary anywhere a screw is used.

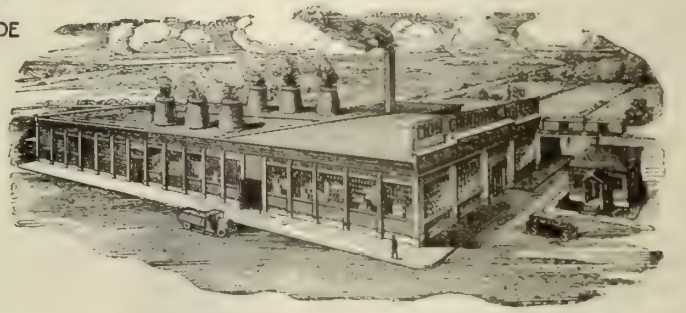
A Special Alloy Steel Tool shown below makes the hole. Two tools, which are interchangeable in the one holder, are used. The first, "A," is used in Brick, Concrete, Metal, or any hard material, while the tool "B" is used in Plaster or any soft material. Find out how useful RAWLPLUGS are by ordering a box at once. We have a mechanic's outfit which comes complete and is very reasonable in cost. Let us tell you all particulars about it.

Rice Lewis & Son, Limited

Established 1847 **TORONTO, ONT.** **19 Victoria Street**

"LION" GRINDING WHEELS

MANUFACTURERS OF HIGH GRADE GRINDING WHEELS



ALU-LION

For Grinding High Tensile Material

CARBO-LION

For Grinding Low Tensile Material

The Wheels You Will Eventually Buy. Why Not Now?

LION GRINDING WHEELS Ltd.

BROCKVILLE, ONT.

Agents for Prov. Quebec
J. R. Baxter & Co., Ltd.
Montreal

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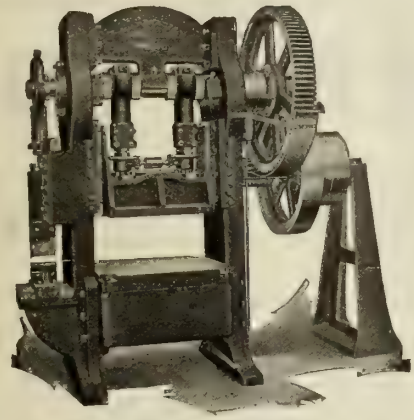
BROWN-BOGGS

B B

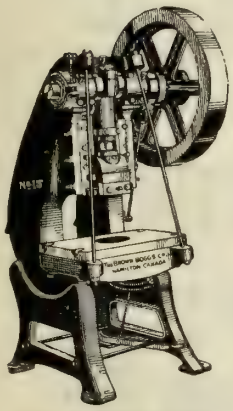
There's Only One Way To Buy Presses—



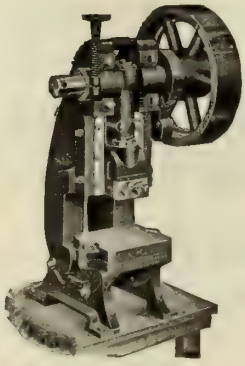
No. 140—Double Crank Trimming Press.

or. for that matter, any machinery—that is on the **satisfaction-guaranteed basis,** and it is upon this basis that all **"B-B"** machines are sold.

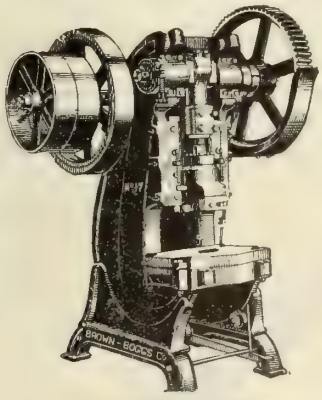
More than half a century's practical experience in anticipating the requirements of the trade by the introduction of improved machinery for more accurate and quicker production, is behind the all-round satisfaction given by our line of Power Presses. We are sincere in our belief that they are capable of turning out more top-notch work in one day than has ever been produced before.



No. 15—Power Press.



No. 10—Bench Press.



No. 17—Power Press.

The "B-B" line also includes Dies, Shears, Punches, Drop Hammers, Canners' Evaporating Machinery and Special Machinery. Let us know the machine in which you are interested and we will furnish complete information. If you wish advice, consult us freely—without obligation.

TORONTO OFFICE:
Holbrook Building

A. B. WALKER
Representative

THE BROWN-BOGGS CO. LIMITED
HAMILTON, CANADA.

A Better Furnace
for general tool work

Bellevue No. 106

Small tool annealing and tempering costs are reduced to the lowest possible point when this highly efficient scientifically built **Bellevue Furnace** is employed.

Reverberatory flame action—no direct flame on the work.

Our engineers will gladly assist in solving your furnace problems. Write us.

Bellevue Industrial Furnace Co.

2977-2981 Bellevue Ave. - Detroit, Mich.

Representatives in Canada:

CHAS. A. STRELINGER COMPANY, WINDSOR

GARLOCK MACHINERY LTD., Toronto, Montreal, Winnipeg

MORSE No. 728 Adjustable Reamer

Strength and Accuracy

with great range and ease of adjustment are the essential features of this reamer. It has a Wide Range of Expansion. From 1-16″ in the smallest to 3-16″ in the largest. Set A to H (eight reamers) has cutting radius 15-32″ to 1 1-16″. Set A to K (eleven reamers) 15-32″ to 1 17-32″. The blades of this reamer are replaceable and being ground to size are ready for insertion and immediate use. Furnished in both carbon and high speed steel.

Send for Descriptive Circular

Morse Twist Drill Mch. Co.
New Bedford, Mass., U. S. A.

The Hammer With The Human Stroke

HEADS RIVETS COLD

Heads 'em tight or loose, flush, countersunk, or finishes heads any shape desired, and at the rate of:
A rivet a second, sizes up to 3/16″.
A rivet in two seconds, size ¼″ to ⅜″.
A rivet in three seconds, size 7/16″ to ⅝″.
And on special order we build machines to handle rivets up to 1½″ with proportionate rapidity.
Built in eight sizes.
Besides riveting, the High Speed Riveting Hammer does all kinds of peining, swaging, upsetting, etc.
Send us sample assembly parts with rivets or sketch of your work,

and

Let us shoulder your riveting problems.
Send for the High Speed Hammer Book.

THE HIGH SPEED HAMMER COMPANY, INC.

ROCHESTER, N.Y.

If interested tear out this page and place with letters to be answered.

GUTTA PERCHA & RUBBER, LIMITED
TRADE PMS MARK
THE "RED RIBBON" BELT
TORONTO, CANADA

Great Strength

With Greater Adhesion to the Pulley, Even Pliability and Remarkable Resistance to Heat, Cold and Moisture.

"P. M. S."

THE "RED RIBBON" BELT

What does interruption to production mean to you? Whenever belts break, and machines and men stand idle, what does it cost?

Good belting is an important consideration in your plant. If conditions are a severe test on belting—use "P.M.S." If you want low ultimate cost—buy "P.M.S."

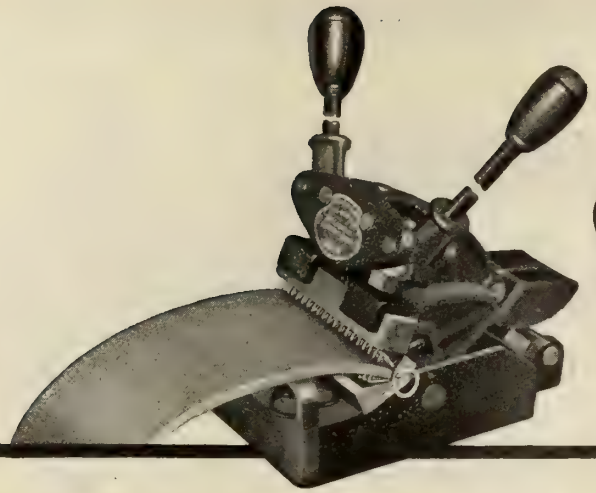
Manufactured Exclusively by

Gutta Percha & Rubber, Limited

Head Offices and Factories

TORONTO

Branches in All Leading Cities of Canada



The $36 Workman on the $3700 Job *Makes Good*

How Clipper Belt Lacers Cut This Firm's Operating Costs

A well known manufacturer—name on request—reports that two $35 Clipper Belt Lacers save $3700 annually. One millwright using two Clippers spends three hours a day caring for more than 500 belts ranging in width from 1" to 6".

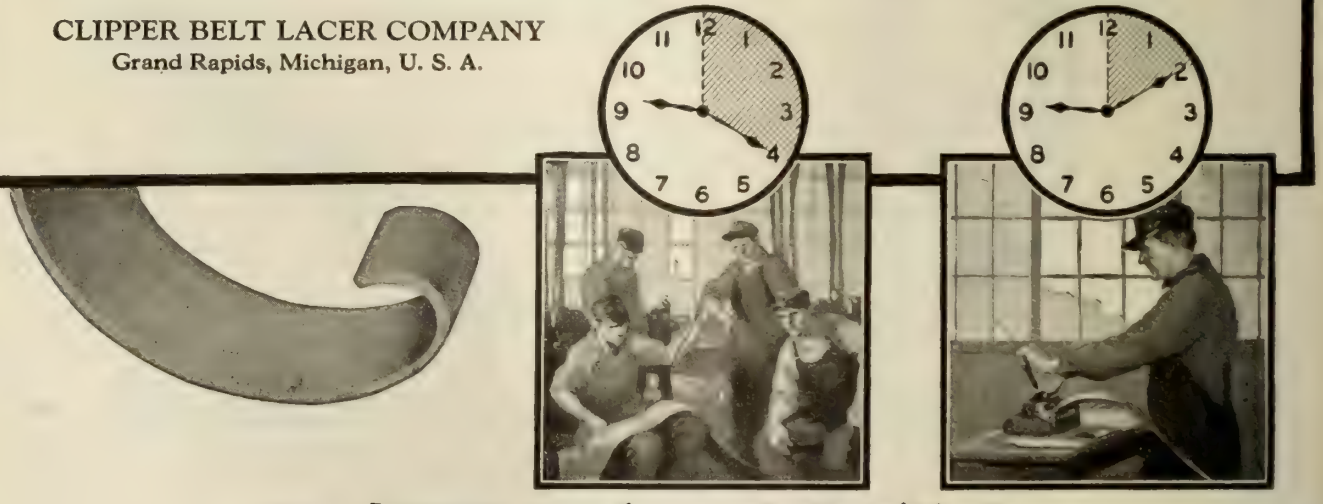
Formerly it required 20 minutes to repair a broken belt. Now ten minutes does the entire job with the Clipper. Idle man time and idle machine time were cut in half. In addition, the life of clipper joints averaged 40% longer than hand lacings because the Clipper neither cuts nor punches the belt.

Packard Motor Car Co., Dodge Brothers, Klaxon Company, International Silver Co., are a few of the thousands of companies using Clipper Belt Lacing.

To Jobbers and Dealers in Mill Supplies

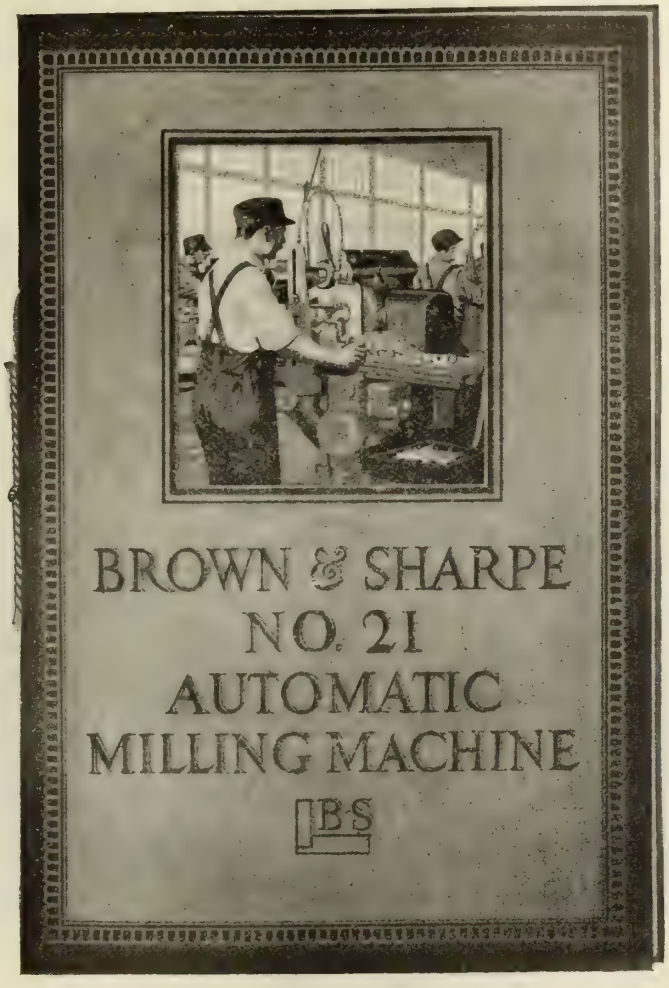
The Clipper is a nationally advertised cost-cutting tool that every factory and shop needs. Rapid turnover of 3 sizes, one shown being largest. Steady sales of carded hooks at good profit. Ask for our proposition. (1)

CLIPPER BELT LACER COMPANY
Grand Rapids, Michigan, U. S. A.



Anyone can lace a belt with the

"Clipper"



MILL IT AUTOMATICALLY

This Book Tells You How

Speed, accuracy, adaptability—highly desirable features in any machine tool—are all combined in our No. 21 Automatic Milling Machine, a production unit of the highest value.

This machine is fully described in a 40-page booklet which includes detailed production figures giving an excellent idea of what our No. 21 could do in your plant.

Write for this booklet to-day.

BROWN & SHARPE MFG. CO.

Providence, R.I., U.S.A.

Canadian Representative:
CANADIAN FAIRBANKS-MORSE CO. LTD.

Brown & Sharpe Mfg. Co.,
Providence, R.I., U.S.A.
Send me your book describing your No. 21 Automatic Milling Machine.

NAME .....

STREET .....

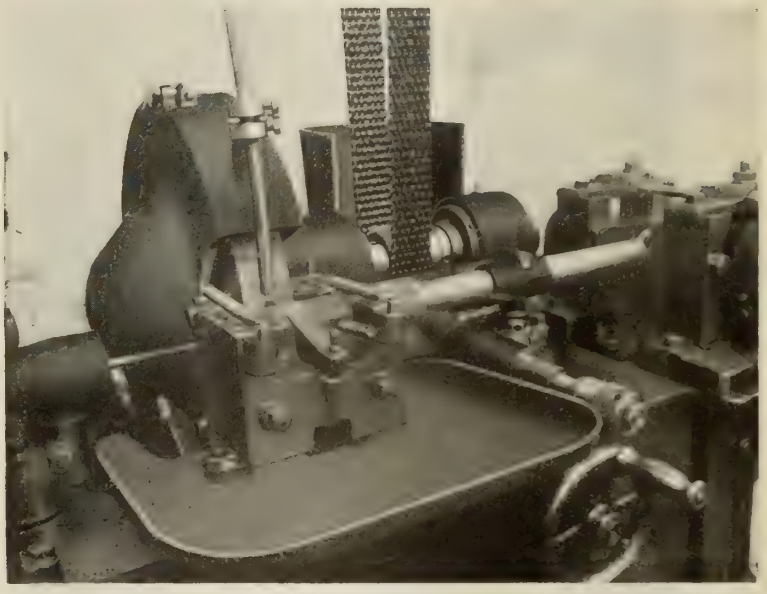
CITY .....

PROVINCE .....

BELT

vs

RENOLD CHAIN DRIVES



An Interesting Experiment

was made to obtain the comparative efficiencies of Belt and Chain driving on a number of Grinding Machines designed for the grinding of steel rods up to .375-in. diameter; 7 to 8 ft. long; to a working limit of .00025-in. The original spindle drives on these machines were by belt from three-speed countershafts. These belt drives gave considerable trouble due to slip, which resulted in irregularity in size and finish of the rods and considerable loss of time in keeping the belts sufficiently tight to stand up to the work. The life of the grinding wheels was uncertain, and time spent in trimming up kept the machines idle many hours per day.

Inverted Tooth Chain was fitted to the spindle, as shown above. Roller chains were also fitted in place of the round leather belt feed motion drives which had been giving trouble owing to slip, causing irregular feed which, in turn, necessitated a close watch on the rods for flats, finish and size.

The Result

of these conversions was an immediate improvement, there being a 40 per cent. increase in production during roughing, and a 20 per cent. increase during finishing. The number of passes on the rods was reduced accordingly and the net power saved was 26 per cent. In addition, the wheel consumption was reduced and the productive hours increased by less frequent trimming up of the grinding wheels.

Let us show you how "Renold" Chain Drives will benefit you.

HANS RENOLD OF CANADA, LTD.

11 SACRAMENT ST., MONTREAL - 32 FRONT ST. WEST, TORONTO

If interested tear out this page and place with letters to be answered.

CANADIAN MACHINERY
AND
MANUFACTURING NEWS

VOL. XXVIII, No. 16 OCTOBER 19, 1922

Automatic Production in a Locomotive Works

Blanks, Castings and Forgings Successfully Machined—Work Must be Carefully Checked—Special Jaws for Irregular Shaped Pieces—Multiple Tool Holding Fixtures—Overhead Pilot

THE auto lathe, or automatic turning machine as it is sometimes called, is in reality a turret lathe for dealing with detacned pieces such as blanks, castings and forgings on which all cutting operations proceed automatically after the work has been chucked. When the cycle is completed, the machine stops automatically: a new piece is put in the chuck by the operator and the machine re-started. It is possible, therefore, for one operator to attend several machines, so that the labour cost per machine hour is low. Where the quantities of work which can be put in hand at one time are sufficiently large to justify the use of auto lathes, this type of machine produces work at a lower cost than the combination turret lathe, although the machining times may be approximately the same.

At first sight, it might appear that in a locomotive works it would hardly be possible for the auto lathe to be a paying proposition, yet by careful standardization in the design of component parts of the locomotive, it is possible to put large batches through for stock and draw upon them as required.

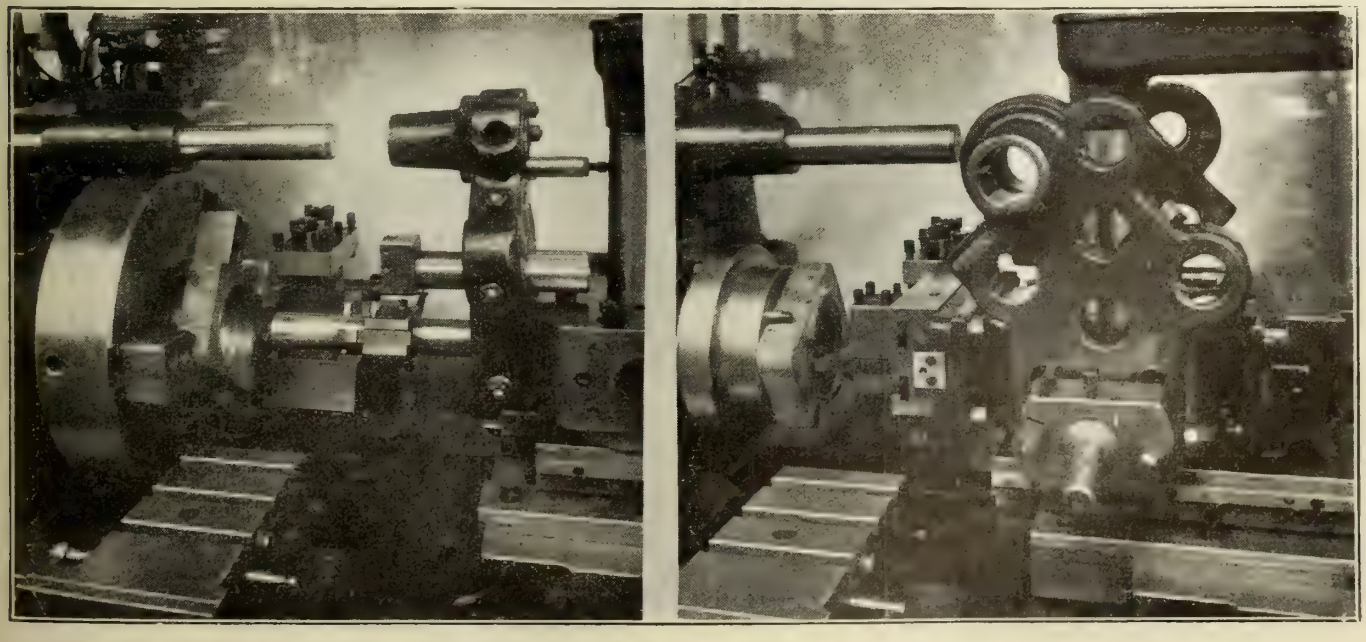
About the first railway company in England to consider the possibilities of auto lathes on locomotive work was the Lancashire & Yorkshire Railway Co., of Horwich who, in 1912, examined the question from their own point of view. After careful consideration of the estimated production times on various pieces of work which were considered suitable, three automatic turning machines were installed, two of the No. 4 size and one of the No. 2 size. The work for which these machines were ordered included the following parts:—wash-out cap nut, safety valve chuck, mud collector cover, coupling rod bush, reversing shaft bush, air pump, piston head, radial check spring bush, train pipe syphon, feed pipe flanges (round and oval), connecting rod nut, suspension stay bolt, spring link adjusting nut.

This method of production proved profitable and two more No. 4 "Herbert" machines were installed in 1913. During the war the continuation of this policy was temporarily suspended, but recently a larger machine, a No. 6 automatic turning machine, was installed. This machine was supplied with tool equipment for a number of parts which are typical of those which can be economically handled by automatic methods, and the purpose of the present article is to consider in detail the machining methods on these parts as illustrative of the possibilities of this type of machine on work of this class.

Piston Rod Gland

The piston rod glands are made from rectangular iron castings 7¾ inches x 6⅛ inches, the leading dimensions of which are given in the detailed view at the top of the layout for the first operation, Fig. 1. The chucking is particularly interesting as it shows the adaptability of the Coventry concentric chuck to irregular objects by the use of special jaws.

Illustrations and information through courtesy of Alfred Herbert Co., Coventry.



Figs. 2 and 4.—Set-up for first and second operation for machining piston rod gland.

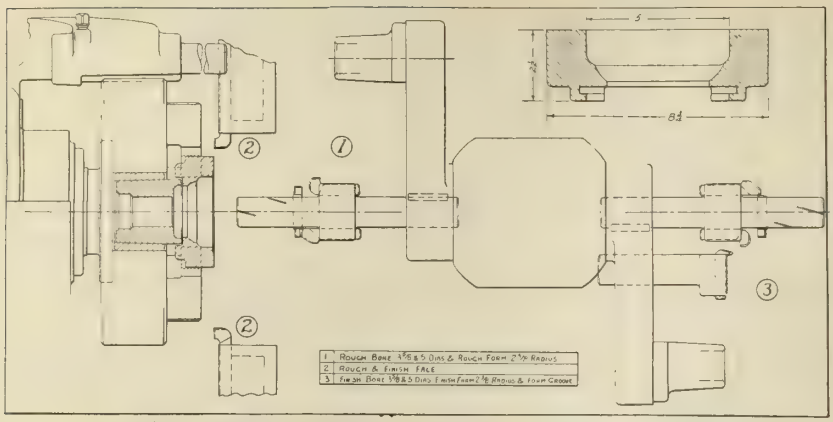


Fig. 1.—Tool layout for first operation on piston rod gland.

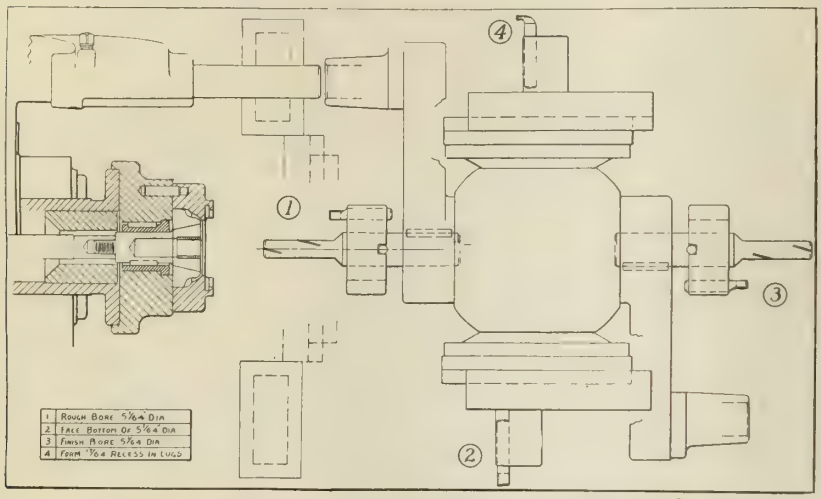


Fig. 3.—Tool layout for second operation on piston rod gland.

At first sight it might appear that the chucking of this casting was legitimate work for a four-jaw chuck, but with independent jaws chucking would obviously be a slower operation, and moreover the work might possibly get out of truth unless carefully chucked. With the Coventry concentric chuck, once the jaws are set it is easy to chuck this piece of work as an ordinary circular object.

In order to facilitate identification of the tools throughout the following descriptions, they have been numbered on the layouts for reference.

Tool No. 1 is a boring bar which carries a rounded cutter for roughing the small bore. An enlarged portion on this bar carries two form boring cutters for dealing with the two other portions of the bore. Simultaneously with this boring operation, the back and front cross slides come in for facing. A roughing tool is carried on the back and a finishing tool on the front tool post, the roughing tool being set to cut about ⅛ in. in advance of the finishing tool. From a production point of view it is a great advantage to have these two tools operating simultaneously, and it is an important feature of the Herbert design that this can be done with the independent cross slides which can be set to operate together or independently at any part of the cycle as desired.

Tool No. 3 is a boring bar with cutters similar to No. 1, for finishing the corresponding surfaces. It is clamped in a standard combination tool holder which also carries a turning head in which is fixed a small cutter for grooving the face of the gland. It will be noted that both boring bars are piloted in the chuck steady bush: it is good practice to make these steady bushes taper on the outside and fit them into a liner with a taper bore which is left in the chuck. The taper is approximately the same included angle as a Morse taper, and facilitates removing the steady bushes from the chuck. The set-up of the machine on the first operation is shown in Fig. 2.

At the second operation—Figs. 3 and 4, the work is chucked on an expanding drawback arbor bush operated by a handwheel at the rear of the spindle. The tapered peg is bored out and fitted with a phosphor bronze liner which serves to steady the boring bars used at this operation. A positive drive to the work is obtained by a pin fixed in the faceplate, engaging one of the sides on the casting.

Tool No. 1 is a bar carrying a cutter head for rough boring the counterbore. Tool No. 2 is a slide facing tool for machining the face at the bottom of this counterbore with a traversing cut. This is better practice than coming on to scale with a flat cutter, as scale would rapidly destroy the cutting edge. Instead, the slide facing tool is attached to the turret which is brought forward to the work and held stationary by means of a retaining cam, while one of the tool blocks carries a simple cutter. A piece of rectangular stock in the tool post, or the tool post itself, then comes up against the slide with the ordinary cross slide feed and pushes over the tool slide which thus machines the inside face with a traversing single point cut.

Tool No. 3 is a boring tool similar to No. 1 for finishing the counterbore. Tool No. 4 is another slide facing tool carrying a hooked cutter for forming the undercut. As in the case of No. 2 this slide is brought forward and held stationary while it is pushed over by the back tool post. The machining time for the two operations is 22 minutes.

Machining Valve Head

The valve heads are made from iron castings which at the first operation—Fig. 5, are gripped under the head by special jaws in the Coventry chuck. This is often a very helpful way of gripping the work as it frequently enables the whole of the outside to be machined at one chucking, thus avoiding the necessity of matching up. It is a very important point, therefore, in the choice of a chuck to see that it is equally power-

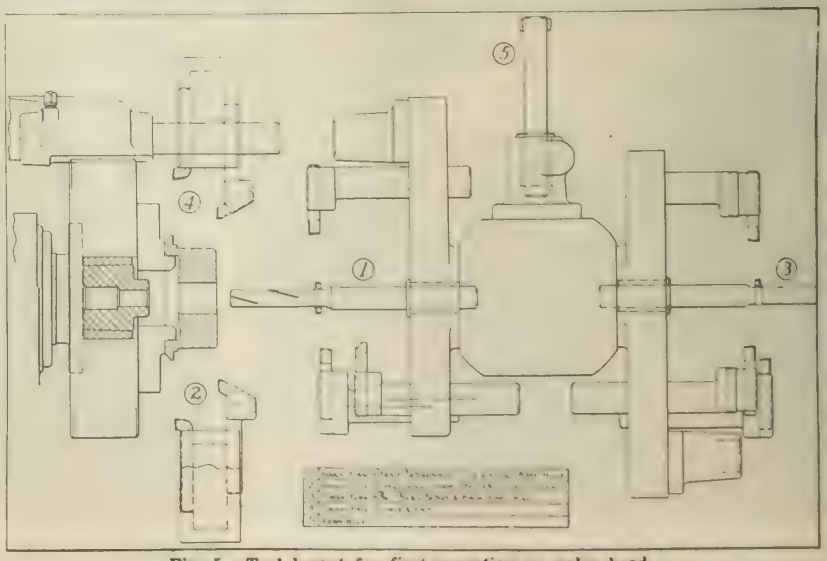


Fig. 5.—Tool layout for first operation on valve head.

ful in gripping outwards as well as inwards.

Tool No. 1 is a combination tool holder carrying a boring bar with a double ended cutter for roughing the 2⅛ in. bore, two turning heads with cutters for the external diameters, and a radius form tool for the end. Simultaneously with this, the front cross slide operates, facing the large shoulder, forming the short diameter, and facing the end. The cutting tool for the latter surface is carried in a special holder which enables it to be ground straight from a piece of black square stock by the Lumsden method. It is often economical in cases such as this to make a special holder as the cutting tool is then a cheap replacement, whereas the cost of the holder never recurs.

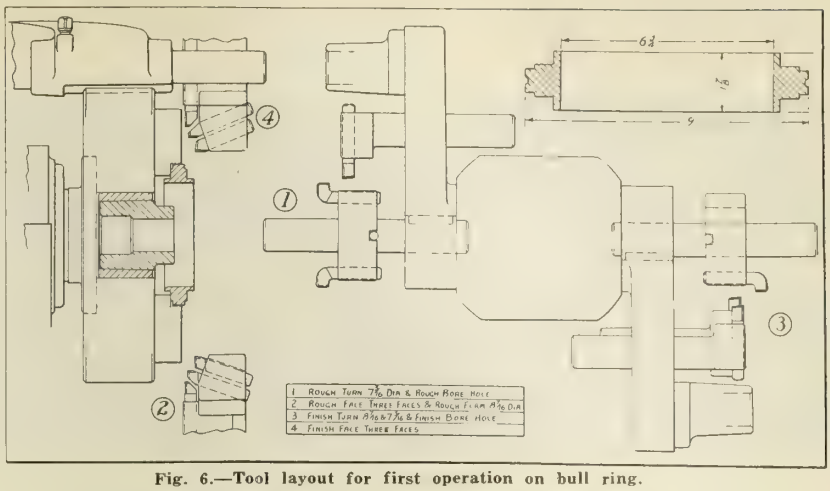

1 Rough Turn 7/16 Dia & Rough Bore Hole
2 Rough Face Three Faces & Rough Turn A 7/16 Dia
3 Finish Turn A 6.6875 & Finish Bore Hole
4 Finish Face Three Faces

Fig. 6.—Tool layout for first operation on bull ring.

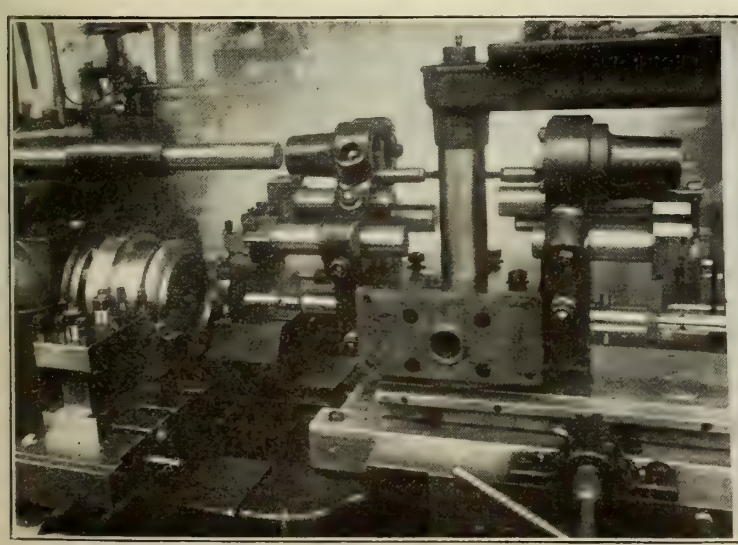
Tool No. 3 is a combination tool carrying a finish boring bar and three turning cutters. Simultaneously with this, the back cross slide operates and finishes the shoulder and the end. No. 5 is one of the standard boring bars with adjustable floating cutters, which are now rapidly replacing adjustable reamers. This sizes the hole very accurately and gives a highly finished bore with a minimum of trouble. The set-up for this operation gives a good instance of the use of the overhead support which is fitted to the machines. It consists of a bracket bolted to the headstock which carries a steel bar 2⅛ in. diameter. On each combination tool there is a pilot bush attached by three studs in clearance holes so that the bush can be aligned true with the overhead bar. It will be appreciated that this arrangement ties up the combination tool to the headstock very rigidly and enables coarser feeds to be used and a greater accuracy to be obtained than would be possible without it. It is especially useful when dealing with work having no through hole, where it is of course impracticable to pilot in the chuck, and on work where only a very small bar will pass through.

At the second operation the work is gripped in soft jaws and the only turret tool is a slide facing tool which provides another good example of its application. In this case two tool blocks are used, one carrying a roughing, and the other a finishing cutter. The face inside the work to be dealt with is comparatively narrow, and it is impossible to rough and finish with the one traverse, the roughing cutter being set to finish cutting before the finishing cutter starts. The machining time for the two operations is 23 minutes.

Operations on Bull Ring

Previous to the introduction of automatic turning machine methods, the bull rings were parted off from pot castings; they are now, however, made from separate castings. Chucking is done in stepped jaws and in the combination tool No. 1, Fig. 6, is a bar to which is clamped a double cutter boring head for roughing: this is positively fixed to the bar by a transverse pin engaging a slot in the head. It should be noted that two cutters are employed in the rough boring head, as the balanced cut helps to steady the work and a coarser feed can be used than with a single point cutter: the combination tool also carries a turning cutter for roughing the small diameter. Simultaneously with this the front cross slide comes in with three facing tools. It will be noted that here again a tool holder is employed for carrying some of the facing tools in order that they can be made from simple stock. No. 3 is a combination tool similar to No. 1 except that a single point cutter is used for finish boring, and there is an additional turning cutter. Simultaneously with this, the back cross slide 4 comes in and finish faces the three shoulders.

At the second operation, Fig. 7, the drawback arbor is again made use of for gripping the work by the bore finished at the first operation. Broadly speaking, the tooling is similar to that used at the first operation except that at the second the large external diameter has to be dealt with and the groove put in. In the combination tool No. 1 there are two additional cutters, one of which is used for turning the large diameter and the second for rough facing the end. The front cross slide No. 2 which operates simultaneously, carries the grooving tool and two facing cutters for the shoulders. Combination tool No. 3 finish turns the three diameters and simultaneously the back cross slide 4 finishes the three shoulders. The set-up for the second operation is shown in Fig. 8, the



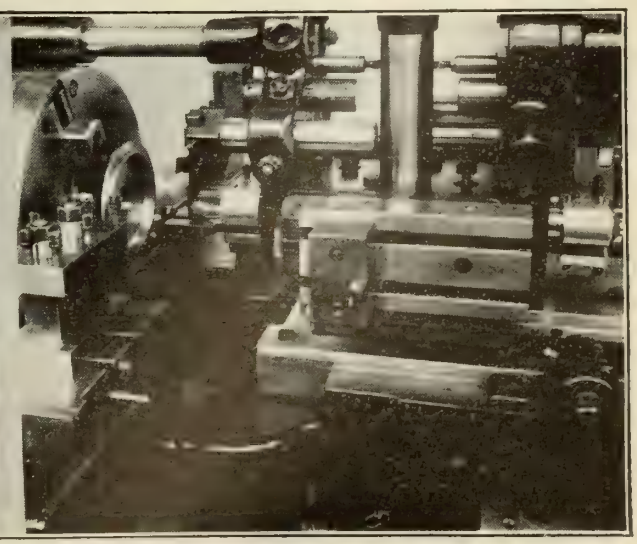


Fig. 8.—Left: set-up for machining bull ring (second operation). Fig. 9.—Right: set-up for first operation on valve head.

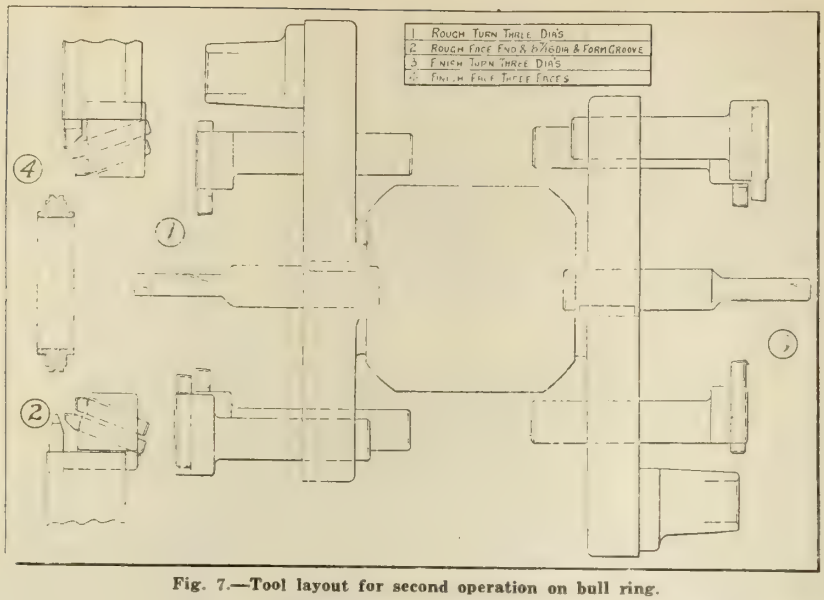


Fig. 7.—Tool layout for second operation on bull ring.

machining time for the two operations being 24 minutes.

Valve Follower

Valve followers are machined from mild steel stampings which at the 1st operation are gripped on the boss by special jaws in the Coventry chuck. The stamping sets back against the jaws which thus square it up and provide a support. The combination tool in the first position carries two turning tools and a patent straight flute drill with inserted spiral cutter. On the latter is mounted the same cutter head as is used for the bull ring; this now deals with the 6¾ in. bore. The slide facing tool in the second position carries cutter for facing the bottom of the 6¾ in. bore and the edge; it is pushed over by the front tool post which carries a cutter for facing the shoulder. The combination tool in third position is fitted with finish boring and turning tools while the slide facing tool in fourth position and back tool post finish the surfaces corresponding to those in second turret face. The set-up is shown in Fig. 9. At the second operation the machining consists of facing the boss and sizing the bore, the work being gripped in the 6¾ in. diameter by soft jaws. The boss is sized with the same type of tool as is used for the valve head. The machining time for the two operations is 22 minutes.

Piston Valve Cover

Another piece which is being successfully handled on the same type of machine is the piston valve cover shown in Fig. 10. The machining on this is such as can be explained without reference to a layout drawing. The casting is chucked by gripping on the boss. The first turret tool is a single point starting tool which opens out the core true for about ½ inch. The next turret face carries a combination tool with a four-flute core reamer and a turning tool for the 9½ inch diameter spigot. On the third turret face is a slide facing tool which roughs and finish faces, the two bosses being pushed over by the back cross slide which carries a tool for rough facing the large shoulder. Simultaneously the back cross slide comes in with a tool set ⅛ inch behind the rougher and finish faces the shoulder. On the last turret face is a combination tool which carries a bar for truing up the 2½ inch bore with a single point tool and a turning cutter for finishing the 9½ inch spigot. The machining time for the operation is 28 minutes.

Uniform Tooling Methods

In the layouts which have been described it will be noted that the cutting tools are of a very simple nature so that

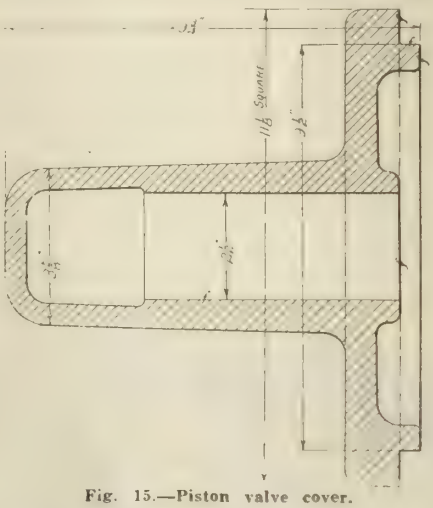


Fig. 15.—Piston valve cover.

consequently the cost of tool upkeep is low. Much of the prejudice which exists against automatic turning machines in their early days was due to a fear that they would be run inefficiently through lack of proper tool equipment. Standard tool outfits of wide general utility have, however, been developed by the manufacturers, to such an extent that with a proper equipment of these the laying out of operations for different pieces can be undertaken by anyone having a sound knowledge of ordinary turret lathe tooling.

It is important to note that the production times which have been given in this article are times on which the machines can be run in production, without repeated breakdowns for tool grinding; and on iron castings of average quality. Occasionally production times from other sources may at first sight appear better, but it should be borne in mind that much depends on the material which is being operated on, as some grades of cast iron are much softer than others, and can consequently be machined at higher speeds. These records were made on a special high-grade, hard, close-grained iron.

In these days of costly labour it behooves production engineers to explore all avenues which may lead to reduced manufacturing costs and whilst this article shows what is being done to this end in the locomotive industry by the use of auto lathes, the methods described are obviously such as can be applied in many other industries.

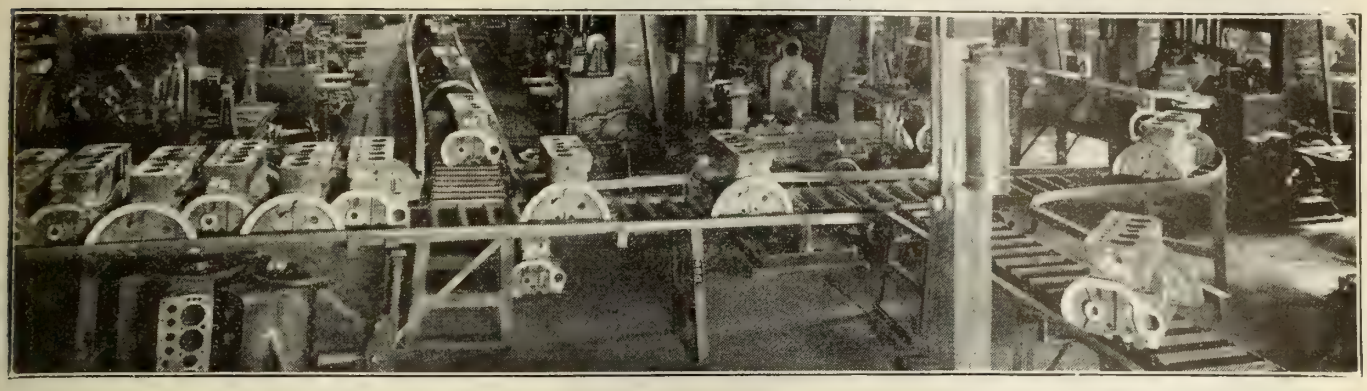
ORIGIN OF BALATA

The origin of balata gum, which forms the base of balata belting, dates back about 400 years. It was originally used by the Incas Indians to make crude suits of bull-hide armour, which they had to wear in order to protect themselves against the fatal effect of poisoned-tipped arrows. These suits of armour were composed of two plies of bull-hide, which were welded together with balata gum which they procured from the Bocla tree. These suits of armour were found by the Spaniards at the time of their conquest of that country and were subsequently transferred to European museums as historical relics. The balata gum used in the making of these suits of armour still retains its full strength unimpaired. The same result is obtained by using the Lanco impregnation process in the manufacture of balata belting.

BELT CONVEYOR SERVICE

Even in India, where the native labourers receive a very small wage, the belt conveyor is scoring in such work as unloading sand and brick from barges at the railway cars which stand alongside the slip, and also for loading sand from ground storage into bullock carts. The portable belt conveyors were equipped with a receiving hopper that would eliminate the necessity of placing the brick carefully on the belt, and they were thrown on the tail end where they could be conveyed into cars. These machines are operated by paraffin engines of 5 horsepower, and have given very good results. The belts are 25 ft. long, equipped with a 11 in. wide four-ply Goodyear rubber belt, and have a rated capacity of approximately 1 yard per minute. They are mounted on two wheels which are equipped with roller bearings, making it very easy for two men to move the belt to different parts of the yard.

Importance of Proper Routing Through the Plant



Showing gravity conveyor handling cylinder blocks.

By H. A. WILSON

ROUTING might appear at a first glance to be one of the points that could be classed as of secondary importance. However, in the present day of economic manufacturing, the subject has become of prime importance, especially in lines that are produced in great quantities. In fact in many factories the design and general layout has been very definitely influenced by the manufacturing plan of routing. In any factory it is rather difficult to isolate one particular phase of production and discuss it, to the exclusion of the several other interlocking problems. Some of these which are closely associated with efficient routing are, shipping facilities, natural lighting, amount of space available, etc.

The routing of materials through a manufacturing plant may be considered as a cycle. The raw materials enter at one point, circulate through the factory and return to that same point for shipment. The solution of the routing problem, expressed in a few words, is to have all raw materials enter the factory and pass through the various stages of manufacture, continuing to move in a general direction without unnecessary handling, or "dribbling back" at any time. The details of the problem are different in every factory and each solution requires individual and separate attention.

Basic Conditions

The primary factor to consider is that of receiving goods, and this point of origin, as we term it, is often the final stage in the routing schedule, as in most places goods come in over the railway siding and leave by the same route. When raw materials are received they are immediately checked into stores. Now store rooms should be adjacent to the receiving platform and also to the initial manufacturing operations so as to avoid useless trucking and handling. In some instances, where raw materials are subjected to widely differing preliminary handling and machining, it has been found convenient and economical to provide several store-rooms more or less widely separated, but adjacent to the manufacturing departments where the various raw materials are consumed.

Under the subject of basic conditions we must bear in mind that the finished product must return to its point of origin for shipment and that the receiving department must not be permitted to monopolize all the available space in the neighborhood of the railway siding, or the receiving and shipping platform.

Factory Construction

If the manufacturing is all done on one floor the problem is somewhat more simple than if several floors were utilized. In the one-floor proposition all materials can be conveyed progressively from one machine to another and travel toward the assembling department. From the assembling they would continue on through inspection and to the shipping department which would be beside the receiving department.

In the case of the factory consisting of several storeys, it has to be determined whether the preliminary operations could best be done on the ground floor or on the top floor, and then the subsequent operations must be classified as to floors. With this accomplished the individual routing schedule for each floor is devised.

Method of Transporting Materials

The hand-operated truck was perhaps the first piece of equipment to be used to transport material in a factory. From such a simple apparatus there has been developed many more modern pieces of equipment, such as the travelling crane, the overhead track, the gravity conveyor, the belt conveyor, etc. Travelling cranes are only used where large, bulky, and heavy equipment is being handled. The overhead carriers are used on a variety of articles, and are of value because they can be arranged to carry a very wide range of material.

Belt conveyors are used for handling such articles and materials as grain, sand, gravel, and all kinds of crushed or powdered materials. The gravity conveyor, however, is the most important factor in routing in any modern factory. Except in some unusual or special instance no power is required to operate the gravity conveyors. The special instances referred to, are met when a factory occupies several storeys and an initial step in the routing is to elevate all

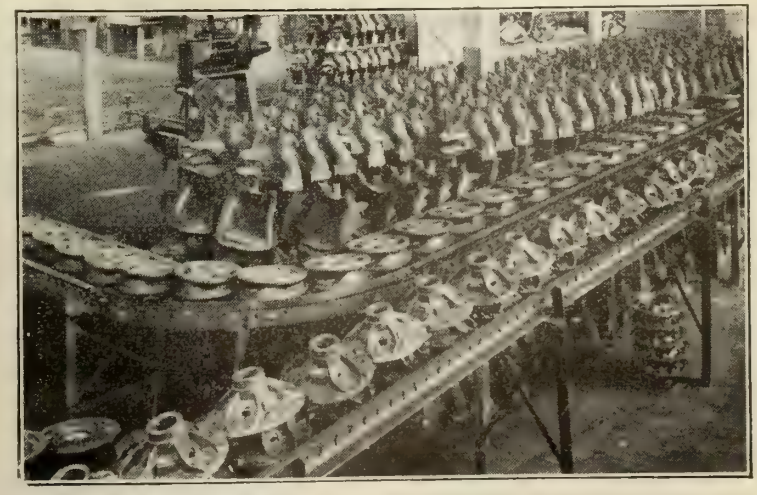


Fig. 1.—Handling differential carriers and transmission covers from storage to machines.

Illustrations through the courtesy of Jones and Glasco, Canadian agents for the Dow Co.

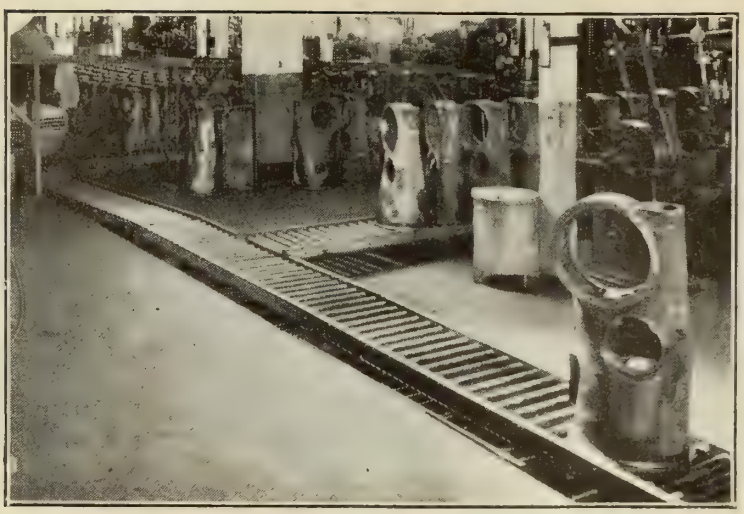


Fig. 3.—Showing gravity conveyor handling heavy transmission housings between machine operations.

material to the top storey, or when an insufficient height is overcome by a direct lift to a gravity line.

Machine Shop Applications

Probably the automotive industry furnishes us with the best example of production work in manufacturing plants. In no other line of machine shop activities does routing assume the same importance. Practically the whole shop is built around a production schedule. Of course these automotive shops were not always models of efficiency and thus some interesting comparative production figures are available. In the old days work-in-progress cluttered up the surplus floor space and encroached on the aisle space. Men were busy with hand trucks moving pieces of work from machine to machine. To save time, equipment was placed so that batteries of machines handling successive operations were adjacent to one another. Still it was evident that a great deal of floor space, man power, and material were being wasted and conveying systems became a necessity. Meanwhile, with these improved methods of handling work, in conjunction with improved machinery, the production per man per day increased two hundred per cent. and more, in a decade.

Conveyor Installations

Fig. 1 illustrates a gravity conveyor system handling differential carriers and transmission covers from storage to machines. It will be noted that the floor space is comparatively free from castings and work. This equipment is capable of handling vast quantities of these pieces without congestion.

Fig. 2 shows another installation of gravity conveyors transporting cylinder blocks from one location to another. There are numerous operations on various machines on these castings and records show that when these blocks were "man-handled" the time of transporting some was almost as great as the machining time. With this system in use, no man-power is required and there is only a nominal overhead charge to be reckoned with, while the capacity of the conveyor is in excess of all possible requirements. Here again the floor space is not monopolized.

Fig. 3 illustrates the conveying of heavy transmission housings from one machine operation to another. If this illustration is studied it will be seen that the piece would be an awkward one to handle by other means, especially if the production was large.

Fig. 4 illustrates an installation of conveyors in a shop where a large number of machine tools are installed. Miscellaneous castings are being handled on a double line of conveyor, having two different elevations.

Fig. 5 illustrates another special type of gravity conveyor with 1 1/16 inch diameter rolls handling crank shafts in a vertical position.

Reducing Idle Time

The above illustrations only go to show how closely the routing problems are tied up to transporting and conveying problems. The present high rates paid to mechanics and operators make it imperative that this class of labor be employed sixty minutes every working hour. If routing conditions are not good, congestion and delays frequently occur, and idle time results. This idle time adds to cost of production and cuts down profits.

The subject is a very broad one and there are many interlocking factors. It is very difficult to express in figures just what savings can be made. Men who have studied the problem from all angles, and whose experience covers a score or more of years, state that actual savings of twenty-five per cent, are frequently made in factories that were considered reasonably well laid out, to begin with.

Of course the ultimate has not been reached and in every factory certain compromises have to be made in developing a routing schedule. The problem is one that is never finished, particularly in a growing business.

CUTTING STEEL BARS

One of the most ordinary processes in engineering ships is the cutting up of steel bars. As usually performed, the process is very uneconomical, especially when a large number of pieces of the same size have to be cut off. In order to get over this difficulty a British firm has introduced a new method which enables several bars to be cut simultaneously. A feature of the machine lies in the vise, which has two jaws, one moving horizontally and the other vertically. The machine is designed to cut off a six inch bar, and by the use of the special vise it can cut off three 4 inch bars, or seven 2 inch bars, and so on at one time. By an ingenious arrangement the saw is never engaged on the full thickness of all the bars at the same moment. This enables a high speed of cutting to be maintained. An incidental feature is the use of a revolving mechanism, which removes all the chips from the saw. As an indication of the speed at which this machine will work it may be mentioned that three 4 inch bars were cut through in less than ten minutes.

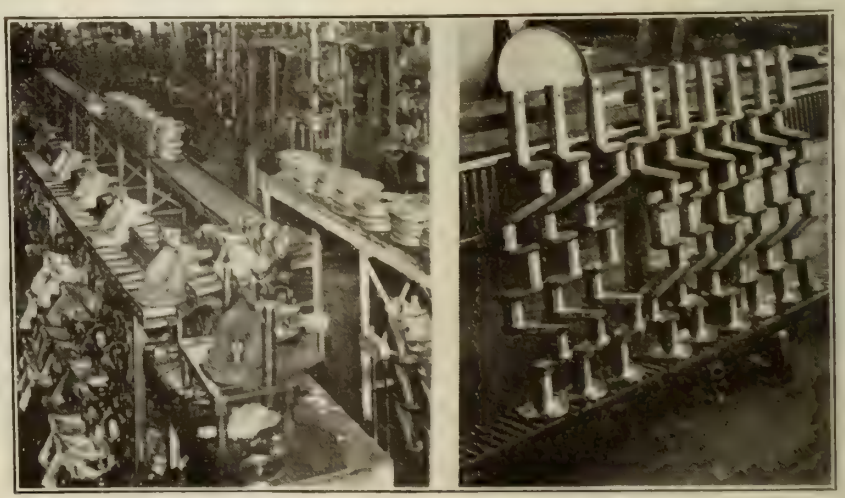


Fig. 4.—Left: gravity conveyor handling miscellaneous castings on a double line of different heights.
Fig. 5.—Right: gravity conveyor with 1 1-16 dia. rollers handling crank shafts in a vertical position

Multiple Spindle Milling on Vertical Machine

Demand for Greater Production Calls for Tools of Higher Efficiency—Rotary Table Allows for Continuous Operation—Roughing and Finishing Performed at the Same Time

WITHIN the past few years the development of the milling machine has demonstrated the rapidly increasing application of this type of equipment to the solving of many of the more intricate problems related to general shop practice, where greater production is a vital and ever-present question. This method of surfacing metal has an almost unlimited field and it appears to be largely a matter of design in order to obtain a machine that will take care of an every increasing range of requirements. Where it is a question of quantity output on any specified class of work the construction of a single purpose tool to handle the work is a profitable proposition as machine adjustments are reduced to the minimum, and the greater percentage of operator's time is utilized in actual production. However, it is only a comparatively small number of plants that can provide sufficient work for the constant operation on one particular so that the selection of any machine must be based on its serviceableness to a varied range of work.

Speeding-Up Production

It may be true that the single spindle machine can be adapted to a greater variety of work but as a production unit on many similar parts its ultimate efficiency is undoubtedly restricted. The tendency is to develop tools that will be constantly engaged and in such a way as to minimize the idle production time between the actual cutting operations. From the single spindle machine which featured the design of early milling machines the multiple spindle type of the present day provides an interesting development in the cutting of metal with a multiple arrangement of tools or cutters. The multiple spindle type of milling machine provides for the roughing and finishing of many surfaces during the one continuous movement of the work beneath the cutters. The rotary table, equipped with special work holding fixtures, permits parts to be placed in position and removed after machining without the necessity of stopping the machine. The production is therefore dependent on the steady supply of raw material to the machine.

Milling Connecting Rods

Four good examples of machining parts on the heavy duty knee type of milling are shown in the accompanying illustrations. Fig. 1 shows a rotary continuous milling machine set up for performing the roughing and finishing operations on both sides of each end of connecting rods for International Harvester Motors. It will be noted that the work holding fixture is made exceptionally high to permit of using the extra cutter head for milling the lower portion of the outer end of the connecting rod. The outer spindle extends down into the centre of the fixture and spaced cutters take care of both faces of the rods.

The design of the fixtures is very often an essential factor in meeting production requirements, as adequate clamping and locating facilities are imperative where standardization is desired. Owing to the continuous movement of the rotary table it is important that the parts be inserted and secured in position with the greatest convenience and assurance of rigidity and accuracy.

Motor Frames

Surfacing the bases of electric motor frames is shown in Fig. 2 at the right. The fixture used for holding the part is of hexagon design capable of carrying six frames. The method of operating the clamping devices is illustrated at the extreme left. The central bolt is hinged at the inner end to a plate secured to the face of the fixture by means of four bolts. On the outer edge of the base is supported a swinging yoke that carries the three-point clamp that bears against the outer edge of motor frame. It will be seen that the clamping nut is of small size to allow the frame to be passed over, the slotted clamp allowing free passage over the body of the bolt. In this way it is not necessary to remove the nut when placing the work in position. One spindle is fitted with a roughing cutter and the other is used for finishing. The production time on this particular piece is one frame a minute, or a complete revolution of the table every six minutes. Machine is operated continuously, work being removed and located while table is in motion.

While this fixture was primarily designed for this particular job, it will be noted that the plates on each face are detachable, so that a slight modification of the clamping members will permit of using the jig for work of a similar character.

Three-Spindle Machines

Two three-spindle machines are illustrated in Figs. 3 and 4. That at the left is operating on cylinder heads for Buda

Illustrations supplied through the courtesy of The Ingersoll Milling Machine Co., Rockford, Ill.

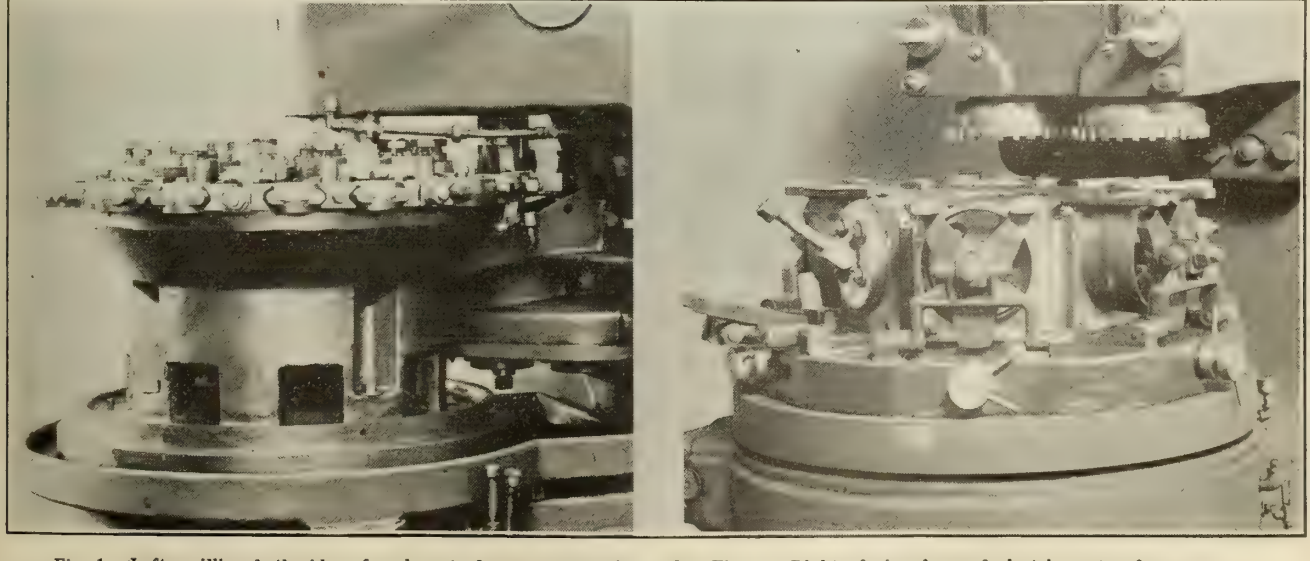


Fig. 1.—Left: milling both sides of each end of motor connecting rods. Fig. 2.—Right: facing base of electric motor frames.

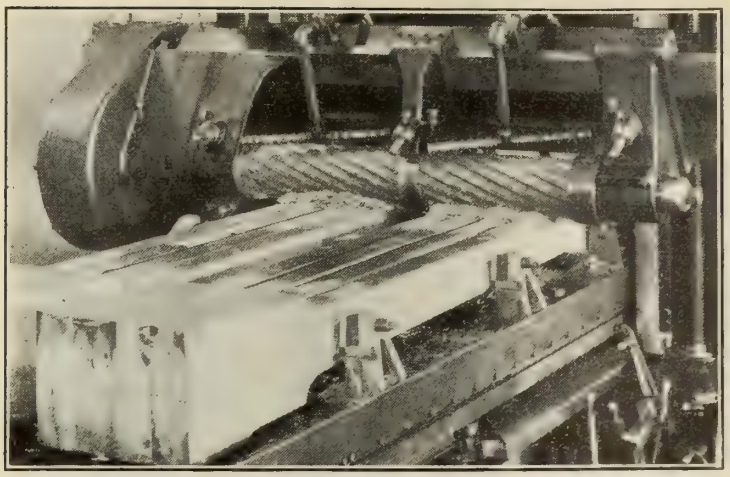


Fig. 5.—Edging eight locomotive main rods.

Motors. The work holding fixture is of simple yet interesting construction. As is general with jigs of this nature it is of the single purpose type. Four locating stops are arranged in the centre of the base to support the inner edge of the casting. Two swinging clamps are used for holding each piece, these being directly in line with the rear locating block to avoid any possibility of springing the work. A coil spring is placed on the clamping bolt so that the reaction when the nut is released frees the clamp from the work. Height stops and thrust stops are likewise provided. The two left hand, small-diameter cutters are used for roughing and the large cutter, in its passage over the work finishes the entire surface. Where surfaces are to be in the same plane it is advisable to finish same with one cutter.

Fig. 4 shows a similar machine milling the sides of flywheel housings for automobile motors. Again a fixture of special design is used, in this instance the work being placed on two sets of stops, one set at the base of the work and the other inside the casting extending up to the inner edge of the surface to be milled. The clamping is accomplished by gripping the protruding lugs. Places for three castings are provided on the fixture. This machine has three spindles, two with small cutters doing the roughing and the large one for finishing.

Locomotive Main Rods

An excellent example of heavy duty horizontal milling is shown in Fig. 5. This cut illustrates a 75 h.p. milling machine edging eight locomotive main rods, taking a cut ¼ in. deep and using a table feed of 8½ in. per minute. Fifty-nine and one-half inches of steel are being removed each minute, and it is necessary to use 68 h.p. to accomplish this work; one and one-quarter horsepower per cubic inch of metal removed. The machine is equipped with special rod fixtures, universal for all locomotive rods. The cutters used are 9 in. by 24 in. Ingersoll helical inserted tooth slabbing type. The tail support and intermediate steady head are adjustable along the cross rail so that a wide range of work within the capacity of the machine is possible. Adjustable brackets are provided for supporting the pipes that carry the cutter lubricant.

Keep Cutters Sharp

Too much stress cannot be laid on the importance of maintaining a keen edge on milling cutters. It is a wasteful and expensive practice to try and retain an efficient set of cutting tools without suitable equipment for keeping the same in good working condition. Cutters to be really "sharp" must have the proper clearance. Too little clearance will cause the teeth to drag and absorb power that should be used for cutting; too much clearance will cause the tool to chatter and result in inefficient production. Cutters should be ground so that every tooth has the same rake and clearance angle; thus distributing the cutting action uniformly among the teeth in the cutter.

GRINDING STAINLESS STEEL

Tests show that annealed stainless steel, under constant feed, developed the highest grinding resistance of any metal tested. Wheel wear, when rough grinding it, was excessively high and the wear continued high even with hard wheels, because the clearance between grains was insufficient and loading increased. Hardened stainless steel also caused considerable wear when fairly heavy feeds were taken. Also, if light cuts are employed, as for finished grinding of a flat surface, the hardened stainless steel has a tendency to burn.

EFFECTIVE BELT SPEED

Practice is still rather uncertain about the ratio of horsepower and belt width, despite the many views—or, perhaps, in consequence of the many views—expressed by investigators. Wider belts for heavier loads sums up the apparent requirement. Speed investigations recently were expressed in the formula that belt speed is almost exactly in proportion to the width of the belt. In relation to high speeds the effect of centrifugal action must be considered, and the conclusion is expressed that nothing is gained by operating a belt in excess of 4,000 ft. per minute, an dthat at 5,000 ft. the particulars given, that horse-power increases directly as to speed up to 4,000 ft. per minute, and that at 5,000 ft. per minute the effective tension or pull is reduced about 10 per cent. The preference should be for a maximum of 4,000 ft. To secure transmission at a higher speed it becomes necessary to increase the tension of the belt to a point beyond economical operation.

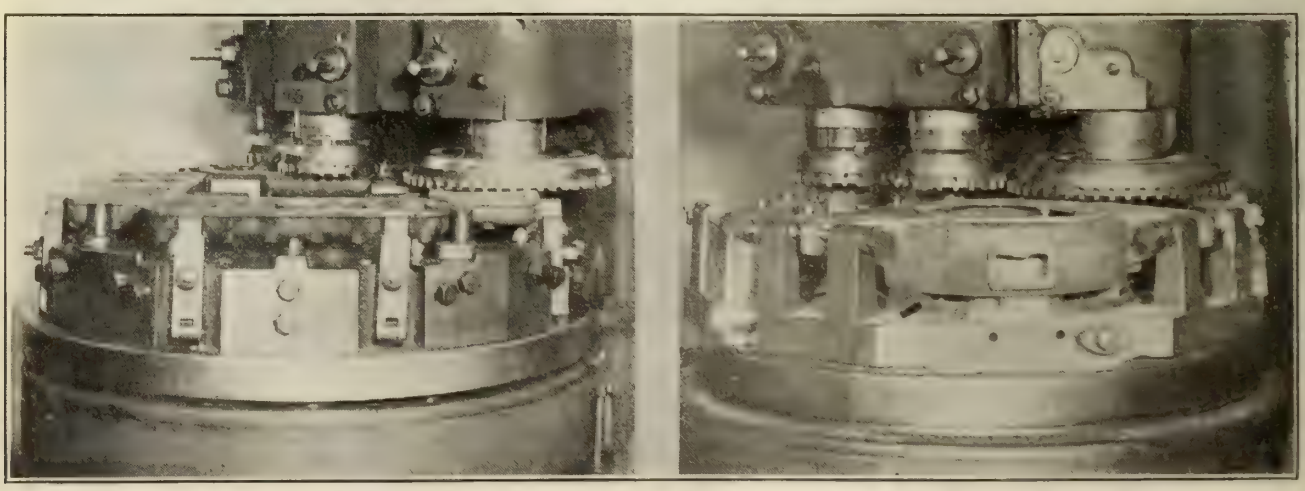


Fig. 3.—Left: roughing and finishing motor cylinder heads. Fig. 4.—Right: roughing and finishing flywheel housings.

Duplicate Pieces Machined by Automatic Milling

Constant Fast Travel Between Cuts—Automatic Change to Variable Cutting Feed—Standard Vise Fitted With Special Jaws Used for Work-Holding Fixtures—Milling Bolt Heads

INCREASED demand for more economical production is an influencing factor in the development of machines requiring the least amount of human attention in their operation. Today we find manufacturers availing themselves of every opportunity in the installation of automatic machinery in an endeavor to reduce their manufacturing costs and increase output. Automatically controlled equipment is the logical consequence of the efforts put forth by engineers to meet this growing requirement. The Brown and Sharpe Mfg. Co. has produced a special knee-type automatic machine for the milling operations on a wide range of parts within its capacity.

Squaring Bolt Heads

The illustration to the left shows the machine adapted to the squaring of bolt heads. In this instance in order to mill the four sides of the bolt head uniformly it is necessary to employ standard index centres. These are set for rapid indexing and the operator has only to withdraw a locking pin and give the hand wheel a quarter turn. At the completion of the cut both the spindle and the table stop. The machine is set to operate semi-automatically, as the loading time is slightly in excess of the cutting time and a much higher production per hour may thus be obtained than if operated fully automatically. As the fixtures are set as close together as possible that the non-cutting travel of the table may be reduced to a minimum, the stopping of the spindle and table is also a safeguard to the operator when loading and unloading the fixtures. For such operations it will be noted how conveniently the control levers are arranged and the ease and speed with which they may be operated.

These bolts are made of steel and the operation consists of straddle milling the sides of head at two index settings of the chuck. Cutter spindle operates at 101 r.p.m. under a feed of 4.6 in. per min. The length of cut is ⅝ of an inch, the cutting time for each pair of sides being 8½ seconds, giving a total time of 23 seconds for each bolt head, including the fast travel speed of six seconds. Production is at the rate of 156 bolts per hour. The top surfaces of these bolts are milled by a method similar to that used for the pump bodies shown to the right.

Facing Pump Bodies

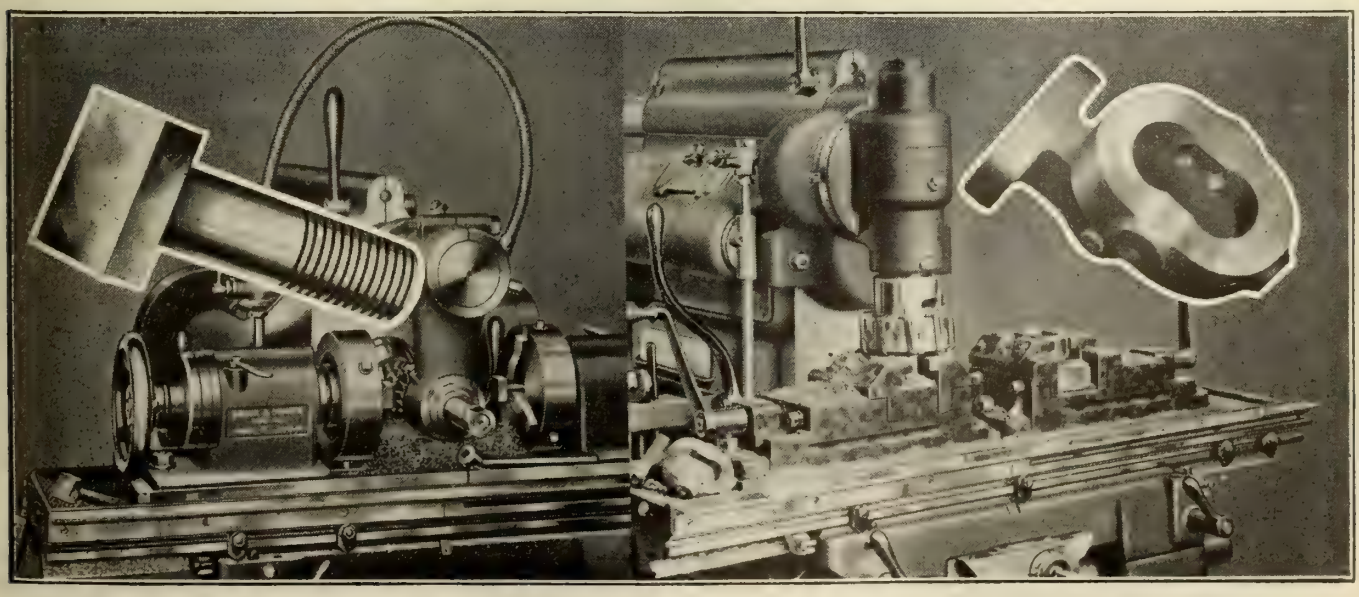
The right-hand view of the accompanying cut clearly illustrates the adaptability of the vertical spindle attachment to the milling machine. A large inserted tooth milling cutter is rotated in the same direction for both cutting operations At the finish of each cut the spindle is automatically stopped upon the reversal of the table, thus eliminating the possibility of marring the work when the table moves at its constant fast travel, in bringing the other fixture up to the cutter. It will be noted that the extreme left-hand table dog is about to engage the plunger, stopping the spindle, reversing and throwing the table into its constant fast travel. The operation is a completely automatic one —the operator only loading and unloading one fixture while the cutter is engaged in milling the part in the other. The fixtures are of simple construction, being the regular standard vises fitted with special jaws. These pump bodies are made of cast iron and are milled on the face shown at a spindle speed of 53 r.p.m. The table travels at a speed of 4.6 in. per min. The cut of 2.75 in. is performed in 37 seconds, with a constant fast travel between the two pieces of 3 seconds. The total time per piece is 40 seconds, giving an output of 90 pump bodies per hour.

Operating Features

In the operation of this machine four different styles of table dogs are required to obtain all the automatic movements of the machine. These table dogs are located as shown in a tee-slot on the front face of the table and actuate the two sets of tripping plungers located on the saddles, causing the necessary movements that operate the mechanisms contained in the reverse gear and feed cases.

This motion is transmitted to the cases by telescopic shafts, one end of each of which is a part of the hand control levers on the front of the machine When reversed the table always moves at its constant fast travel.

The constant fast travel is obtained through hardened spiral gears and the variable cutting feed by means of a worm gear. By the action of a cam and the operating clutch the change is made from one to the other automatically. To provide for maximum efficiency the hardened and ground steel shafts operate in phosphor bronze bushings and journals are fitted with ball thrust bearings.



Left: Automatic milling machine, squaring off bolt heads. Right: facing pump bodies automatically.

Overcoming Difficulties in Babbitt Bearings

Proper Temperature of Mandrel—Coarse Granular Structure—Blowholes in Linings—Uneven Wear—Effect of Too Much Dross—Shrinkage of Shell—Two-Part Split Bearing

By W. S. STANDIFORD

IN the previous part of this article the author dealt with babbitt in general and the method adopted in overcoming different faults in bearing practice. Here he deals with a number of difficulties and their respective remedies.

Difficulties and Remedies

Difficulty.—Blisters on solid one-piece and also two-part bearings.

Remedy.—These blisters are caused by a workman putting oil on the mandrel so as to prevent the latter from sticking to the finished casting. They occur mostly on one-piece castings, although the two-part ones will show this defect if oil is used. Their size varies with the amount of oil put on and its viscosity. Rub flake graphite over mandrel's surface that is in contact with the hot metal, don't use oil for this purpose. If no graphite is handy, use a very thin coating of white lead and let it dry before use. Two-part shells, in most cases, will not need any graphite or white lead on mandrel as the latter can be easily removed when the metal is cold enough to handle. The mandrel ought not to be taken out of contact while the casting is hot, as warping and hollow cavities will be the result of such treatment.

Difficulty.—High-grade babbitt casting has large numbers of hard and soft spots and it has a dirty-looking, casted surface.

Remedy.—Cold babbitt that has been solidified in the melting pot, has been heated too rapidly by the workmen trying to hustle along the work. The lighter metals in its composition rises to the surface and become oxidized by contact with the air, while the heavier ones sink to the bottom. Pouring under the above conditions makes a series of hard and soft spots. Slower heating, more stirring, and the use of a layer of charcoal or sawdust on top of the molten mass, will produce a uniform wearing casting.

Difficulty.—Extreme shrinkage of high-grade babbitt castings in bearing shells resulting in loose bearings, broken anchors and porous areas. The metal will also be found to be oxidized, softened and dirty, and its antifrictional qualities destroyed.

Remedy.—The above is one of the cases in which the employees put the blame on the metal's quality as being of an inferior grade instead of their own fault in handling. This condition of babbitt is due to the fact that it was heated and poured at too high a temperature; thus burning and oxidizing some of the more fusible metals. Careful attention to the proper melting point and also to the mandrel's and shell's temperature and use of charcoal on babbitt's surface, will obviate this trouble. All babbitt metals of the various grades on the market ought to be heated to such a temperature so that it will just char a stick when it is plunged into it and instantly removed. This is a rough-and-ready shop method, but effective just the same.

The proper temperature of any mandrel is shown to be just right when a drop of water will evaporate quickly from its surface without spluttering, the heat of the mandrel being about that of boiling water. Never allow any babbitt of the various grades that are used in factories to get red hot in its melting pot as it will be ruined. Some workmen have the habit, when doing work among crowded lines of machines in factories, of locating their fire too far away from their place of work and then running with it to the machine, expecting it to have the right temperature for pouring and making good castings when they get there. This is bad practice, as it causes the finished work to contain all of the above defects enumerated. The proper thing to do in cases of this kind is to shut down the machine that is next to the one requiring rebabbitting, or better still, if it can be done, to have a small stock of finished bearings in the stockroom and insert one of them in the machine thus keeping the latter out of operation for as short a time as possible. Should it be impossible to do so on account of circumstances, bring the portable forge used in heating the metal as close to the machine as possible so as to avoid burning of the babbitt.

For field work of this character it is much better to **use a tin base alloy**, as it is much better suited for field work than a lead base one on account of its capability to withstand more abuse than the lead base material. Of course, it is understood that abuse of any babbitt metal is deprecated, but as long as the "human element" is in charge of machinery repairs, precautions ought to be taken by executives to help matters along by purchasing a suitable grade of metal and impressing upon their workers that care must be used.

Coarse Granular Structure

Difficulty.—The lining has a coarse granular structure, it looking as if sand has been added to it when melted. **Remedy.**—This coarse granular structure is due to babbitt having been heated and poured into lining shells at too low temperature. The latter should be just right for good results. Too low heating of babbitt is mostly done by **"workmen who watch the clock and wish to quit when the whistle blows;"** although it occasionally happens through carelessness of workmen in desiring to get a disagreeable job done quickly when they are working in a place where there is not much light.

Difficulty.—Numerous blowholes in linings, the latter shrinking away from the shells when metal is cold. **Remedy.**—this is a case in which the heat of the melted babbitt is correct, **but the shells and mandrel are too cold.** Proper heating of both shells and mandrel will cure this defect. If blowholes are still plentiful after application of the above remedy, have more air-vents when pouring the hot metal; a lack of air-vents will make the molten babbitt bubble and prevent some of the bubbles from escaping.

Uneven Wear

Difficulty.—Linings soft at tops and brittle at their bottoms thus wearing unevenly. **Remedy.**—Shells and mandrels are too hot, the result being that **the hot babbitt is made to cool too slowly**, which allows the heavier ingredients to sink to the bottom of lining while the lighter ones remain on top. Proper attention to heating and other details will remedy this state of affairs.

Difficulty.—Spongy and dirty looking castings when metal and mandrel and also shells have the right temperature. Remedy.—Too much dross was allowed to get into melted babbitt while pouring. Workmen should always dip ladle from the bottom of the pot so as to avoid getting too much of the surface metal. Use a self-skimming ladle having a spout so shaped as to pour a round thick stream instead of a wide flat one. Such a ladle will prevent the castings, to a large extent, from being spongy and dirty. A broad, thick stream which is poured intermittently and slowly, will also produce porous areas and blowholes, **the air oxidizing the babbitt surface.** The latter ought to be poured in an even, steady stream without surging in ladle, as surging forces dross into the castings. Spongy and dirty castings are many times caused by workers throwing too many pieces of solder into the babbitt melting pot. All small pieces of solder should be saved for future use in soldering, and be remelted into long sticks, an angle iron mold making a very desirable stick; all lengths of stick can be controlled by clay spacing the iron into sections.

Shrinkage of Shells

Difficulty.—Too much shrinkage in shells when using a low grade babbitt, temperature of metal, lining shells and mandrel being just right. Remedy.—If much low grade metal is used as a lining

it is best to employ a much smaller diameter mandrel; then take a round-faced hammer, and starting in the centre of casting tap it lightly along its centre, extending the blows gradually up both right and left hand sides until the top is reached. This hammering process spreads the metal sufficiently so as to make it fit the lining shells. Next, bore in a boring mill or scrape to size. This method, though effective, is not to be recommended for continuous use as it **wastes too much time and money, but it will do for emergencies when breakdowns occur and a factory is caught without a supply of higher grade metal, which obviates this trouble,** it being best at all times to purchase the best grade babbitt.

Split Bearings

Difficulty.—Small two-part split bearings made out of lead-base babbitt have a spongy surface on shaft bearing part. Heating of shells, mandrels and babbitt being correct. **Remedy.**—This is due to the fact that the shells have been poured with their mandrels on top, thus allowing a certain amount of dross to fill up the part of shell in contact with the revolving shaft; a lead-base alloy generally has more dross to it than a tin-base one. These small two-part bearings are best poured in a horizontal position, bottom upwards (which causes any dross to rise to the top and makes it stay next to the bottom of the shell when casting is done), the mandrel resting on a surface plate and the molten metal poured through holes in the bottom of shells. This method of working has the great advantage of making the bearing surface very clean and dense, the babbitt is compressed by the weight of metal on its top, which faces the bottom of shells, an impurities or dross thus remaining bottom part of the finished casting

In the pouring of large 2-part bearings using the same quality lead-base alloy, as in the small bearings listed above, it is much better practice in order to get sound castings, to have the shell and mandrel in a vertical position, the front bearing surface facing downwards. This causes any dross that will form to rise to the back end of the casting part which faces toward a shaft's end so that there will be a thin layer of dross that can be cut off if proper allowance has been made for extra metal. These large bearings can also be cast bottom upwards like the small two-part ones, but, as a general rule, it will be found much more convenient to do this pouring with the shells in a vertical position.

Bronze Linings

Difficulty.—Babbitt will not stick to bronze lining of electric motor shells, mandrels, hot metal and shell temperature being right. **Remedy.**—The part of the shells where the hot babbitt touches them ought to be tinned with a thin film of half-and-half tinners' solder, using a flux of chloride of zinc. The hot babbitt coming into contact with this solder's surface will melt the film and effect a firm junction between the two metals. **Under no circumstances should the soldering flux be added directly to the melted babbitt as it doesn't work well with it and causes trouble.**

Difficulty.—Workmen trying to make babbitt stick directly to iron shells by tinning the latter with solder in order to do without anchors, everything else being at the right temperature. **Remedy.**—The sticking together of cast iron shells and babbitt cannot be depended upon, as these metals do not alloy at the molten solder's temperature, it not adhering to the shells when cold. Should a higher heating of the babbitt be tried in order to effect a junction, the solder will be oxidized and the babbitt's quality ruined with no adherence between the iron and babbitt taking place.

Difficulty.—A lead-base alloy refuses to give satisfactory service on factory machines with hot metal and shell heat being correct. **Remedy.**—It is evident from the above state of affairs that too much vibration of moving parts is the cause of this very rapid wearing of metal, a lead-base mixture proving much too soft a metal for use on such type of machines. A tin-base alloy, one that contains a very high percentage of tin and antimony, will work well and prevent trouble of this kind.

Difficulty.—A high grade babbit wears unevenly and is very brittle, crumbling like granulated sugar in spots. **Remedy.**—Workmen, having burnt overheated babbitt in a ladle, have attempted to restore its quality by adding new metal to it. Such a mixture ought to be thrown away as it cannot be restored. Care should always be observed in the heating and handling of babbitt of any grade so as to avoid such a waste of money. Quick and rapid methods of doing repair work is the rule nowadays, and any method that helps to reduce the time taken in getting various classes of machines into operation after breakdowns always meets with a warm welcome by employers, as machinery breakage will occur at the most unexpected times.

(To be continued.)

SQUEAL OF A LEATHER BELT

There is one characteristic of the leather belt which has not been given the prominence to which it is entitled, and that is the habit the belt has of squealing whenever it slips. Whenever a leather belt, travelling even at a moderate rate of speed, slips on the pulley, whether it is because of an excess load, or because of reduced tension resulting from the slackness of the belt, whenever this slippage passes a certain low point, the belt emits a sound very much like a squeal. This is noteworthy because this squeal is not characteristic of other forms of belting, which, in fact, may slip very greatly without making any sound.

It is not known at what point the leather belt will begin to squeal. The slippage of the leather belt transmitting its load under favorable conditions is usually about 1½ to 2 per cent. Of this amount some considerable part is recognized as "creep," as distinguished from the real slipping of the belt on the pulley, and actual slipping does not begin until after the full effect of creep has been registered, so that a slippage of 1½ per cent. or 2 per cent. is made up of all the creep of the belt and some little slip. The belt will not begin to squeal until it begins actually to slip, and possibly this point would vary in different belts with different classes of surface or finish, and also with the different conditions of tension, load, etc.

But the point to be emphasized here is the fact that the leather belt will not slip to an extent to impair its transmission qualities without giving due notice of the fact, without signalling a note of warning. This is characteristic of leather belting. The eye cannot detect the diminuation in speed of either the belt or the driven pulley, and many a belt owner, with the belt running directly before his eyes, may be robbed of power as represented in the diminished speed of his machine, unless he takes warning of the "squeal" that registers excessive slip.

EMPLOYMENT AT HIGHER LEVEL

Higher than at any time since the middle of December, was the level of employment during August, according to statistics of the Department of Labor. The record was over 7 points above that of August 31 of last year. Reports were received from 4,019 manufacturers employing 420,879 persons, as compared with 416,699 employees on July 31, an increase of 4,180 workers or 1 per cent. Automobile, fruit and vegetable factories, copper smelters and refineries, tin can, boot, shoe, fur, pulp, paper, tobacco and electrical apparatus works were considerably more active. On the other hand, contractions were evidenced in saw-mills, rubber, textile and petroleum product factories. The tendency during August of last year was downward, the closing of the railway car shops at the end of the month having affected employment materially.

In the iron and steel industry, the resumption of operations in automobile plants temporarily closed at the end of July, caused fairly large increases in staff, which were supplemented by gains in the employment afforded in steel shipyards, machinery, iron and steel fabrication works and foundries. The production of agricultural implements, crude, rolled and forged products, and weighing and measuring instruments, on the other hand, showed a decline. Firms in all provinces except the Maritimes were decidedly busier and in that district the contraction was chiefly due to a partial shutdown in the Sydney district. Reports received from 724 concerns indicated a total pay-roll of 112,819 persons as compared with 110,106 employees at the close of July, a gain of 2,713 workers, or 2.5 per cent. The tendency at the end of August, 1921, had been distinctly downward as the railway car shops had reported one of their frequent shutdowns.

Producing Heavy Parts on Automatic Turret Lathe

Operator Must Understand Machine Thoroughly—Special Instruction for Operators—Advantages of Eight-Faced Turret—Operations on Differential Carrier—Length of Cut Regulated by Timer Dial

IRRESPECTIVE of the type of machine, production is largely dependent upon the knowledge and ability of the operator to get the most out of it. It is essential for him to understand its construction and to keep it properly adjusted and in good working order. The machine with the best production record will invariably be one that is operated by a man who has made a special study of its design and arrangement and manipulation of the different mechanisms. The intricate and accurate construction of automatically operated machines requires a specially trained man in charge of its operation. It is now the practice of many large manufacturers of automatic machines to provide special instruction to those desiring to operate this class of machine tool equipment successfully and economically.

Duties of Operator

An operator must be able to approach his work with the greatest degree of confidence, so that every move will be a well ordered detail in the necessary cycle of operations required to produce the part for which the machine is being tooled. He must know how to adjust and care for the machine so that delays due to break-downs, which cause loss of production, will be minimized.

The grinding of the cutting tools is very important as the automatic feature necessitates that continuous operation be carried on without interruption. Not only the grinding but the setting and arrangement of the tools in their respective positions should be carried out without hesitation. Special application to this problem will result in a fuller realization of doing things promptly, neatly, accurately and quickly. Many graduates from these manufacturers' instruction schools have been able to double their former production, and in several cases, the increased output has been greater even on work which they thought was already being produced at a very good rate.

Cuts and data through courtesy of Gisholt Machine Co., Madison, Wis.

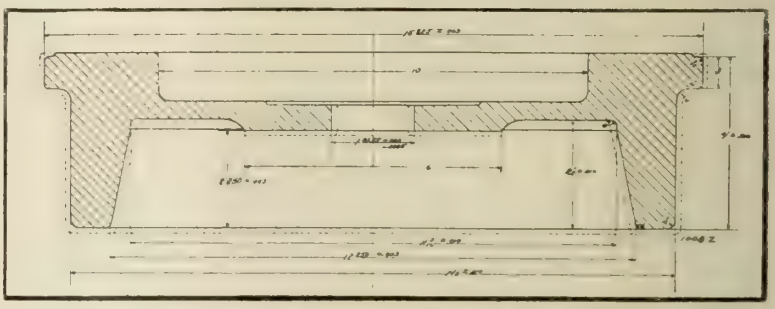


Fig. 2.—Sectional view of automobile flywheel.

Machining Flywheel

The advantages of the eight-faced turret are clearly indicated in Fig. 1, which illustrates an aeroplane view of the set-up for machining the cast iron flywheel shown in Fig. 2. In the arrangement of the different tool holding fixtures that are attached to the various faces of the octagon turret it is necessary to consider the successive stages of machining so that the cutting of the metal will be accomplished in the most economical and convenient method. The sequence of operations in the production of the flywheel here shown are: (1) The piece is held with hardened jaws in a three-jaw chuck and supported at the back by using chuck jacks. (2) The face of the hub B is machined with tools held in a sliding block on the first turret position, at the same time the three faces E, H and J are roughed off by the respective tools in the front tool post. (3) The second turret face supports the fixed bar that carries the flat cutters for roughing the bore and face of the hub. (4) Side 3 of the turret supports the large combination tool block that carries the tools for initial roughing the taper on inside of rim, the outside diameter G and the flange I. (5) The fourth index position of turret carries the boring bar and facing tool for finish turning the bore and face C. (6) The final reaming of the bore is accomplished with the reamer held in the fifth turret face. (7) Final roughing of D, G and I is performed by the tools held in the large tool block fixed to the sixth turret face. (8) The final operations at this setting are accomplished with the head on side 7 of the turret; these tools finish the inside taper and the two outside diameters, while the face E and shoulder H is machined with the tools held in the rear tool post.

The front and rear tool blocks are mounted on the cross slide and are adjustable to each other. Special tool holders can be mounted on top of either block, or a special block substituted in place of the standard one.

The finished diameter of the flywheel flange is 15.325 in., and that of the main portion 14.125 in., with a variation allowance on the flange of .003 in. and .010 in. on the wide section. The bore is finished to a diameter of 1 9375 in. with a low tolerance of .0005 in. The surfaces machined are shown by the dotted lines in Fig. 2, and the floor to floor time is approximately 14 minutes.

An interesting turret lathe operation

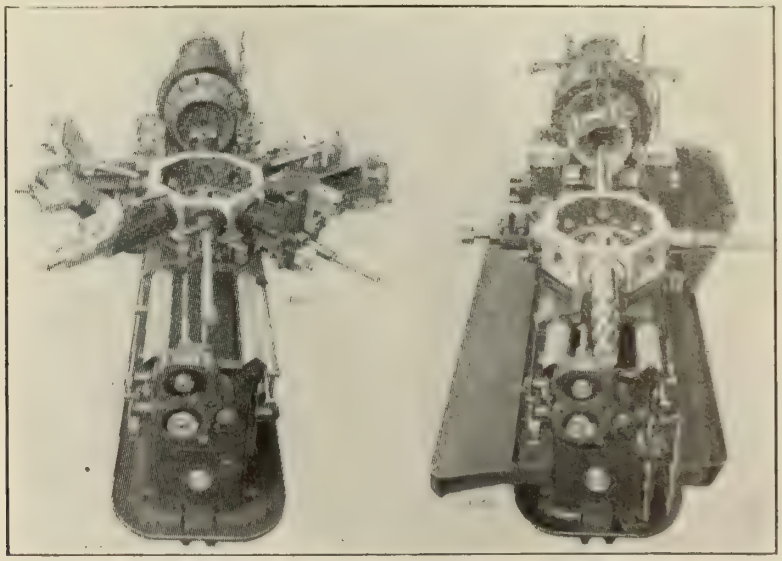


Fig. 1.—Left: automatic turret lathe set up for machining flywheel shown in Fig. 2. Fig. 3—Right: set-up of machine when working on differential carriers, shown in Fig. 5.

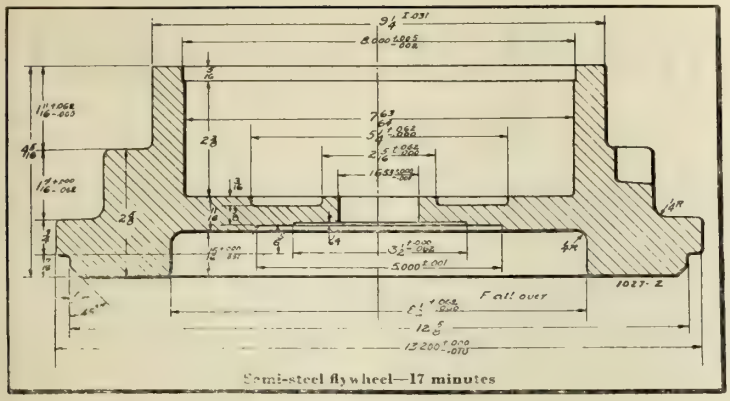


Fig. 6.—Semi-steel flywheel finished all over in 17 minutes.

is illustrated in Fig. 3, which shows the machine set-up for tooling the malleable iron differential carrier, a dimensional sketch of which is shown in Fig. 5. It was necessary to design a special chucking fixture to facilitate the proper handling and holding of this particular piece. Where the work is of an irregular shape, and production is sufficient to warrant the construction of single purpose chucking devices the advantages derived more than repay for the initial cost of the special fixture. The time required to place the work in the chuck is then reduced to a minimum and assures a higher degree of interchangeability, especially when some of the surfaces are not machined.

The sequence of operations on this differential carrier is as follows: After the work is located in the special fixture the several bores, A, B, C, D, and E are roughened with the cutters held in the bar located in the first face of turret; simultaneously the faces F and G are roughened with the tools held in the front rest. The finish boring and facing of the respective surfaces just mentioned is accomplished by the boring tools in the bar held in the third turret position. The final facing is accomplished at the same time by the tools in the rear slide rest. The fifth turret face carries the triplex reamer for finishing the three bores A, B and D. The thread C is tapped with the collapsible tap carried on the seventh face of turret. In this case the alternate faces of the turret are not used.

The possibilities of the heavy duty automatic lathe is indicated by the sketch Fig. 6. This is a semi-steel flywheel and is finished all over, in some places with high and low tolerances of .001 and less. The extreme outside diameter is 13.2 in. These parts are finished in 17 minutes, floor to floor.

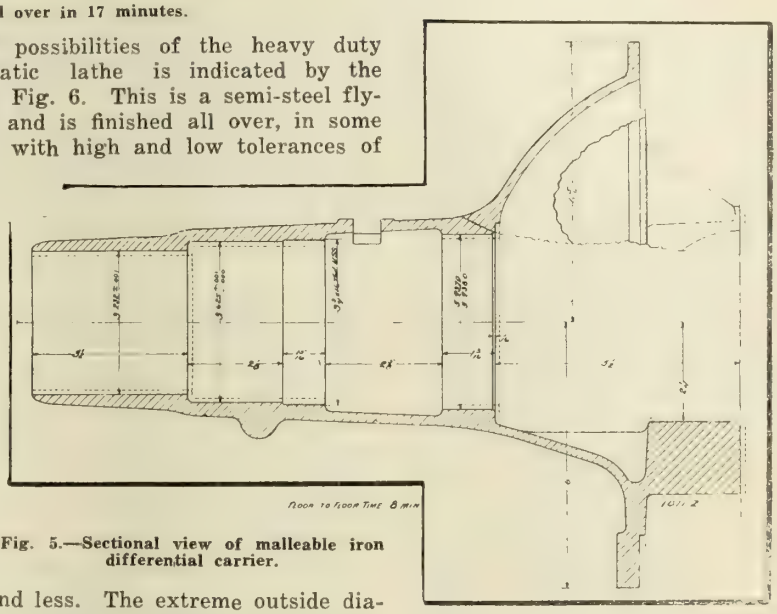


Fig. 5.—Sectional view of malleable iron differential carrier.

Feed Control

The various feeds are controlled by four independent sets of change gears which can be used for any face of the turret or for feed of cross slide in either direction. When the fine feeds are used, the length of cut is regulated by a timer dial which trips the feed at the completion of a predetermined number of spindle revolutions. Independent trip blocks are provided on each face of the turret so that each tool mounted on any face is entirely independent of the others as regards the point at which the forward quick traverse is disengaged and the feed engaged.

As the handling of the work is generally considered one of the chief unproductive factors in the manufacturing problem, the reduction of the necessary idle time between machining periods is important. For ordinary work the machine used on these operations is equipped with an air operated chuck controlled by double acting air cylinder. The mechanism provides for either internal or external chucking, and when the character of the work necessitates a light grip, the air pressure on the chuck jaws is reduced by an automatically controlled air regulated valve. The air cylinder on these machines is mounted on the spindle between the bearings, thus avoiding the overhang necessary when the cylinder is located at the rear.

Shafting must be supported at regular intervals by hangers in exact line. The least inaccuracy of alignment of hanger bearings demands that the shaft be bent by that amount continuously as it revolves, and this bending strain eats up power, racks the hangers, and tends to throw off the belts.

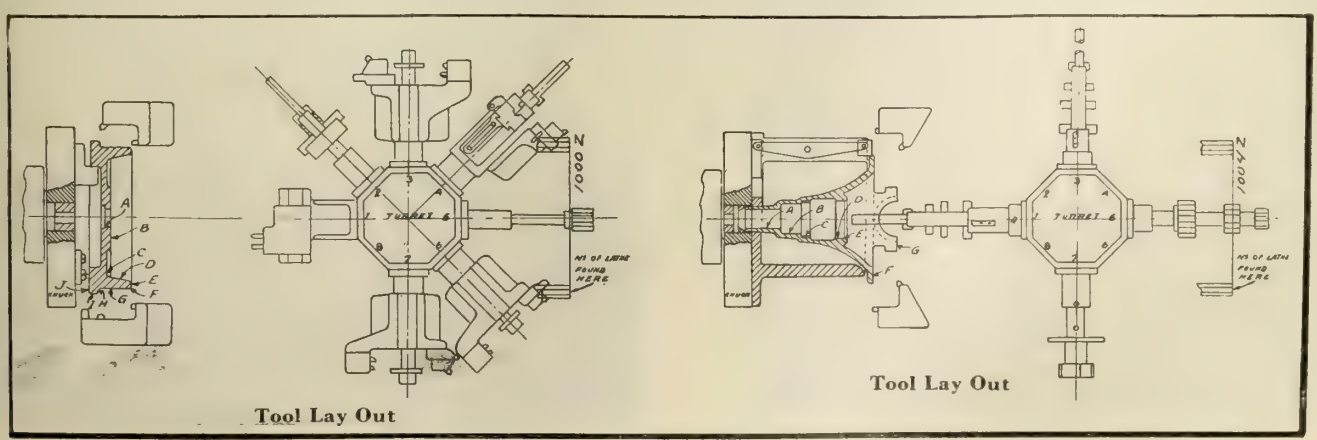


Fig. 4.—Left: tool layout for automobile flywheel shown in Fig. 2. Right: arrangement of tools when machining differential carrier shown in Fig. 5.

News From the Welding Field

Result of Several Tests Made on Welded Cylinders

Method of Making Seamless Pipe—Process of Welding Girth Seams—Practice Followed in Testing the Welds—Results of Observations—Determining the Factor of Safety

By PROF. E. A. FESSENDEN and S. J. BRADFORD

WITH A view of determining the most satisfactory method of welding cylinders for handling anhydrous ammonia a number of tests were recently made at the request of a large machinery manufacturer. The cylinders tested involved the following four types of construction: Flange steel shell, acetylene-welded longitudinal seam, concave heads forge welded to shell; seamless-pipe shell, convex heads acetylene welded to shell; seamless-pipe shell, concave heads forge welded to shell; flange-steel shell, acetylene-welded longitudinal seam, convex head, acetylene-welded to shell. All of the dished cylinder heads were hot pressed from flat discs in a large press on flanging machine.

Methods Used in Making Welds

In making the forge-welded heads the shell and head were heated to the welding heat in an ordinary forge fire and the welds were made by hand hammers and sledges. Fig. 1 shows a construction of one of these forge-welded heads. The following description of the method of making a cylinder of seamless pipe will indicate the methods used for all the acetylene-welded cylinders.

A piece of seamless pipe of the required length to make the shell is cut off by an acetylene torch. The ends of this shell piece are not scarfed, the heads being welded directly to the ends as they are left by the cutting torch. The head is made of flange steel pressed into the dished shape, convex outward, commonly used for cylindrical vessels made to withstand internal pressure. The edge of the flange of the head is turned so as to make a square face and then the outer corner is beveled off to form a scarf. The shell and the head are then placed close together but not touching, the distance between the end of the shell as left by the cutting torch and the nearest edge of the scarf on the head being about ⅛ in. Fig. 2 is a detail of the method of scarfing for making the joint and Fig. 3 shows a head in the process of welding.

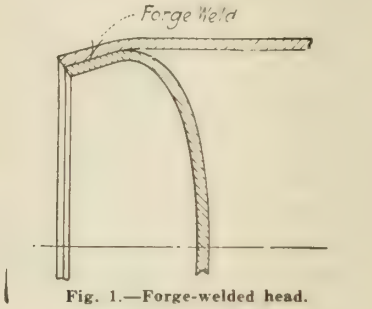


Fig. 1.—Forge-welded head.

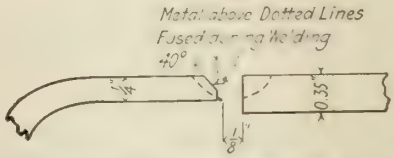


Fig. 2.—Scarfing method for making the joint.

When the torch is applied the metal of the shell and the head are first heated until they melt into a viscous fluid which flows down and closes up the gap between the two edges. Most of this material is taken from the shell, so that this melting-down process is practically equivalent to scarfing the edge previously left by the cutting torch. The metal from the welding wire is introduced not by melting it off the end of the wire and dropping it into the crevice between the parts to be welded as in a soldering operation, but by stirring the end of the welding wire in a little pool of molten material formed from the metal of the shell and head. Welds made in this manner are often called "ripple welds." Only very rarely was the hottest part of the torch flame allowed to play upon the welding wire, material from the wire being almost invariably introduced into the weld by the puddling process just outlined.

For longitudinal seams the welding operation was carried on in the same manner as that described for girth seams, the process being as follows: The plate used to form the cylindrical shell is rolled into shape so that the edges of the longitudinal joint nearly touch, the shell being laid longitudinally with the joint uppermost. The seam is then started at one end and welded for a distance of about 2 in. For the remainder of the seam the edges are spread apart and held in position by a jack. The amount of spreading is about ½ in. to ¾ in. per ft. length of seam and thin shells are spread the most. As the welding progresses toward the end where the jack is placed, the strain on the edges is gradually reduced so as to allow the edges to be welded to approach each other. This device is used to eliminate as far as possible temperature stresses due to a high temperature of the welded seam.

Method of Conducting Tests

The cylinder under test was blocked up on a light truck and filled with water through openings left for the purpose. The diameter was then carefully measured at five points equally spaced along the length of the cylinder. In the cylin-

Extract of a paper presented at a recent meeting of the American Society of Mechanical Engineers.

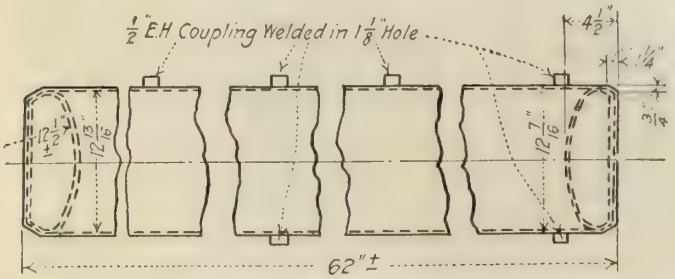


Fig. 4.—Construction of cylinder, No. 1.

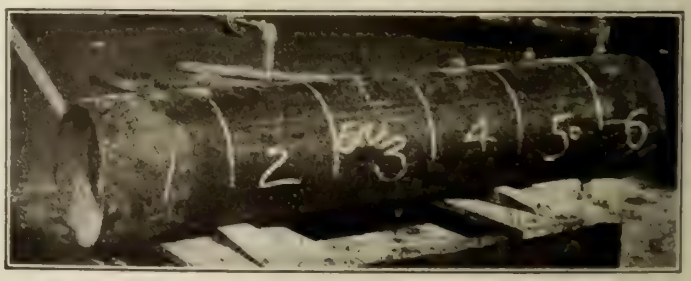


Fig. 5.—Cylinder No. 1, ready for testing.

ders made of seamless pipe these diameters were measured only horizontally as the cylinder lay in the testing rack, but in the cylinders rolled out of flange steel vertical diameters were also measured at all the five points where the supporting blocking did not interfere with the use of calipers. Careful measurements were also made to determine the contour of each cylinder head.

The cylinder was then connected to a hand-operated hydraulic-testing pump, with a new and calibrated hydraulic-pressure gauge in the connecting pipe line. The pressure was then gradually increased, stopping occasionally to observe carefully the condition of the cylinder and to repeat the measurements indicated above whenever it seemed desirable to record changes in the shape of the cylinder. This was continued until the cylinder failed to such an extent that the defects which developed caused leaks which made it impossible to operate the pump rapidly enough to cause further increase in the pressure.

Test Results on Cylinder No. 1

The construction of cylinder No. 1 is shown in Fig. 4. The shell was made of flange steel, ¼ in. thick, with the longitudinal seam acetylene welded. The heads were pressed from ¼-in. flange-steel plate to a dished shape, and with a straight cylindrical flange about 2½ in. long. The heads were inserted into the end of the shell with the convex side inward and the edge of the flange of the head forge welded to the shell, the depth of the weld being from 1 in. to 1½ in. in the case of this cylinder. The welded ends were then crimped over to reinforce the weld as shown previously in Fig. 1. The cylinder set up for testing is shown in Fig. 5. The outside diameters, measured before testing on the lines between the numbered sections, were as follows:

Between sections	1-2	2-3	3-4	4-5	5-6
Horizontal diameter, in.	12.17	12.28	12.34	12.34	12.28
Vertical diameter, in.	.....	12.41	12.38	.....	12.44

The following observations were made during the test at the pressure indicated: 500 lb. per sq. in. The concave head of section 1 began to reverse curvature, becoming completely convex shortly afterward. 700 lb. per sq. in. The concave head of section 6 began to reverse curvature, and very rapidly became completely convex. 950 lb. per sq. in. Leakage began through forge weld at head of section 1. 1350 lb. per sq. in. Forge weld at head of section 6 began to leak slightly. 1450 lb. per sq. in. Very bad leak through weld at head of section 6. Complete failure.

Fig. 6 shows the head of section 6 after complete failure had occurred at 1450 lb. per sq. in. internal pressure. The defective spot in the forge weld which caused final failure is on the upper left-hand quadrant. This illustration also shows very clearly the final shape of the head after complete reversal of curvature had taken place. Accompanying the deformation of the heads the ends of the shell which were crimped over to reinforce the weld were straightened out by the bending stress on the flange of the head. As a result, after the head had completely reversed its curvature it was found that the crimpage had nearly all disappeared. This obviously introduced a circumferential tensile stress upon the weld that probably contributed to the final failure. The spreading of the crimped end can be seen by a comparison of Figs. 5 and 6 and is particularly noticeable along the upper side of the shell.

During the test, measurements were taken to give the contours of the heads in order to show their progressive deformation under increasing pressures. These readings were later plotted.

The factor of safety may be considered to be any one of a number of values, depending upon what is considered to be the point of failure of the cylinder. The cylinders were similar to those used by the company for holding anhydrous ammonia at an internal working pressure of 185 lb. per sq. in. gauge. Using this as a basis the authors find the following factors of safety: (a) If failure is considered as occurring at the first indication of deformation of the concave heads, the factor of safety is 2.70. (b) If the vessel be considered to have failed as soon as the first leakage occurred, the factor of safety is 5.13. (c) On the basis of the maximum pressure attained in the test with complete failure of the forge weld, the factor of safety is 7.85.

At the maximum pressure attained in the test the stress in the material forming the shell was 34,400 lb. per sq. in. of cross-section, computed on the basis of the original mean diameter of the shell. If the effective thickness of the weld is considered to be the same as that of the shell material, this value is also the stress safely withstood by the acetylene-welded longitudinal seam.

(To be Continued)

If the drill splits in the web, it is either ground with improper center lip angle or the feed is altogether too heavy.

Fig. 3.—Partly completed acetylene weld.

Fig. 6.—Head of cylinder, No. 1, after test, showing forge weld, which failed.

Practical Ideas From Practical Men

UNIVERSAL JIG FOR DRILLING THRUST WASHERS

By Robert Mawson

When manufacturing machine tools, washers are used to a large extent for taking the thrust on various revolving elements such as the spindle. When these machines are made in different sizes or types it is necessary to design the thrust washers also in more than one size. We recently designed and made a universal jig to take care of the problem of machining the different washers and this tool is illustrated in this article. One size of washer is shown in Fig. 1. These parts are made from punchings being produced with the outside diameter and hole within the limits specified, using commercial flat steel in sheet form. The two ⅛ in. holes are then drilled with the jig shown in Fig. 2.

The body of the tool is made of cast iron provided with machined feet at each corner so that the jig will rest squarely on the drilling machine table. At the forward end of the jig base is fastened a steel plate B machined with a vee-shaped slot made with an under cut edge of one degree for locating the washer to be drilled. On the left and right hand sides are attached two steel drill guiding plates C, these elements as well as the locating plate being held with bolts and nuts as shown. At the rear of the jig is fastened the stop plate D, a knurled headed screw being used to hold it in position.

Referring again to pieces C and D it will be noticed that these are made one inch wide and that slots are machined the same width so that the plates will slide in line and not tend to move when they are fastened down with their respective bolts. The locating plate A is secured with two bolts that are a close fit in the ⅜ inch holes drilled in the plate and therefore does not require any guiding slot in the jig body.

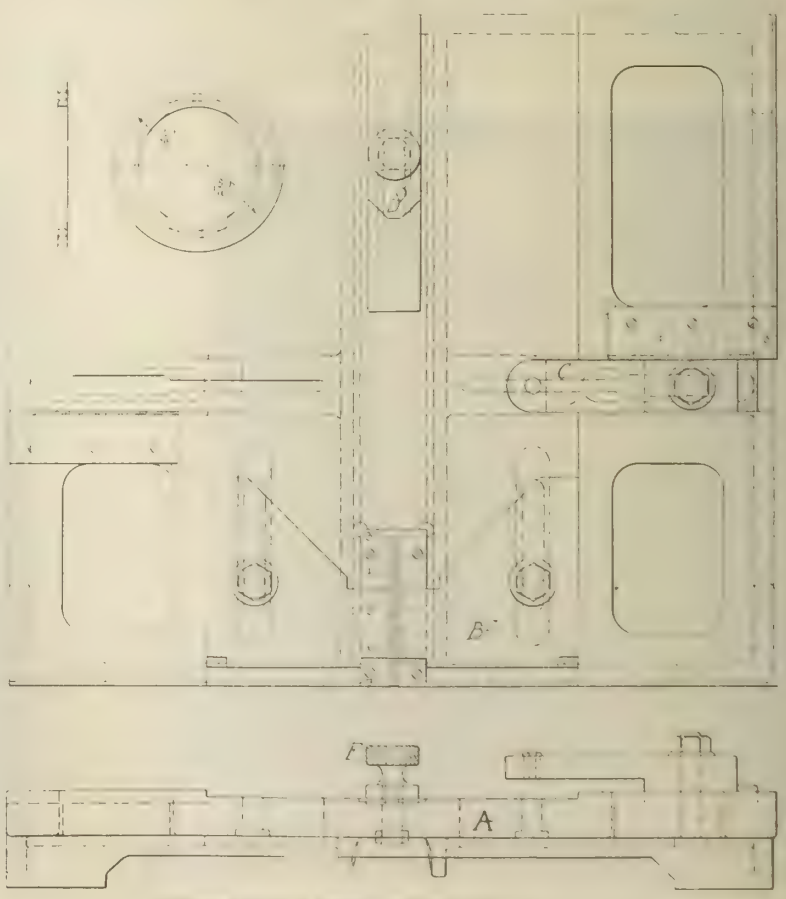
In order to provide a tool not only universal but also quick setting, three scales are fastened to the jig body, one for the locating block and one for each of the drill guiding plates. On each of these plates are machined index graduations marked with a zero. To use the jig and taking the Fig. 1 as an example, the plate A is first placed so that the zero on the edge of the plate is in line with the dimension 3¼ inches, which is the outside diameter of the washer to be drilled. It will be seen that there are three index lines, one in the center and one on each edge. The purpose of the two outer graduations is for setting the block when drilling washers of odd diameters.

For such parts the washer is first accurately placed and then a line marked on the face of the base of the jig, and a number stamped on, this being the part number of the element in question; this setting is then used for all subsequent drilling operations on this part. It will be observed that the holes to be drilled in the piece Fig. 1 are 2⅝ in. apart and to obtain this distance for the drilling plates the index zero line on detail C is placed at 1-5/16 in. which is half of the total spacing between the holes. A second graduation on the lower side of the plate is used for setting when drilling odd spaced holes or those which are not in even 1/32 of an inch, the scales being graduated for this reading. The manner in which this lower scale is used is similar to that noted for the locating block and need not be repeated. After the washer has been correctly located as described the plate D is brought up against the rear end and after being fastened with the screw, the plate holds the washer firmly in position for the drilling operation.

This jig can be used for drilling washers from 3 to 7 inches inclusive, a smaller tool of similar type being employed for washers up to 3 inches diameter. A quick acting feature of the tool is the knurled screw E which secures the locking plate D, so that after the plates B and C have been once correctly set and fastened down, all one size of washers can be drilled quickly and interchangeably, it being not necessary to loosen the knurled head screw E, slide back the plate D, and either put in a washer ready for drilling or remove the one already machined. After the washers have been drilled with this jig the oil grooves are formed in a standard milling machine for this work. The sides are next ground within the limits specified, this work being performed on a vertical grinder, the washers being held on magnetic chuck.

It might be added that this tool is simple in construction as may be seen from the illustration but produces parts quickly and absolutely inter-changeable and during the work the man can at all times be assured that the correct spacing is being obtained as a simple check on the graduated scale will furnish this information.

If a twist drill chips on the edge it invariably indicates that the lip clearance is too great and fails to support the cutting edge.



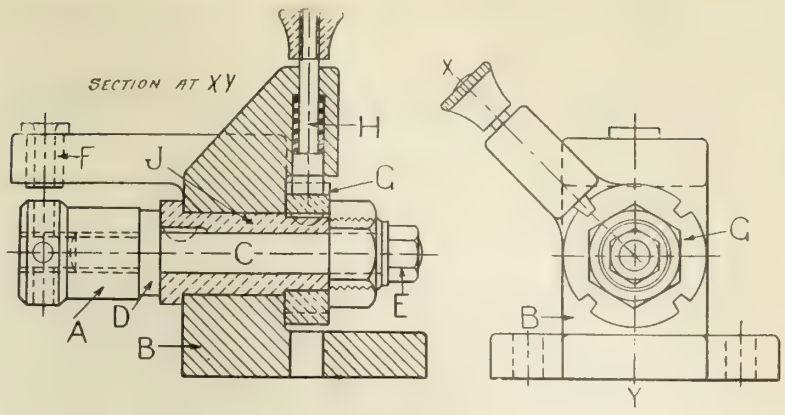
Universal jig for drilling thrust washers.

INDEXING DRILL JIG

By Hubert Bentley

The accompanying drawing, shows a simple but effective indexing drill jig, used for facilitating the quick and accurate drilling of four equally spaced holes in cast iron bosses or centres, ready for the insertion of the handles. The cast iron boss is shown in position ready for drilling at A. It is the type used with two, three or four handles for the friction feed engagement in various machine tools. Prior to these holes being drilled, the boss is bored and tapped out a fine thread to fit the shaft which carries the friction disc and is also turned up on the outside. The jig body B is in one piece of cast iron with a suitable foot and lugs for securing to the drilling machine table. The boss to be drilled is mounted on the threaded end of the spindle C, which is keyed to a bush J, fitting in the main casting. The boss is tightened against the collar D which in turn is drawn up tight by the small hexagon nut E at the other end of the spindle. Drill bush F is carried in the projecting arm an guides the drill. It should be noticed that the part of the boss to be drilled is quite clear of the spindle end so that damage does not occur when the drill comes through.

A division plate G with four grooves cut across, into which a spring operated steel plunger H engages, enables accurate spacing to be accomplished. On the completion of the first hole, the plunger is withdrawn by hand and the work turned round until the next groove engages the plunger. This operation is continued until all the holes have been drilled and tapped. To suit the different bores of the bosses for various sizes of machines, spindles with screwed ends of differing diameters were required and interchanged when necessary. It will be understood that the jig is applicable to any number of equally spaced holes being drilled according to the number of grooves cut in the division plate.



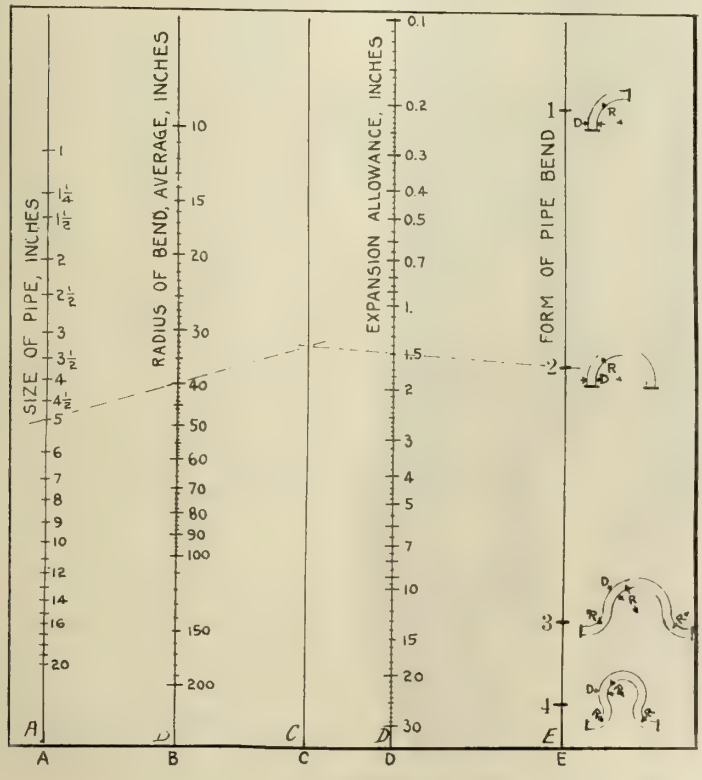
A USEFUL PIPE BENDING CHART

By W. F. Schaphorst

Here is a chart that will be found valuable and convenient for determining the average radius of bend that should be given to common forms of pipe bends, numbers 1, 2, 3, and 4, as shown at the right, column E. Or, knowing the radius of bend, the size of pipe, and the form of bend, column D gives the expansion allowance of that bend.

For example a five inch pipe was made to a radius of 40 in., the bend being a common U-bend as shown by No. 2 in column E. What expansion may be allowed? The dotted line drawn across this chart shows how it is used. Run a straight line through the 5 column A and the 40 column B and locate the intersection with column C. Then from that point of intersection run over to the mark in column E opposite the figure 2 and the intersection through column D gives the answer as 15 inches expansion allowance.

Similarly if the expansion allowance, the form of bend, and the size of pipe are known, the average radius to which the bend should be made may be determined in the same way. In other words knowing any three of the four factors given in columns A, B, D, and E the fourth or unknown factor is easily determined by following the method as explained above. This chart is based upon the following much used and well-known rules: For bend No. 1—Square the average radius of bend in inches and multiply by 0.0026 and then divide by the outside diameter of the pipe in inches. Bend No. 2.—Same as No. 1 but use 0.0052 instead of 0.0026. Bend No. 3—Same as No. 1 but use 0.0104. Bend No. 4.—Same as No. 1 but use 0.013. In the chart all of these operations are already performed—the radii are squared, exact outside pipe diameters are employed, and the proper factors are used.



Pipe bending chart.

'LECTROMELT CALCULATOR

The Pittsburgh Electric Furnace Corporation have just developed a handy calculator made of celluloid for figuring the amount of ferro-alloy required for different alloys and various metal mixtures to allow any given percentage of alloy, and allow any ordinary percentage of loss in the absorption of an alloy. This device is intended for the aid of the furnace superintendent and melter in the foundry and metallurgical industry generally, and on account of the rapidity and accuracy with which the calculations are made, will serve a very useful purpose throughout the steel and metal field. The device is of circular form, 7 inches in diameter and made in three pieces pivoted in the centre. Six graduated scales provide for the direct reading of the various elements used in the calculations. The price of this device is $5.00.

New Things in Shop Equipment

SELF-FITTING KEYS

To facilitate the rapid fitting of keys a special type, capable of making its own fit in the keyway by shaving the sides of the latter as the key is driven in, has recently been placed on the market. Owing to the fact that the section of the keyway in the shaft and that in the hub are seldom in accurate alignment a certain amount of fitting is usually necessary. In making this special key a tough chisel key is used for the key, which is ground to a size slightly larger than the nominal keyway width. One end of the key is provided with a cutting edge and chip recess. Ahead of the recess is a pilot a little smaller than the keyway so that it fits the latter and guides the key. When installing the key the pilot is entered with the cutting edge on the side and driven home with a hammer or sledge, depending on the size of the key. On the smaller sizes the cutting edge is placed on the one side only but on the larger sizes double cutting edges are used. Special keys with three cutting edges may be obtained if desired. These keys are made in a wide range of sizes and are made by Smith and Serrell, Newark, N. J.

HEAVY-DUTY GEARED-HEAD

A lathe particularly adapted to heavy service has recently been placed on the market. It is stated that these machines are capable of transmitting double the power ordinarily possible with lathes of the same size. The 16-in. lathe will transmit 9.2 h. p. with a belt pull of 65 lb. per sq. in. The direct-connected motor-driven lathes can be fitted with either chain or belt drive. The belt drive is direct from the countershaft to a constant-speed pulley. A feature of the machine is a disc clutch fitted with a brake which is incorporated in the drive so that the spindle is disconnected from the gearing when the machine is stopped. This does away with the flywheel effect of large rotating gears attached to the spindle. This action is of special advantage when centering irregular work in the chuck, Twelve spindle speeds can be obtained by means of three handles on the front of the head. In the 16-in. machine the speeds range from 13.5 to 400 r. p. m. in geometric progression. The lathe can machine work at its maximum swing at a cut speed of 55½ ft. per min. It is claimed that the complete range of speed changes can be made in 12 seconds. These lathes are made by the Cincinnati Lathe and Tool Co., Cincinnati, Ohio.

ACME OIL DRIP PAN

A drip pan especially made for use on hangers for catching oil from bearing boxes, has been placed on the market recently. These pans are made in three sizes, all of which are 2 in. deep, and can be quickly installed or removed without disturbing the hanger or bearing. They are made by the Akron Sheet Metal Co., Akron, Ohio.

IMPROVED WIZARD CHUCK

This drill press chuck consists of only two main parts, a driving body with a Morse taper shank to fit the drill press spindle and a slotted collar to hold the collet up in the driving body. This collar is straight and uniform in shape and hardened all over. These improvements are said to increase the resistance to hard usages and make the chuck much easier to handle. The bayonet locking slots in the collar that admit the driving lugs of the collet are so designed that the collet can be inserted or released with one hand, without slowing or stopping the machine. Little mechanical skill is necessary. To insert a tool the operator needs only to push the collet into the revolving chuck. The positive, automatic latch locks it instantly. Releasing is also rapid and easy. A slight pressure of the thumb and forefinger on the knurled collar of the chuck releases the collet instantly and allows it to drop into the operator's hand. These chucks are made by the McCrosky Tool Corporation, Meadville, Pa.

Wizard drill chuck showing method of locking and release.

PORTABLE DISC SANDER

A 9-inch motor-driven disc sander suited to general work has been placed on the market recently. The machine is fitted with garnet paper discs for sanding wood and grinding brass and aluminum, while emery cloth is used for iron and steel. The machine is self-contained, the motor being directly mounted on the disc shaft; being set on a pedestal the unit is easily portable.

The motor is of 1-6 h.p. operating at 1,725 r.p.m. A tumbler switch is provided on the end of the motor. The table is located 38 in. from the floor and is 5¼ x 10 in. in size. Provision is made for tilting it to an angle of 45 deg. down and 15 deg. up. A thumb screw serves to tighten the table firmly at any angle, a graduated plate providing an accurate means of setting. The head is so mounted as to be turned to any desired position on the pedestal. The machine is made by the Syracuse Sander Manufacturing Co., Syracuse, N. Y.

TELESCOPING TIERING MACHINE

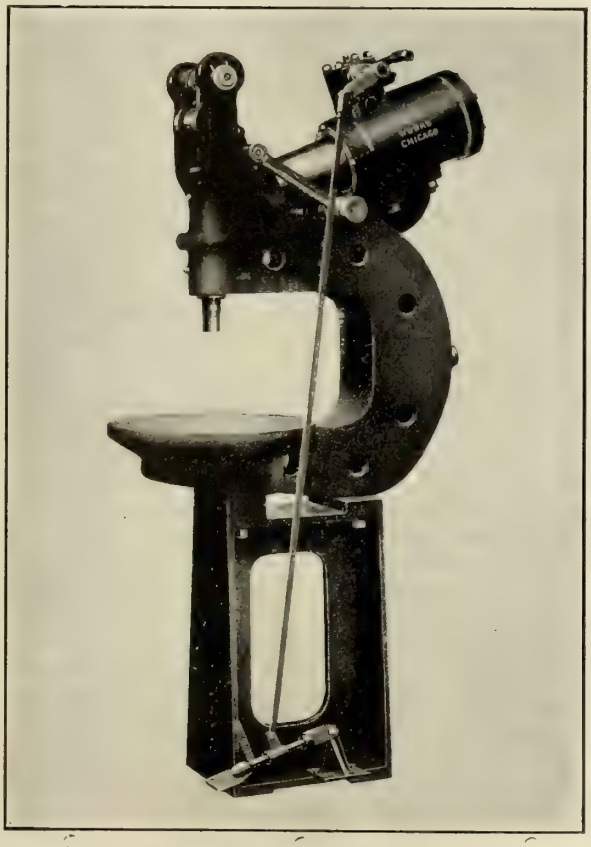
A portable tiering machine in which one section of the frame telescopes into the other, providing a lift nearly twice as high as its normal height, has recently been developed and placed on the market. Both hand-operated and electric driven machines are constructed, the heavy duty type being operated from a power line while the lighter sizes may be operated from an ordinary lighting circuit. The machine is mounted on three roller casters for moving about the plant, but when located for lifting or tiering purposes the steering wheel is raised, allowing the truck to rest on two fixed legs and prevent the machine from moving. When using the machine for raising material above the minimum height the platform is raised to the top of the inner frame and then the latter, together with the platform continues to move upward to the desired height. The reverse action takes place when lowering the platform. The platform is automatically held in position at whatever point it is stopped. Protective devices are provided on the power-driven machines for automatically stopping at the top and bottom limits of travel. These machines are manufactured by the Economy Engineering Co. of Chicago, Ill.

UNIVERSAL INCLINOMETER

A device intended for direct reading and checking of angles has recently been offered to the trade. This instrument consists of an aluminum housing carrying a graduated dial and mounted on a semi-steel base. Pivoted in the centre of the dial is a vernier pendulum that always hangs in a vertical position. A small brake is employed to steady the pendulum after the setting has been made. It is especially adapted to tool room service and for structural and erection work. The graduations provide for reading to every 5 min., but the device can be fitted for one min. reading if desired. The instrument is plumb when the zero on the pendulum coincides with the zero on the dial. As the dial is graduated on the entire circle a reading may be obtained when in any position. The base is ribbed and may be fitted directly to the work being measured. The base is made in lengths of 7, 18 and 24 in. For similar angles the reading will always be the same irrespective of the operator using the instrument. These tools are made by the Stevens-Prentice Mfg. Co., Milwaukee, Wis.

TOGGLE AND LEVER PRESS

A pneumatically operated general utility press has recently been offered to the trade. The press can be equipped with various forms of platens or work-holding fixtures, so as to make it adaptable to such work as straightening, bending, forcing, marking, and many similar operations. The machine is built in a number of sizes ranging in capacity from 15 to 200 tons. The press is self-contained and is portable in every sense. It only requires a small floor space. An adjustable screw is used for locating the vertical position of the die. Adjustable toggle mechanism allows of regulating the length of stroke. The piston imparts to the die a gradually decreasing speed and an increasing pressure for each unit of piston and travel during the first part of the stroke. The last portion of the stroke is made at a uniform pressure. In bending and straightening operations it is possible to throttle the air supply so as to apply just sufficient pressure to deflect the work the desired amount. If the die travel is stopped by contact with the work at any point within the uniform pressure stroke the pressure on the die is a known predetermined amount in proportion to the pressure in the air line. When used for marking, embossing, forging, etc., the pressure can be regulated by means of the valve and maintained at the pressure while that particular job is being performed. These presses are made by the Hanna Engineering Works, Chicago, Ill.



Pneumatic toggle and lever press.

AUTOMATIC DIE SINKING MACHINE

A new die sinking machine that is automatic in action has recently been placed on the market. It is designed for such work as forming, stamping, and forming dies, core boxes and pattern work, requiring impressions up to 36 x 20 in., and 8 in. deep. A master form is used for the control of the cutter movement and this may be made of plaster, cement or wood. Only a light pressure is necessary on the tracer point. The machine is constructed to combine tremendous cutting power with great accuracy in following and reproducing any design of pattern. The work is practically finished when it leaves the machine. It is possible to adjust the machine to make allowance for stock thickness. Automatic feeds both horizontal and vertical are provided and on the horizontal travel, quick return is provided for.

Any shape of contour may be obtained from the pattern. The table has a working surface 53 x 22 in., horizontal travel of 36 in., and change gears provide for speed range of from 1½ to 12 in. per min. The vertical slide has a travel of 20 in., with a feed of .10 in. to .83 in. per stroke, which may be increased if desired. A counterbalance is provided for this slide. The spindle is mounted on the vertical slide and has a horizontal movement, in and out, of 8 in. Its movement is controlled electrically. For working an outline on one plane, a special attachment is provided for contouring and profiling; with this device in use the in and out movement is made inoperative.

There is one slow and one high speed spindle. The spindle drive is by a separate motor direct connected with the lower cone pulley shaft on the rear side of the column. The upper cone pulley shaft carries the spindle driving pulley. Two spindle driving pulleys are provided, 4 and 6 in. in diameter, and interchangeable. The slow speed spindle pulley with the back gears are mounted as a unit on the spindle head. The high speed spindle is driven through a grooved pulley from the slow speed spindle pulley shaft. The ratio of back gearing is 3,-724 to 1. Eight changes of speed are provided, four with back gear ranging from 80 to 216 r. p. m., and four with open belt from 298 to 808 r. p. m. Extra high speed can be provided up to 2,424 r. p. m. The machine requires a floor space of 9 ft. x 8 ft.; the height is 6 ft. 8 in. It is manufactured by the Keller Mechanical Engraving Co., Brooklyn, N. Y.

PULLEY GRINDING MACHINE

A machine for grinding the faces and edges of pulleys has been placed on the market recently. The machine is fitted with a 14-in. dia. wheel mounted in a steel chuck. The wheel spindle operates on ball bearings at a speed of 1,500 r. p. m. The work carrier accommodates pulleys from 2 to 18 in. in diameter up to 6 in. face, the work being supported on a pintle positively driven through speed change gears. The work table has screw-operated movement in three planes, and an auxiliary rapid travel to and from the wheel actuated by a hand lever. It is possible to grind pulleys with crown, flat or concave faces by adjusting the work to the desired position. Instead of the usual conical surfaces the face has the form of a true ellipsoid curve. The work is completed in one operation, leaving a semi-polished surface. An attachment is supplied with the machine that may be used for mounting the work when grinding the edges. Guards are part of the usual equipment to provide adequate safety to the operator. Floor space required is 3 ft. 6 in. by 4 ft. 6 in. The machine is made by the Diamond Machine Co.,

It is desirable in the case of long shaft drives to reduce and steady the torque, or twisting, stresses by putting fly wheel pulleys at intervals along the shaft near the drive end. This treatment adds to the smoothness of running of the shaft, the belts and the machine which it drives.

A hanger is no stronger or better than its foundation in securing perfect operation of the shafting and its drives.

CANADIAN MACHINERY
AND MANUFACTURING NEWS

Published in the Interests of the Machinery, Manufacturing, Iron, Steel, and Metal Working Industries.

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Steady Improvement

REPORTS that there has been no falling off in the demand for structural steel are taken to indicate that industry has been more steadily employed in this department than is commonly supposed. Nine months' record shows that steel imports alone are practically double those of last year, and that the demand continues in spite of shipment delays arising out of recent strikes.

Steel warehouses report that, while small orders are not so plentiful, bulk business continues to show fair tonnages. There is, generally, an improvement over last year, and although prices have steadily advanced, they have not brought out any evidence of conservative buying. This is said to indicate an optimistic outlook and confidence that the general movement is in the right direction.

Students of conditions in Canada and United States, and of their relative significance, declare that there should be some reflection, on this side, of the great activity in evidence on the other side. Railways have been a great factor in the improved demand for steel in the United States, while here there has been very little buying either by the C.P.R. or National lines. It is claimed that they have all the material necessary in maintaining track and rolling stock efficiency. Even though a bumper wheat crop looms in the West, it is claimed that Canadian roads are well equipped to handle it.

In spite of the absence of the railroads as a large buying factor, iron and steel business has developed steadily. Much of the improvement is undoubtedly due to general building activity. Government statistics show that in 56 cities during August, permits had a value of $16,970,125, as compared with $14,275,026 in the preceding month, an increase of 18.9 per cent. The total, moreover, was $6,984,531, or practically 70 per cent. higher than for August of last year, the 56 cities having issued permits to the value of $9,985,594 during that month.

Do It Automatically

MODERN industry owes much to automatic machinery. High production records may, as a general rule, be traced to the employment of self-acting equipment. Munition manufacturers, during the war, demonstrated the efficiency of automatic machine tools. In fact, it may be said that every phase of the world struggle, from the workshop to the firing line, brought many devices into play in which the necessity for manual operation was reduced to a nicety. Time, labor, and money had to be conserved. Intensive team work was necessary, and mechanical means to that end were not overlooked.

Electricity, compressed air and automatic mechanisms constitute a mighty trio in the world of industrial effort. Human ingenuity has employed them, in almost innumerable ways, in the elimination of human frailty or in co-operation with human effort. The accuracy that is essential in finished products of iron and steel is almost entirely due to the work of the automatic machine. Fine adjustments and interchangeability, whereby several different operations may be performed simultaneously, or in succession, upon the same machine, represent, it has been said, "an intelligence that is human and a regularity and precision that verges on the superhuman."

Automatics have been a quickening influence in the competition that is "the life of trade." They have enabled men to do things better, to solve problems of time, and to produce, rapidly and efficiently, goods required for world markets. Not only in the machine tool industry has the automatic been seen to peculiar advantage. The weaving, spinning and knitting industries owe much of their development to this equipment. Canada, within comparatively recent years, has seen remarkable growth in the production of knitted goods, and automatics for this purpose are adapted to a wide range of purpose. Railroads are using automatic railway signal systems in introducing a maximum of safety into their operations

There is probably no department of mechanics in which engineering ingenuity has found expression in so varied and interesting form, and industry generally is receiving immeasurable benefits.

Adequate Outlet Wanted

ADDRESSING a gathering of business paper editors during their annual convention in New York, Julius Barnes, President United States Chamber of Commerce, stressed the fact that not until there was adequate passage to the sea for the products of the West, would agriculture function properly as a stable foundation for industrial and commercial activity.

With trunk railway lines unable to handle, eastward to New York, all of the business that was offered, with the Erie Canal hardly a factor, and with the Canadian water route from Buffalo to Montreal equipped with facilities of forty years ago, a condition was set up which advanced freight rates and, to that extent, prevented proper return to the farmer. Large freighters on the upper lakes earn comfortable dividends on a basis of two cents per bushel. If the same service existed east of Buffalo and on to Montreal it would add 10 to 15 cents a bushel to products west of Duluth, Chicago and Fort William. This would eventually have its effect upon industry generally, while the markets of the world would be available without handicap.

Steel Markets Showing Easier Price Tendencies

Due Largely to Settlement of Strikes—Industry Not Slowing Up —No Reductions in Steel Quotations—Competition Growing in Pig Iron—Demand for Boiler Tubes—Machinery Prices May Advance

THREE DOLLAR DROP IN DOMESTIC PIG

ALTHOUGH there have been no declines in steel prices, some readjustment is appearing in coke and pig iron. Canadian furnaces announce a reduction of $3.00 bringing the price per ton to $36.30, while Pittsburgh reports a softening process that does not appear to be sufficient to produce a market.

It would almost appear that buyers had anticipated more of a shortage in deliveries than has developed, but there is no indication that the easier undertone to the market is caused by decrease in general industrial activity. Seasonal influence will undoubtedly have its effect, and while it may develop that there has been a fair amount of work done, it is more notable that progress has been made in spite of strikes and other problems. The easier price tendency may be attributed almost entirely to cessation of labor troubles.

Steel ingot production is back to the rate of last June, or on a basis of about thirty-seven million tons a year. The August production had dropped to a basis of twenty-five millions, while September had a corresponding increase, showing a thirty-three million ton average at the close. At the present rate of going, according to advices from American centres, a shortage in production need not justify consumers stocking in anticipation.

While the general tone of the steel market is easier, no reductions have been made. Merchant bars have been quoted at $2.00 mill, Pittsburgh, but it is said some are offered at $1.95. The Hamilton price rules at $2.70, with the Montreal and Toronto warehouse range from $3.15 to $3.25. There has been a good demand recently for boiler tubes. This is a seasonal feature, and prices show a slight advance, about 5 per cent.

Congestion at American centres of production is undoubtedly a factor in maintenance of prices. Shipments are much below production, but it is reported that steel mills are not accumulating anything like the volume they had at the high point of 1920, when three million tons of finished steel were piled up. At the present time there is not one-tenth as much, and mills are reluctant to go further, as buyers may not want the material if late in delivery. The unfilled obligations of the Steel Corporation, at the end of September, amounted to 6,691,607 tons.

Montreal reports that no price changes are anticipated, and that they will remain steady until the close of navigation. The limit of the upward movement has been reached, and revisions, if any, should be in a downward direction. The situation as regards galvanized and black sheets has become a little easier owing to slight falling off in demand and larger supplies from British mills. There is good demand for boiler tubes and the market is adequately supplied.

Some machine tools and mill equipment are moving, but the demand spasmodic. There is some indication that prices may move higher, as it is a question whether machinery reproduction could be carried on at present figures. Should the movement acquire strength, it will, it is said, tend to eliminate the "business-at-any-price" element that makes its appearance under conditions that have existed for the past year.

Toronto

October 18

WITHOUT feature, but with general demand shaping well for a favorable month, the market appears to be proceeding along lines that generally mark the year-end season. The inventory period is in sight, and with prices at their present level, buying, it is predicted, may show a hand-to-mouth tendency. There are not likely to be any price recessions until well into the new year. An analysis of the situation establishes that fact. Steel men say that storage and extra cost of handling, while products are piling up, during shortage of cars, would be sufficient in themselves to discourage expectation of reduction, to say nothing of labor and coal costs.

Import steel tonnages, which doubled during September over August, show a slight falling off this month, but this was expected as business in this department has shown a remarkable record largely on seasonal operations. The railways have not appeared in this market to any extent, apart from comparatively light tonnages of rails, while on the other side, a slight advantage in the market, preceding Oct. 1, brought out orders for a million tons. The taking by the New York Central, one hundred thousands tons, is about the amount turned out by the Algoma Steel Co. this year. The coming year should see marked improvement in railway activity.

Pig Iron.—A reduction of $3 per ton on domestic iron has been announced as effective Oct. 13. This brings the Toronto price to $36.30, and may be regarded as representing some easing in conditions under which Canadian furnaces were operating. Buffalo producers also reflected improvement in their prices and, as a result, a serious competitive factor was developing. Domestic furnaces may be expected to improve their position gradually. There are those who look for $25 iron "before snow flies," but furnace men reply that if the weather is at all sympathetic with difficulties surrounding pig production, it will be a green Christmas at least. Reports from American centres indicate a softening with little business offering. Buffalo is quoting 2.25 and 2.75 silicon at $33 and malleable at $32.

Iron and Steel.—That stage has been reached where advances seem out of the question, and declines impossible. There has been a range from $3.25 to $3.40 in bars, but the latter figure never became a fixture. Quotations depended upon the buyer and terms of purchase, although some dealers declare that a boost in price of 50 cents during the past four months has been about all the traffic would bear. By these people, $3 40 is considered an absolutely outside figure. They are the conservatives who maintain that business is at that point where it may be made or marred by a trifle. On the other hand the market is not without those students who declare that Toronto prices have represented a proper spread as between mill and warehouse. Current prices follow:

Iron bars	3 25	3 40
Steel bars	3 25	3 40
Reinforcing bars	3 25	3 40
Steel hoops		4 75
Tire Steel		3 50
Spring steel	7 00	14 00
Band steel, No. 10 gauge and 3-16 in base		3 90
Small shapes		3 50
Sheets, black, No. 28		5 50
Sheets, blue ann., No. 10		4 50
Canada plates, dull 52 sheets		5 75
Canada plates, all bright		6 75
Galvanized Sheets, No. 28		6 75

Scrap Materials.—This market is described as "quite steady, but without spectacular movement." There is not much offering in machine cast iron, or in any other grade for that matter, and at the present time much of this material is going out of the country. Copper scrap is stronger. Copper wire is quoted at $11.50; heavy copper at $12.50; crucible copper at $12 and light copper at $9, but much depends upon grading, and on handling necessary for market requirements. Dealers' average buying prices follow:

Copper, light	9 00
Copper crucible	12 00
Copper, heavy	12 50
Copper wire	11 50
No. 1 compositon	9 00
New brass cuttings	6 00
Red brass turnings	6 50
Yellow brass turnings	5 25
Light brass	4 50
Medium brass	6 00
Scrap zinc	3 50
Heavy lead	4 50
Tea lead	3 00
Aluminum	11 00
Boiler plate, per gross ton.	9 00
Heavy melting steel	10 00
Axles (wrought iron)	20 00
Rails (scrap)	11 00
Malleable	10 00
No. 1 machine castiron	18 00
Pipe, wrought	7 00

Non-ferrous Metals.—For what business is going in ingot metals, there is keen competition. Dealers declare that sales taxes, amounting in all to 6%, as between sellers and ultimate purchaser, has done a lot to divert big business away from middlemen, who have been considered necessary when quick deliveries are essential, or when the small buyer has to be considered. There is, practically, a double sales tax, one of 3¾ per cent. on being cleared through customs, and one of 2¼ per cent. from the dealer to the manufacturer. Large buyers, however, by buying direct, may now save the 2¼ per cent. Small foundries, however, are not in that fortunate position. Their purchases are not large, and they buy through the dealer. Much non-ferrous scrap is now going direct to the foundries, rather than through dealers, in order to save taxes and extra handling charges.

Much war material is still on the market. There are great supplies of lead with small percentages of antimony. Supplies of this bulk so large in fact that the price is below normal. The demand comes from producers of type and babbitt metals. Prevailing prices:

Lake copper	17 25
Electrolytic copper	17 00
Castings, Copper	17 00
Tin	37 00
Antimony	8 50
Spelter	8 50
Antimony	8 50
Aluminum	23 00

Machine tool demand continues spasmodic. Enquiries are good, and some sales are being made, but there is no steady movement, and what is selling requires keen salesmanship. Some stiffening of prices is reported. It is doubtful if dealers could reproduce for present figures the equipment that has been sold during the past six months. Sales at any price have, therefore, become faded out, as a feature of the market. Shop supplies and mill equipment still make a fair showing.

Montreal

October 18

MARKETS during the past week have been quiet, although business on the whole has been well up to the average of the past six months. Industry is still hampered by poor deliveries on materials coming from American steel centres and this may delay progress on work scheduled for advanced operations before winter. However, the prolonged favorable weather is an assisting factor.

Discussing general conditions here, a large dealer had this to say:—

"In regard to general conditions, we might say that no price changes are anticipated. They are steady and with indications that they will continue so until the close of navigation. The opinion is generally current that the upward trend has been reached and, with a fair demand prevailing, values will remain on about the present level for some time, but any revisions should be in a downward direction.

"**Galvanized and Black Sheets.**—The situation regarding supplies in stock can be said to have become a little easier particularly in regard to galvanized sheets. Two reasons account for this, namely: a falling off in the demand and receipt of larger supplies lately from British mills, but prices on both commodities hold firm for the present.

"**Boiler tubes.**—The demand continues to keep up and stocks are quite able to take care of all supplies needed. Prices are holding steady."

Pig Iron.—There is no doubt that the supplies of Scotch and English pig iron on the market have helped save the day for foundries that were running short. Although it may be that much of this iron came in as ballast, rather than exclusive cargo, and the full amount, therefore, not large, it arrived at the psychological moment. Some export business, England to U. S. A., is being done through local houses. It is not so much competition from this source, however, as from producers of pig iron in Buffalo district that a reduction of $3 per ton on domestic iron has become effective. Whereas Ontario consumers are continuing to buy liberally, there is not much change in Eastern Canada, general foundries still being poorly occupied and manufacturers of special castings fairly well covered for their immediate needs. Prices follow:

Algoma, No. 1, car lots on tracks, nominal quotation		38 65
Summerlee, 30-ton lots, dock	35 00	
Carron, 30 ton lots	35 00	
Do., 5 ton lots, ex. warehouse	40 50	

Iron and Steel.—Merchant bars are still in strong demand, with no change in prices. The likelihood that there may be an easing in American quotations may explain a conservative tendency in buying, but in well-informed circles, it is considered unlikely that there will be any reduction until first quarter 1923. Products are piling up at production points owing to scarcity of cars, and this fact alone, it is claimed, will have a tendency to keep prices at present levels. In some quarters slightly easier prices have been reported on sheets, but this may be regarded as one of those superficial fluctuations significant of nothing. The range on black sheets, $4.60 to $4.75, and on Canada plates, $6.40 to $6.50, is a narrow one, and may be said to represent selling factors rather than basic market movement. Zinc sheets are quoted at $9.75 to $10.25. Prices follow:

Iron bars, base	3 15 to 3 25
Steel bars, base	3 15 to 3 25
Reinforcing bars, base	3 15 to 3 25
Steel hoops	4 25
Tire steel	3 25 to 3 40
Spring steel	7 00
Band steel, No. 10 gauge and 3-16" base	3 65 3 75
Small shapes	3 40
Sheets, black, No. 28	4 40
Sheets, blue, ann., No. 10	4 00
Canada plates, dull, 52 sheets	5 50
Canada Plates, all bright	7 00
Galvanized Sheets, No. 28	6 50

Non-ferrous Metals.—Markets in these lines are generally firm. Ingot metals are more active, except copper, which is rather dull and slightly easier. Tin is especially strong. Prevailing prices:

Lake Copper	17 75
Electrolytic Copper	17 50
Castings, Copper	17 25
Tin	36 50
Lead	7 50
Spelter	9 00
Antimony	6 75
Aluminum	22 00

Scrap Metals.—There is no outstanding activity in this market, although prices have been quite firm. Dealers' average buying prices follow:

Copper, light ... per 100 lbs.	9 00
Copper, crucible	11 50
Copper, heavy	11 25
Copper Wire	11 25
No. 1 composition	9 00
New brass cuttings	6 00
Red brass turnings	6 50
Yellow brass turnings	5 25
Light brass	4 50
Medium brass	6 00
Scrap zinc	3 50
Heavy lead	4 50
Tea lead	3 00
Aluminum	11 00
Boiler plate, per gross ton	9 00
Heavy melting steel	10 00
Axles (wrought iron)	20 00
Rails (scrap)	11 00
Malleable	10 00
No. 1 machine cast iron	20 00
Pipe, wrought	7 00
Car wheels	17 00
Steel Axles	15 00
Machine shop turnings	4 00
Stove plate	16 00
Cast boring	4 00

In copper products, some stiffening of prices has appeared. Copper bars are quoted at 30-31; plain sheets, 32-36; copper sheet, 39-41; copper sheet, planished, 44-46. Deliveries of materials from mills show little improvement.

Pittsburgh

PRICES in the iron and steel industry have entered into a period of readjustment. A week ago, coke began declining sharply and pig iron is now in the act of declining, although it has gone down but little as yet. There has been practically no decline in steel prices, merely a softening in the undertone.

Occasion for readjustment is furnished by the ending of the coal strike, making production of coal, coke, pig iron and steel easier, and probably also by the existence of stocks of steel of considerable size in the hands of buyers, who anticipated more of a shortage in deliveries by the coal strike and the subsequent transportation disability than has actually occurred.

There is no definite evidence that readjustment is influenced by any unfavorable change in the general volume of industrial activity. No decrease in general industrial activity can be observed.

nor is there any definitely in prospect, except such as would naturally occur between now and the end of the year from purely seasonal influences. It may be, however, that some observers in the past few months have been over-rating the industrial activity then in progress. There has been a tenseness that should be ascribed not to the amount of work being done being extra large, but to its being difficult to do work on account of strikes and the indisposition of some workmen to work efficiently.

Small Curtailment.—Steel ingot production has now gotten back approximately to the rate of last June, the high rate of the year, and is probably slightly above that rate, which was 36,600,000 gross tons of ingots a year. The American Iron and Steel Institute reports the September production of ingots by the 30 companies that make monthly returns at 2,373,779 tons. From this it can be computed, after allowing for the producers not reporting, that the average rate of production during September by the whole industry was about 33,000,000 tons a year, against an average rate during August of 30,000,000 tons. During August production was decreasing sharply, until a rate of 25,000,000 tons or less was reached at the end of the month, while during September production was correspondingly increasing, and thus going much above the 33,000,000 ton average at the close.

If the June rate of production, the highest rate for more than a year and a half, had continued during July, August and September, the production of ingots in the three months would have been about 9,150,000 tons. The actual production was about 8,250,000 tons, showing what may for comparative purposes be called a deficit of 900,000 tons. This is about seven days of production at the present rate, certainly not enough to make much trouble, or enough to justify consumers stocking up very largely in anticipation. A consumer ought to have a leeway of more than seven days even if no strike or railroad blockade is in prospect.

Decline in Coke.—The Connellsville coke market held up until recently at a fictitious price, due to the anxiety of furnaces to get supplies, encouraged by the high prices being quoted on pig iron, although, as a matter of fact, there was scarcely any buying at these fancy prices. Coke ruled at $12 or higher for several weeks. Early last week it sold at $11 and by the end of the week it had sold at $10.50. There is much room still for it to decline. Coke has not infrequently sold at less than the market value of the coal involved, 1½ tons, plus cost of coking. Coal is now rather easy in the market at $3.50, while the cost of coking, with the very high wage scale now paid, is about $1.25. The formula would make a coke price of $6.50.

Pig iron prices have begun softening but no actual market has been developed, as consumers require a decline of several dollars a ton and have not even begun to nibble as yet. Basic iron can be bought at $30, valley. At one time it was claimed to be worth $34, though the highest sale to a consumer seems to have been at $32.50, and that was only one case. Foundry iron can be had at $32.50, while it is claimed a few stray carloads sold some time ago at $36, marking the very outside of the market.

All told, several merchant furnaces have gotten into blast, the two latest, just about in now, being Cherry Valley and McKeefrey, both at Leetonia, O. Besides the merchant furnaces, the Cambria Steel Company has been offering all grades for several weeks, and at least one other steel interest is now offering basic iron. Since consumers bought very little iron while the merchant furnaces were down, they can hardly be expected to buy much now, when various furnaces have resumed and are making deliveries on old orders. Competition will, therefore, bring pig iron prices down, aided soon by coke becoming available at reasonable prices.

In steel prices there is scarcely any change to be recorded, but the undertone is softer and delivery premiums are narrowing. When they have disappeared, basic prices for forward delivery are likely to begin yielding. Of late, merchant bars have been plainly at a minimum of 2.00c, but rumors are now going around of some being offered at 1.95c. Sales of sheets at above 3.60c have become small in point of tonnage.

Car shortage and embargoes have been the main support of the steel market in the past week or two. At many mills, shipments are not equal to production, while shipments are not well distributed, it being impossible to reach some customers on account of embargoes. The steel mills, however, are not accumulating anything like the volume of steel they had at the high point in 1920, when some estimates were that 3,000,000 tons of finished steel were piled at mills. Accumulations now are hardly one-tenth as much, and mills will not pile up much more, being in doubt whether buyers would want the steel, of the particular specifications involved, if shipped much later than the specified time.

The Steel Corporation's unfilled obligations increased by 741,502 tons in September, against increases of 173,944 tons in August and 602,769 tons in April, hitherto the record month this year for bookings. The large increase in September was due chiefly to the 100,000 ton Sinclair pipe line order and the large volume of rail business done, in anticipation of the advance in price from $40 to $43, now effective. Some of the rail tonnage was not formally entered in September, and will influence the statement for October. Unfilled obligations at the end of September amounted to 6,691,607 tons, equal to what production would be in seven months at a 70 per cent. operating rate, although of course the obligations are not uniformly distributed among the different departments. The independents, on the other hand, have as a rule, very small order books. The relative condition in this respect is much the same as that which obtained at the end of 1920.

MARKET FOR TOOLS IN HONDURAS

With reference to the machinery market in British Honduras, Trade Commissioner Stevens writes:—"The total imports of this colony under this head are negligible. Power producing machinery is represented by fuel oil engines of stationary British and American types, but importers do not carry such engines in stock because of the fractional demand. There is no agricultural machinery of any importance except the most primitive types of sugar mills, with a capacity of a few barrels per day. Even the equipment of the saw-mills is limited, and the ease of replacement of spare parts from New Orleans prevents the introduction of other lines.

"Certain limited business exists in small marine engines for use on the rivers, and in this connection a certain amount of business might be done with detachable motors. Beyond this latter opening, however, there is nothing in the machinery line to be anticipated from British Honduras at present. The only machines for which business could be expected would be light scales of American type, and sewing machines. A considerable number of standard American varieties of counter scales were noted. The sewing machines in evidence were the 'Singer' and the 'New National.'

"A considerable trade is done in woodworking tools in this colony. All timber is shipped in hewn logs, so that the demand is restricted to tools of primary manufacture. The ordinary chopping axe of the type common in Canada does not appear to be as popular as some of its odder-looking relatives. The Kentucky axe is the more common specimen. Supplementary to the axe imports, there are fairly large imports of grindstones, which might be supplied from Canadian quarries. These stones are of moderate quality and are imported in sizes of 6 to 24 inches diameter. The smallest of these stones sell at 40 cents each. Complaints were heard regarding the unevenness of these American stones, but to date no competitor has appeared to replace them.

"Some business is done in hand saws, and rather more in cross-cut saws. Mahogany cutting is single-handed sawing, and Canadian offerings of cross-cuts should be this type of saw. The Disston and Atkins houses, both of which have Canadian factories, furnish nearly all the saws in use at present."

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Toronto price:—

Silicon, 2.25% to 2.75%	36 30
Algoma, No. 1, Montreal	38 65
Summerlee, Scotch, Montreal dock	35 00
Summerlee, Warehouse, 5-ton	40 50
Carron, Montreal docks	35 00
Grey forge Pittsburgh	33 77
Lake Superior, charcoal. Chicago	36 15
Standard low phos., Philadelphia	38 00
Bessmer, Pittsburgh	35 27
Basic, Valley furnace	31 00

METALS

	Montreal	Toronto
Lake Copper	$17 75	$17 25
Electrolytic Copper	17 50	17 00
Castings, Copper	17 25	17 00
Tin	36 50	37 00
Spelter	9 00	8 50
Lead	7 00	7 50
Antimony	7 00	9 00
Aluminum	22 00	23 00

Prices per 100 lbs.

BILLETS

F. O. B. Pittsburgh

	Per gross ton
Bessemer billets, 4 in. x 4 in. and larger	40 00
Open hearth billets	40 00
O. H. sheet bars	40 00
Forging billets	45 00
Bessemer rods	46 50

IRON AND STEEL

Per 100 lbs. to large buyers

Iron bars, base, Toronto	$3 25	3 40
Steel bars, base, Toronto	3 25	3 40
Small shapes, base		3 50
Iron bars, base, Montreal	3 15	3 25
Steel bars, base, Montreal	3 15	3 25
Reinforcing bars, base	3 35	3 40
Steel hoops		4 50
Tire steel, base		3 50
Spring steel	7 00	14 00
Band steel, No. 10 gauge and 3-16 in. base		3 90
Chequered floor plate ¼" and heavier	6 25	7 00
Chequered plates ¼-in. and heavier, sunken diamond		5 40
Bessemer rails, heavy, at mill		2 35

PITTSBURGH MILL

Steel bars	2 00	2 25
Tank plates	2 00	2 50
Structural shapes		2 25
Steel hoops	2 90 to	3 25

F. O. B. Chicago Warehouse

Steel bars	2 80
Structural shapes	2 90
Plates	2 90
Small shapes under 3-in.	2 90

PLATES

Plates 3-16 in.	$3.85	$3 60
Plates, ¼ up	3 50	3 40

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$4 60	$5 50
Sheets blue ann., No. 10	4 50	4 50
Canada plates, dull, 52 sheets	5 25	5 75
Can. plates, all bright	6 50	6 75
Galvanized sheets, No. 28	6 75	6 75
Queen's Head, 28 B.W.G.	7 25	
Fleur de Lis, 28 B.W.G.	7 00	
Gorbal's best, No. 28, U. S. G.	6 10	
Colborne's Grown, No. 28		
Premier	6 85	6 35
Premier 10¾ oz.	6 85	6 75
Zinc sheets	9 75	10 25 11 00

FREIGHT RATES

	Per 100 lbs. C.L.	L.C.L.
Pittsburgh to Following Points		
Montreal	52	65½
St. John, N. B.	76	96
Halifax	77½	97
Toronto	34	48½
Guelph	34	48½
London	34	48½
Windsor	31½	45½
Kingston	48½	61

Current surcharge 1 per cent.

OLD MATERIAL

Dealers' Average Buying Prices

	Montreal Per Ton	Toronto Gross
Boiler plate	$ 9 00	$ 9 00
Heavy Melting Steel	10 00	11 00
Axles (wrought iron)	20 00	16 00
Rails (scrap)	11 00	11 00
Malleable scrap	10 00	11 00
No. 1 Machine cast iron	20 00	18 00
Pipe, wrought	7 00	6 00
Car wheel	17 00	16 00
Steel axles	15 00	15 00
Mach. shop turnings	4 00	6 00
Stove plate	16 00	14 00
Cast boring	4 00	6 00
Copper, light	9 00	9 00
Copper, crucible	11 50	12 00
Copper, heavy	11 25	12 50
Copper, wire	11 25	11 50
No. 1 machine composition	9 00	9 00
New brass cuttings	6 00	6 00
Red brass turnings	6 50	6 50
Yellow brass turnings	5 25	4 85
Light brass	4 50	3 50
Medium brass	6 00	4 50
Scrap zinc	3 50	4 00
Heavy lead	4 50	4 50
Tea lead	3 00	3 00
Aluminum	11 00	11 00

COLD ROLLED STEEL

(At Warehouse)

Rounds and squares	$4 75 base
Hexagon and flats	$5 75 base

COPPER PRODUCTS

Prices per lb.

	Montreal	Toronto
Copper bars, 1¼ to 2 in.	30-31	.28
Brass Tube		.30
Plain sheets, 16 oz. in. 30 x 72	31-32	.29
Copper sheet, tinned, 16 oz.	39-41	.36
Copper sheet, planished, 16 oz. base	44-46	.41
Braziers', in sheets, 6 x 4 base	.30	.29
Copper tubing, seamless		.33
Brass rod		.22

LEAD SHEETS

Roll Lot Prices

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$9 15	$11 50
Sheets, 3½ lbs. sq. ft.	9 05	11 50
Sheets, 4 to 6 lbs. sq. ft.	8 90	10 00

Cut sheets, ¾c. per lb. extra

Cut sheets to size, 1c. per lb. extra

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	20
Brass sheets, 24 gauge and heavier base	23
Brass tubing, seamless	28

WROUGHT PIPE

Price List No. 56. August 23, 1922.

Standard Buttweld Pipe S/C

Size	Steel Blk.	Steel Galv.	Gen. Wrot. Iron Blk.	Gen. Wrot. Iron Galv.
⅛ in.	6 00	8 00	....	....
¼ in.	3 96	6 00	7 20	9 36
⅜ in.	3 96	6 00	7 20	9 36
½ in.	5 02	6 55	7 31	8 93
¾ in.	6 10	7 82	8 86	10 76
1 in.	8 50	14 22	12 58	15 36
1¼ in.	11 50	15 18	17 02	20 76
1½ in.	13 75	8 15	20 35	24 75
2 in.	18 50	24 42	27 38	33 36
2½ in.	29 25	38 61	....	....
3 in.	38 25	50 49	....	....
3½ in.	49 68	64 40	....	....
4 in.	58 86	76 30	....	....

Standard Lapweld Pipe S/C

Per 100 feet.

Below dividing line—price per foot.

Size	Steel Blk.	Steel Galv.	Gen. Wrot. Iron Blk.	Gen. Wrot. Iron Galv.
2 in.	22 20	27 75	31 08	37 00
2½ in.	32 76	41 54	46 80	56 16
3 in.	42 84	54 32	61 20	73 44
3½ in.	50 60	66 24	72 68	89 24
4 in.	59 95	78 48	86 11	105 72
4½ in.	68 58	87 63	1 04	1 24
5 in.	79 92	102 10	1 21	1 45
6 in.	1 04	1 32	1 57	1 88
7 in.	1 38	1 79	2 02	2 45
8L in.	1 45	1 88	2 13	2 58
8 in.	1 67	2 16	2 45	2 97
9 in.	2 04	2 62	2 97	3 59
10L in.	1 89	2 43	2 75	3 33
10 in.	2 43	3 13	3 54	4 28

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4-in. and under, close and short, 55 per cent.

4½-in. and larger, close and short, 45 per cent.

4-in. and under running thread, 35%.

Standard couplings 4-in. and under 25%

Do., 4½-in. and larger 5 per cent.

MALLEABLE FITTING LIST

1 in. elbow	.32	.53
2 in. elbow	1.05	1.70
1 in. tee	.43	.70
2 in. tee	1.45	2.40
1 in. coupling R. & L.	.33	.53
1 in locknut R. & L.	.15	.23

Discount to dealers—70 per cent.

BOILER TUBES

Size	Lapweld Toronto	Seamless Montreal	Lapweld Montreal
1 in.	19 00		
1¼ in.	23 00		
1½ in.	23 00		
1¾ in.	23 00		
2 in.	18 00	20 00	19 00
2¼ in.	20 00	23 00	21 50
2½ in.	21 50	26 00	22 50
3 in.	27 50	32 00	28 50
3½ in.	30 50	37 00	33 00
4 in.	39 00	47 00	42 00

Prices per 100 ft., Montreal and Toronto

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, 7-16 and up	30
Carriage bolts, ⅜ in. and smaller 6 in. and shorter	40
Coach and lag screws	45
Stove bolts	72½
Wrought Washers	60
Do., corru. head	60
Machine bolts, 7-16 and over	35
Machine bolts, ⅜-in. and less	35
Blank bolts	35
Bolt ends	35
Machine screws, fl. and rd. hd., steel cut thread	37½ & 10
Machine screws, o. and fil. hd., steel cut thread	30
Machine screws, o, and fil. hd., brass cut thread	15
Standard couplings, 4-in. and under, brass cut thread	30% 30
Nuts, square, blank off net list	$1.00
Nuts, square, tapped off net list	50c.
Nuts, hex., blank off net list	50c.
Nuts, hex., tapped net list	
Copper rivets and burrs, list less	32c.
Burrs only, list plus	10%
Iron rivets and burrs	47%
Boiler rivets, base ¾ in and larger	$5.75
Structural rivets, as above	5 65
Wood screws, O. & R., bright	80
Wood screws, flat, bright	82½
Wood screws, flat brass	77½
Wood screws, O. & R., brass	75
Wood screws, flat, bronze	72½
Wood screws, O. & R., bronze	70

NAILS AND SPIKES

Wire nails, base	$3 65
Cut nails, base	4 35
Miscellaneous wire nails	72½%

MILLED PRODUCTS

(Prices on unbroken packages)

Set screws	65
Square and hexagon head cap screws	60
Round head cap screws	20
Fillister head cap screws	35
Flat head screws	25
Button head cap screws	20
Studs	45
Semi-finished nuts up to and including 9/16 in.	70
Semi-finished nuts ⅝ to 1¼ in.	65
Semi-finished nuts 1⅜ to 2 in	35
Coupling bolts	35
Taper pins, No. 2 to No 5	65
Taper pin No. 6 and over	10
Planer bolts without fillet	10
Planer bolts with fillet	Net
Patch bolts	Plus 10%
Hollow set screws	20
Thumb screws	50
Thumb nuts	70

CARBON DRILLS AND REAMERS

	Discount.
S. S. drills, wire size	60
Can. carbon cutters	plus 10
Standard drills, all sizes	60
3-fluted drills, plus	10
Jobbers and letter sizes	60
Bit stock	50
Ratchet drills	25
S. S. drills for wood	10
Wood boring brace drills	50
Electricians' bits	30
Sockets	50
Sleeves	30
Taper pin reamers	25
Drills and countersinks	20
Bridge reamers, carbon	50
Centre reamers	Net
Taps, machine screw	50 to 60
Taps, hand, sizes up to 1"	30 to 60
Chucking reamers	20 off
Hand reamers	20
High speed drills, list	40
Can. high speed cutters	plus 10
American	plus 40

FILES AND RASPS

Globe	60/5
Vulcan	50
P. H. and Imperial	60/5
Nicholson	40
Black Diamond	40
Heller	40
Jowitts	net
J. Barton Smith, Eagle	55
McClelland, Globe	50
Delta Files	20
Disston	40
Disston	50
Great Western-American	50
Kearney & Foote, Arcade	60/5

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

PROOF COIL CHAIN

B. B. B. CHAIN

⅜ in., $16.45; 7-16 in., $14.00; ½ in., $12.95; 5-8 in., $13.15; ¾ in., $12.75; ⅞ in., $12.25; 1 in., $11.85; 1⅛ and 1¼ in., $10.55. Fire weld chain same sizes respectively are $14.00; $11.50; $10.40; $10.55; $10.15; $9.75; $9.35; and $8.25.

ELECTRIC WELD COIL CHAIN B.B.B.

⅛ in. $20.00; 3-16 in. $16 50; ¼ in. $15.50; 5-16 in. $12.70.

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	30%
Standard	30 and 10%
Cut leather lacing, No. 1	1.75
Leather in side, (Lacing)	1.50

RUBBER BELTING

Standard 36 ....28% Best grades 28%

TAPES

Chesterman Metallic, 50 ft.	$5 00
Lufkin Metallic, 603, 50 ft.	3 17
Admiral Steel Tape, 50 ft.	3 00
Admiral Steel Tape, 100 ft.	4 50
Major Jun. Steel Tape, 50 ft.	3 75
Rival Steel Tape, 50 ft.	4 00
Rival Steel Tape, 100 ft.	8 75
Reliable Jun. Steel Tape, 50 ft.	5 25

PLUMBING SUPPLIES

Plumbers' oakum, per cwt.	6 00
Solder, strictly	$0 22½
Solder, guaranteed	0 24
Soldering coppers, lb.	0 62½
White lead, pure, cwt	13 20
Red dry lead, 100-lb. kegs, per cwt.	10 75
Wood alcohol, per gal.	1 75
Whiting, plain, per 100 lbs.	3 00

ROPE AND PACKING

Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope ¾ and larger, base	0 21
British Manila rope	0 19
New Zealand hemp	0 19
Jute packing, fine	15c
Jute packing, coarse	11c

OILS AND COMPOUNDS

Castor Machine Oil, per lb.	34½
Royalite, per gal. bulk	20
Palacine	23
Machine oil, per gal.	39
Black oil, per gal. (Summer)	19
Cylinder oil, Capital	69½
Petroleum fuel oil bbls., net	10.80
Turp., single bbls., gal	1.75
Linseed oil, raw, single bbls.	1.02
Premier gasoline	32 00
Fuel oil, bbls., gal.	11 80

WASTE

XXX Extra	16
Atlas	18
Peerless	21
X Empire	13
XX Grand	15
Ideal	18
Superior	20
X Press	11½
X L C R	14

Colored

Lion	12
Fancy	13½
Standard	10½
Popular	9
No. 1	13
Keen	7½

Wool Packing

Arrow	24
Anvil	16
Axle	20

Washed Wipers

Select White	18
Dark colored.	13
Mixed Colored	14

This list subject to trade discount

PLATING SUPPLIES

Polishing wheels, felt	$3 25
Polishing wheels, bull-neck	1 60
Emerey in kegs, Turkish	7½
Pumice, ground	04½
Emery glue	26
Tripoli composition	08
Crocus composition	12
Emery composition	11
Rouge, silver	60
Rouge, powder, nickel	35

Prices per lb.

ANODES

Nickel	40 to .45
Copper	.38 to 22
Zinc	.16 to .12½

PLATING CHEMICALS

Acid boracic	.20
Acid, hydrochloric	.03¾
Acid, nitric	.10¼
Acid, sulphuric	.03¾
Ammonia, aqua	.20
Ammonium, Carbonate	.15
Ammonium, chloride	.18
Ammonium, hydrosulphuret	.75
Ammonium, sulphate	.10
Arsenic, white	.18
Copper carbonate, anhy.	.26
Copper, sulphate	.08
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.14
Nickel carbonate	.32
Nickel sulphate	.14
Potassium sulphide (substitute)	.40
Silver chloride (per oz.)	.85
Silver nitrate (per oz.)	.65
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.32
Sodium hyposulphite	.08
Sodium phosphate	.10
Tin chloride	.50
Zinc chloride, C. P.	.30
Zinc sulphate	.06

Prices per lb. unless otherwise stated

News From the Industrial Field

Windsor Machine and Tool Co., Windsor, Ont., contemplate the erection of a plant at St. Thomas, Ont., at a cost of $100,000.

Canadian Westinghouse Motors will be installed at the new power plant being erected at Price, Que., for the Lower St. Lawrence Power Co.

International Combustion Co., Montreal, capital $50,000, has been incorporated to manufacture and deal in stoves, furnaces, boilers, hot water heaters, radiators and sanitary apparatus.

Linde Canadian Refrigerator Co. of Montreal, has awarded the roofing contract of their new factory at Lachine, Que., to Pilon and Beauchamp of Lachine.

The Dominion Bridge Co. of Montreal, has been awarded the steel contract for the new City Hall of Montreal; the cost of the steel work will be approximately $124,500.

The Trussed Concrete Steel Co. of Montreal, have secured the contract for the reinforced steel for the $60,000 factory being constructed for W. C. McDonald of Montreal.

The Imperial Oil Co. has awarded the general contract for the erection of an oil refinery plant at Calgary to McDonald Bros. of that city; the estimated cost will be about $2,500,000.

The Trussed Concrete Steel Co., and the Canadian Bridge Co. of Walkerville, have secured the contract for steel work for the new Leggatt and Pratt factory being erected at Windsor, Ont.

The Provincial Government has recognized the possibilities of iron mining in Ontario and has appointed a committee to investigate the prospects. The Hamilton Steel Works will shortly make a test with 43,000 tons of briquetted ore obtained from the Moose Mountain Mine.

Sydney, N. S.—The Grand Trunk Railway has ordered 29,000 tons of 100-pound steel rails for delivery next Spring, according to announcement made by the British Empire Steel Co. This, it is said, will help keep the Sydney plant going, with a force of 3,000 men, all winter.

Harris Oil Corporation, Toronto, has been incorporated with two million dollars capital to acquire, develop and operate mineral, oil and gas lands. The directorate includes Lloyd Harris, and W. T. Henderson, Brantford; Noel Marshall, D. B. Hanna, and C. J. Harris, Toronto; W. H. Magill and J. A. Thomson, Hamilton.

National Steel Car Corporation, Hamilton, reports uncompleted orders amounting to three million dollars.

Minto Coal Co., Montreal, Que., capital $1,000,000, has been incorporated to develop coal mining properties in New Brunswick, and to deal in coal, coke and by-products.

Ottawa announces that the rate of exchange on freight shipments between Canada and United States, Oct. 15 to Oct. 31, will be one-eighth of one per cent. No surcharge will be collected on international freight or passenger business.

Some cases of undue delay in delivery of Canadian Machinery to subscribers have come to our attention. This paper is mailed every Wednesday afternoon. If you do not receive your copy promptly, please advise us so that we may take the matter up with the post office.

In an educational bulletin from the Algoma district, the C. P. R. mention F. E. Veaudry, Schreiber, Ont., an engineer, for meritorious service. He repaired his engine, which became defective on the road, and brought his train through to terminal.

Canadian trade for the first six months of the present fiscal year ending Sept. 30 was $37,664,156 better than for the same period last year. Exports increased by $59,556,165. The increase in September alone was over thirteen millions. Imports showed a falling off of $14,899,514.

Gladys Belle Canadian Oil and Refining Co., Lethbridge, Alta., with capital of ten millions, has been incorporated to acquire and develop petroleum properties and to refine and deal in petroleum products. Chas. Benton Coon, of Tulsa, Oklahoma, is named as an applicant for incorporation.

Holmes & Schultz Electric Co., Kitchener, are a new concern specializing in electrical maintenance, mill and factory supplies. The members of the firm are F. O. Schultz, formerly with the Westinghouse Co., and H. W. Holmes, with Canadian Hart Products and Victor Saw.

Steady progress is being made on the new sugar refinery at Petrolia, Ont., for the Peninsular Sugar Co. The Sarnia Bridge Co. has been awarded the contract for 75 tons of steel, this to be delivered within four weeks. The steel sash and steel doors will be supplied by the Trussed Concrete Steel Co., of Windsor. The Grand Trunk siding will soon be completed.

Robb Engineering Works, Amherst, N. S., report a marked improvement in business. Orders had been received from Montreal for ten boilers, some of the Victoria type for heating large buildings and other steam boilers for power purposes. Other orders were for two large engines of Robb-Armstrong type, for a power company at Fort William and also for a number of buoys from the Department of Marine and Fisheries. Prospects are bright for further business.

Belleville.—For some months past the Springer Lock Manufacturing Co. has been working to capacity in all departments as reflecting activity in building industries. During the past summer an addition to the machine shop was erected, which increases the shop floor space by about fifty per cent. During the last few weeks a number of new machine tools arrived and are being installed in the new wing. Among the larger tools is a Brown and Sharpe Universal milling machine, with vertical milling attachment, a die engraving machine, a shaper, a large punch press, a battery of three screw machines, two dozen bench vises and a miscellaneous lot of power-driven bench tools. The company has secured supplies of raw material, coal, coke, scrap and pig iron, which fact ensures uninterrupted operation throughout the present winter, as the sales department is crowding the production department. A new pattern storage vault has recently been completed, in order to store the increasing number of patterns.

Belleville.—Elliot Machinery Co., of this city, manufacturers of woodworking machinery, state that their business has been steadily improving through the present year. This is particularly true of the domestic trade. Sales in the province of Ontario have made the largest improvement, western sales being next, while only a nominal increase was noted from Quebec and the Maritime Provinces. The company has developed a nice export business and are shipping this week twelve of their Universal Wood Workers to New Zealand. This will make a total of seventy machines to New Zealand recently. Twenty-five of these machines have been shipped to Australia. A large number of machines were exported to Great Britain until recently arrangements were made to manufacture in England. Some time ago the company designed and commenced to manufacture a household clothes washer. The latest line the company has taken up is school desks of the pedestal type with the height of seat and desk adjustable.

This Machinery List will Interest You

If you are not getting the Williams' Machinery List regularly every month you may be missing more than you realize. Each issue contains many bargains in machinery, both new and old. Each machine listed is backed by the Williams' Guarantee of "after-sale" satisfaction. Get this list before you buy again.

Better send a card today.

The A. R. Williams Machinery Co., Ltd.

64 Front Street W., TORONTO

Halifax, St. John, Montreal, Winnipeg, Vancouver

Loss by fire to the extent of about $10,000 occurred last week to the planing mill of the James Gilchrist Lumber Co. of Toronto.

National Bronze Co., Limited, Montreal, capital $50,000, has been incorporated to manufacture and deal in metal and metal products.

The McKinnon Steel Co., of Sherbrooke, Que., has been awarded the steel contract for the new power house, dam, etc., under construction, for the Lower St. Lawrence Power Co., at Price, Que. The steel plate for the same projects will be supplied by the Horton Steel Co., of Montreal.

P. H. Secord and Sons of Brantford, Ont., have secured the contract for the construction of the main Arts building for the Western University at London. The estimated cost will be $450,000. The chimney for the power house will be erected by the Webber Co. of Chicago and will cost nearly $6,000.

The Foundation Co. of Montreal, has been selected as the general contractors for the construction works in connection with the work on the new pumping station and pipe line for the St. Lawrence Pulp and Paper Co. at Three Rivers, Que. The cost of the undertaking will be about $200,000.

Kingston.—The Canadian Locomotive Co., Ltd., have taken on one hundred and five men, in the last few days, for locomotive repair work. The general manager, William Casey, states that Canadian roads are inquiring about new locomotives and there is every prospect that orders will be received at an early date. Prices of locomotives will increase with the price of steel. The company quoted a Canadian road on a certain type of locomotive on August 10th last, and on October 10th the increased cost of iron and steel had added nine hundred dollars to the cost. This is not the limit as prices are going higher yet. Mr. Casey believes that next spring locomotive and car shops in Canada will be working to capacity.

Montreal.—W. W. Butler, president Canada Car and Foundry Co., expresses the belief that Sir Henry Thornton, new head of the C.N.R., will first turn his attention to the equipment needs of the system. Canadian roads, he said, had been long out of the market, and it was obvious that a great deal of business should develop in that direction. Recent inquiry by the Grand Trunk for prices on approximately 7,000 cars is considered significant and Mr. Butler anticipated that in the course of the next two or three months, equipment companies in this country will have received orders from the Canadian roads of no inconsiderable size. The Canadian Car Company is at present engaged on repair work for the Grand Trunk on 1,500 cars with more in anticipation from that source shortly. In the matter of business from the United States, Mr. Butler was rather pessimistic, stating that new building was naturally prohibited by the tariff and that even in the matter of repair work the constant changing of tariff regulations at Washington would likely make such work impossible. There does loom up for the company, however, prospects for export business, that is to various parts of the British Empire. The last export order that the company received was that from the Soviet Government last year, an order which amounted to about two million dollars.

AUSTRALIA ADDS TO REDUCED RATE LIST

Under recent by-laws issued by the Department of Trade and Customs, Australia, the following are added to the list of materials and articles which may be imported into that country at reduced rates of duty if used in the manufacture of specified goods, or for specified purposes within the Commonwealth:—

(Continued on page 46)

The Pyrometer From the Standpoint of the User

Thermocouple Principle Now Generally Employed—Electric Welded Couples Give Best Results—Instruments of Great Assistance to Furnace Operators—Protecting Tubes from Gases

By A. N. ARMITAGE

NEARLY all the articles dealing with the subject of pyrometers have been written by people who were financially interested in some particular make of instrument, and however impartial they may have tried to be, they have at least failed to mention imperfections or disadvantages to be found in the particular type of installation in which they were interested.

The thermocouple principle is now almost universally employed as a means of measuring heat in the steel industry except for very high temperatures such as the temperature of molten metal in which case, optical pyrometers are used. All the makes of pyrometers now on the market have their good points, the question is, which kind, if any, is the best for our particular purpose. It is possible that a system which would be satisfactory for use in the ceramic industry would not be of much use for the treatment of steel. The indicating and recording millivoltmeter perhaps is the simplest measuring instrument and the one which requires the least attention from the operator. We now have a single point recorder which requires almost no attention except to keep the clockwork wound up and a little cleaning and oiling when the roll of paper is renewed.

The millivoltmeter employed should be of sufficiently high resistance to take care of the resistance of the lead wire which varies with the temperature to which the lead wire is exposed and also with the length of lead wire used. If the instrument is located near the furnace and compensating lead wires are used, a low resistance instrument can be employed and will give sufficiently accurate readings, but if it is necessary or advisable, as is often the case, to locate the measuring instrument at some distance from the furnace, an instrument of much greater resistance will be necessary to read the true electromotive force of the couple.

Using Heads Repeatedly

A pyrometer system arranged so that couples can be made up at the plant probably is more economical in operation than the one in which the couples must be purchased completely assembled. The different parts, including the time of the operator taken to make up and calibrate the couples, do not cost nearly so much as new couples, and new couples must be calibrated also. The heads can be used repeatedly. Couples, can also be shortened a few inches when the ends become burned off or when the couples are found to be incorrect on checking.

We have an instrument in connection with four coal-fired pit furnaces which was made to be used with shunted couples, and as we often have to run the furnaces at very high temperatures to reach the Acm point in hyper eutec toid steels, the couples were very easily destroyed and new ones had to be bought. It was found that cromel-alumel wire had a millivolt-temperature curve that was very similar to that of the couple of the instrument in question. By carefully calibrating the cromel-alumel couple against the couple intended for the instrument, a shunt was made for the millivoltmeter so that correct temperatures were recorded and couples made up at the plant could be used.

These couples would read correctly only between the temperatures of 1,550 and 1,800 degrees Fahr.; the slight error recorded when the heat was rising and falling was not important. A double throw switch is arranged so that either one of two shunts can be used, one to be used for high temperatures and the other for the draw.

At first some trouble was had in twisting the ends of the wire being used to make up the couples, especially with the No. 8 wire. It was found, however, that by clamping the two wires about ½-inch apart in an ordinary vise with about 1½ inches to be twisted and, after first hammering the wires for the first turn of the twist then holding them with a monkey wrench, a twist could be obtained equal to that of couples received from the factory.

Electric Weld Gives Best Results

An electric weld is better than an acetylene weld for couples and we are welding our couples by using the rheostat on the optical bench. Disconnecting the wires from arc lamp, we connect two insulated wires to the rheostat, one of them to the couple and the other to a discarded piece of carbon from the arc lamp. A package of borax completes the outfit and good welds are very easily and quickly obtained.

A single point recording millivoltmeter is used in connection with six drying ovens used for drying molds, and the recorder can be transferred to any one of the six ovens through a six-point switch.

At first the firemen were not interested in the pyrometer at the drying ovens but now they swear by it and the molds are thoroughly and uniformly dried. The only occasion for complaint regarding the condition of the molds since the pyrometers were installed was, when the light in the instrument case burned out during the night and the firemen could not see to read the temperatures.

It has been found that when the different pyrometers are kept in order, the operators at the furnaces depend almost entirely on them, which is as it should be, especially on coal-fired furnaces where the physical strength of the operators is the principal requirement. The pit furnaces previously referred to are operated by a gang of huskies who refer to the temperature as so many pounds instead of degrees. They are given a schedule showing the required temperature at each hour as for example:

10:00 a. m. 1200 degrees Fahr.
11:00 a. m. 1210 degrees Fahr.

Annealing Forgings

In annealing or treating very large forgings or castings, special effort is made to have the hot junction of the couple touching the metal being treated and protected somewhat from the direct flame. For castings such as press cylinders, bare couples are used so that they can be twisted or turned in any desired direction. For instance, a bare couple about 12 feet long is placed with the hot end of the couple inside the cylinder so that temperatures on the inner wall can be obtained. The couple is then covered with wet fire clay along its length to protect it from the flame.

The temperatures at the car type furnaces are recorded on 12-point potentiometer recorders except when we have occasional demands for temperatures higher than 1,600 degrees Fahr. In a treatment where temperatures higher than 1,600 derees Fahr. are desired the recorder is run to this point, the couples are then removed from the furnace and the temperatures taken with a pyrometer ball. Our own pyrometer balls are made from wrought iron stock and are very accurate so much so that if there is occasion to doubt the accuracy of a couple during the progress of a heat, a ball is taken at this point. If a couple and the ball do not check, the offending couple is substituted for another.

The potentiometer is undoubtedly the most accurate instrument for measuring temperatures, line resistance can be neglected and closer readings usually can be made. The type of potentiometer provided with a cold junction compensator is very dependable, the only objection being the care required to keep the instruments in working order.

In making up couples of the iron-constantin type, it is desirable to use some kind of powder in the protecting tubes

(Continued on page 46)

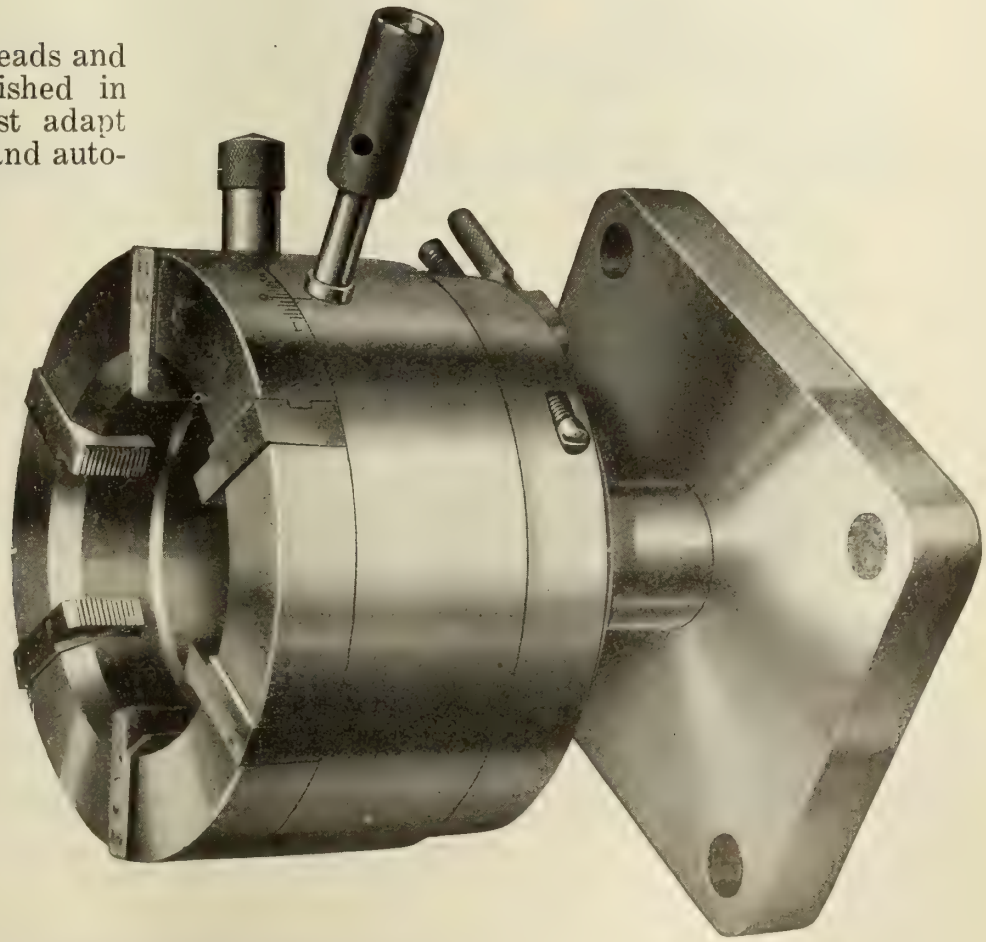
RELIABLE - DURABLE - ADAPTABLE

Whatever Qualification You Seek
In a Screw Cutting Tool
You will Find in a

GEOMETRIC

Right in the Lead

Geometric Automatic Die Heads and Collapsing Taps are furnished in several types so as to best adapt them to the turrets of hand and automatic screw machines.



This Geometric Die Head is flanged for bolting to the turret face.

When once in use, Geometrics speak for themselves

THE GEOMETRIC TOOL COMPANY

NEW HAVEN, CONNECTICUT

Canadian Agents :

Williams & Wilson, Ltd., Montreal. **The A. R. Williams Machinery Co., Ltd.,** Toronto; St. John, N.B.; Halifax, N.S.; Vancouver, B.C.

If what you need is not advertised, consult our Buyers' Directory and write advertisers, listed under proper heading

INDUSTRIES REPORT GOOD LABOR DEMAND

THERE was a fairly brisk demand for farm labour in the provinces, mainly for threshing and filling silos, while a few vacancies for fruit pickers were offered at Oshawa and in the Niagara Peninsula, according to the Bulletin of the Government Employment Service for August. In addition, numbers of men were transferred to the prairie provinces to assist in the harvesting of the wheat crop. In the construction groups, the erection of homes and public buildings continued to afford employment in the building trades and at Kitchener, Peterborough, Port Arthur, and Ottawa, there was a slight shortage of experienced bricklayers, plasterers and carpenters.

Labourers for road and highway construction, and bridge and dam improvements, were in demand at various points, especially at Pembroke, Timmins, North Bay, Toronto and Cobalt.

Railway construction and extension work in the vicinity of Cochrane and Kippewa gave employment to workers from Timmins, North Bay and Cobalt, while railway maintenance gangs were required at Toronto, St. Thomas and Oshawa.

The offices reported that prospects are bright for employment in the logging group during the winter. At many offices, especially at Pembroke, North Bay, Toronto and Timmins, several large orders for road cutters and bushmen have been received and no difficulty is anticipated in securing experienced workers. At Cobalt a few vacancies for miners were easily filled.

In the manufacturing groups, many sawmill and pulp mill workers, and yard labourers, were required at Pembroke, Port Arthur and Timmins. At Oshawa, moulders, polishers, trimmers and assemblers, for the automobile industry, were in demand, while at Toronto numbers of skilled machinists, electric workers and skilled factory hands, were employed. A few workers for the canning industry were placed at Chatham, while at Toronto and Pembroke expert woollen weavers and garment workers were required.

There was a demand for sailors at Sarnia with few applicants to fill the positions. Calls for cooks, waitresses and institutional workers, were fairly numerous at Toronto, Hamilton and London, while the demand for casual workers showed little increase.

AUSTRALIA ADDS TO REDUCE RATE LIST

(Continued from page 43)

Materials and minor articles for use in the manufacture of the undermentioned goods within the Commonwealth:—(Provided security is given by the owner that such will be used for that purpose only, and that evidence of such use be given to the satisfaction of the collector within six months, or such further time as the collector may allow, after delivery by the customs)—Knife plates, ledger sections, for use in the manufacture of reaper threshers; calcium chloride, for use in manufacture of refrigerating materials and general purposes; tubes and rods, insulating, except of hard rubber, for use in manufacture of electrical apparatus and appliances; wedge wire for use in manufacture of maltsters' kiln floors; Paris white, for use in manufacture of paints, porcelain glazes and fluxes; steel tubing, locked jointed (a) round, exceeding 1 inch internal diameter, and (b) rectangular or square; for use in manufacture of bedsteads; aluminium plates and sheets, plain, satin-finished and/or polished, for use in manufacture of metalware and general purposes; zinc sheets, for use in manufacture of metalwork and for general purposes; steel wire (bright), half-round, for use in manufacture of wire shoelaces; wheel rims (plain, undrilled and unenamelled), for use in manufacture of motor cycle side cars.

Machines, machine tools and appliances:—But not the motive power, engine combination, or power connections, if any, when not integral parts of the exempt machines. Accumulators (storage) having plates 14 3-8 inches by 13¾ inches, for use in production and distribution of electricity from brown coal. Balling machine, semi-automatic, for balling cotton, silk, linen, wool, etc., of any shape, and with or without wood or paper centres. Crushing machine for treating of prickly pear. Dies wire drawing. Glue distributing machine and glue boiling apparatus connected therewith, for the manufacture of pianos. Shaping machines, metal working, over 24-inch stroke. Testing machine, for testing strength of paper. Cherry pitting machines. Bin-aural instrument, for detection and location of sound.

Tools of trade for artisans and mechanics and tools in general use:—When not wholly made of wood, and not being machines:—Manure drags and hooks (similar to hop and potato hooks).

The above specified minor articles, machine tools and parts, and tools of trade, are now admitted (for the purposes specified) free of duty if from the United Kingdom and at the rate of 10 per cent. ad valorem if from any other country.

PYROMETER FROM THE STANDPOINT OF THE USER

(Continued from page 44)

to exclude gases as the couples last much longer when the powder is used. We use dry fireclay and the only trouble experienced was in getting the powder into the pipes. The couple heads of this particular type were evidently designed with the idea of keeping everything out of the pipes but we finally decided to make up some tubes with the hot end threaded instead of plugged. The thermocouple was first inserted by standing the pipe upside down, pouring in the powder and closing the end of the pipe with a pipe-cap.

GENERAL ELECTRIC CO. MAY LEAVE TORONTO

CANADIAN General Electric Company may move their plants from Toronto to an outside centre, where their operations may be carried on to more economic advantage. The Toronto plants represent an investment of more than one million dollars, and in normal times they employ four thousand men. Peterborough, where the main manufacturing plants of the Company are located, is making a strong bid for the Toronto branches.

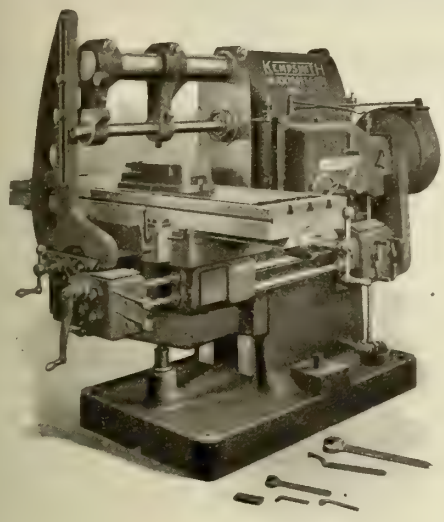
Discussing the matter with Canadian Machinery, J. J. Ashworth, general manager, Toronto, stated that when the Company first located there, they selected a site on the outskirts of the city. Due largely to expansion of the industry, that section of the city was built up, value of property increased and also assessment and taxes. Yet, the Company claims, their land is of no more value to them now than it was twenty years ago. In Peterborough, they have, at present, plenty of land available for additional plant; a new power house was recently installed for their exclusive purpose on the Otonabee River, and operations, on the whole, could be carried on much more cheaply. There is also a branch at Rockford, Que., where labor and other conditions are better.

Should the company decide to move, the Toronto property would be disposed of. As against taxes, the interest at 6 per cent. on one million dollars' investment, or $60,000, is little more than a drop in the bucket. It is this ever mounting tax bill that has practically decided the company to make a move.

There is another phase of the matter, but one which probably has little to do with the company's attitude or intentions. So far as contracts are concerned, they practically owe Toronto nothing. It is stated that they have received no consideration, whatever, from the city in this particular. Regardless of the problems attending their operation here, the city has bought wherever it could secure equipment at slightly lower prices. On the other hand, there is said to be no evidence that other cities adopt this course. It seems to be considered good policy, all things being about equal, to patronize, first, local concerns who have their investment in city property and contribute to the upkeep of city homes.

While the company has made no definite decision, the next move would seem to be the city's business.

If the outer corner of the drill wears it shows that the speed is too high and therefore it should be reduced. This is especially emphasized when drilling cast iron. Drilling cast iron can be done at a little faster speed than for steel but the corners must be watched.



THE

MAXIMILLER

FOR

PERMANENT PRODUCTION PROFITS

BECAUSE:

RIGID CONSTRUCTION!
AMPLE POWER!
POWER RAPID TRAVERSE!
(in all directions)
CENTRALIZED CONTROL!
GEARS RUN IN OIL!

Built by

KEMPSMITH MFG. CO., MILWAUKEE, U.S.A.

Builders of Cone-Geared Head and Production Type Milling Machines.

Send for Circular

MAKE GOOD WITH YOUR PRODUCT

and then

ADVERTISING CAN MAKE GOOD FOR YOU

STEEL TUBING

CLOSE Joints and Welded Steel Tubing for Bedsteads, Trolley Arms, Agricultural Implements, and all other manufacturing purposes, reliable quality, uniform in size, 14 to 20 gauge, 3-8 inch to 2 inch outside diameter.

STANDARD TUBE COMPANY, LIMITED
WOODSTOCK, ONT.

Classified Opportunities

Two cents a word, including "Canadian Machinery" box numbers; minimum charge is $1.00 per insertion for 50 words or less, set in 6-pt. type. Each figure counts as a word. Display ads., or ads. set in border, are at the card rates.

PATENTS

THE OLD ESTABLISHED FIRM. PATENTS everywhere. Head Office, Royal Bank Bldg., Toronto. Ottawa Office, 5 Elgin St. Offices throughout Canada.—Booklet free.
FETHERSTONHAUGH & CO.

OPPORTUNITIES

FOR SALE OR ROYALTY—CANADIAN PATent No. 214964 on resilient wheel for automobiles and trucks, absorbs the shock in the leaf spring spokes of the wheel, either hard rubber or pneumatic tires may be used; simple, practical and substantial in construction. Reasonable terms. Wm. H. Schlake, Yuma, Colo.

FOR SALE

ADDRESSING MACHINE FOR SALE

We have a complete Belknap Equipment for sale. This equipment is still in use in our Subscription Department and is in excellent working order. We have placed an attractive price on this outfit, and would advise manufacturers or merchants having a mailing list to let us tell you how it will save you money. We will give a guarantee as to the proper working condition of this equipment.

THE MACLEAN PUBLISHING CO., LIMITED
143 University Avenue, Toronto, Ontario

Grey Iron Castings

Light and Medium-Bench and Floor Repetition Castings; Capacity 15 tons per day.
Expert Metal and Wood Pattern Work. Our advice and estimates will save you money.
Semi-finishing operations on Lathe or Grill on Castings supplied if required.
ASK US.
THE KATIE FOUNDRY. GALT. ONT.

GRINDERS and SPECIAL MACHINERY

We make a complete line of Bench and Floor Grinding Machines, equipped with Patented Adjustable Guards and Tool Rests, and Special Mounting Means. We also design and manufacture special machinery for any purpose. Let us have your enquiries.

SUMBLING MACHINERY Company Ltd.
7 St. Mary St. - Toronto, Ont.

FOR SALE

Japanning Oven Electrically Heated

Size Over All: Height, 60″; Width, 36″; Depth, 57″

500 lbs. dead weight, will reach temperature 370 deg. F. in 1 hour.

Core Ovens—Swing door type, 5 shelves or sectional wall construction.

24″ Kernchen Siphonage Ventilators—Special price, made of Toncan galvanized iron.

Double ball bearing casters with 4″ single wheels. The best truck caster made and with an easy swivel.

Fully illustrated catalogs on application.

The Brantford Oven & Rack Co., Limited
Brantford, Canada

MECHANICAL SUPERINTENDENT

Or General Foreman open for engagement. Ten years' executive experience. Efficient and up-to-date methods used (under local conditions) to get quality and quantity production. For further information and references, etc., Apply to
Box 815, CANADIAN MACHINERY,

FOR BEST VALUE

In Wiping Rags, Cheese Cloth and Cotton Waste USE

Sani-washed WIPING PRODUCTS

Manufactured and sold by

Sanitary Wiping Products Co.
239 Richmond St. W., Toronto

COSTS LESS AND GOES FARTHER

WANTED

SCRAP ENDS
STEEL PLATES 9, 10, 11 Gauge

Carloads or less. Suitable for making Iron Washers.

The Graham Nail Works
Toronto

If you want something unusual

and it isn't advertised here, the logical thing would be to advertise for it. You'll find that a small ad. in the Classified Advertising Section will save you a great deal of time in locating men or machinery. Look over these pages and if you don't see what you want, send us your copy to-day for next week's issue.

CANADIAN MACHINERY
Classified Advertising Section
143-153 University Avenue
TORONTO

PATTERNS

TORONTO PATTERN WORKS, 65 JARVIS Street, Toronto. Patterns in wood and metal for all kinds of machinery. (ctfm)

BRANTFORD PATTERN WORKS ARE PREpared to make up patterns of any kind—including marine works—to sketches, blue prints or sample castings. Prompt, efficient service. Bell 'Phone 631; Machine 'Phone 733. Brantford Pattern Works, 49 George St., Brantford, Ont. (ctfm)

POSITION WANTED

MANAGER OF FOUNDRY MACHINE SHOPS desires a larger opportunity. Age 45. Can personally run office, foundry and machines. Practical training as draughtsman, pattern maker and machinist. Can handle iron, brass and aluminum. References the best. Box 816. Canadian Machinery.

FOREMAN WANTED

WANTED — FOREMAN FOR PLATE SHOP equipped with Hydraulic Machines, employing 30 men, Winnipeg. Apply Box No. 814.

Rubber Mill MACHINERY
BERTRAMS LIMITED
SCIENNES EDINBURGH

STEEL

Air Pressure Tanks, Air Receivers, Steel Plate Tanks, Pneumatic Tanks, Tote Boxes, Shop Barrels, Steel Factory Equipment, Smoke Stacks, Gasoline Tanks.
Write For New Catalogue
THE STEEL TROUGH & MACHINE CO. LTD.
TWEED - ONT.

"Maple Leaf"

BRAND
Stitched Cotton Duck Belting

Save Money

Use ONLY "Maple Leaf" Belting. Costs less than leather, rubber or balata. Has a very positive grip on any pulley, always runs true and saves expense in many other ways.
"Maple Leaf" belting is the best obtainable. It embodies "Economy, Strength and Durability."
We will willingly send you samples. Write us today.

Dominion Belting Co. Ltd.
Hamilton, Canada
Quebec Branch: 51 Duluth Bldg., Montreal

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HAMILTON, ONT.
Grey Iron.

Fisher Motor Co., Limited.
ORILLIA, ONT.
Die Castings.

Sully Brass Foundry, Limited
618 Brock Ave., TORONTO, ONT.
Brass, Bronze, Copper and Aluminum.

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S. Vessot & Company
JOLIETTE, QUE.,
Grey Iron, Brass and Aluminum.

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Grey Iron, Semi-Steel Castings up to 10 tons.

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Grey Iron Machinery Castings.

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LIMITED
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Brass, Bronze, Manganese Bronze, Aluminum.

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Steel Castings all sizes.

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Office Winnipeg. Works Selkirk, Man.
Steel Castings up to 5,000 lbs.

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Aluminum, Brass, Bronze, Specialty.

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Grey Iron, Semi-Steel, Brass, Aluminum.

William Kennedy & Sons, Ltd.
OWEN SOUND, ONT.
Steel, Malleable and Heavy Grey Iron.
See Advertisement Page 7

Machinery & Foundries, Ltd.
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Light and Medium Grey Iron.

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W. W. Wells
370 Victoria Street, TORONTO, ONT.
Nickel and Monel Metal.

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Light Grey Iron.

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Light Grey Iron, Tinning same a specialty.

The Eureka Planter Co., Ltd.,
WOODSTOCK, ONT.
Specialty Light Grey Iron.

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Grey Iron and Semi-Steel to 75 tons.

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Smith's Falls Malleable Castings, Limited
SMITH'S FALLS. ONT.
Malleable.

Imperial Foundry Company
2167 St. Clair Ave., TORONTO, ONT.
Grey Iron Castings. Phone Junction 7935.

International Malleable Iron Company, Limited
GUELPH, ONT.
Malleable.

Getting The Business
You Can Do Likewise
A Few Panels For Sale

APPLY

Canadian Machinery & Mfg. News
143 University Avenue,
TORONTO, CAN.

BRANTFORD BRASS FOUNDRY COMPANY
BRANTFORD ONTARIO

FOUNDRY AND OFFICE
29 LEONARD ST

June 17th., 192

The MacLean Publishing Co., Limited
Toronto, Ont.

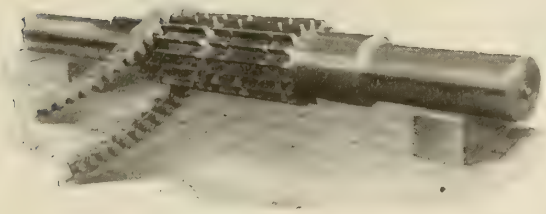
Gentlemen;-

We wish to inform you that we have had quite satisfactory results from our advertisement in Canadian Machinery and Manufacturing News, which runs under the classified heading, "Where to Buy your Castings".

Yours Truly,
Brantford Brass Foundry Company.
per David Alphabet

CUT GEARS

Special Forms for Special Purposes



The above illustrated pinion for large silent chain drive is cut solid on the shaft from a massive steel forging.

Write us for quotations on anything in gears.

Hamilton Gear & Machine Co.

76 Van Horne St. - Toronto

Do You Ask for Just "Files"?

Do you know that by specifying one of our brands you can get files that are recognized everywhere as standard quality?

Why not secure this protection? Why not make sure you are getting the very best obtainable?

Fifty years of experience in file making have produced these brands.

Kearney & Foot
Great Western
American
Arcade
Globe

NICHOLSON FILE COMPANY

PORT HOPE ONTARIO

Heavy Duty Grinding With

NORTON GRINDING WHEELS

It Makes No Difference:

CASTINGS may be large or small. They may be malleable iron — annealed or unannealed. They may be grey iron. They may be steel — carbon steel, manganese steel or any alloy steel.
MACHINES may be swing frame, pedestal or flexible shaft.
SURPLUS MATERIAL may consist of sharp fins, and long gates, or only rough scale to be "Cleaned off."

For UNIFORMITY, SPEED and ECONOMY, Norton Crystolon or Norton Alundum grinding wheels will meet all the conditions.

The abrasive, grain and grade will depend on the size of casting, its composition, style of machine used, and speed of wheel.

Make your own test of the wheel we recommend.

NORTON COMPANY OF CANADA, LIMITED

HAMILTON, CANADA

Electric Furnace Plant:

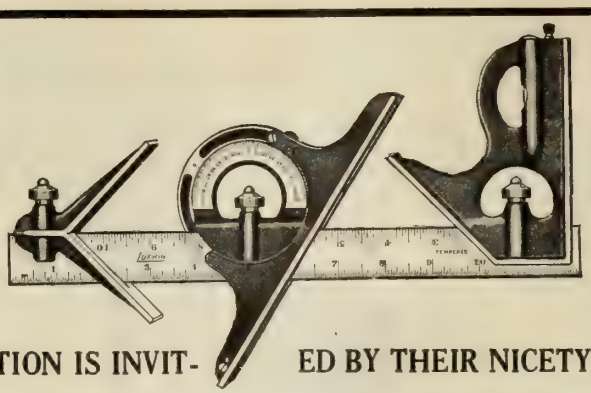
CHIPPAWA, ONTARIO, CANADA

CANADIAN AGENTS:

The Canadian Fairbanks-Morse Co., Ltd., Montreal, Toronto, Ottawa, St. John, N. B., Winnipeg, Calgary, Saskatoon, Vancouver, Victoria. F. H. Andrews & Son, Quebec, Que. Simonds Canada Saw Co., Vancouver, B. C.

LUFKIN

COMBINATION SQUARES



LUFKIN

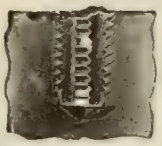
BEVEL PROTRACTORS COMBINATION SETS

YOUR CLOSE INSPECTION IS INVITED BY THEIR NICETY OF DESIGN AND FINISH

You will then see, among other improved features, center head with both legs exactly same length and ends formed, insuring accuracy on any circumference, large or small. Double protractor readily convertible into single protractor, serving perfectly for every sort of work.

THE LUFKIN RULE CO. OF CANADA. LTD. WINDSOR ONT.

Buried in the Work and Broke!



Next time a tap breaks below the surface of a large casting, don't let some makeshift method of removing it injure the thread and waste half an hour of valuable production time. Instead—

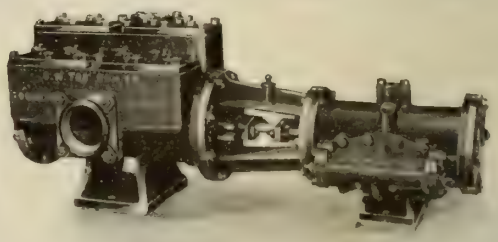
Walton it Out in a Jiffy

And save the casting.

Special analysis steel fingers of the Walton Extractor drop into the flutes of the broken tap—and grip. Then a few turns of a wrench applied to the squared end of the Extractor backs out the buried tap.

Sixty-day trial offer proves the Walton Extractor pays for itself. Write.

The Walton Co.
Hartford, Conn.



The only Self Draining Steam Pump Made in Canada

Minimize Pump Troubles!

YOU don't have to put up with troublesome and costly pumps—pumps that leak and are in constant need of adjustment.
Your solution is in the Hepburn Patent Vacuum Pump. It requires very little attention; there are no tappets or levers to give trouble; the valves are very accessible and the long strokes assure a decided steam economy.

Write us for a complete list of features as well as particulars of Hepburn Engines, Compressors, Cranes and other Machine Shop Equipment. Information will be freely given.

JOHN T. HEPBURN LIMITED
Engineers and Iron Founders
18-60 VAN HORNE ST., TORONTO

HEPBURN PUMPS

HANNA

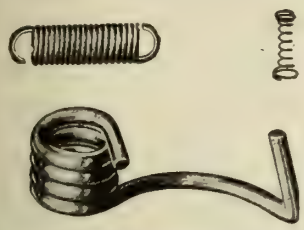
Buffalo Cleveland Detroit Cincinnati Pittsburgh New York Philadelphia Toronto

—the name of a service supplying approximately 1,000,000 tons of pig iron annually in all required grades to the merchant iron trade.

M.A. HANNA & CO.

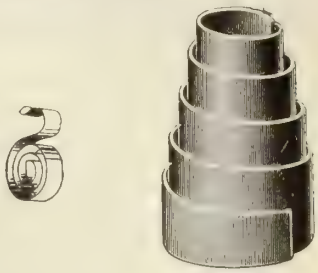
PRECISION SPRINGS

SPECIAL TORSION AND SMALL WIRE SPRINGS



THE WALLACE BARNES CO. LIMITED
WIRE
BARNES CANADIAN SPRINGS
STEEL
HAMILTON, ONTARIO
CANADA

FLAT AND FLAT COIL SPRINGS OF ALL DESCRIPTIONS



DON'T

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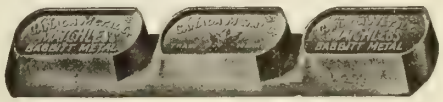

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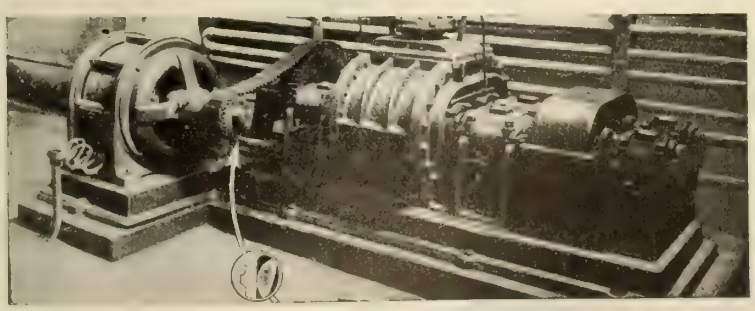

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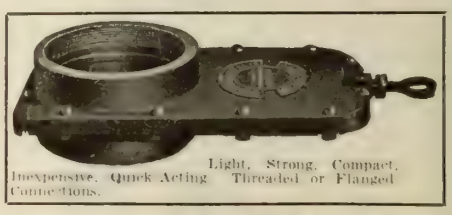

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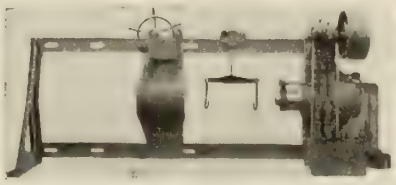

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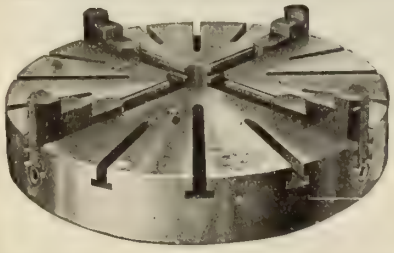

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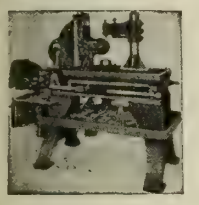

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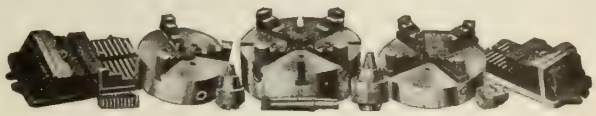

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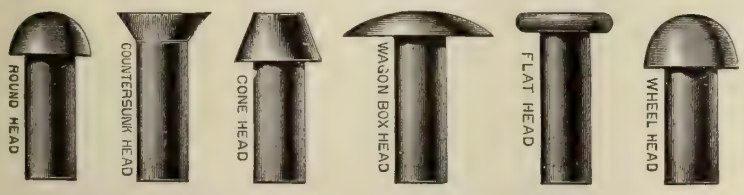

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Can.-Link-Belt Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Northern Crane Works, Walkerville, Ont.
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.

CRANES, LOCOMOTIVE
Can. Link-Belt Co., Toronto, Ont.

Bertram & Son Co., td., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Northern Crane Works, Walkerville, Ont.

CRANK PIN TURNING MACHINE
Underwood Corp., H.B., Philadelphia, Pa.

CUTTERS, GEAR
Brown & Sharpe Mfg. Co., Providence, R. I.

Butterfield & Co., Inc., Rock Island, Q. Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CUTTERS, HIGH SPEED
Atkins & Co., Inc., E. C., Indianapolis.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
..... & Trecker Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CUTTERS, MILLING
Brown & Sharpe Mfg. Co., Providence, R. I
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.

CUTTERS, STAY BOLT
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.

CUTTING-OFF MACHINE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Starrett Co., L. S., Athol, Mass.

CUTTING OFF MACHINES, PIPE (SEE PIPE-CUTTING AND THREADING MACHINES)
Landis Machine Co., Inc., Waynesboro, Pa.

CUTTING-OFF TOOLS
Armstrong Bros. Tool Co., Chicago, Ill.

CUTTING OIL FILTERS (SEE OIL FILTERING SYSTEMS
Bowser, S. F. & Co., Ltd., Toronto.

CUTTING, OXY-HYDROGEN
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

DETACHABLE CHAIN
International Malleable Iron Co., Guelph, Ont.

DIAMONDS, BLACK AND ROUGH
Can. Desmond-Stephan Mfg Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

DIAMOND TOOLS
Can. Desmond-Stephan Co., Hamilton,
Wheel Trueing Tool Co., Windsor, Ont.

DIAMOND CROSSINGS
Can. Steel Foundries, Montreal, Que.

DIAMONDS, IMPORTERS
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Co., Windsor, Ont.

DIES, SCREW AND THREAD CUTTING
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.

DIES, SHEET-METAL AND SUB-PRESS (See Tool Work)
Brown, Boggs & Co, Ltd., Hamilton, Ont.

DIES, FORGING
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

DIES, SELF-OPENING, ADJUSTABLE
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Landis Machine Co., Inc., Waynesboro,
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DIES, THREADING-OPENING
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DIVIDING HEADS
Burke Machine Tool Co., Conneaut, Ohio.
Hendey Machine Co., Torrington, Conn.
Kearney & Treacker Co., Milwaukee, Wis.

DOGS, LATHE AND MILLING MACHINE
Armstrong Bros. Tool Co., Chicago, Ill.

DRAFTING MATERIALS
American Lead Pencil Co., New York City, N.Y.

DRESSERS, GRINDING WHEEL
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ont.
Norton Co., of Can., Ltd., Hamilton.
Wheel Trueing Co., Windsor, Ont.

DRESSING TOOLS
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Co., Windsor, Ont.

DRILL HOLDERS
Armstrong Bros. Tool Co., Chicago, Ill.

DRILLING MACHINES, BENCH
Burke Machine Tool Co., Conneaut,, Ohio.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Hardinge Bros., Inc., Chicago, Ill.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, ELECTRIC AND HAND
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, GANG
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

DRILLING MACHINES, HEAVY DUTY
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
Herbert, Limited, Alfred, Toronto, Ont.

BORING, DRILLING AND MILLING MACHINES, (HORIZONTAL.)
Gisholt Machine Co., Madison, Wis.
Herbert, Limited, Alfred, Toronto, Ont.

DRILLING MACHINES, Multiple Spindle
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
National Acme Co., Cleveland, Ohio.

DRILLING MACHINES, Pneumatic
Cleveland Pneumatic Tool Co., Toronto, Ont.

DRILLING MACHINES, PORTABLE
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, RADIAL
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Herbert, Limited, Alfred, Toronto, Ont.
Williams Machinery Co., A. R., Toronto,

DRILLING MACHINES, SENSITIVE
Burke Machine Tool Co., Conneaut, O.
Herbert, Limited, Alfred, Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Williams Machinery Co., A. R., Toronto.
Wisconsin Electric Co., Racine, Wis

DRILLING MACHINES, TURRET
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wisconsin.
Williams Machinery Co., A. R., Toronto.

DRILLING MACHINES, VERTICAL
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Herbert, Limited, Alfred, Toronto, Ont.

DRILLS, CENTRE
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DRILLS, ELECTRIC
U. S. Electrical Tool Co., Cincinnati, Ohio

DRILLS, ELECTRIC
Black & Decker Mfg. Co., Ltd., Montreal, Que.

DRILLS, HIGH SPEED TWIST
Butterfield & Co., Inc., Rock Island, Que
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Cleveland Twist Drill Co., Cleveland, O.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DRILLS, RATCHET
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

DRILLS, TWIST AND FLAT
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.

DROP FORGINGS
Steel Co. of Canada, Ltd., Hamilton

DUMB WAITERS
Roelofson Elevator Works, Galt, Ont.

DUST HANDLING EQUIPMENT
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

ELECTRIC DRILLS AND GRINDERS
Black & Decker Mfg. Co., Ltd., Montreal, Que.
U. S. Electrical Tool Co., Cincinnati, Ohio.

ELECTRICAL INSTRUMENTS
Bristol Co., Waterbury, Conn.

ELECTRICAL SUPPLIES
Atkins & Co., Inc., E. C., Indianapolis.
Diamond State Fibre Co., Toronto, Ont.

ELECTRIC TOOLS
U. S. Electrical Tool Co., Cincinnati, Ohio

ELEVATORS AND CONVEYORS
Can. Link-Belt C., Toronto, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q

ELEVATORS, FREIGHT AND PASSENGER
Roelofson Elevator Works, Galt, Ont.

EQUIPMENT, ELEVATOR SAFETY
Jones & Glassco, Montreal, Que.

EMERY WHEELS (See Grinding Wheels)
Lion Grinding Wheels, Limited, Montreal, Que.
Atkins & Co., E. C., Indianapolis, I
Norton Co., of Canada., Ltd., Hamilton.

ENGINES, CAPSTAN
Kennedy & Sons, Wm., Owen Sound, Ont.

ENGINEERS, MECHANICAL
Dominion Engineering Works, Limited, Montreal, Que.
Gisholt Machine Co., Madison, Wis.
Hamilton Gear & Machine Co., Toronto.

EXPANDERS, TUBE
Jardine & Co., A. B., Hespeler, Ont.

FANS, ELECTRIC
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

FANS, EXHAUST
Can. Blower & Forge Co., Ltd., Kitchner, Ont.

FANS, VENTILATING
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

FIBRE
Diamond State Fibre Co., of Can. Ltd., Toronto, Ont.

FILES AND RASPS
Nicholson File Co., Port Hope, Ont.
Simmons Canada Saw Co., Montreal, Que.

FILLER, IRON (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J.

FIRE ESCAPES
Roelofson Elevator Co., Galt, Ont.

FITTINGS, PIPE
International Malleable Iron Co., Guelph.
Fittings, Limited, Oshawa, Ont.

FLEXIBLE SHAFTS
Strand & Co., N. A., Chicago, Ill

FLUXES, WELDING
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd. Toronto
Liquide Air Company, Toronto, Ont.

FORGING MACHINERY
Acme Machinery Co., Cleveland, Ohio
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown Boggs & Co., Ltd., Montreal.
National Machinery Co., Tiffin, Ohio.
Steel Co. of Canada, Ltd., Hamilton

FORGINGS, DROP
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Ltd., Toronto, Ont.

FORGINGS, HAMMER
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Hepburn Ltd., John T., Toronto, Ont.

FOUNDRY EQUIPMENT
Rice Lewis & Son, Ltd., Toronto, Ont.

FOUNDRY SUPPLIES
Rice Lewis & Son, Ltd., Toronto, Ont.

FROGS, SPRING OR RIGID
Can. Steel Foundries, Montreal, Que.

FURNACES, ELECTRIC
Rockwell Co., W. S. New York City.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

FURNACES, HEAT TREATING COAL
Rockwell Co., W. S., New York City.

FURNACES, HEAT TREATING OIL AND GAS
Bellevue Industrial Furnace Co., Detroit, Michigan.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Rockwell & Co., W. S., New York, N Y

FURNACES TEMPERING AND ANNEALING
Bellevue Industrial Furnace Co., Detriot, Mich.
Brown & Sharpe Mfg., Co., Providence R. I.
Rockwell Co., W. S., New York City.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

FURNACES AND OVENS, ELECTRIC
Rockwell & Co., W. S., New York, N.Y.
Starrett Co., L. S., Athol, Mass.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

BUYERS' DIRECTORY

GAGES, MEASURING (See Tool Work)
Brown & Sharpe Mfg. Co., Providence, R. I.
Greenfield Tap & Die Corp., Galt, Ont.
Lufkin Rule Co., Windsor, Ont.
Starrett Co., L. S., Athol, Mass.

GAGES, RECORDING
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GAGES, SPECIAL MEASURING
(See Tool Work)
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GAGES, THREAD
Brown & Sharpe Mfg. Co., Providence R. I.
Herbert, Limited, Alfred, Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

GALVANIZING
Fittings, Limited, Oshawa, Ont.

GAS, COAL COMPRESSED
L'Air Liquid Society, Toronto, Ont.

GAS, COMPRESSED
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

GASKETS
Diamond State Fibre Co. of Ca., Ltd., Toronto, Ont.
Smooth Mfg. Co., Jersey City, N. J.

GAUGES VACUUM AND PRESSURE
Taylor Instrument Co. Toronto, Ont.

GEAR BLANKS
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.
Dominion Engineering Works, Limited, Montreal, Que.

GEAR COUNTERS
Hart Mfg. Co., R. A., Battle Creek, Michigan.

GEAR CUTTING MACHINES
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Fellows Gear Shaper Co., Springfield, Vt.
Whiton Machine Co., D. E., New London, Conn.

GEAR TESTING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.

GEARS, CAST
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Hull Iron & Steel Foundries, Hull, Que.
Dominion Engineering Works, Limited, Montreal, Que.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

GEARS, CUT
Brown & Sharpe Mfg. Co., Providence, R. I.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Gardner & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto, Ont.
Hepburn Ltd., John T. Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

GEARS, DRESSED
Kennedy & Sons, Wm., Owen Sound, Ontario.

GEARS, FORGED
Canada Foundries & Forgings Co., Welland, Ont.

GEARS, HERRINGBONE
Hamilton Gear & Machine Co., Toronto, Ont.

GEARS, RAWHIDE (See Gears, Cut)
Hamilton Gear & Machine Co., Toronto.

GEAR, SILENT CHAIN
Gardner & Son, Robt., Montreal, Que.
Can. Link-Belt Co., Ltd., Toronto, Can.
Hans Renold of Canada, Ltd., Montreal, Quebec.

GEARS, WORM
Hamilton Gear & Machine Co., Toronto.

GENERATORS, ACETYLENE
L'Air Liquide Society, Toronto, Ont.

GOGGLES, SAFETY
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

GRAB BUCKETS
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Cleveland Twist Drill Co., Cleveland, O.

GREASE CUPS, PRESSED STEEL AND BRASS
Can. Winkley Co., Ltd., Windsor, Ont.

GREASES, LUBRICATING
Canadian SKF Co., Toronto, Ont.

GRINDERS, ELECTRIC
Black & Decker Mfg. Co., Ltd., Montreal, Que.
U. S. Electrical Tool Co., Cincinnati, Ohio.

GRINDING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Norton Co., of Canada, Ltd., Hamilton.

GRINDING MACHINES, ABRASIVE BELT
Norton Co. of Can. Ltd., Hamilton, Ont.

GRINDING MACHINES, AUTOMATIC
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, BENCH
Blount Co., J. G., Everett, Mass.
Geometric Tool Co., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co. of Canada, Ltd., Hamilton, Ont.
Pratt & Whitney Co. of Canada, Ltd.,

GRINDING MACHINES, CENTER
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES, CUTTER AND REAMER
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, CYLINDRICAL
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.
Norton Co., of Canada, Ltd., Hamilton.

GRINDING MACHINES, DIE
Geometric Tool Co., New Haven, Conn.
National Acme Co., Cleveland, O.
National Machinery Co., Tiffin, Ohio.

GRINDING MACHINES, DRILL
Bellevue Industrial Furnace Co., Detroit, Mich.
Bertram & Son Co., Ltd., The John, Dundas, Ont.

GRINDING MACHINES, ELECTRIC
Strand & Co., N. A., Chicago, Ill.

GRINDING MACHINES, FLOOR AND TOOL
Blount Co., J. G., Everett, Mass.
Herbert, Limited, Alfred, Toronto, Ont.
National Acme Co., Cleveland, Ohio.
Norton Co. of Canada, Ltd., Hamilton, Ontario.
Greenfield Tap & Die Corp., Galt, Ont.

GRINDING MACHINES, INTERNAL
Garlock Machinery Ltd., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES PORTABLE
Strand & Co., N. A., Chicago, Ill.

GRINDING MACHINES, SNAGGING
Blount Co., J. G., Everett, Mass.
Norton Co., of Can. Ltd., Hamilton, Ont
U. S. Electrical Tool Co., Cincinnati, Ohio

GRINDING MACHINES, SURFACE
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, THREAD
Pratt & Whitney Co., of Canada, Ltd.,

GRINDING MACHINERY, TOOL POST
Gisholt Machine Co., Madison, Wis.
Grenfield Tap & Die Corp., Galt, Ont.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES, UNIVERSAL
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Herbert, Limited, Alfred, Toronto, Ont.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co., of Canada, Ltd., Hamilton Ontario.

GRINDING WHEELS
Lion Grinding Wheels, Limited, Montreal, Que.
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Norton Co. of Can., Ltd., Hamilton, Ont.

GUN-BARREL MACHINERY
Steinle Turret Machine Co., Madison, Wisconsin.

HACK SAWS, POWER
Atkins & Co., Inc., E.C., Indianapolis, Indiana.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.

HAMMERS, CHIPPING
Cleveland Pneumatic Tool Co., Toronto, Ont.
High Speed Hammer Co., Rochester,

HAMMERS, DROP
Bertram & Son Co., Ltd., The John Dundas, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

HAMMERS, ELECTRIC
Brown, Boggs & Co., Ltd., Hamilton, Ont.

HAMMERS, PNEUMATIC
Can. Steel Foundries, Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto Ont.

HANGERS, SHAFTING
Canadian SKF Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Hamilton Gear & Machine Co., Toronto.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

HOBBING MACHINES
Shore Instrument Co., Jamaica, N.Y.

HARDENING, CASE-HARDENING AND TEMPERING
Barnes Company, Wallace, Hamilton
Gisholt Machine Co., Madison, Wis.
Cleveland Pneumatic Tool Co., Toronto Ont.

HAMMERS, POWER
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

HOBS
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

HOISTS, ELECTRIC
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.

HOISTS, HAND
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio

HOISTS, PNEUMATIC
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

HOLDERS-ON, PNEUMATIC
Cleveland Pneumatic Tool Co., Toronto Ont.

HYDRAULIC MACHINERY
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

IGNITERS, GAS ENGINE
Canada Foundries & Forgings Co., Welland, Ont.
Burke Machine Tool Co., Conneaut, O

INDICATORS, SPEED AND TEST
Brown & Sharpe Mfg. Co., Providence, R.I.

INSULATION
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.

IRON BARS
Steel Co. of Canada, Ltd., Hamilton, Ont.

JACKS, HYDRAULIC
Norton, A. O., Boston, Mass.

JACKS, PLANER
Armstrong Bros. Tool Co., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

JAPANNING AND VARNISHING OVENS
Brantford Oven & Rack Co., Brantford, Ont.

JIGS AND FIXTURES (SEE TOOL WORK)
Fisher Motor Co., Ltd., Orillia, Ont.
Gisholt Machine Co., Madison, Wis.

KEYSEATING MACHINES
Morton Mfg. Co., Muskegon, Mich
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

KEYS, MACHINE
Can. Drawn Steel Co., Hamilton, Ont.
Morton Mfg. Co., Muskegon, Mich.

KNIVES, MACHINE
Atkins & Co., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

KNURL HOLDERS
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

LATHE ATTACHMENTS
Hendey Machine Co., Torrington, Conn.

LATHE TOOLS
Armstrong Bros. Tool Co. ,Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Terrington, Conn.

LATHES, AUTOMATIC AND SEMI-AUTOMATIC
Gisholt Machine Co., Madison, Wis.
Herbert, Limited, Alfred, Toronto, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, BENCH
Hardinge Bros., Inc., Chicago, Ill.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

LATHES, BORING
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, CHUCKING (SEE LATHES, HORIZONTAL TURRET, AND LATHES, VERTICAL TURRET)
Acme Machine Tool Co., Cincinnati, O.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
Herbert, Limited, Alfred, Toronto, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, ENGINE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hendey Machine Co., Torrington, Conn.
Herbert, Limited, Alfred, Toronto, Ont

LATHES, EXTENSION AND GAP
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison Wis
Herbert, Limited Alfred, Toronto, Ont
National Acme Co., Cleveland, O.
Steinle Turret Machine Co., Madison, Wis.

LATHES, PRECISION
Hardinge Bros., Chicago.

LATHES, RELIEVING
Hendey Machine Co., Torrington, Conn

BUYERS' DIRECTORY

LATHE, UNIVERSAL HAND
Brown & Sharpe Mfg. Co., Providence, Rhode Island.

LATHE, SPEED AND HAND
Blount Co., J. G., Everett, Mass.

LATHES, SPINNING
Pryibil Machine Co., Torrington, Conn.

LATHES, VERTICAL TURRET
Bertram & Son, Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

LATHES, WOOD TURNING
Blount, Co., J. G., Everett, Mass.
Can. Fairbanks-Morse Co., Ltd., Montreal.

LEAD PIPE
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

LEATHER FILLET
D. K. McLaren, Limited, Montreal.

LINOLEUM MILL MACHINERY
Bertrams, Ltd., Edinburgh, Scotland.

LIQUID AIR PLANTS
L'Air Liquide Society, Toronto, Ont.

LOCKERS, CLOTHES
Dennis Wire and Iron Works, London, Ont.

LUBRICANTS
Oakley Chemical Co., New York, N.Y.

LUBRICATING SYSTEMS
Bowser, S. F., & Co., Ltd., Toronto, Canada.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Ltd., Welland, Ont.
Ker & Goodwin Machine Co., Brantford, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R. Toronto Ont.

MANGANESE STEEL
Can. Steel Foundries, Montreal, Que.

MANDRELS, EXPANDING
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MANDRELS, SOLID
Greenfield Tap & Die Corp., Galt, Ont.
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Pratt & Whitney Co., of Canada. Ltd., Dundas, Ont.

MEASURING MACHINES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MECHANICS' FINE TOOLS
Lufkin Rule Co., Windsor, Ont.

METALS, ALLOY
Canada Metal Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.

METAL WORKERS
Parker Co., Charles, Meriden, Conn.

MICROMETER CALIPERS
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Rice Lewis & Son, Ltd., Toronto, Ont.

MILLING ATTACHMENTS
Burke Machine Tool Co., Conneaut, O.
Hendey Machine Co., Torrington, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.

MILLING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Burke Machine Tool Co., Conneaut, O

MILLING MACHINES, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence, R. I.
Hardinge Bros., Inc., Chicago, Ill.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

MILLING MACHINES, BENCH
Burke Machine Tool Co., Conneaut, O
Hardinge Bros., Inc., Chicago, Ill.

MILLING MACHINES, HAND
Brown & Sharpe Mfg. Co., Providence
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MILLING MACHINES, HORIZONTAL PLANER TYPE.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Kearney & Trecker Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto.

MILLING MACHINES, PLAIN
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, O.
Hendey Machine Co., Torrington, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.

MILLING MACHINES, THREAD
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MILLING MACHINES, UNIVERSAL
Brown & Sharpe Mfg. Co., Providence,
Hendey Machine Co., Torrington, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.

MILLING MACHINES, VERTICAL
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, O.
Herbert, Limited, Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto.

MILLING TOOLS, ADJUSTABLE HOLLOW
Geometric Tool Co., New Haven, Conn.

MOTORS, ELECTRIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Roelofson Elevator Co., Galt, Ont.
Williams Machinery Co., A. R., Toronto,
Wisconsin Electric Co., Racine Wis.

NAILS AND STAPLES
Canada Metal Co., Ltd., Toronto, Ont.

NIPPLES
Canada Metal Co., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton.

NITROGEN
Carter Welding Co. Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

NUT TAPPERS
(See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
National Acme Co., Cleveland, Ohio.

NUTS, FINISHED and SEMI-FINISHED
Galt Macine Screw Co., Galt, Ont.
National Acme Co., Montreal, ue.

NUTS (Up to 4-in.)
Steel Co. of Canada, Ltd., Hamilton.

NUTS, S.A.E., PLAIN AND CASTELLATED
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

OIL FILTERING AND STORAGE SYSTEMS
Bowser, S. F., & Co., Ltd., Toronto,

OIL STORAGE ENGINEERS
Bowser, S. F., & Co., Ltd., Toronto,

OIL HOLE COVERS
Can. Whitney Co., Ltd., Windsor, Ont.

OILS, SOLUABLE
Brantford Oven & Rack Co., Brantford, Ontario.

ORNAMENTAL IRON AND WIRE WORKS
Roelofson Elevator Works, Galt, Ont.

OXYGEN
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

OXY-ACETYLENE APPARATUS
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Atlas Press Co., Kalamazoo, Mich.

PAINT SPRAYERS
Spray Engineering Co., Boston, Mass.

PAPER MILL CONVEYORS
Bertram Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd., Montreal, Que.

PATTERNS, WOOD AND METAL
Fittings, Limited, Oshawa, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.
Victoria Foundry Co., Ltd., Ottawa.

PHOSPHOR TIN
Canada Metal Co., Ltd., Toronto, Ont.

PHOTOGRAPHIC DUPLICATING MACHINES
Photostat Corp., Providence, R. I.

PIPE BENDING MACHINES
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Underwood Corp., H. R., Philadelphia, Pa.
Williams Machinery Co., A. R., Toronto.

PIPE CUTTING AND THREADING MACHINES
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Petrie, Ltd., H. W., Toronto, Ont.

PIPE
Canada Metal Co., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.

PIPE FITTINGS
Canada Metal Co., Toronto, Ont.
International Malleable Iron Co., Guelph Ont.

PIPE AND NIPPLE THREADING MACHINES
Landis Machine Co., Inc., Waynesboro, Pa.

PIPE FITTERS' TOOLS
Rice Lewis & Son, Ltd., Toronto, Ont.

PIPE THREADING DIE HEADS
Landis Machine Co., Inc., Waynesboro Pa.

PISTON-RING MACHINES
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

PLANING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont
Morton Mfg. Co., Muskegon, Mich.
Williams Machinery Co., A. R., Toronto

PLANING MACHINES, ROTARY
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Herbert, Limited, Alfred, Toronto, Ont.

PLATE ROLLS
Bertram & Son Co., Ltd., The John, Dundas, Ont.

PNEUMATIC TOOLS
Cleveland Pneumatic Tool Co., Toronto

POLISHING AND BUFFING MACHINES
Lion Grinding Wheels, Limited, Montreal, Que.
Blount Co., J. G. Everett, Mass.
Brown & Sharpe Mfg. Co., Providence.
Pryibil Machine Co., New York, N.Y.

PRESSED STEEL PARTS
American Pulley Co., Philadelphia, Pa.
Fisher Motor Co., Ltd., Orillia, Ont.

PRESSES, ARBOR
Atlas Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

PRESSES, DROP AND FORGING
Brown, Boggs & Co., Ltd., Hamilton.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

PRESSES, FOOT AND HAND
Brown, Boggs & Co., Ltd., Hamilton

PRESSES, HYDRAULIC
Bertram & Son Co., Ltd., The John Dunidas, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Perrin Ltd., W. R., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

PRESSES, POWER
Bliss Co., E. W., Prooklyn, N. Y.
Brown, Boggs, & Co., Ltd Hamilton
Hepburn Ltd., John T., Toronto, Ont.
Stoll Co., Inc., D. H., Buffalo, N.Y

PRESSES, SCREW
Brown, Boggs & Co., Ltd., Hamilton

PROFILING MACHINES
Pritt & Whitney Co., of Canada, Ltd., Dundas, Ont.

PROTRACTORS
Brown & Sharpe Mfg. Co., Providence
Lufkin Rule Co., Windsor, Ont.

PROPELLERS
Kennedy & Sons, Wm., Owen Sound Ontario.

PULLEYS, CORK INSERT
American Pulley Co., Philadelphia, Pa

PULLEYS, METAL AND FIBRE
American Pulley Co., Philadelphia, Pa.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.
D. K. McLaren Co., Limited Montreal, Que.

PULP AND PAPER MILL EQUIPMENT
Dominion Engineering Works, Ltd., Montreal, Que.

PUMPS, HYDRAULIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Dominion Engineering Works, Ltd. Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont

PUMPS, LUBRICANT AND OIL
Bowser, S. F., & Co., Ltd., Toronto.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Hepburn Ltd., John T., Toronto, Ont.

PUMPS, POWER
Bowser, S. F., & Co., Ltd., Toronto.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hepburn Ltd., John T., Toronto, Ont.

PUNCHES, CENTER
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

PUNCHES, HAND
Brown Boggs & Co., Ltd., Hamilton.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Jardine & Co., A. B., Hespeler, Ont.

PUNCHES, POWER
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

PUNCHING MACHINES, HORIZONTAL
Bertram Ltd., Edinburgh, Scotland.

PYROMETERS, ELECTRIC
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Hiram Walker & Sons Metal Products Co., Walkerville, Ont.

RACKS, CUT
Hamilton Gear & Machine Co., Toronto.

RACKS, STORAGE
(See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ontario.

REAMER HOLDERS
Simonds Canada Saw Co., Montreal, Q.

REAMERS, EXPANDING
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

REAMERS, SOLID
Butterfield & Co., Inc., Rock Island, Q.
Morse Twist Drill & Machine Co., New Bedford, Mass.

REAMERS, TAPER
Brown & Sharpe Mfg. Co., Providence, R. I.
Butterfield & Co., Inc., Rock Island, Q.
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canad, Ltd., Dundas, Ont.

RECORDERS, TEMPERATURE
Taylor Instrument Co., Rochester, N. Y.

RECORDERS, TIME
Gisholt Machine Co., Rochester, N. Y.
Taylor Instrument Co., Toronto, Ont.

REGULATORS, TEMPERATURE
Taylor Instrument Co., Toronto, Ont.

RIVETS AND BURRS
Parmenter & Bulloch Co., Gananoque, Ont.
Steel Co., of Canada, Ltd., Hamilton,

RIVET-MAKING MACHINERY
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

BUYERS' DIRECTORY

RIVETING MACHINES
Can. Fairbanks-Morse Ltd., Montreal, Q.
High Speed Hammer Co., Rochester, N.Y.
Parmenter & Bulloch Co., Gananoque Ont.

RUDDER FRAMES, STEEL
Can. Steel Foundries, Montreal, Que.

RUBBER MILL MACHINERY
Bertram Ltd., Edinburgh, Scotland.

RULES, STEEL AND WOOD
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Windsor, Ont.

RUST PREVENTATIVES
Oakley Chemical Co., New York, N. Y.

SAND EQUIPMENT
Can. Link-Belt Co., Toronto, Ont.

SAND RAMMERS, PNEUMATIC
Canadian Pneumatic Tool Co., Toronto.

SAW FRAMES AND BLADES, HACK
Atkins & Co., Inc., E. C., Indianapolis.
Diamond Saw & Stamping Works, Buffalo, N. Y.
Rice Lewis & Sons, Ltd., Tornto, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWING MACHINES, POWER HACK
Atkins & Co., Inc., E. C., Indianapolis.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

SAW SHARPENING MACHINES
Atkins & Co., Inc., E. C., Indianapolis.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

SAWS, CIRCULAR METAL
Atkins & Co., Inc., E. C., Indianapolis.
Pryibil Machine Co., New York, N. Y.
Gisholt Machine Co., Madison, Wis.

SAWS, HAND
Atkins & Co., Inc., E. C., Indianapolis
Simonds Canada Saw Co., Montreal, Q.

SAWS, HOT AND COLD
Atkins & Co., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Q.

SAWS, HIGH SPEED STEEL
Atkins & Co., Inc., E.C., Indianapolis, I.
Butterfield & Co. Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWS, METAL BAND
Atkins & Co., E. C., Indianapolis, I.

SAWS, METAL CUTTING
Brown & Sharpe Mfg. Co., Providence.
Butterfield & Co., Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.
Starrett Co., L. S., Athol, Mass.

SAWS, SCREW SLOTTING
Atkins & Co., Inc., E., C., Indianapolis.
Butterfield & Co., Inc., Rock Island, Q.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canda, Ltd., Dundas, Ont.

SAWS, SCREW SLOTTING
Atkins & Co., Inc., E. C., Indianapolis.
Butterfield & Co., Inc.. Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWS, WOOD
E. C. Atkins & Co., Indianapolis, Ind.

SCALES
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Lufkin Rule Co., Windsor, Ont.

SCREENS
Dominion Engineering Works, Ltd., Montreal, Que.

SCREW DRIVERS, OPTICAL, JEWELRY AND NOVELTY
Strand & Co., N. A., Chicago, Ill.

SCREW MACHINE WORK
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Montreal, Que.

SCREW MACHINERY, WOOD AND LAG
Cook Co., Asa S., Hartford, Conn.

SCREW MACHINES
Brown & Sharpe Mfg. Co., Providence, Rhode Island.

SCREW MACHINES, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.

SCREW MACHINE PRODUCTS
National Acme Co., Montreal, Que.

SCREW PLATES
Butterfield & Co., Inc., Rock Island. Que.
Jardine & Co., A. B., Hespeler, Ont.

SCREWS, CAP AND SET
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

SCREWS, SAFETY, SET
Galt Machine Screw Co., Galt, Ont.

SECOND-HAND MACHINERY
See last page of directory.

SEPARATORS, MOISTURE AND OIL
Bowser, S. F., & Co., Ltd., Toronto, Canada.

SEPARATORS, OIL AND WASTE
Bowser, S. F., & Co., Ltd., Toronto.

SHAFTS, FLEXIBLE
Strand & Co., N. A., Chicago, Ill.

SHAFTING
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
Williams Machinery Co., A. B., Toronto.

SHAPES, COLD-DRAWN SPECIAL STEEL
Union Drawn Steel Co., Hamilton, Ont.

SHAPING MACHINES
Hendey Machine Co., Torrington, Conn.
Morton Mfg. Co., Muskegon, Mich.
Williams Machinery Co., A. B. Toronto.

SHEARS HAND
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

SHEARS, POWER
Bliss Co., E. W., Brooklyn, N. Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Stoll Co., Inc., D. H., Buffalo, N. Y.
Williams Machinery Co., A. B., Toronto, Ont.

SHEARING MACHINES, ANGLE, IRON BAR AND GATE
Bertrams Ltd., Edinburgh, Scotland.

SHEET LEAD
Canada Metal Co., Ltd., Toronto, Ont.

SHEET METAL WORKING MACHINERY
Bliss Co., E. W., Brooklyn, N. Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Stoll Co., Inc., D. H, Buffalo, N.Y.

SHEETS, NICKEL, MONEL AND FIBRE
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.

SHEETS, O.P.C.R. & B. A. AND BLUE ANNEALED
Steel Co., of Canada, Ltd., Hamilton, Ont.

SIDE FRAMES, LOCOMOTIVE
Can. Steel Foundries, Montreal, Que.

SLOTTING ATTACHMENTS
Brown & Sharpe Mfg. Co., Providence, R.I.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

SLOTTING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.

SOLDERS
Canada Metal Co., Ltd., Toronto, Ont.

SPECIAL MACHINERY AND TOOLS
Brown Engineering Corp., Ltd., Toronto.
Gisholt Machine Co., Madison, Wis.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.
National Acme Co., Cleveland, O.

SPIKES, RAILWAY AND PRESSED
Steel Co of Canada, Ltd., Hamilton, Ont.

SPINNING LATHES
Prybil Machine Co., P., New York City.

SPRING, MILLED
Barnes & Co., Wallace, Hamilton, Ont.

SPRINGS, SMALL SPIRAL HELICAL, COMPRESSION, EXTENSION, TORSION AND SPECIAL
Barnes Company, Wallace, Hamilton.

SPRINGS
Barnes Company, Wallace, Hamilton.
Cleveland Wire Spring Co., Clevleand, O.
Steele Ltd., James, Guelph, Ont.

SPRINGS, FLAT STEEL, BRUSH HOLDER, CLOCK, SMALL FLAT SPRINGS
Barnes Company, Wallace, Hamilton.

SPROCKETS AND CHAINS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Renold Hanson of Canada, Ltd., Montreal, Que.

SQUARES
Brown & Sharpe Mfg. Co., Providence, R.I.
Lufkin Rule Co., Windsor, Ont.
Steel Co. of Canada, Ltd., Hamilton. Ont.

STAMPING, METAL
American Pulley Co., Philadelphia, Pa.
Barnes Company, Wallace, Hamilton.
Diamond Saw & Stamping Works, Buffalo, N. Y.
Parmenter & Bulloch Co., Gananoque, Ont.

STAMPS, STEEL
Diamond Saw & Stamping Works, Buffalo, N. Y.

STEEL CONCRETE REINFORCEMENT
Steel Co. of Canada, Ltd., Hamilton.

STEEL PLATE
British Empire Steel Co., Montreal, Que.

STEEL AND IRON BARS
Steel Co. of Canada, Ltd., Hamilton.

STEELS TOOL
British Empire Steel Co. Montreal Q.

STEEL, COLD-ROLLED STRIP
British Empire Steel Co., Montreal, Q.
Barnes Company, Wallace, Hamilton.

STEEL, CRUCIBLE, SPRING
Barnes, Company, Wallace, Hamilton.
British Empire Steel Co., Montreal, Q.

SHEETS, OPEN HEARTH STEEL
Steel Co., of Canada, Ltd., Hamilton.

STEEL, SHAFTING AND FREE CUTTING SCREW
Union Drawn Steel Co., Hamilton, Ont.

STEEL, SHEET
British Empire Steel Co., Montreal, Q.
Rice Lewis & Son, Ltd., Toronto, Ont.

STEEL, STAINLESS
Steel Co., of Can. Ltd., Hamilton, Ont.

STEEL STAIRS
Roelofson Elevator Works, Galt, Ont.

STEELS, ALLOY AND CARBON
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Can. Steel Foundries, Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton. Ont.

STEELS, HIGH-SPEED
Armstrong Bros. Tool Co., Chicago, Ill.
Atkins & Co., Ltd., Wm., Sheffield, England.
British Empire Steel Co., Montreal, Q.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton.

STEEL TUBING, CLOSE JOINT AND WELDED
Standard Tube & Fence Co., Ltd., Woodstock, Ont.

STERN FRAMES, CAST STEEL
Can. Steel Foundries, Montreal, Que.

STRAIGHTENING MACHINERY
Bertram Ltd., Edinburgh, Scotland.
Williams & Co., Ltd., J. H., Brooklyn, N.Y.

STUDS
Geometric Tool Co., New Haven, Conn.
Galt Machine Screw Co., Galt, Ont.

SWAGING MACHINES
Atkins & Co., Inc., E. C., Indianapolis, Indiana.

SWITCHES, RAILWAY
Can. Steel Foundries, Montreal, Que.

TACHOMETERS
Bristol Co., Waterbury, Conn.

TANKS AND PUMPS, OIL
Bowser, S. F., & Co., Ltd., Toronto.

TAP HOLDERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
William L. Procunier, Chicago, Ill.

TAPER PINS
Galt Machine Screw Co., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

TAPES, MEASURING
Starrett Co., L. S., Athol, Mass.
Lufkin, Rule Co., Windsor, Ont.

TAPPING MACHINES AND ATTACHMENTS
Burke Machine Tool Co., Conneaut, O.
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.
Wm. L. Procunier, Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

TAPS AND DIES
Butterfield & Co., Inc., Rock Island, Q.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Herbert, Limited, Alfred, Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

TAPS, COLLAPSING
Geometric Tool Co., New Haven, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.

TEETH, DREDGE BUCKET
Kennedy & Sons, W., Owen Sound, Ont.

THERMOMETERS
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Greenfield Tap and Die Corp., Galt, Ontario.

THREAD-CUTTING TOOLS
Butterfield & Co., Inc., Rock Island, Q.
Greenfield Tap and Die Corp., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

THREAD CUTTING MACHINES
Landis Machine Co., Inc., Waynesboro, Pa.

THREADING MACHINES
Acme Machinery Co., Cleveland, Ohio.
Geometric Tool Co., New Haven, Conn.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Williams Tool Corp., of Can. Ltd., Brantford, Ont.

THREAD LEAD TESTING MACHINES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

THREAD-ROLLING MACHINES
Bliss Co., E. W., Brooklyn, N. Y.

TIE PLATES
Steel Co. of Canada, Ltd., Hamilton.

TIME RECORDERS
International Business Machine Co., Ltd., Toronto, Ont.

TONGS
Hepburn Ltd., John T., Toronto, Ont.

TOOL CASES
Rice Lewis & Son, Ltd, Toronto, Ont.

TOOL HOLDERS
Armstrong Bros., Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Bertrams Ltd., Edinburgh, Scotland.

TOOL POSTS, LATHE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Williams & Co., Ltd., J. H., Brooklyn, N.Y.

TOOLS, SMALL
(See Machinists' Small Tools)
Armstrong Bros. Tool Co., Chicago, Ill.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Lufkin Rule Co., Windsor, Ont.
National Machine Tool Co., Racine, Wis.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S. Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A.B., Toronto.

TOOL WORK
Brown Engineering Corp., Ltd., Toronto, Ontario.

TORCHES, BLOW
Rice Lewis & Son, Ltd., Toronto, Ont.

TRACKWORK, RAILWAY
Can. Steel Foundries, Montreal, Que.

TRACKWORK, MANGANESE STEEL
Can. Steel Foundries, Montreal, Que.

TRANSMISSION MACHINERY
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound.
Renold, (Hans) of Canada, Ltd., Montreal, Que.

TROLLEYS AND TRAMWAYS
Can Link-Belt Co., Toronto, Ont.
Northern Crane Works, Walkerville, Ont.
Wright Mfg. Co., Lisbon, Ohio.

TROLLEY WHEELS
Langley & Austin, Galt, Ont.

TROWELS, PLASTERING
E. C. Atkins & Co., Indianapolis, Ind.

WRENCHES, MACHINISTS'
Armstrong Bros. Tool Co., Chicago, Ill.

TRUCKS
Can. Fairbanks-Morse Ltd., Montreal, Q.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.

BUYERS' DIRECTORY

TUBING, SEAMLESS STEEL, BRASS AND COPPER AND FIBRE
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

TURRET HEADS
Bertram & Son Co., Ltd., The John Dundas, Ont.

TURRET MACHINES
(See Lathes, Horizontal Turret)
Acme Machine Tool Co., Cincinnati, O.
Cook Co., Asa S., Hartford, Conn.
Gisholt Machine Co. Madison Wis.
Herbert, Limited, Alfred, Toronto, Ont.
National Acme Co. Cleveland O.
Pratt & Whitney Co. of Canada Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin

TURRETS, TOOL POST
Gisholt Machine Co. Madison, Wis.

UNIONS, PIPE
Fittings, Limited, Oshawa, Ont.

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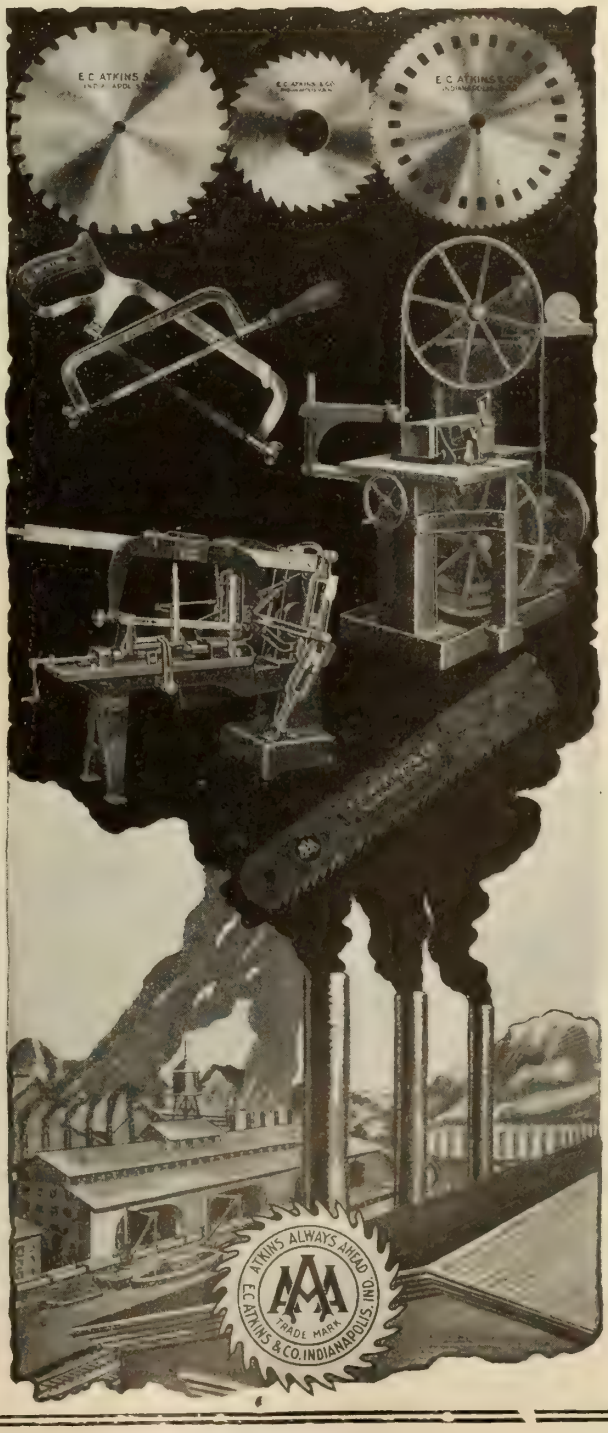

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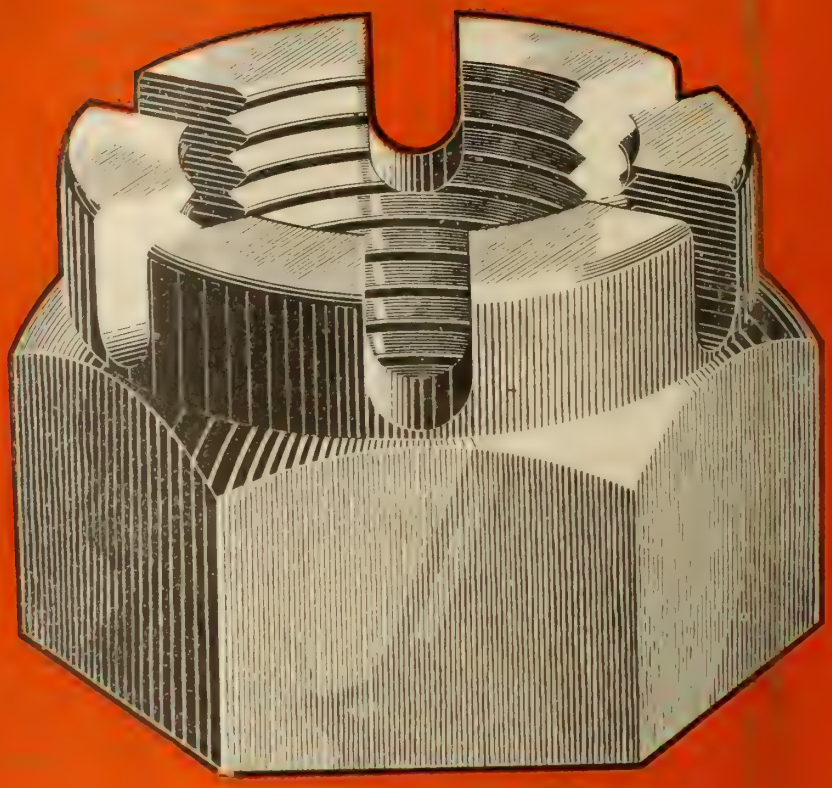

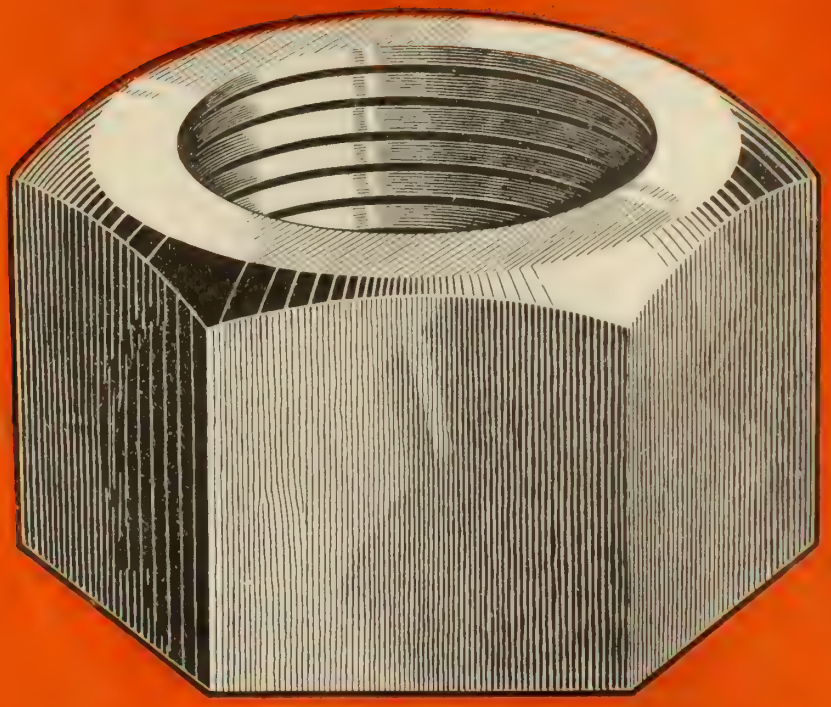

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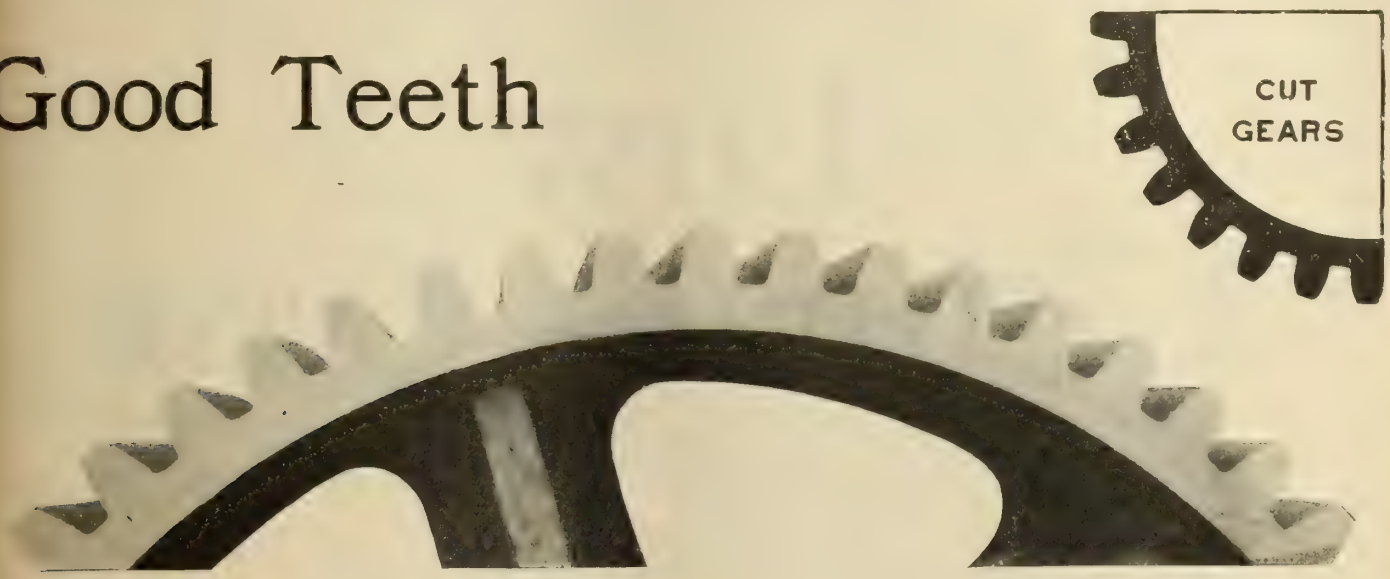

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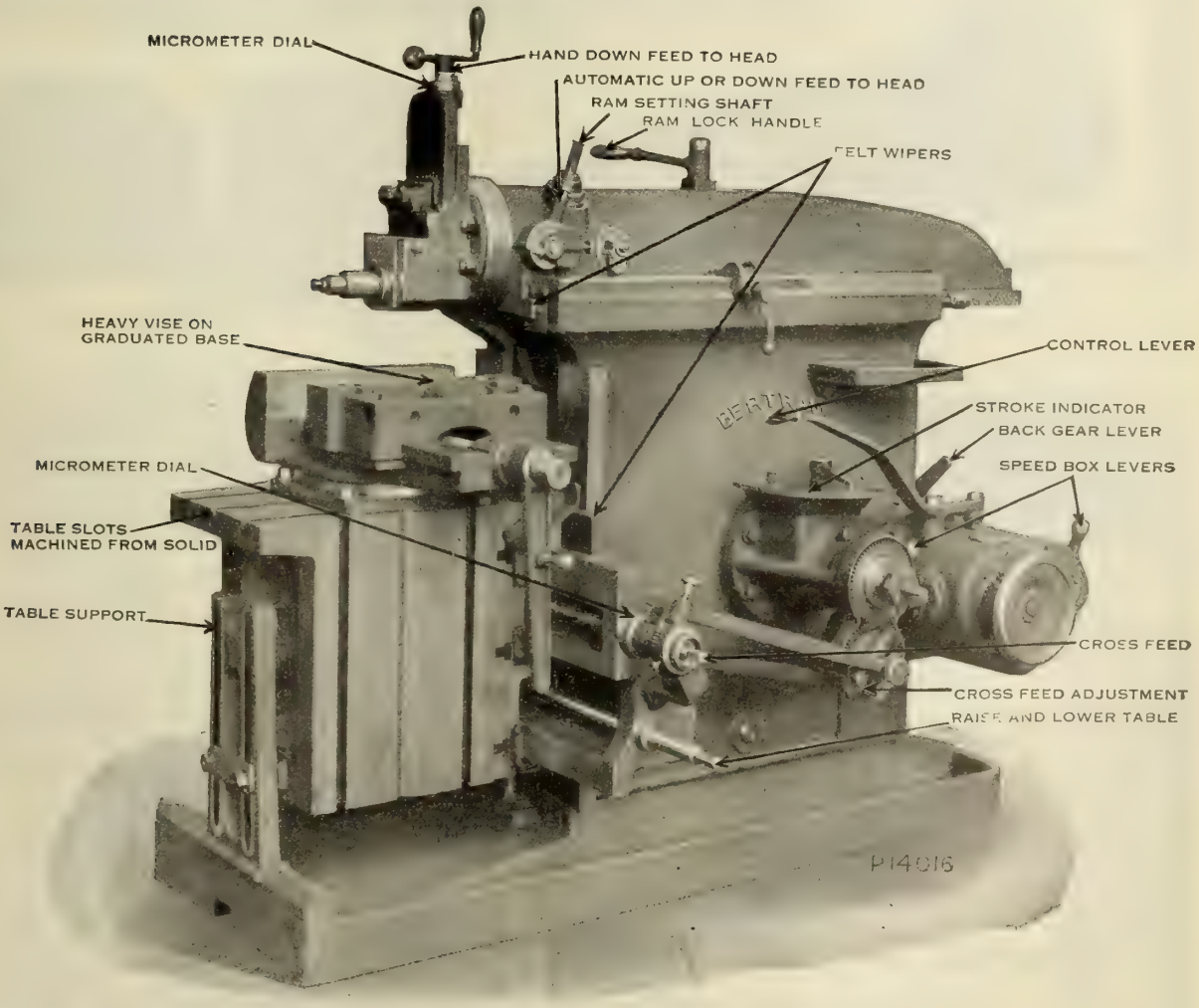

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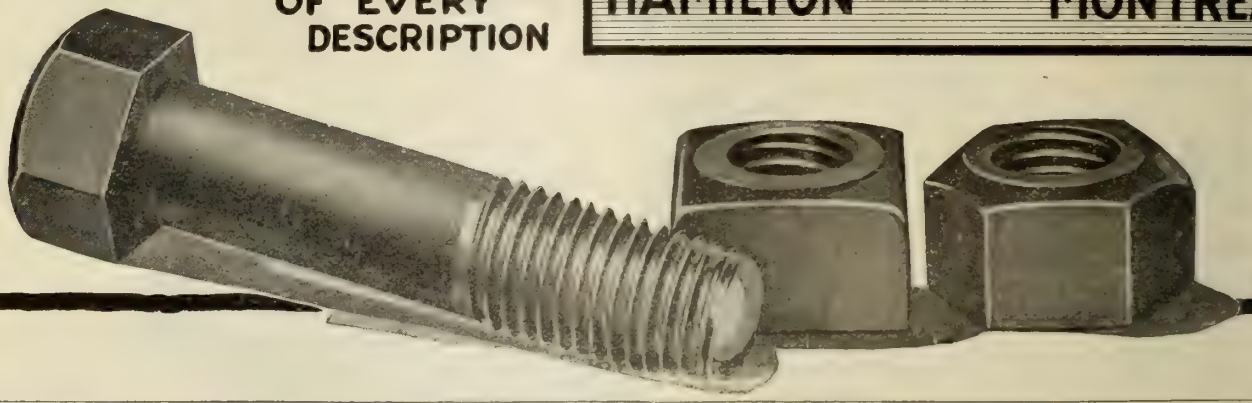

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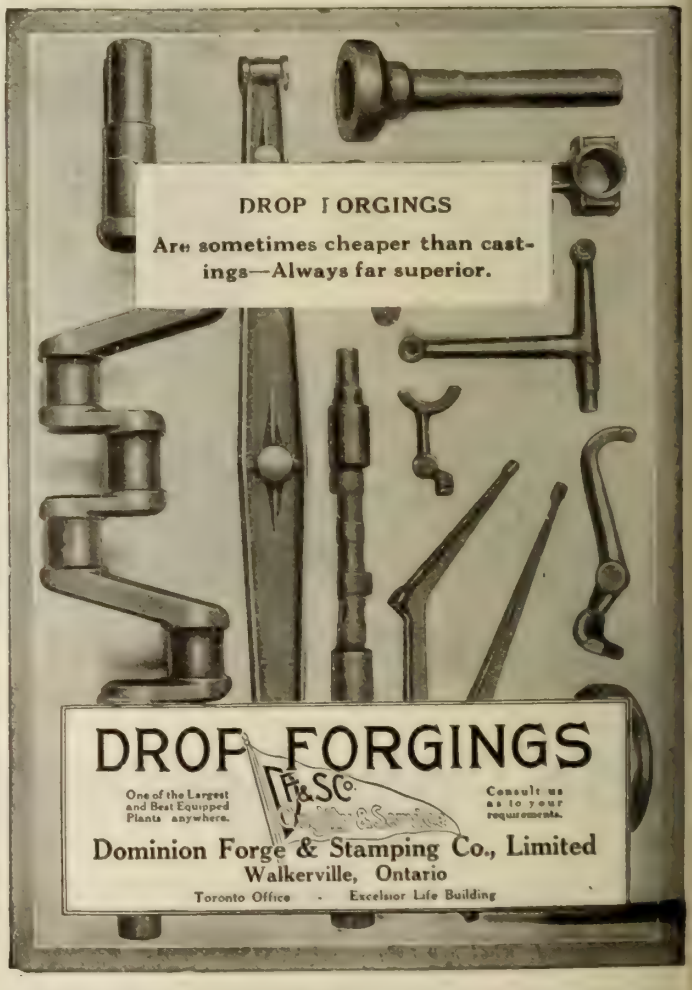
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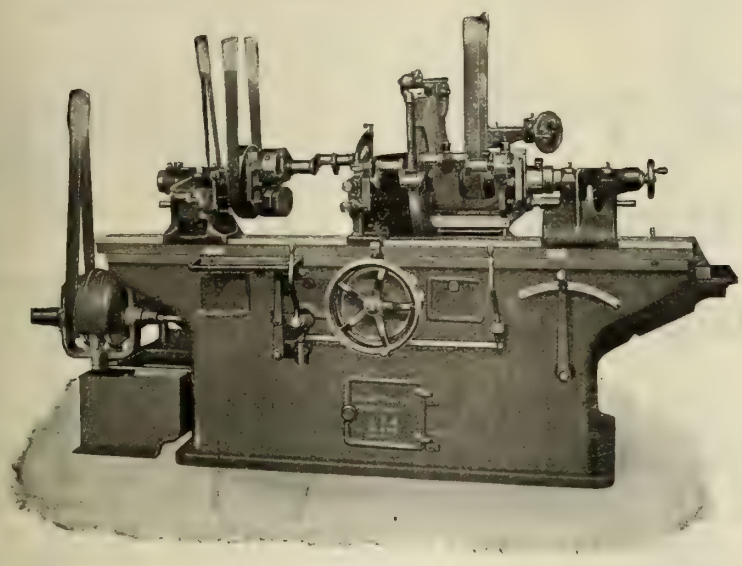

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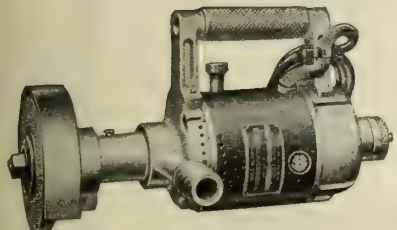

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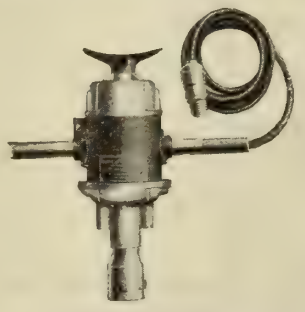

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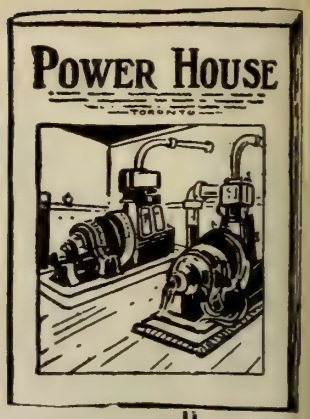

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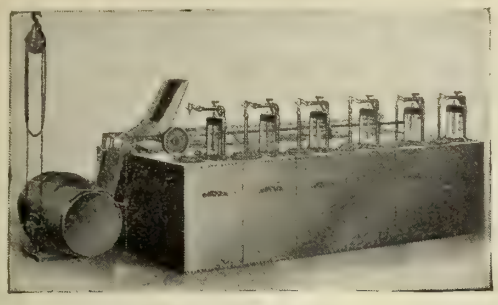

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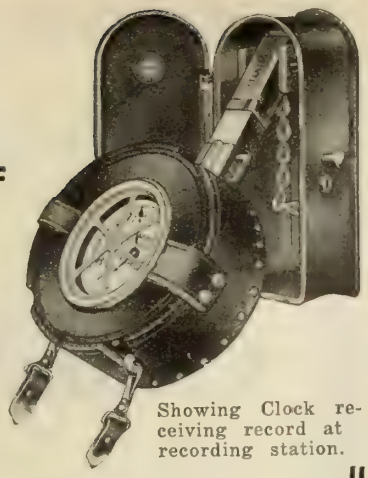

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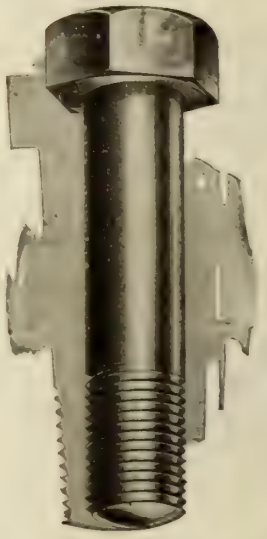

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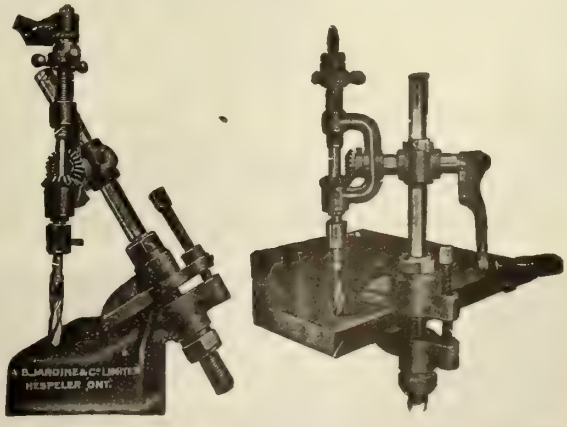

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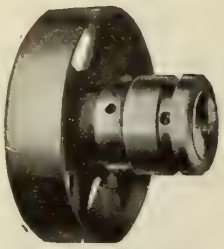

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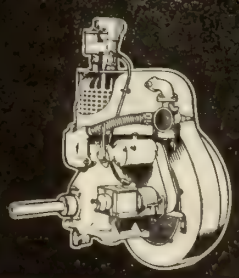

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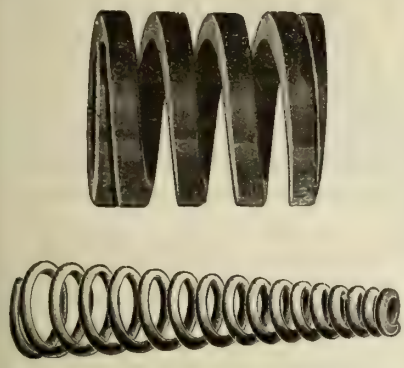

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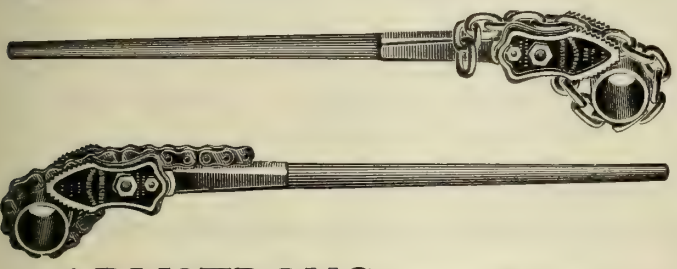

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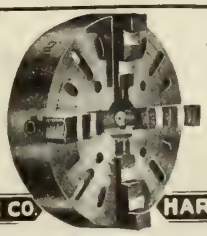
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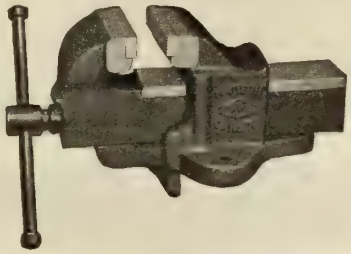

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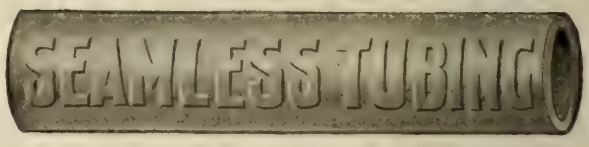

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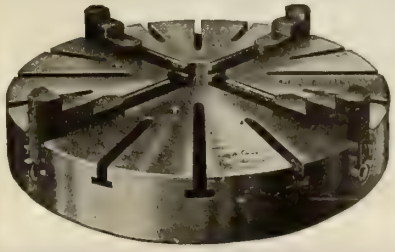

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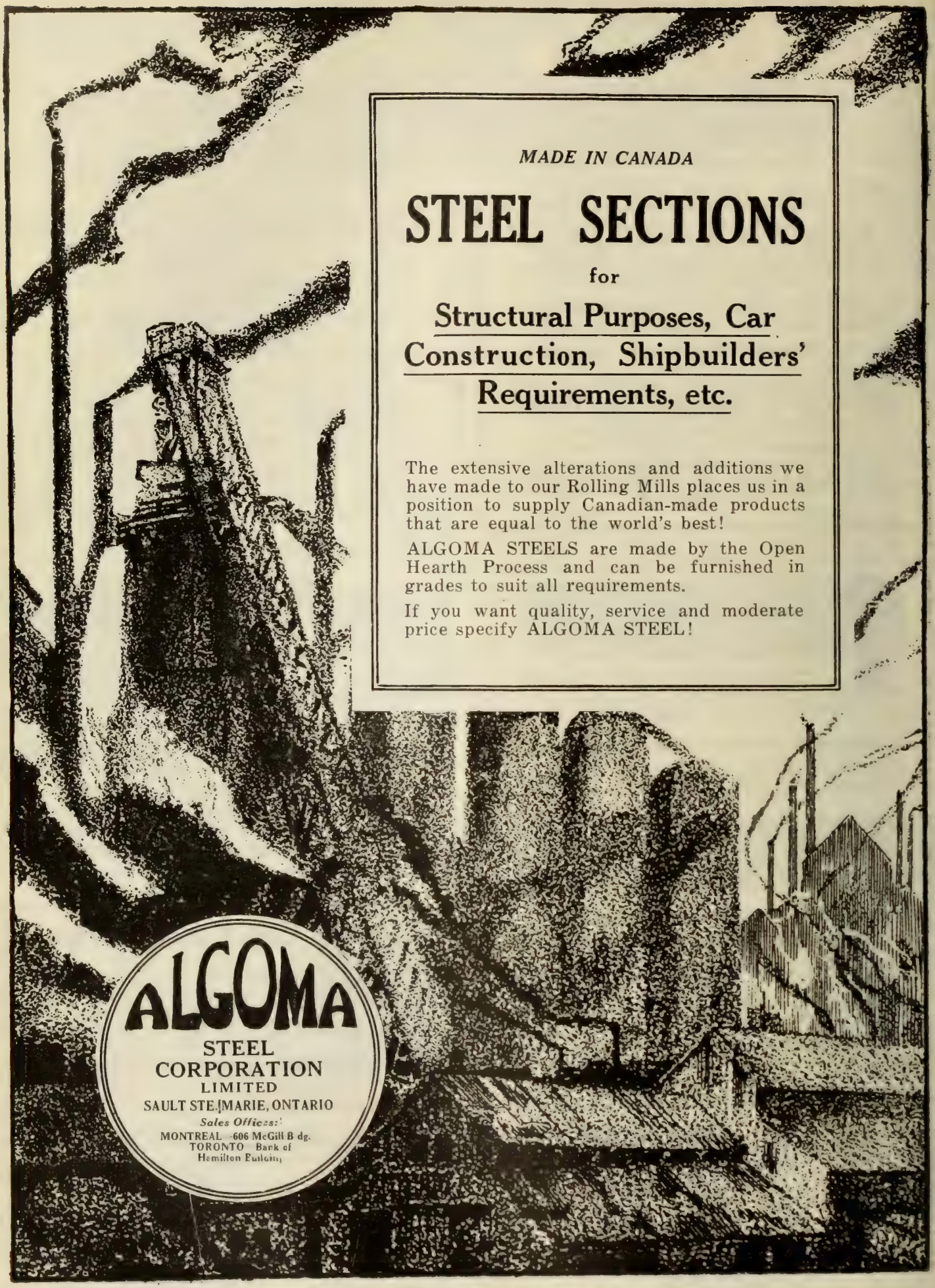

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CANADIAN MACHINERY
AND
MANUFACTURING NEWS

VOL. XXVIII, No. 17 OCTOBER 26, 1922

Continuous Operations on Sensitive Drill Press

Difficulty Experienced With Hand Operated Machines—Automatic Control of Spindle Movement—Special Indexing Fixture for Small Work—Intermittent Relief When Drilling Deep Holes

APPLICATION of the automatic principle to sensitive drilling dates back only a comparatively short time, as the difficulties to surmount in this direction are invariably greater than in other branches of shop practice. Considerable success, however, has been achieved by the Kingsbury Manufacturing Co. of Keene, N. H., who have been working along these lines for many years.

The high speed sensitive hand drilling machine is one of the recent developments in production tools, yet it is necessary for the work to be performed by a highly skilled operator, as great judgment is required in maintaining the right pressure on the drill to minimize breakage. In the automatic machine the spindle pressure is controlled as readily as under the hand of a skilled operator. When the spindle is released the drill is automatically brought to the work at as rapid a rate as the drill will stand without injury; as soon as the drill strikes the work the feed through the metal is governed by the weight pressure, hardness of work, and cutting capacity of the drill. When the drill breaks through the work it is held back from a too rapid feed, which has the same effect on the drill as the hand operator letting up on the pressure. The drill is then raised rapidly and retained at the top of its stroke until released by the operator.

Special Drill Fixture

Fig. 1 illustrates the automatic sensitive drilling machine operating on small parts held in a special fixture mounted on the two tables of the machine. The table is indexed automatically after the drill has been raised from the work. Each of the two spindles operates independently and the feeding of the drill is accomplished by a weight located on the lever at the top of the machine; this weight is adjustable and exerts a constant pressure from the moment that the drill engages the work until it has completed its operations. The spindle is carried down to bring the drill to the work, and returned after the drilling of the hole, by means of a combination of levers and a friction-driver crank disc, which operates as follows: when a piece has been placed under either of the spindles, the operator pushes the rod below the table, which results in throwing the latch F out of engagement with the end of the arm that is connected to the weight lever by means of a connecting rod. The action of the weight pressing downward causes the friction-driver crank disc to come in contact with the driving member.

Near the middle of the vertical shaft which carries the driving pulley at its upper end, is a worm that meshes with a worm wheel carried at the center of the shaft on which the two grooved friction driving members are mounted. When the crank disc at each side of the machine is carried down into engagement with the driving member, the disc is rotated through the frictional action of the grooved contact surfaces of these two members.

Where articles are to be manufactured in large quantities the method of handling during machine operations is of vital importance. Automatic equipment assures continuous machining and the possibility of error, due to the human factor, is reduced to a minimum. By conserving the energy of the workmen by mechanical appliances the output is correspondingly increased.

Operation of Machine

With the two-spindle machine shown, the method of procedure is to load the jig under one spindle and start the operation by pushing in the starting rod, and then to do the same with the other. By operating the spindle alternately, non-productive time is reduced to a minimum, thus effecting a substantial improvement in the rate of production.

When the point of the drill comes into contact with the work, the resistance offered to its penetration is sufficient to lift the friction disc out of engagement but still keeping it in light contact with the driving member, thus engaging the friction drive and placing dependence on the action of gravity to feed the drill through the metal. When the drilling operation has been completed and there is no longer any resistance to the advance of the drill, the weight once more establishes tight contact between the crank disc and driving member, and through the link mechanism provides for rapidly lowering and then raising the spindle to the starting point. When the spindle has been raised to the top of its stroke the latch F snaps in under the end of the bell-crank arm, thus stopping the operation until the starting rod is once more pushed in.

Efficiency Device

In setting up the machine for the performance of a specified drilling operation, the automatic efficiency device is set to provide for stopping the machine if the use of a dull or improperly ground drill is causing the drilling time to extend over more than the proper predetermined period.

The arrangement of the device is shown in Fig. 2. Secured to stud L on which link F is pivoted, there is a ratchet wheel M which is engaged by two pawls. One of these is actuated by an eccentric connected to the feed control shaft, while the other is a retaining pawl that holds the ratchet wheel in position against the tension of a spring, as it is turned by the first pawl. If the drilling operation is completed within the specified length of time, the returning of the drill to its starting position causes a lever to lift both of the pawls out of engagement with ratchet M, so that the spring may return this ratchet to the starting position, which is determined by means of an adjustable graduated disk N carried on stud L between the ratchet wheel and the frame of the machine. As the ratchet snaps back to its starting position, a pin on the side of the ratchet comes into contact with a pin on the side of disk N which arrests the backward movement of the ratchet.

Should it happen that the drill has be-

come dull, thus preventing it from accomplishing the drilling operation within a specified time limit, forward rotation of the ratchet M is continued. A pin on the opposite side of this ratchet comes into contact with a corresponding pin carried by lever O and swings this lever over into such a position that a lug on this lever is ready to engage the end G of bellcrank lever I and, although allowing the completion of the present cycle, prevents further operation of the machine and notifies the operator that satisfactory working conditions are not being secured. Lever F carries a spring plunger P that runs over a pin mounted on the hub of lever O, to provide for holding this lever in either of its two positions. In order to restart the machine, the operator has to pull up on handle O, thus causing plunger P to first move inward and then latch the lever in the operating position. With an arrangement of this kind, it will appear that a constant safeguard is placed upon the efficiency of the operation.

The capacity of this drill depends on the nature of the work. It is rated to take drills from 3/16 in. down to 1/16 in., but larger and smaller drills have been economically used. The tool may be adapted to almost any class of work but it is especially serviceable on castings, forgings and other metals which vary in hardness. The machine has operated at the rate of from 1,000 to 3,000 holes per hour, varying with the character of the work.

Fig. 3 shows a diagram of the drill action. When the drill strikes the work it automatically slows to the drilling feed. After breaking through it again comes under the control of the eccentric and is held to the maximum feed. The curve is that of a special cam designed to feed the drill efficiently in the shortest period of time if a positive feed were used. It is thus indicated how the actual drilling feed takes care of itself while all the idle time is controlled by the eccentric.

In drilling deep holes it is necessary to raise the drill to relieve the chips and promote better lubrication in order to prolong the life of the drill. This is done by designing the cam with a "hump" on the downward stroke.

PRACTICE ON LOCAL QUENCHING

As Recommended by the American Gear Manufacturers' Association

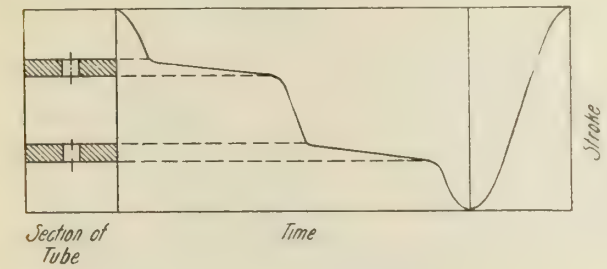
Local quenching is merely the immersion of the part desired hard or toughened in the bath. The parts desired soft are allowed to cool naturally in the air, either to cold, if considerable softness is desired, or allowed to cool below the critical temperature Ar, before immersion, if only moderate softness is the objective.

Similarly, as with local carburizing, some of the clay and sodium silicate mixtures may be applied to the part desired soft. On quenching, the coating will usually stay on long enough to slow up the quenching rate of the part covered. Sheet metal strips or collars may be wired over the part desired soft. It is necessary, with these methods, that some of the water of the quench, if water is used, shall turn to steam and by so doing will prevent contact of further water.

Pinions may be hardened on rods or long bolts. The rod is held by the tongs and pinions and rod quenched together. This will usually leave the bores soft. A little clay between pinions and at ends of rod will help, if found necessary. Localized streams of the quenching fluid may be forced against the part desired especially hard, with good results.

As a warning, in all local heating, or quenching, strains caused by unequal contraction and expansion are set up in the work and cracking is liable to occur. This is more pronounced with the steels which harden directly than with the carburizing steels. The core of the latter, being a more ductile metal, can stand the sudden deformation better.

In connection with bearing metals it has been shown that while the liability to failure of the oil film can be minimized by careful design and operation it cannot be entirely eliminated. The danger is always present and a knowledge of the conditions that follow the suspension of the oil film is essential to the intelligent selection of a babbitt.



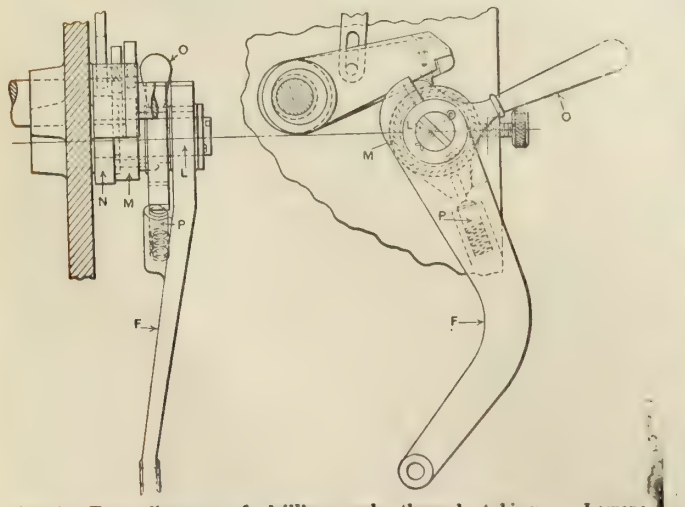


Fig. 3.—Top: diagram of drilling cycle through tubing. Lower: automatic efficiency device.

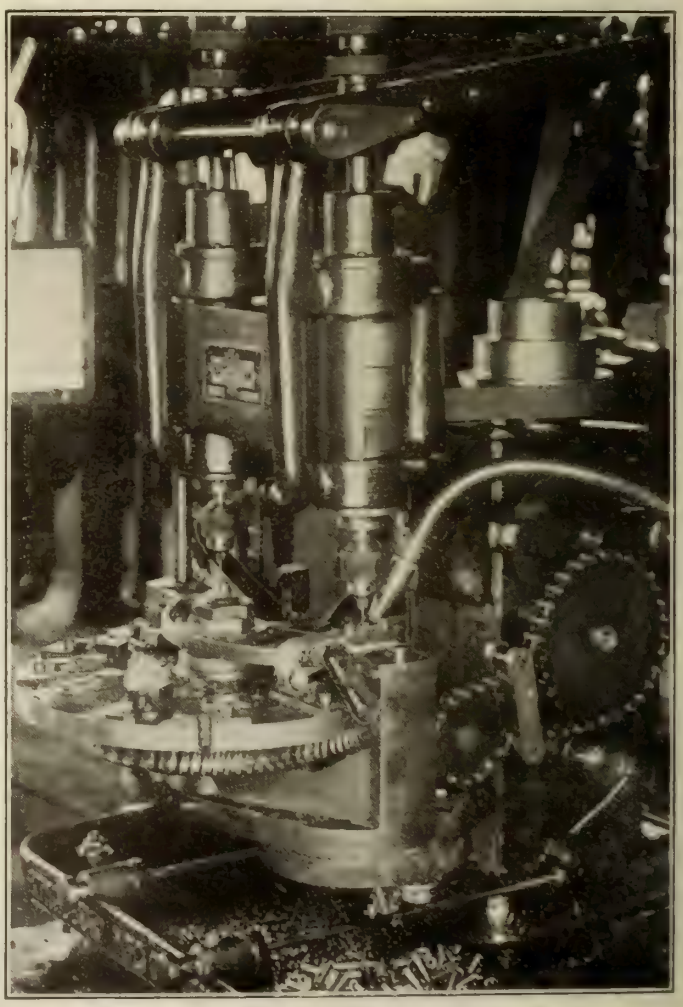


Fig. 1.—Automatic sensitive drilling machine in operation.

Demand for New Designs in Production Machines

Customers Beginning to Look Ahead—Labor Shortage Will Create Call for High Speed Equipment—Farsighted Builder Will Lay His Plans for Future Output—Figuring the Costs

"WHILE there still seems to be a sufficient supply of the ordinary type of machines, the demand for labor-saving and high production machines is improving. New designs are being sold with less effort than old types."

Thus does E. F. DuBrul, general manager National Machine Tool Builders' Association, Cincinnati, summarize conditions in the machine tool industry as regards equipment. He adds that demand for consumer goods is strong, that the prime commercial paper rate shows a slight turn upward, that labor shortage continues and wages are sure to go up, that shortage of effective supply of fuel will limit production in some lines, and that transportation is becoming a serious problem.

Dealing with the stronger demand for consumer goods Mr. DuBrul states:—"As usual in a depression, stocks were depleted and the merchants bought from hand to mouth; they did not anticipate their wants and now find it advisable to stock up again. The upturn in interest rate is due to borrowing to finance increased business. The increase in pig iron production, unfilled orders of the U. S. Steel Corp., postal receipts, freight car loadings, bank clearings, and railroad earnings, all show the upward trend.

"It now becomes a question for each machine tool builder to forecast when he is going to feel his demand with corresponding strength. It always has been later than other industries, as we know. The scarcity of labor in general is sure to create more demand for machinery to do the work that the country and the world want done. Some of our group charts show certain types of machines to have been going out for some months past at even better than the average of the 7 years before the war. The only thing that makes this total look like dull business in those lines, is the additional capacity put on to take care of the war business.

"The forehanded machine tool builder will calculate how long his stocks will last at the present rate of demand and will lay his plans for future production. He will base his calculation of profits on future cost, particularly taking into account the prospective costs of material, labor and fuel.

* * *

"**Labor:**—We hear no more of unemployment. The building boom has absorbed all the floating supply of common labor. So many contracts have been let for building that it will not be surprising to see some people disappointed when wages were down some months ago many began making plans, and by the time the contracts were let there was still ample supply of labor and material. But so many had the same idea at the same time that there were more contracts let than could be filled within the anticipated time. Those who are most pressed by their needs are going to bid the highest for labor, and others either have to stay back and wait until those needs are filled, or else meet the wages offered.

"However, this runs up the cost of building and new contracts will not be let on the basis of the high costs, and then the building boom will flatten down. In the meantime, the labor demand in other industries is quite strong and the general supply quite scarce, so that wages are sure to go up. The man who does not take this into account for his future operations is going to find himself disappointed in his profits.

* * *

"**Material:**—We see the beginnings of another price activity in iron and steel. The coal and railway strikes cut down production. While some of the increase in unfilled orders of U. S. steel is due to inability to ship, a lot more of it is due to increase of orders arising from business activity. The strikes caused a scarcity of iron and steel in the spot market and naturally prices have reacted upwards.

"Some men figure the material in their product at the cost of purchase, instead of figuring it at market price and taking the difference between cost and market into a 'Loss or gain on Purchases' account. Suppose they have been fortunate enough and forehanded enough to purchase a supply of material at a low price when there is no demand for their product from their own customers. Suppose the market has changed and costs have advanced perhaps 30 per cent. If they then base their prices with a certain profit added to this low cost, they merely transfer to the purchaser a profit that they made as speculators or forecasters of the material market, and may not get a profit as manufacturers or converters of that material.

"The only way to figure costs of manufacturing is to take the material into cost at the market price, and not to take it in at cost unless the two happen to coincide.

* * *

"**Fuel:**—With fuel reserves all depleted, there is a natural pressure to get coal. The railroads are not yet able to handle it as fast as the miners can produce it. Even coal actually loaded is not an effective supply of coal. It has to get to the furnace first, and transportation trouble makes scarcity at the point of consumption. Industries that have no reserves are very fearful of shutdowns, such as happened in the iron and steel industry. Coal is worth more money when men haven't any reserves than it is when they have reserves and can afford to wait. It isn't going to do any good to talk about coal profiteers or coal "bootleggers." Men pay the price that coal is worth to them.

"Attempts at government price fixing are not mere harmless diversions for political effect—they are harmful diversions. They lead people to think that they can get cheap coal, and then when coal is higher due to natural causes, the disillusioned buyer gets angry at somebody.

"If all artificial restraint were removed from the coal market, the price would be quite high for a while, and the most pressing needs would be supplied at that high price. High prices would bring into production a lot of coal mines that do not produce except at a high price. When their production comes on the market and restores the balance between supply and demand, the price comes down. Buyers will not buy and store coal in summer when they can get it cheaply, so they must expect to pay high prices right along until they have learned their lesson.

"The fuel situation is going to restrict coal production some more. The wages of miners are so high that a lot of men are leaving other industries to work around mines, preferring long periods of idleness as long as they can get wages high enough to keep them during the idle time.

* * *

"**Transportation:**—The predicted car shortage is upon us, and will get stronger for some time to come. The railroads have not enough locomotives to haul traffic in proportion to the needs of the country. The shopmen's strike diminished the effectiveness of the short supply of locomotives. Besides that, there is a shortage of freight cars needed for full movement. On top of all that the crop is large and relative demand for cars has increased. If to this accumulation should be added a bad winter we are going to find the transportation factor to be a serious handicap to business.

"The forehanded man is going to be getting in his materials, as there will be a strong demand from people who have not anticipated their wants. Those

(Continued on page 23)

Modern Foundry Well Equipped With Air Tools

Molder of To-day Relieved of Much of the Drudgery of Past Practice—Application of Pneumatic Equipment Largely Responsible—Saving Effected in Many Ways

By F. H. BELL

PRESENT day foundry practice reflects the progress that has been made in many lines of mechanical equipment for increasing production on a more economical basis. First place, in this connection, must obviously be conceded to the universal application of pneumatic appliances that have been developed to relieve the foundryman of much of the drudgery associated with molding of a generation ago. Many varied applications of compressed air are now found in the foundry, and to the adoption of this labor saving power medium can be traced the improvement in many other branches of industry that are dependent on the "sand man" for their source of supply. Not only has it resulted in greater output at less cost but it is more or less responsible for the marked improvement in every grade of casting produced.

To enumerate all the different uses to which air has been applied in the foundry is beyond the scope of this article, but it is sufficient to mention a few applications that have proved beyond doubt their worth in making the modern foundry an efficient integral part of the metal industry.

The original air machine for supplying the blast for melting the metal was undoubtedly the bellows. This device while not in general use for this purpose now, is still one of the most useful of the molders' tools. It is, however, doomed to at least partial extinction in the near future, owing to the recent development of the air-gun.

It is only within the last few years that air ramming of molds became general. The old method of hand ramming was tedious and costly and sapped the energy from the workers. To-day the portable air-operated devices for this purpose and similar operations are producing molds of higher quality and at least cost.

On tests made on this class of work it has been shown that it is possible to ram about five molds with a pneumatic rammer to one by the hand method. On a foot pound basis the ratio is approximately 40 to 1, the air rammer delivering 28,000 ft. pounds per min., while the best the hand-operated rammer can do is less than 800 ft. pounds per min.

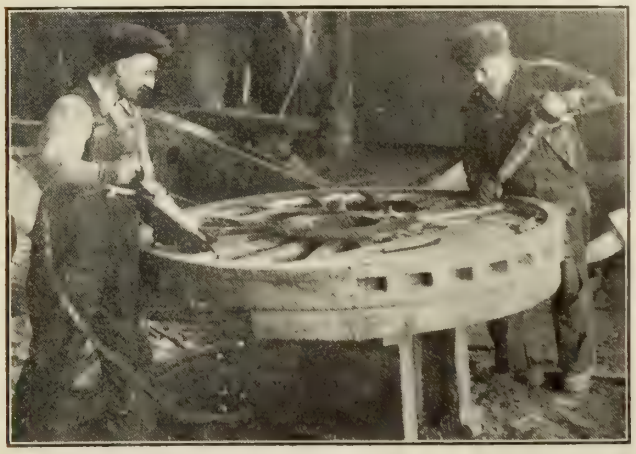
The life of an air-operated rammer depends upon the care taken of it by the user. After a rammer has been in service and it is to be laid away for a time, it is advisable to immerse in carbon oil, and when again required it should be thoroughly oiled with lubricant through the throttle handle. This practice will materially increase the normal life of the tool.

The chipping and cleaning of iron and steel castings constitute two of the most important applications of compressed air to the betterment of foundry practice. The iron castings are generally delivered to the fitting shop comparatively clean except for fins and oversizes, as the adhesion of sand and loose metal is seldom seen on iron castings, while it is nearly always present on castings made of steel. In the case of iron castings the chipping of fins is an easy process as the metal is brittle and breaks freely from the body of the piece. Steel castings, on the other hand, are tough and it is necessary to drive the cutting edge of the chisel through the metal. For these reasons it is advisable to use a harder hitting hammer on steel than on iron. The 3-in. stroke tool is best adapted for steel castings while the 2-in. works satisfactorily on cast iron. A fair example of pneumatic hammer efficiency may be gathered from the fact that a steel roll under the old hand method required several men's time for a week to clean; the same work is now performed by two men, using 3-in. stroke hammers, in about 8 hours. It is possible for an operator to guide his chisel with comparative ease and work in places that would be impossible to reach by the hand-chipping method.

Every up-to-date modern foundry is piped for compressed air the same as it is for water, and every spot where a workman is likely to be employed is provided with a tap and hose connection. When compressed air is installed the molder uses it to advantage in place of the bellows but does not obtain the highest efficiency when using the ordinary nozzle, as it is difficult if not impossible to regulate the flow and the pressure. In using the hand bellows it is comparatively easy to create high pressure in spurts by suddenly closing the bellows, an action that has become an art with many molders. This is what is required of the compressed air device.

The Air Gun

The illustration shows how this is accomplished. The little coil spring keeps the valve in place when not in use, but the real force which closes the valve and keeps it closed is the pressure of the air in the hose. The full force of the air is held back by this valve, and the operator simply presses his thumb upon the cap or button to open it. If he desires to deliver the extreme pressure of the air in order to dislodge some obstacle he opens the valve completely, allowing the air to come out in a spurt at full force and at greater velocity than is possible with the hand bellows. If a light blast is all that is required, the flow of air can be regulated accordingly. The air gun is now an indispensable tool in the foundry as it can be used for removing the debris when chip-



Removing fins from locomotive drive wheel, centre.

The air gun.

Fettling work on a large steel casting.

ping and cleaning castings, for blowing the dust and dirt from between pasted-up cores, and for innumerable other purposes.

Cleaning Large Castings

The two illustrations here shown will give the reader an idea of the class of castings which are being turned out of Canadian foundries at the present time. These castings are made of steel and it is obvious they are large ones. Every foundryman who has ever worked on steel knows that the high temperature at which it has to be poured makes it impossible of any foundry, however carefully managed and operated, to produce castings that are more than ordinarily smooth, so it will be readily seen what a proposition it would be to chip these castings by hand, as it must be remembered that steel does not yield to the chisel as readily as cast iron. Had this been an iron casting it would have worked easier but would have been a big job at that.

The larger of the two castings shown is a plunger cone for a Larner-Johnston hydraulic valve the largest ever constructed. It was cast by the Canadian Steel Foundries and delivered to the Dominion Engineering Co., the builders of the valve. The piece is 13 feet 11 inches in diameter and 7 feet 2 inches deep, and weighs about 25,000 lb. It was a perfect casting but required the services of the pneumatic chippers to make it really presentable for machining.

The other view is that of a locomotive driving wheel centre. Before the piece can be machined it is necessary to remove all fins and remains of risers from the main portion.

The adaptability of air to foundry service is almost unlimited. There is the oil-air torch for starting fires and pre-heating ladles; the air riddle; air-operated tampers; molding machines; sand-blasting and many other uses.

Hobbing Gears of Condensite Celoron

By M. E. Dalton, General Manager, Dalton & Blach

SUCCESSFUL hobbing of silent timing gears of condensite celoron material, while a very simple operation when thoroughly understood, is dependent on several factors, the most important of which is accuracy. As spiral or helical gears are used to give a continuous engagement between gears it is essential that the angle cut is right. This is obtained by a very simple formula. Next to be considered is tooth-shape. This is taken care of by the hob manufacturer. Tooth to tooth spacing is also very important, but this gives no trouble as long as one is not too economical in installing his equipment and gets a good hobber. The usual care should, of course, be exercised in maintaining exact face parallels, eliminating eccentricity of gears with relation to axis thereof and perfectly rounded and true peripheries maintained, as is our practice, by using indicator test lathes when turning up the blanks before cutting the teeth. The arbors on which blanks are set up for tooth cutting must, of course, be perfectly true and rigid always.

Greater latitude as to back lash is permissible by comparison with metal gears, and it is generally found that a back lash tolerance of from three to [illegible] thousandths secures the best results when cutting condensite celoron.

We find that the Lees-Bradner gear hobber with fast head is very well adapted for cutting timing gears of this material. The use of this equipment allows the gear man to run the hob at a very fast speed (about 260 r.p.m.). This is a very important fact, as this material machines better at a fast speed and the cost of cutting is greatly reduced. To illustrate: Take a thirty-tooth Buick crank gear on a hobber; the hob revolves once for each tooth on the gear and, as there are thirty teeth, the r.p.m. divided by the number of teeth would give you the number of revolutions of the gear per minute. Each time the gear revolves it travels past the hob according to whatever feed is used. A feed of .100 in. is used and has been found very satisfactory in practice. If hob r.p.m. is 260 divided by number teeth 30 = 8 2/3 revolutions of the gear per minute. 8 2/3 x .100 feed = .866 in. feed per minute. As the gear is one inch wide it is plainly seen that your cutting time will be less than one and one-quarter minutes per gear. These hobbers also handle any angle gear readily and do not require special long arbors for steep angles. They also have fast head index for gears which have a small number of teeth in conjunction with the regular indexing device.

It is very important that the figures in hobbing these gears be carried out far enough to insure not over an error of .00004 as it is very imperative that the angle be right to assure a bearing all the way across the angular face of the tooth at the pitch line. Formulas for figuring this class of work may be obtained easily and we sometimes furnish them.

We use a larger diameter hob than recommended for the fast head on Lees-Bradner machines, usually 2¾ in. dia. This should be recessed to clear the collet on the fast head and also to clear the nut which holds the hob on. The hob should also be tapered off on the end which strikes the gear first. Left hand hob should be tapered off on the bottom and a right hand hob at the top. While a left hand gear can be cut with a right hand hob and vice versa, still, best results are obtained by using hob of same hand as gear.

Hobs should be kept sharp, as a dull hob will produce a ragged or rough-looking gear. A sharp hob cuts more accurately as the material is resilient and will push away from a dull cutting tool. These are good reasons for high cutter speeds and fast feeds. When producing gears of one inch face thickness, our gears are ordinarily cut five at a time, which makes necessary only one backing disc of fibre to assure a clean finishing cut on the last gear of the set up as the hob comes through.

The use of a little oil on the hob serves to keep the fine dust from floating all over the place, and gives a better appearance to the machined surface.

Generating Steam by High Voltage Current

Several Large Installations Operating Successfully—High Thermal Efficiency—No Chemicals Required—Interior of Boiler Easily Inspected—No Scaling or Erosion of Tubes or Shell

THE "Electro" steam generator described below is the result of several years' tests and experiments by F. T. Kaelin, chief engineer of the Shawinigan Water and Power. Company, Canada, and has been developed in the United States by the Electric Furnace Construction Company, Philadelphia. It is an apparatus for generating steam in any required quantity at any specified pressure by means of alternating current which is led directly into the water to be evaporated. A number of large installations are in successful operation, including one of 20,000 kilowatts capable of raising 60,000 pounds of steam per hour at 130 pounds pressure.

The "Electro" generates steam by the passage of high voltage alternating current between specially designed electrodes immersed in water. The resistance of the water to the passage of this current converts it with almost unbelievable rapidity into steam, so that saturated steam at any pressure can be delivered from a generator occupying only a fraction of the space required by a fuel burning boiler of the same steam-producing capacity. The amount of steam generated, the pressure, and the amount of electric power used are governed by the height of water in the tank or the depth of immersion of the electrode in the water. The flow of water and consequently, all the required conditions for operation are controlled by standard valves.

Efficiency of Generator

The "Electro" operates at an average thermal efficiency of 98 per cent. to 99 per cent. On one installation tested in service, the efficiency of generator, steam connections and about 100 feet of the steam line was over 98 per cent. This was measured on kilowatts used and steam passing through Bailey meter. Power can be used for this generator from any alternating current, although the actual voltage determines to a large degree the individual design of each generator.

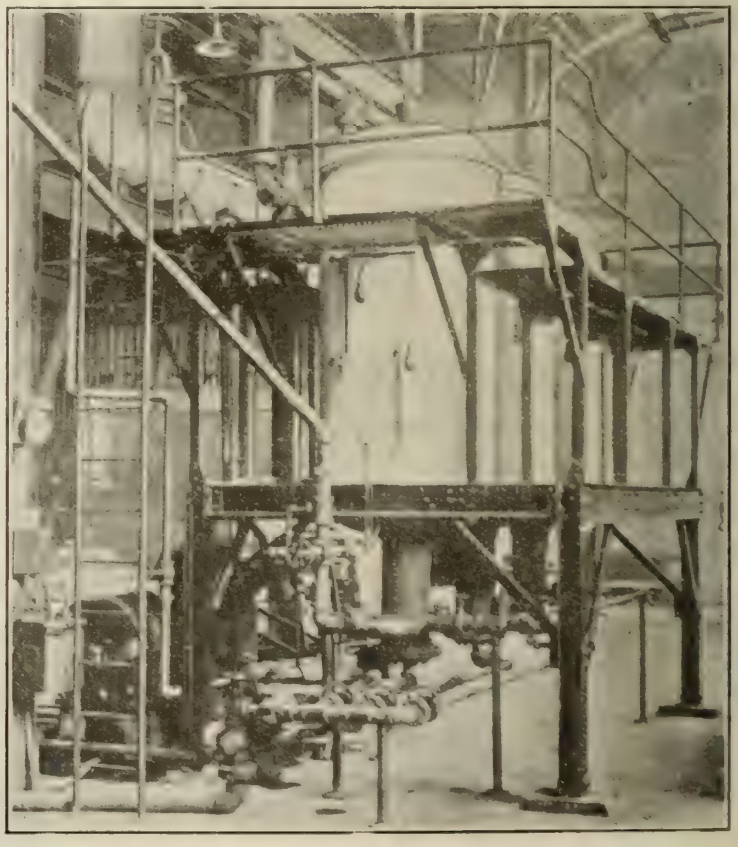
Any water that is suitable for the ordinary boiler is satisfactory for the "Electro." No chemicals are necessary for doctoring the feed water; in fact they are detrimental to its operation. Where condensate is used, a negligible fraction of the supplied water is constantly bled from the generator to prevent accumulation of sludge and foreign matter. A slightly larger amount is bled if raw water is used, but since this waste is only a few degrees above the temperature of the feed, the heat loss is negligible. Valves of special design are used to automatically bleed the necessary amount. Using ordinary water, the average time required to raise full head of steam starting cold is approximately 30 minutes.

The generator is designed, constructed and inspected with the best steam engineering practice and in accordance with the A. S. M. E. code.

No part of the "Electro" is exposed to a higher temperature than that of the steam. Inspection of the interior may be made readily by removing the bolted-on head. The only part of the boiler subject to wear is the electrode, which may be replaced annually at a nominal cost. There is no scaling or erosion of tubes or shell due to high temperatures.

The most important application of the "Electro" steam generator will be found in industries located within the range of hydro-electric power plants where use can be made of surplus energy or water running to waste. A large majority of firms contracting with power companies for blocks of electric power at a fixed rate per horsepower year have a portion of this energy, which is paid for, idle a part of every day; under present conditions a large percentage of this power made available to them, may be idle 24 hours per day. Either condition represents an ideal application for the generator. The generator may be connected up to present steam mains so as to take over the steam load from one or more coal-fired boilers, depending on the amount of electric energy available, or it may be arranged to operate independently in isolated places or where sufficient electric energy is available to shut down all the coal-fired boilers.

In some cases the hydro-electric power companies are taking advantage of surplus power and installing these generators in central locations and distributing steam to a number of nearby industries, selling the steam at a fixed rate per 1,000 lbs. In other cases, where an individual customer is a large user of steam, the power company has installed the generator in customer's plant. A number of Canadian firms have installed these steam generators, so as to make use of their surplus power. This surplus may be available for short periods only, but due to the flexibility of the "Electro" unit nearly 100 per cent use may be made of it.



"Electro" Steam Generator

Inadequate Rail Service Retards Production Growth

Great Volume of Freight Offered, and Long Decline in Expansion Two Causes of Present Problem—Too Much Government Regulation—Locomotive Power and Car Capacity Less

AN INDIRECT explanation of the activity in railway buying that has been taking place in the United States, and a definite opinion as to the handicap placed upon business by inadequate transportation facilities, is offered by Samuel O. Dunn, editor of Railway Age. Discussing these problems at a symposium held by business paper editors, he said:—

"At a time when most people are rejoicing because general business activity is reviving, it is not pleasant to be obliged to express the opinion which, however, I do express, that, because of lack of transportation, there will not be, and cannot be, any such increase of production over commerce in this country in the months and years immediately ahead of us as there have been during corresponding periods of business revival in the past.

"There is no better measure of the increase which has occurred in any period in the volume of production and commerce than the increase in the volume of freight shipped in that period. In the ten years ending with 1907, the increase in railway freight business in this country averaged 14 billion tons carried one mile annually. In the next ten year period, that ending in 1917, the increase in freight business averaged almost 16 billion tons carried one mile annually. The average increase per year in the twenty years from 1897 to 1917 was almost exactly 15 billion tons carried one mile.

"In the latter part of that twenty years the railways had greater and greater difficulties in handling the normal increase in their business. Congestions and so-called shortages of cars ceased to be merely occasional and sporadic, and became chronic.

"In order to increase the business handled, the government assumed operation of the railways at the beginning of 1918. In spite of all the efforts made under government operation, it was found impossible to increase the freight moved in 1918 more than two-thirds as much as what had previously been a normal increase. In 1920, with the railways again under private operation, the managements exhausted their utmost resources in efforts to handle all the business offered. They again increased the freight moved, but they failed by a substantial margin to move all that was offered. The average increase in the amount of freight moved annually, in the three years ending with 1920, was only five billion tons carried one mile, or only one-third of what had been the normal annual increase during the preceding twenty years.

"Now we have a large freight business offered again. What is happening? The railways are putting forth the utmost efforts to move it, and they are not yet quite equalling the record made in 1920. In due time, if the conditions remain reasonably favorable, they will equal and surpass that record. But consider what these facts mean. Never prior to 1917 did the railways, when business was large, fail to move an amount of freight which substantially exceeded all previous records. Now, they are finding it extremely difficult to equal the record of 1920, although in the three years ending with that year they increased the traffic handled only one-third as much per year as they had previously increased it for twenty years.

"Although the coal strike and the shop employees' strike have aggravated the present transportation situation," said Mr. Dunn, "they have not created it. It is mainly due to two series of developments. The first of these is the very large increase, within recent months, in industrial and commercial activity and, in consequence, in the freight offered to the railways for movement. The second is the long decline which has occurred in the expansion of the railroads. If all the locomotives and cars now owned by the railroads were in normal conditions, they could not handle anywhere near all the freight that is being offered to them, and which, in the months ahead, will be offered."

"To what is this situation due? Statistics are always tiresome and often confusing, but I must give you some to show what has happened. Probably you have seen statistics showing that year by year for the last twenty years the number of new locomotives and cars put into service has rapidly declined. It has sometimes been answered that the new locomotives and cars have been more powerful and larger than the old ones, and that therefore this decline in the number of new ones acquired does not show a corresponding decline in the expansion of the capacity of the railways. Let us then use statistics regarding the increase in the total tractive power of locomotives and the total capacity of cars. In the five years ending with 1907 the average annual increase in tractive power of all the locomotives in service was 128 million pounds. In the seven years ending with 1914 the average annual increase was less than 75 million pounds. In the seven years ending with 1921 it was only 63 million pounds. In the year 1921 it was less than 39 million pounds.

"Now, take the capacity of freight cars. The average annual increase in the total capacity of all the freight cars in the country in the five years ending with 1907 was five million tons. In the seven years ending with 1914 it was less than 3½ million tons. In the seven years ending with 1921 it was only one million tons. In 1921 it was only 500,000 tons.

Capacity Has Declined

"These figures indicate clearly how increases in the power of locomotives and capacity of cars have declined until they have almost ceased. The development of the other facilities of the railways has declined in equal proportion. The increase in the total tractive power of locomotives was less than one-half as great in the seven years ending with 1921 as in the seven years ending with 1907. The increase in the total capacity of freight cars was only one-fifth as great in the seven years ending with 1921 as in the seven years ending with 1907. No man in his senses can expect the railways, in view of these facts, to deal successfully with anywhere near as large an increase in freight as they easily dealt with when business revived after the panics of 1893 and 1907, and after the depression of 1914 and 1915.

"It was long predicted by those who opposed the policy of restrictive railway regulation that in time it would result in making railroad transportation the limiting factor in production and commerce in this country. That prediction, unfortunately for everybody, has now been completely fulfilled. Almost every other condition is favorable to an increase of production and a revival of prosperity such as we had after the panic of 1893, after the panic of 1907 and after the depression of 1914 and 1915. The railroad situation makes impossible for the present any such increases of production and commerce as occurred then.

Government Regulation to Blame

"This limitation upon the country's prosperity and development must be removed. How can this be done? The answer is simple and obvious. The influences which have reduced and almost stopped the expansion of the railroads must be removed. Much the greater part, or all of this reduction of the expansion of the railroads has been

(Continued on page 23)

Selection of Babbitt and Maintenance of Bearings

Rebabbitting of Worn Bearings—Method of Aligning Shaft—Babbitt Formula for Electric Motors—Selecting Grade for Special Purpose—Unequal Pressure on Main Shaft Hangers

By W. S. STANDIFORD

THERE are many repair jobs on small machines which, on account of wear on their bearings, require to be "done over again at intervals;" the rebabbitting of boxes on small engines, nail machinery, etc., being among them. After having had a number of rebabbitting of crankshaft shells that were lined up in the usual slow manner, the writer devised a simple and rapid method of leveling shafts, it having been used on numerous occasions with good results as regards the working of the finished machine. Drill two holes opposite each other in both boxes to fit small brass machine screws, place the shaft into position using a level to get it straight, turning the screws in or out until it is level. The usual methods adopted by workmen to prevent molten metal from running out the bearing ends should then be taken. Turning the screws as needed enables very quick work to be done. The shaft may be then removed for warming and put back into place on top of the screws with an absolute certainty of its being level. These brass screws ought to be left in altogether after pouring of the hot metal, as they prevent the threads in the cast-iron retaining shells from getting filled up with babbitt, thus making rapid work possible in replacing new bearings when the old ones are worn. The screws are easily removed when the bearings are worn, as new ones will have to be inserted into the threads for each rebabbitting job when it is necessary.

Motor Bearing Formula

An extra fine electric motor lead base bearing metal babbitt which will run well in an atmosphere of from 90 to 100 deg. Fahr., and give the least amount of trouble in operation is appended. This metal is made out of a mixture of lead and antimony combined with a small amount of tin. Lead and antimony are metals that have a chemical affinity for each other, which property causes them to combine in all proportions without any impairment of the anti-frictional qualities of either. The antimony also confers hardness to the lead, thus enabling it to stand a high rate of speed in a factory without abrasion and heating of linings taking place provided that care be taken by workmen in pouring the hot metal, etc, and dirt is kept out of all all bearings during operation of the machine.

Babbitt bearing formula for electric motor operation in a 100 deg. Fahr. atmosphere:

450 lbs. lead.
155 lbs. antimony.
6 lbs. tin.

It must not be inferred from the foregoing that the above babbitt is only suitable as a bearing lining for machines working in a warm atmosphere, as a matter of fact, it will be found to be of great service for motors and dynamos running in ordinary locations. Should any additional toughness be desired, the tin can be replaced by an equal amount of copper, although it will be found that this metal is tough enough to give good results without any copper.

Judging the Quality

In judging the quality of any babbitt whether it is bought ready made or manufactured on the premises, a good shop way of sizing up its excellence or otherwise, as the case may be, is to examine a bar's fracture when broken. First-class metal should show a fibrous fracture [illegible] white oxide patches. If any bar's fracture contains such patches it denotes that it has been poorly made and is worthless in regard to giving good service in bearings. As a general rule a babbitt with a large tin content will show a lighter surface when broken, as contrasted with a lead base one. All babbitts will also "streak [illegible] more or less, if they are pressed hard enough upon it. However, those that contain the most lead will make the blackest mark. This is a rough shop test for lead contents.

Selecting the Grade

As a guide in selecting a grade of babbitt for any type of machine regardless of whether their parts operate with a jerky motion or otherwise, it is best to get a very tough metal, one having a tin base proves excellent. A mixture composed of 85 per cent. tin, 6 per cent antimony and 4 per cent. of copper will give good service in places where a constant shock is imparted to the bearings. To find out if any babbitt metal is tough or hard, whether it is made upon the premises or purchased ready made hammer a cold bar back on itself until it assumes a U shaped form. A tough metal will show no cracks under this treatment. It ought not to dent easily and will ring when struck against a piece of other metal.

Class of Service

Another point that many factory managers overlook when buying a ready-made metal is that they fail to state to a manufacturer the purpose for which it is intended, and when they find it to be unsuitable they put the blame upon its quality as being N. G., when, as a matter of fact, it is really their own fault as they should have stated what it was to be used for. The writer ran across a case like the above a number of years ago when the bearings of an engine were babbitted with a ready-made article which proved not adapted for the purpose and ran badly, causing considerable trouble. The engine was rebabbitted with another brand and gave no further trouble. The remaining bars from the first lot were laid aside and later on used by the millwrights on another machine, the condemned metal giving good satisfaction in regard to wear. Unless any executive is thoroughly familiar with the varieties of babbitt marketed, and their adaptability for different classes of machinery, it is better policy on their part to state to a manufacturer what class of machinery it is to be used for, giving him details as to speed, etc.

Placing Responsibility

This procedure puts the matter of responsibility upon the maker as to the wearing qualities and gives him a chance "to make good" his advertising assertions, such a course being "fair and square" to all parties, as it avoids injustice to a manufacturer's product, which may be a high-grade article but performs badly on machinery to which it isn't suited. It sometimes occurs during the making of babbitt that small particles of copper and antimony amalgamate into hard pieces; these are generally no larger than a pin head in size, they possessing the property of a fairly hard steel. Sometimes they are located upon a bearing's surface, at others are a short distance under it. As the babbitt wears away these particles are sure to score the shaft. Long continued heating and stirring at a proper temperature will cause them to mix with the other ingredients and do away with this annoyance.

Main Shaft Bearings

There is one class of bearings in factories which are subjected to the roughest kind of usage, and that is line shafting with its rows of pulleys belted to a number of machines. As it is an impossibility to keep all of the belts at the same driving tension it naturally follows that some hanger bearings will have a greater pressure exerted upon them than the others, with excessive wear taking place on their bearings. Besides this disadvantage, these bearings always collect dust to a more or less extent, which stops oilholes in fast and loose pulleys and makes hot bearings. In order to reduce such trouble to the lowest possible extent, experience indi-

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Tension and Working Strains of Belt Fasteners

Value as a Transmitting Medium—Only Fraction of Actual Strength of Belt Needed for Delivering Power—Various Grades of Belts Considered—Maximum Load on Fastener

By ERNEST D. WILSON, B.Sc., Ph.D.

THE VALUE of belting for transmission work is determined by its gravity and its horse power transmitting qualities rather than by its tensile strength. If this were not so, it would be comparatively simple for a belting manufacturer to combine certain materials and produce a belt with a tensile strength far beyond any at the present time on the market, but such a belt might have little or no value as a power transmitting medium. It is very interesting to note that in no case, in a very large series of tests conducted by the Mellon Institute and at Cornell University on power factors with the power transmission of belts, has a tension of over 1,000 pounds per square inch been obtained, even under loads several hundred per cent. larger than the rated capacity of the belts. Since the tensile strength of most belting materials is almost invariably more than 3,000 pounds per square inch, it is evident that only a fraction of the actual strength of the belt is needed for transmitting power.

The same thing applies to belt lacing. If strength alone were desired, a fastener could easily be designed which would never let go, but it would have little or no value as a practical belt lacing. Belt lacing should be sufficiently strong to carry maximum loads with a reasonable amount of safety. It should be durable, flexible, smooth on both sides, and should not injure or weaken the ends of the belting. Even though the use of belts to transmit power is very common, few people have a clear conception of just how and why they do transmit power. In studying the strength required of belt fasteners, it is necessary to clearly understand the mechanism and the stresses involved.

Author is consulting engineer of Clipper Belt Lacer Co., formerly of the Mellon Institute, and Chief Engineer Graton and Knight Mfg. Co.

Effective Tension

Consider a belt placed over a pulley and drawn tightly against the pulley surface. If one strand of the belt is pulled harder than the other, either the pulley turns or the belt slips over the pulley surface. The sum of the tensions on both strands of the belt measures the force with which the belt is held against the pulley face and also the friction load on the bearing. The difference in the tensions of the two strands measures the turning force applied to the pulley, and is often called the "effective tension."

As the belt is turning and transmitting power it is easy to see that the highest tension in the belt is the tension of the tight strand and any fastener must be capable of withstanding this tension, with a fair margin of safety to spare. The question then becomes, "What tensions may we expect in a belt carrying its normal load?"

Ratio of Tension Between T. & L. Strands	Effective Tension or Pulling Strain	Tension in Tight Strand	Tension in Loose Strand	Total Tension causing Bearing Friction
6 to 1	60	72	12	84
5 to 1	60	75	15	90
4 to 1	60	80	20	100
3 to 1	60	90	30	120
2 to 1	60	120	60	180

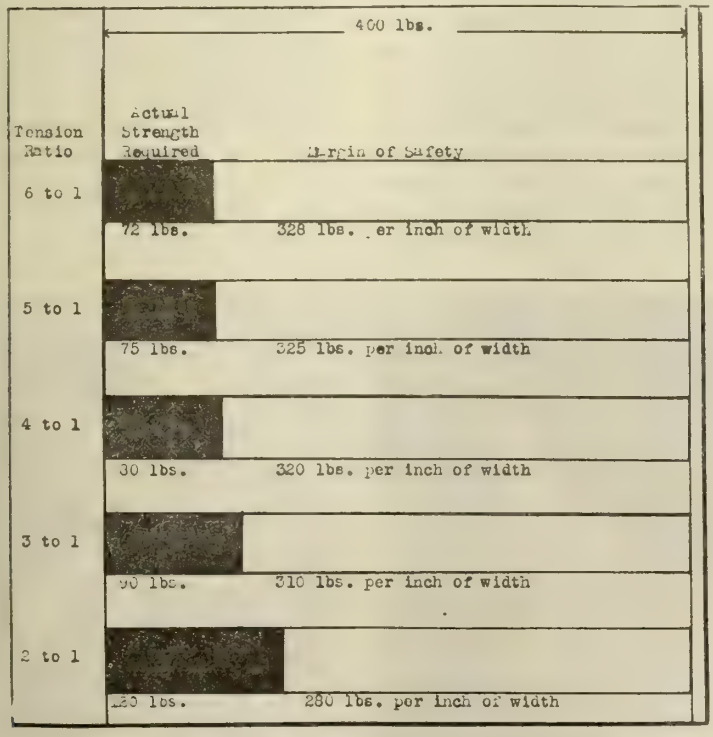
Surface of Belt

The poorer the surface of the belt, the lower is its power-transmitting capacity, and the higher the tension must be to transmit a given amount of power. Belts with good surfaces run constantly with the slack strand actually sagging and show a tension of from ten to twenty times as high in the tight strand as in the loose, whereas when a belt will only allow two times the tension in the tight side as in the loose (which unfortunately is sometimes the case) it is a very poor belt indeed, and has an extremely poor surface.

In the following table the tensions developed with belts of various grades are considered. In each case the belts were run under an effective tension of 60 pounds per inch of width, which is about the maximum recommended by the manufacturers for single leather or four-ply canvas or rubber belt.

In the table given each line shows the tensions which would exist in belts of varying quality as to surface, all 1 inch wide traveling at the same speed, and transmitting the same amount of power. In the second case shown where the tension in the tight strand is 75 pounds, the slack strand carries 15 pounds, and the belt forces the shaft against its bearing with a force of 90 pounds. Contrast this with the extreme case of ratio of two to one. The tight side of the belt must withstand 120 pounds pull and the

(Continued on page 38)



Total strength of efficient belt lacing in a one-inch belt. Black area shows proportion actually required to transmit rated h.p.

Form of Gear Blank Affects Efficiency of Drive

Shafts Should be Rigid and in Proper Alignment—Stiffening for Shock and Vibration—Shape and Number of Spokes—Convenience in Casting Gears—Cooling of the Metal

By CHESTER B. HAMILTON, Jr., B.A.Sc., M.E.

THE FORM of the gear blank chosen by the designer of the mechanism has a great influence on the ultimate success of the drive. Another important item which, however, does not lie within the field of the present discussion, is the rigidity and alignment of shafts and bearings which carry the gears. Springy shafts, badly over-hung mountings or bearings in bad order will greatly reduce the effectiveness of any gear drive.

Small Pinions

(a) If a pinion must, on account of the ratio, be very small in comparison to the size of its shaft, it may frequently with advantage be cut solid on the shaft. The thickness of metal over the key way, measuring to the bottom of the nearest tooth space, is usually the deciding factor. The stock from which the combined shaft and pinion are turned would practically always in such a case be a steel forging. It is preferable that the root diameter of the pinion be not smaller than the shaft in order that the cutter may pass through and clear the shaft. The minimum limit is when the outside diameter of the pinion equals the diameter of the shaft. This construction, of course, weakens the shaft seriously. The limiting condition for no weakening of the shaft is with the pitch diameter of the pinion not smaller than the diameter of the shaft. In any case, where the root diameter is less than the shaft diameter, the cutter must be sunk into the work to the proper depth before feeding it along the tooth. This applies in all cases, no matter which process is used in forming the tooth, and the machine designer must provide space between bearings for this additional cut-into portion of the shaft, the length of which varies with the process of cutting used. If the space between bearings is great and the pinion considerably larger than the bearing diameter, it is advisable to make the shafts conical, tapering from just below the root of the teeth down to the bearing diameter.

Annular Groove on Face

(b) The great majority of pinions are in the form of plain cylinders with a bored or broached hole. A better form for all but the smallest is with annular groove on each end face, occupying the space between what would be the outside diameter of the hub and the inside diameter of the rim on a gear. This makes an appreciable difference in lathe time, especially on quantity work where two tools can be working at once.

Webbed or Disc Form

(c) This form of construction carried further in gears of larger relative diameter becomes the webbed or disc form of gear blank. For heavy work subject to great shocks and vibration and not too large diameters this is a very economical type. If the face is wide or the hub long, it may be stiffened by a number of triangular gussets or braces arranged at intervals. The fillet between the web and the rim, and particularly at the hub, should be very much larger than usual if full advantage is to be taken of the strength of this type of gear. The inner surface of the rim should be as nearly cylindrical as possible, with minimum draft, or the lathe department will have trouble chucking such a casting. On medium or heavy work, four or six holes in the web, two or three inches in diameter or more according to size of gear, do not weaken it and are a great help in handling and bolting to face plate. In large work the holes would, of course, be large enough to pass a sling chain.

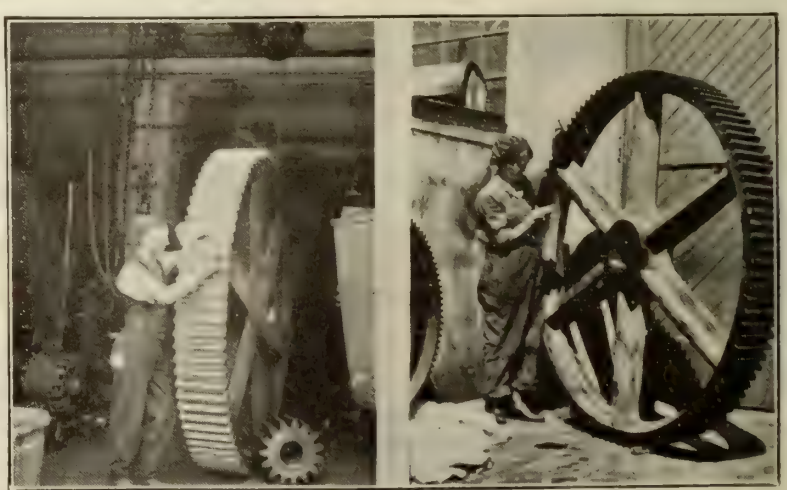
Spoke Size and Shape

(d) Most gear blanks are spoked. The spokes may be of many forms and numbers according to purpose and size. The number of spokes is usually six for small and medium gear and eight for large. The number of spokes is somewhat related to the number of teeth, for if the pitch is less the thickness of the rim will be less, and a thin rim, relatively to the diameter, calls for more points of support. British draftsmen very frequently use five arms, but the logic of this choice is difficult to see, for the number of jaws in chucks and the number of slots in boring mill tables is always a multiple of two or three and never of five, so the odd number of arms is liable to make trouble in chucking, especially when wide arms and large fillets are used.

Factors of Strength

Curved arms, intended to spring to take up shrinkage strains, were formerly much in vogue but are seldom seen now. One reason is that modern machinery averages much heavier in cross sections, relatively to diameters, than formerly, and the modern designer depends on correct proportions to prevent undue cooling strains in the foundry. In the form of transverse section of the arms the draftsman has a range of choice. Most arms are of elliptical section with the long axis in the plane of rotation. While it may be argued that this is not the most economical distribution of the metal for strength, the reason for its adoption is that a more economical form would distribute the metal in thinner section and it would cool too rapidly and pull away from the rim. This refers to the average gear. The "H" and "I" sections are commonly found in large heavy-duty gears, but it is to be noted in these cases that the economic section was not attained by spreading out the metal there would be in an oval into thinner sections, or not much so, but mostly by adding more metal to carry the greater load or shock, and adding it in the most advantageous position.

An arm in the form of a cross is us-



Left: large gear with H-shaped spoke. Right: Large gear with spokes of cross section.

Author is President of the Hamilton Gear and Machine Co., and a member of the American Society Mechanical Engineers; Engineering Institute of Canada; Society of Automotive Engineers; American Gear Manufacturers' Association, Steel Treating Research Society; Standardization Committee of A.G.M.A.; Member of Canadian Engineering Standards Association.

ually a confession of a desire for a cheap pattern, though not always. The "H" arm has the disadvantage that it will not draw out of the sand. Otherwise, it is the best for wide face gears, applying the force to the rim at two points instead of one and working in well with the provision of two circular ribs around the inside of the rim which is an advantage. This class of wheel is usually cast with six or eight segmental cores between the arms. The "I" section arm is suitable only for narrow-face gears, as it is weak laterally unless the two parallel portions are made quite wide. This works in only with a single rib inside the rim, which, again, is suitable only with a thick rim, stiff in itself, and a coarse pitch. This, then, is the field of the "I" arm. A condition under which a modified cross form would be suitable arises when the "H" would be too expensive to mould, the "I" stronger than necessary if made heavy and thick enough to avoid cooling strains, and the oval section not strong enough. Then a cross with extremely heavy fillets making it resemble an ellipse with re-entrant quarter curves, would be good practice.

Ring Gear

(e) The ring gear is simply the rim of a gear, integral with which are lugs or flanges, extending inward or outward, by which it is attached to the other portion of the mechanism which carries it. For a wide-faced gear there may be two flanges, and it may be mounted on a pair of spiders, or one spider, or on a drum, or against the side of another wheel. It is essential in the production of ring gears that the faces of the flange which are to act as locating faces, are known, and the teeth made accurately to these faces without regard to any others. Ring gears should be mounted with fitted bolts, in holes reamed after assembly, except small ones, which may be riveted. The bolts should be drilled and provided with split pins or wired in pairs.

Internal Gear

(f) Each kind of gear so far considered in this section has successively less metal within the circle of the teeth. Carrying this idea a step farther, the next class is the internal gear, which has all the rim metal outside the teeth.

In the preceding five sections only differences of form of body have been considered, but with the internal gear the form of gear and the tooth action are so inter-related that it is difficult to consider one without the other. The internal has a number of advantages over the external. First, on account of its form: the pinion being inside the gear it is located at only a fraction of the centre distance from the gear axis that would be needed for the external arrangement. The gear forms its own guard for the protection of the teeth, and can be shrouded to completely cover both ends of the teeth, leaving only a hole on the pinion drive side of diameter equal to twice the centre distance plus the pinion shaft diameter, plus clearance.

As the internal gear curves toward the pinion teeth and the external curves away, it is obvious that the arc of contact is greater with the internal. This gives greater strength, particularly with small pinions. There is also less shock and noise as the teeth enter engagement, and less friction and wear while in mesh, but these and some other advantages are due to the peculiar tooth action, and need not be elaborated in this section.

DEMAND FOR NEW DESIGNS

(Continued from page 15)

who need goods badly are now paying premiums to get them.

"All these things make it desirable not to book too far ahead at fixed prices. Cost conditions on the one hand, and demand conditions on the other will have quite an influence on future prices.

* * *

"**Equipment**:—The amount of movement in machine tool orders indicates that customers are beginning to look ahead. Demand is not yet so strong, however, as to show any great shortage in equipment generally. There is probably enough equipment of the ordinary type as a hang-over from the last boom. But labor shortage will create a demand for more productive equipment, as we have pointed out right along. New designs of high production machines are now getting most of the limited business that is coming out, and the chances are good for them to continue to do so. The old designs will not sell as well as they have heretofore, and those who have newer designs and put a stiff push behind their selling are now getting a good increase in business."

INADEQUATE RAIL SERVICE

(Continued from page 19)

due to the policy of the government regulation which has greatly reduced and narrowly restricted the net return earned by them. This reduction and restriction of their net return has driven new capital from them. Unable to raise new capital in relatively as large amounts as in former years they have been unable to develop and increase the capacity of their properties as formerly. Under the Transportation Act they were assured in 1921 a net return of six per cent. Business fell off, expenses were high, and they earned and received only 3.3 per cent. Under a ruling of the Interstate Commerce Commission it is now held that they are entitled to earn 5¾ per cent. Thus far in 1922 they have earned 4 1/3 per cent. They never can raise enough new capital adequately to develop their facilities until they earn a much larger net return. With the large increase in business that is now occurring and the shop employees' strike behind them, they probably can soon begin to earn the 5¾ per cent. to which the Commission says they are entitled But how long will it be after they begin to earn it until there will be another wide-spread demand for general reduction of freight rates?

Not Question of Rates

"The public long has been told that the railroad problem of this country was ceasing to be one of rates, and was becoming one of lack of transportation. The public, however, has insisted in regarding the problem as chiefly one of rates and in consequence cannot now get, and for a long time will be unable to get, anywhere near enough transportation. It will lose many times more in a short period by this lack of transportation than it has gained in the last ten years by keeping rates on a basis which has almost stopped railroad development.

"Do not in this crisis denounce the managements of the railroads. The farmers and business men and the regulating authorities who have done what the farmers and business men have demanded are the people who are responsible. There is no immediate remedy for the present transportation situation. It must be borne as best it can. It can be remedied in time by the adoption of a wiser and fairer policy which will let the railways earn the net returns they require in order to furnish adequate service. There is no other remedy under private ownership, and very few men wish to take a chance with government ownership."

SELECTION OF BABBITT

(Continued from page 20)

cates that a specially compounded shaft metal is better for all-around use on shaft hangers than some of the formulas given for other types of machinery. Appended is a formula of a good-wearing babbitt for this purpose.

Babbitt formula for lines of shafting:

15 parts antimony.
90 parts lead.

Some mechanics add phosphorus to the babbitt with the idea that it will cause this metal to adhere better to iron shells. Phosphorus has the above effect, but it also has the drawback of making it flow very sluggish when pouring and makes the casting full of blowholes. On this account phosphorus should not under any circumstances be added to babbitt as it is a detriment instead of a benefit. When the simple rules for doing babbitting, as given in this article, are followed, neat and clean castings will be the result regardless of the grade of metal used.

BOOKLET

The Backbone of Automobile Service is the title of a small booklet recently distributed to the trade by the Jacobs Mfg. Co., of Hartford, Conn. It has been prepared with the assistance of many prominent machine tool builders, and it is intended to promote a more general appreciation of the importance of adequate shop equipment in the service station.

Business Papers Have Inspiring Field for Service

Their Duty to Preach Gospel of Progress Through Common Effort and Thought—Bring Business Man Into Touch With National Problems—Supply Him With Facts for Sound Conclusions

THAT they have a great and inspiring opportunity for service; that they are in a position to influence business thought and to direct it into proper channels; that they can bring home to industries their dependence upon each other, and their interest in the progress of the country as a whole—these were the duties and responsibilities which Lewis E. Pierson, chairman of the Board, Irving National Bank, declared business papers must recognize in any united effort looking to better business. It was, in fact, on this question of unity that he addressed editors of American and Canadian business papers recently at their annual convention in New York.

"Over a period of seven years," Mr. Pierson said, "business operated under conditions which were unhealthy because they were temporary and abnormal. The long period of expansion established false standards for labor and capital alike, and the abrupt transition to the depression of 1921 bred discontent and dissatisfaction among labor, and induced caution approaching timidity among industrial and financial leaders.

Encouraging Reaction

"Perhaps never in our history was the change from prosperity so sudden or severe.

"Examination of the facts and figures now available for the present year shows an encouraging reaction. Turn to the reports of industrial earnings, to the volume of business done, to bank loans, to investment buying, to stock prices, in short turn to whatever index of events you please and you will find that the present year has shown a distinct and encouraging improvement over the corresponding period of 1921.

"Then compare the results for 1922 with the results for the pre-war year of 1913 and the conviction is borne home that this country, after the vicissitudes of the war, is establishing herself on a new normal level of prosperity which in many respects is above the pre-war level. It is true that in some instances profits are still lacking, but wherever the question of expense and overhead has been intelligently handled, our industries are either showing profitable operation, on a basis equal to our above the pre-war standards, or indicate that they are rapidly working into a position where profits will come shortly.

"Do not misunderstand these indications or these results as the precursors of a sudden revival of boom times. Do not imagine because we have successfully weathered one storm that the need for caution and patience has passed."

The speaker maintained that, in spite of the fact that the air was full of panaceas which proposed to solve existing problems and bring the world to a plane of greater prosperity, the man or nation that relied for a cure-all on anything but work, patience and still more work, was headed for disappointment.

"To make that work more effective should be the common aim. We cannot legislate our business into a state of blissful prosperity, but we can, and should endeavor to improve, wherever possible, the machinery of business. In that endeavor the first object should be to stabilize our business processes.

"The nearer we can come to a situation where our industries will proceed on a settled, and established level, and where the inter-relation of the various factors of our national business will be thoroughly fixed and universally understood, the better we shall be equipped to meet and deal with whatever new situations may arise.

"Sudden bursts of good times followed by abrupt periods of depression are not calculated to increase the real prosperity of a nation. They indicate that there is something wrong with the processes of national business and argue a weakness in the nation's economic structure which should be corrected.

Business on More Even Lines

"If we can arrange our affairs that the chart of national business will show a more even line, if we can fill in the hollows, and make the peaks less abrupt, it will be possible to plan our progress more intelligently and execute our program more surely.

"The business man has come to realize that the more evenly business is conducted, the better it is for everyone. And the obstacles to that orderly progress spring from a common source. Cast back over the causes of depression, over-production, strikes, ill-advised legislation, reckless competition, and you will be led to the conclusion that most of our difficulties proceed from the failure of the country as a whole to secure a thorough understanding of our national problems or from the inability or unwillingness of various sections and classes of the body politic to work together for the common good.

"The farmer, for instance, in seeking legislation which will give him higher prices for his wheat, is too apt to forget that this immediate advantage may react upon him in the higher prices which the industrial labor, which eats his wheat, must have for the products of the factory

"The labor which advances its rate for building construction pays higher rent for its own quarters.

"The railroad worker seeking an increase in wages, thinks only of the immediate gain, without pausing to consider that he is at the same time increasing the price of every commodity that he uses, which the railroads transport.

Better Mutual Understanding

"Our greatest need, then, is for a better knowledge, a better understanding of each other's difficulties, of the underlying economic laws which regulate all business, and a greater readiness to work for the general good as the surest means of promoting individual welfare.

"If we can reach a point where there is general agreement on our national problems, and where we can bring th full force of an intelligent public opinion to the solution of these problems, we can stabilize our national business.

"If we can secure a crystallized national thought which will not hunt for vague panaceas, for prosperity through legislation, for any of the artificial expedients which attempt to over-ride the inexorable laws of economics, but instead will seek progress through intelligent effort and moderate but steady gain we can look confidently to the future.

"In the creation of this national attitude, the business papers have a great and inspiring opportunity for service. Reaching, as they do, the industries of the country, they are in a position to influence business thought and to direct it into proper channels. They can bring home to our industries, their dependence on each other, and their interest in the progress of the country as a whole.

"Week after week, and month after month, they can preach the gospel of progress through common effort and common thought. They can bring the business man into touch with all the national problems which affect him profoundly though indirectly. They can supply him with the facts which will enable him to form correct conclusions not only on his own business but on the business of the country as a whole.

"Finally they can throw their great influence toward the achievement of industrial understanding which will do for industry what the Federal Reserve system has done for finance.

"Until the creation of the Federal Reserve System the country was torn from

(Continued on page 38)

Practical Ideas From Practical Men

CARE OF TURRET LATHE TOOLS

By Harry Moore

Turret lathe tools, for various reasons, have a much shorter life generally than tools used around an engine lathe. Take, for instance, the chucks, universal or independent. It is a much more difficult operation to remove one of these from the spindle of a turret lathe than an engine lathe, chiefly because there is never the same amount of room to work in. Thus many turret lathe chucks receive hard knocks which they are unable to stand, and their accuracy is destroyed. A simple device can be made up easily for this particular job. This consists of a short piece of round stock about 2 in. dia., through the side of which is drilled a 1-in. hole to take a bar of this size which is tightly driven therein. The short piece is gripped tightly in the chuck and the bar brought down sharply on a hard wood post resting on the floor. Another thing frequently seen on the turrets is the badly pitted condition of the tool holes, the result of numerous slips when driving in tight holders. This is bad practice indeed, no holder or tool should require driving into the turret hole; if a slight tapping with a lead hammer is not sufficient to place a holder, the shank of the holder should be inspected for burrs, lumps, etc., and the hole in the turret thoroughly cleaned.

In Fig. 1 a hollow mill holder is shown that can be used in many cases with a big reduction of the percentage of broken mills. The holder is bored deeper than usual so that only the face of the mill A protrudes, a hole B drilled in the bottom allowing the free exit of any chips that may work inside. Fig. 2 shows an ordinary taper shank tool holder furnished with two hardened pins A-A at the front. A holder so fitted is spared the knocked and bulged condition resulting from resting the front of the holder on the vice jaws, etc., when knocking out stubborn shanks, or shanks with broken tangs. Very often more tools are required on a job than the turret can accommodate, which means that two must be used in one hole, being removed when finished with. To avoid tightening up such spare holders, an eccentric groove A should be cut in the shank as shown at Fig. 3. The tightening screw B in the turret need then be only adjusted by hand, which means a considerable saving of time in placing and removing the holder. It will be seen that the shank tends to tighten itself automatically when the tool is cutting and is prevented from being pushed by, into the hole, by the same groove.

The flat cutter holder shown at Fig. 1 is fitted with an auxiliary collar, screw and locknuts. It is sometimes impossible to get this kind of tool to work right unless it is set in a certain position. This may be right side up, or upside down, or to the right or left at an angle; this peculiarity preventing the use of a flat on the shank to keep the tool from turning under the cut. For this purpose the collar A is used: It is held to the holder by screw B, and afterwards nuts E E and tightened and locked on the turret top as shown. Thus, any position the holder may be in at the time is fixed without relying on the regular screw in the turret, which, if tightened onto the bare shank of the holder with enough force to keep the latter from turning would soon roughen the surface quite sufficient to spoil it.

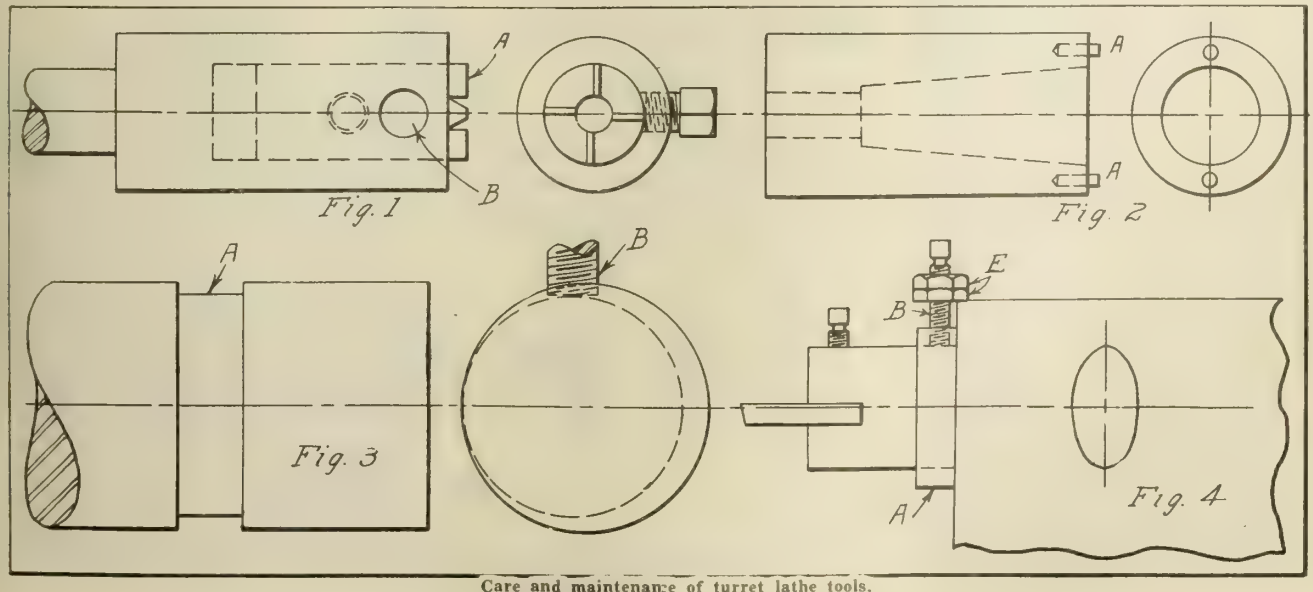
BUSHINGS FOR THE ARBOR PRESS

By D. A. H.

Most arbor presses come with a slotted plate having about four sizes of openings in it. Where arbor presses are not used for lathe work—and there are thousands of them in use on assembling or disassembling operations—the slotted plate has its disadvantages. It swings around, though this may be overcome by a pin or screw; the slots are just a little too big or too small; and the slots present only a half bearing or less to the work, so that it tips and it also results in rapid abrasion of the face. To try to press a piece in or out, have it line up square and true, and not bend anything under such conditions is almost impossible.

In our shop, we have removed this slotted swivel plate. In its place we have a casting permanently fastened. The center of this casting has a hole clear through and recessed about two-thirds of the way down from the top, leaving a shoulder from ¼ in. to ½ in. wide according to the size of the press.

If the press is used exclusively on one job, there is a steel bushing tightly pressed in that hole and left there. It offers a square working surface for the job and supports the work right up to the shaft or pin being pushed through the center. Presses on general work have sets of bushings made up for them—bushings that can be removed with the fingers and with the bore made 0.005 in. larger than a nominal size, such as 0.505 in, 0.755 in., etc. The time saved and the avoidance of spoiled work will pay for this equipment in a short while.



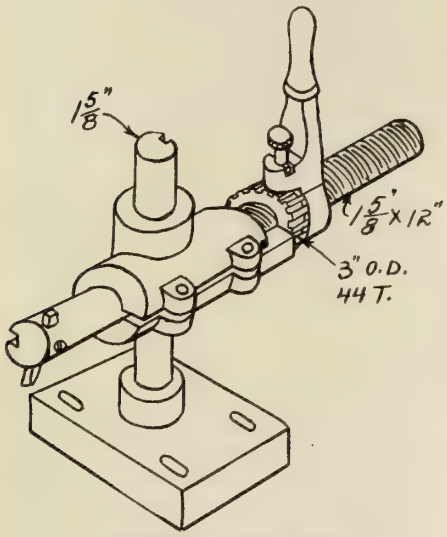
Care and maintenance of turret lathe tools.

COMMUTATOR TURNING DEVICE

By D. A. Hampson

There were quite a number of direct current dynamos and motors in our vicinity and it fell to our lot to true up the commutators when in bad shape. Besides the larger ones, there were even more of 1 h.p. to 5 h.p. size but these latter were dismounted and the armatures removed for putting in the lathe. It is of those that were more advantageously trued up right in position that we will here consider.

We had an 18-in. planer that wasn't used much and we frequently took the cross rail off, trucked it to a plant, and



Commutator turning device.

turned the commutator at night or on a Sunday, using the cross feed for turning, the vertical feed for positioning the tool, and blocking the entire rail up to bring the tool on a center line. These jobs came so numerous and the time spent changing the planer being a dead loss (for the customer) that we made up the portable device shown by the drawing.

This has a flat cast iron base which is attached to some part of the dynamo pedestal, either by tap bolts or through bolts and a clamp. Where we could not conveniently do this, we got permission to put in two or four holes to fit our slots. The upright post shown permits a wide range of adjustment in that direction for the saddle which is bored a close fit and supplied with key and set screw.

At right angles to the vertical post, is the tool shaft and bored hole to fit. For this, the casting is split and binder screws put in, making it possible to snub up as tight as the tool shaft can be fed. The far end of the shaft is cut with a 12 thread screw long enough to permit a movement of 9 inches. A steel nut is made a close running fit on this thread and has ratchet teeth cut on its periphery, to be engaged by the pawl set in the cast iron handle whose hub also rides on the threaded shaft.

An extension of the saddle casting is bored so the steel nut may be dropped in the recess and one half of it is cut away as shown. This provides the stationary member from which the feed movement is obtained. The tool shaft is splined full length. The cutting tool is held by a set screw at the near end. This device is easily portable, can be set up in less time than a machine tool slide, and its use does not tie up a machine. In the six years of its use, it has paid for itself many times over.

REPAIRING GASOLINE TANKS

By C. Howard

Should a gasoline tank, or can which has contained gasoline, need repairs for which a soldering iron is to be used, great care is necessary in charring the container of any gasoline fumes which may be in it. If extreme care is not exercised there is a possibility of an explosion occurring. Gasoline fumes being heavier than air will remain in any container for a considerably length of time even though it has an opening to the air. There are several methods of clearing away such fumes of which turning the tank with its opening to the lowest point and leaving it so for several hours is perhaps the easiest. Another way is to subject the container to indirect heat in a similar position to that stated. It is advisable however, to keep the blow-pipe as far away as possible.

TEMPERING TAPS AND REAMERS

By C. H.

A very good way to hold a tap or reamer when drawing the temper is with threaded or fluted end in a roun pair of tongs, the squared end to the flame. Draw the tool to the proper degree of heat at the point. When drawn to the proper color quench it in oil or lukewarm water, this gives the cutting end of the tool the necessary hardness to stand up under the cut and the shank the strength and toughness necessary to prevent it from breaking. For tapping or reaming cast iron draw to a light straw and for steel draw to a light brown.

REPAIRING AN OLD LATHE HEADSTOCK

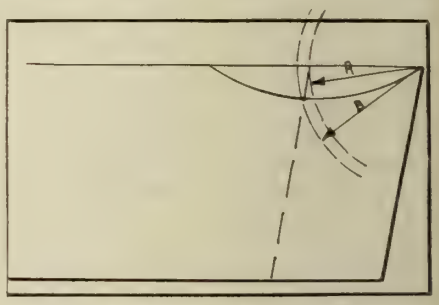
By G. Blake

The writer had to overhaul the headstock shown in the accompanying sketch and this is how it was effected: the headstock was for a 3 in. centre, hand turning lathe for wood and metal. The back stay consisted of a screw with lock nuts, and pointed at one end similar to an ordinary lathe centre and engaging in a female centre in the lathe mandrel. With constant usage the male centre began to wear away and it would frequently seize up after being adjusted to take up end play. The female centre in the lathe mandrel was trued up again and a new back centre was made, only instead of a male it was made female and a ⅜ in. dia. steel ball was inserted as shown in the sketch. The ball provided a much better thrust bearing than the male centre and the lathe spindle ran much easier and without any shake as it had less friction to overcome.

GRINDING KINK FOR THREAD CHASERS

By G. B.

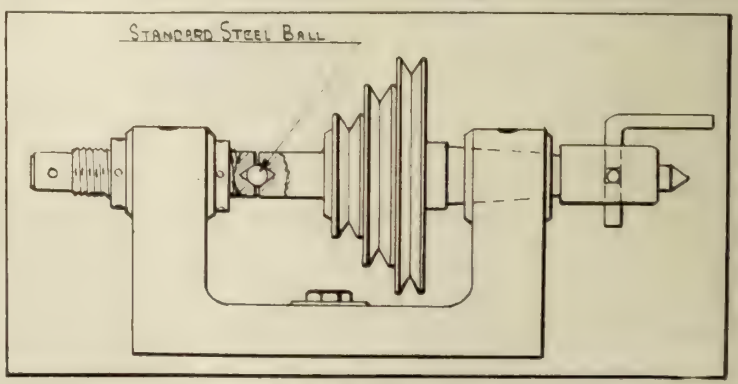
It is somtimes desirable to cut a thread slightly deeper than the standard, and it is a very easy matter to do this with a single point screwing tool, but the result will be a thin thread, diameter reduced on outside work, dia-



Kink for thread chasers.

meter increased on inside work and a poor fit on the mating part.

It is quite possible to cut a thread deeper than the standard and not affect the diameter or thickness of the thread by means of a chaser ground with a lip as shown in the sketch. The maximum or standard depth is shown at A, before the tool has been lipped. The increased depth over the maximum is shown at B. No further explanation is necessary as the sketch shows very clearly how the increased depth is obtained without sacrificing the thickness of the thread.



Repairing an old lathe headstock.

New Things in Shop Equipment

SUNDSTRAND STUB LATHE

The Sunderstrand stub lathe, though primarily designed for piston turning, may be adapted to a varied line of production. This machine, which has been placed on the market recently, is of unique design, the carriage ways being integral with the unusually heavy headstock. The bed is well ribbed and braced throughout. The spindle is of ample size and runs in phosphor bronze bearings well lubricated with wick feed from an oil reservoir. Front spindle bearing measures 6 by 4¼ by 3¼ in., rear bearing 3⅜ by 4 in. Take-up for both bearings is adjusted by means of a single nut at rear of spindle. Spindle nose is 4 in. in diameter with two threads to the inch. Spindle is driven by heavy bronze wheels and worm provided with ball bearing thrust to eliminate friction, and geared to 3 to 1 reduction. Gears furnished with lathe give spindle speeds as follows: 40-50-65-85-110-145 revolutions per minute. Provision is made for mounting an air cylinder and a quick acting draw back.

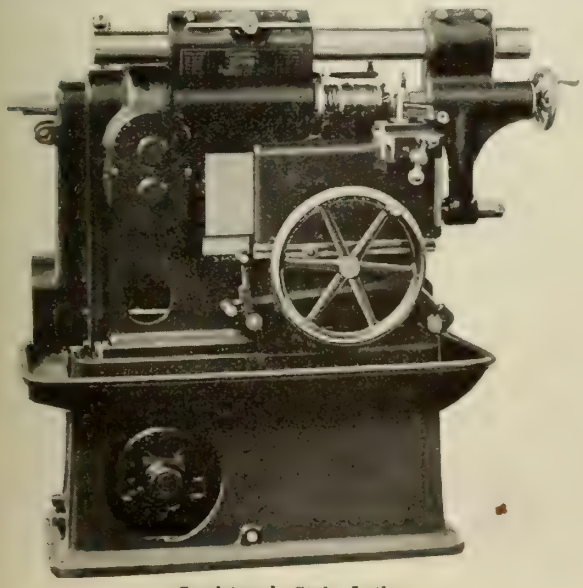
The feed is driven from the spindle by chain and pick-off gears located at headstock end of machine, and standard gears furnished with machine provide following feeds: .020, .030, .038, .050, .066, .090 inches per revolution of the spindle. Feed arrangement to carriage and rear tool is very simple, driven by worm through a large diameter worm wheel. Worm is constantly submerged in oil, and to engage the feed is lifted into worm wheel by handle conveniently located at front of machine. Worm wheel is keyed on pinion shaft that drives the carriage, no gearing required in the apron. On pinion or worm wheel shaft is a large hand wheel measuring 15½ inches in diameter.

The tripping mechanism consists of a dog on carriage which trips the feed lever and automatically disengages worm from worm wheel. This provides a reliable and accurate knockout, and a dependable one when working or facing to close diameters.

The carriage is 18 inches long with full length bearing surface on an 8 inch face at front of bed and 4 in. angular surface on top. An angular gib at bottom of carriage is provided to take up any wear, and adjustment can be made from front of machine. Front tool slide has stop screws underneath for tool adjustment, and slide is of sufficient width so that several tools can be clamped on at one setting.

The tailstock is extremely heavy and is clamped securely to the large overhanging arm and supported by means of a stud protruding from the bed. This method of supporting and locking tailstock insures rigidity and absolute elimination of vibration. A large diameter screw with a lead of 1½ inches to each revolution of the tailstock hand wheel is provided. Spindle is of sufficient diameter to withstand any tendency of spring, and has a longitudinal adjustment of 5 inches. Tailstock spindle bearing is split the full length and held in position with screws which may be adjusted to the wear of spindle. This feature does away with any chance of spindle being loose and causing chatter.

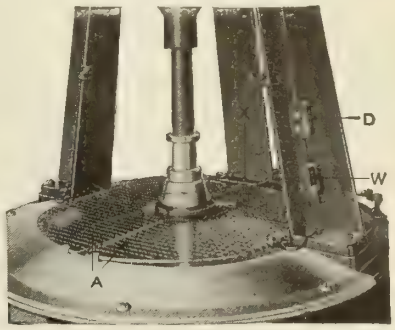
The 3½ in. dia. overhanging arm is so arranged that tools can be clamped on, as required, for performing several operations, including the facing and boring of the open end of pistons, centre drilling, etc. An adjusting rack is cut on the overhanging arm. Power is transmitted by motor direct. A 5 h.p. motor is regularly furnished, securely fastened on pivoted frame or plate inside the bed and entirely out of the way of operator. An adjustment is provided for belt tension. A friction clutch pulley is located at back of machine, mounted on roller bearings, with starting handle conveniently located for the operator when standing in position at front of machine. This machine has been developed by the Rockford Tool Co., Rockford, Ill.



Sundstrand Stub Lathe.

AUTOMATIC SAFETY GUARD

A safety device for self-balancing centrifugal extractors has recently been placed on the market. The guard consists of three essential parts. The hinged cover stands completely clear when open. The construction of the cover is such as to completely guard the basket and yet allow a clear view of the interior and permit a free passage of air to assist extraction. A loop is



Extractor Safety Guard.

connected to the belt shifter in such a way that the belt cannot be shifted by the handle and the power applied until the guard has been completely closed. A lock is placed on the spindle or shaft which automatically and positively prevents the opening of the covers until the basket has come to a complete stop. This lock makes it impossible for the operator to open the cover after shifting the belt while the machine is running or coasting. The lock is simple and so small as to offer no obstruction while loading or unloading the basket. New extractors may be ordered or guards may be applied to existing equipment. These guards are made by the Tolhurst Machine Works, Troy, N. Y.

HIGH SPEED MULTIPLE DRILL

A multiple drilling machine designed to give a centre feed over the drilling area has recently been developed and placed on the market. This particular construction provides for a true alignment of spindles and prevents the head from springing out of line from the drilling pressure. This also prevents the cramping of the head on the ways which is very important. In preventing the springing of the head, the friction between the drills and the bushings is eliminated, and thereby does away with the severe pressure, not only of the drills and connecting spindles but also with a needless strain on the feed mechanism and subsequently throughout the whole machine.

There are four optional methods of

drive:—three-speed cone pulley; three-speed change gear box, motor driven; three-speed change gear box, belt driven; direct connected variable speed motor. The main drive comes through the base of the machine, thence directly to the head gears. This avoids complication and tends to eliminate vibration. The feed is accomplished by means of a heavy ram which is directly above the center of the drilling area. The ram is moved by means of a pinion which is connected through the change feed gear box directly to the main drive of machine. The feed is driven by means of direct connected gears which operate the centre feed ram. For each change of speed, of which there are three, there are three changes of feed which vary according to different combinations from .0018 in. to .023 in. per rev. of spindle. These feeds are standard, but feeds either faster or slower will be provided to suit special requirements.

Heads of various sizes, both round and rectangular, can be furnished. These allow a liberal vertical adjustment of spindles and allow a center distance to be obtained equal to the diameter of the spindle itself. This arm is equalled by no other multiple drilling arm on the market. Universal joints are used not only on the multiple drills but are sold exclusively throughout the trade. The head is provided with an automatic safety counterweight catch which prevents it from falling in case of an accident to the cable. The capacity of the machine in cast iron is twelve 1 in. drills, or equivalent. Owing to the center feed construction, it is possible to make the distance from the center of the head of the face of the post considerably greater than as though the feed was directly from the post.

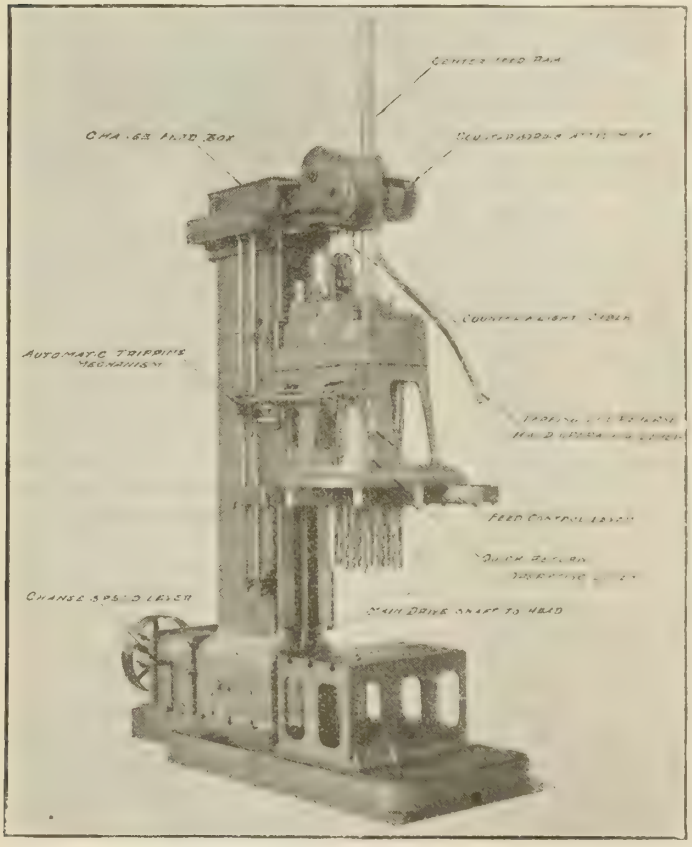
This machine can be built for tapping in addition to drilling. In the tapping model, back gears on the head for reducing the spindle speed are used. These can be engaged or disengaged while the machine is running. The operation of tapping is as follows: the operator brings the taps down into the work by means of the quick approach. Further downward movement of the head is then controlled by the lead of the taps in the work. At a certain point, the direction of rotation of the taps is automatically reversed. After the taps have cleared themselves from the work, the operator throws in the quick return and head travels quickly up to the starting position and stops, the spindles being automatically reversed ready for the next operation.

A feature of this machine is the ease of operation. It is equipped with a quick approach and return of the head operated by means of friction clutches in the feed gear box. The operator is thus permitted, by means of a conveniently located lever, to raise or lower the head at a fast speed. The head can come down at this fast speed until the drills come in contact with work, no care being necessary to prevent damage, since when the drills strike the work the friction clutches immediately slip. The power feed is then thrown in, and upon completion of the drilling operation the head automatically returns at fast speed and stops at the starting position. This quick approach and return feature is not an attachment but is built integrally in all machines of this model.

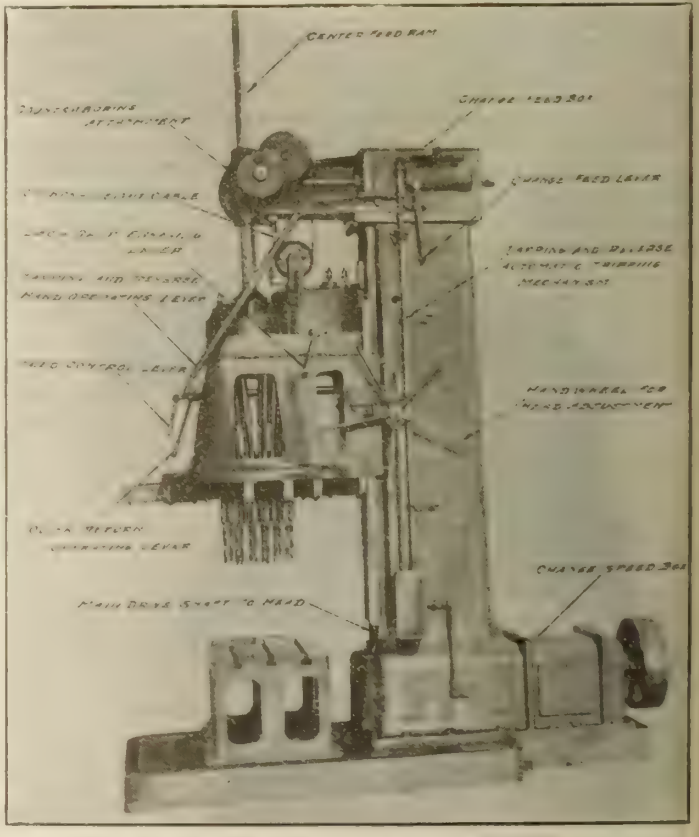
Roller bearings are used for shafts and ball thrust bearings wherever required. All driving gears are of steel and the machine throughout embodies the best materials and workmanship. The drill requires a floor space 3 ft. by 8 ft., 10 in. Extreme height 12 ft., 3 in. Maximum distance between spindles and table 45 in., minimum distance 20 in. Traverse of head 25 in. Drill requires 15 to 20 h.p. It is manufactured by the Baush Machine Tool Co., Springfield, Mass.

BENCH-TYPE MARKING MACHINE

A bench-type marking machine capable of marking four lines of 11.16 in. lettering on flat or cylindrical articles up to 2 in. dia. has recently been placed on the market. The marking is done by means of cylindrical steel marking dies. When working on flat articles the die rolls over the work, while on round pieces both the work and the die revolve. The pressure is applied from the top by a cam movement operated through rack and pinion. The slide is fitted with roller bearings and the table can be elevated by a hand wheel by steps of thousandths of an inch, and locked in position, thus permitting control of the depth of marking. It is possible to mark articles at the rate of 700 pieces an hour. The machine requires a bench space 10 x 12 in. and weighs about 60 lbs. It is made by the Noble and Westbrook Mfg. Co., Hartford, Conn.



Left and front view of multiple drill press.



Right hand side view of multiple drill

CANADIAN MACHINERY
AND MANUFACTURING NEWS

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Guiding Business By Facts

FACTS AND figures in business are essential to sound judgment. They are a guide in intelligent buying and they contribute to efficient selling. When properly used, they give to employees a better viewpoint and in that way make for more effective co-operation.

These points were emphasized in a talk to business paper editors by the head of a large manufacturing concern who has been a close student of cycles as revealed by the actual history of his company, and who has built up an advisory staff whose functioning has been based largely upon a systematic application of facts and figures as revealed by practical operation of the business. It was pointed out as an example, that, in an investigation of selling, forty per cent. of his actual time was consumed by the salesman in traveling, that something like fifteen per cent. was wasted in waiting to see the prospect, and that only fifteen per cent. was consumed in selling. This information was of value, not as a basis of criticism of the salesman, but as assisting in readjustments of territory whereby the salesman might work with greater advantage to himself and to the company employing him. The same use of facts and figures was applied in connection with the advisability of buying new equipment and in many other departments of activity. Not the least interesting feature was the gradual development of a system of charts which showed, at a glance, the movements or cycles that could, to large extent be relied upon as assisting judgment.

Some criticism has developed because of the apparent overstressing of the cyclical theory as applied to business. It is pointed out that serious depressions have been brought about because of propaganda which sought to establish recognition of the idea that, because business has been good therefore it must follow that a period of depressions will succeed within a certain period. This so-called fatalistic assumption, it is claimed, had caused a lot of trouble in the industrial world. The speaker, on the occasion referred to, claimed that he was no advocate of blind submission of cyclical recurrence, but maintained that the application of absolute facts to business might discourage the growth of abnormal buying orgies as occurred in 1920, and make for procedure along more rational lines.

Every industry is productive of statistics. These are of greatest importance to those directly engaged in it. Secondly they have a relative bearing upon other industries. This is strikingly so of basic enterprises such as steel, mining and lumbering. It is here that the statistical expert finds much material for deduction and for evidence of cyclical movement. This information is a great aid to judgment on many matters, but it is a question whether they are reliable as to operations of cause and effect within specific time limits.

Reader Interest is Essential

WHEN John Wanamaker, some years ago, withdrew his advertising from free-distribution mediums, it was because these had no fundamental reader interest. This was the finding after a deep study of the subject. It was the conviction that the man who subscribed for a newspaper or other publication, expected to find advertising in it and valued that advertising as in the light of an investment, as something he had appreciated sufficiently to pay for.

The opposite was the effect of the free-distributed product. Here the receiver had no primary interest in the publication; it appeared in unexpected places, without request, and had somewhat the status of an unexpected guest.

Then, as now, free-circulation mediums were found to recognize no responsibilities toward the problems attending the business or industry, offered no constructive service through their columns, had no means of developing helpful discussion, offered no interchange of news or views, and in short had no interest beyond that contained in their advertising pages and the revenue they represented.

Car Shortage Holds Up Industry

IN A RECENT discussion, in which word pictures of basic industries were featured, it developed that all of these had experienced marked improvement during the past six months, with the exception of shipbuilding, but that inadequate transportation facilities were acting as a serious handicap to the full development of prosperity. Steel ingot production, it was pointed out, was on a basis 70 per cent. and had shown a strong recovery from strike influences. Lumbering, mining, automotive, electrical and textile industries had shown good growth, but all of these were held back by what appeared to be chronic traffic congestions and car shortages.

These reports form a composite picture with agreeable foreground but with disconcerting perspective. It is the result of influences which have retarded railway expansion, and much of this has been due to government regulation. This is not so strikingly true of Canadian as of American roads, but the congestion of traffic across the line to-day is certainly such as to point a moral. Reduction and restriction of net return has driven away new capital. Up to the present time this year, the roads have not even earned the 5¾ per cent. to which the Interstate Commerce Commission claim they are entitled. Not long after they do earn it, there will be another call for rate reduction. It is a case where, in contending that low rates are the chief consideration, the public is inclined to lose sight of the essentials of service in relation to industrial requirements.

October Best Month in Two Years Say Steel Men

Prices Firm, Orders Showing Larger Bulk—Market Has Better Supply of Galvanized Sheets—Deliveries From American Centres Poor—Pittsburgh Reports Dullness—Inflation May Cause Depression—Pig Iron Easier

ADVANCE PREDICTED IN WROUGHT STEEL PIPE

PITTSBURGH reports a dull fortnight in the finished steel markets. Toronto and Montreal jobbers state that October, to the present time, has been the best month in two years, with prices firm and orders showing a larger bulk than was the case in the more reticent period of early summer.

Shortage of cars is an acute problem at the producing centres on the other side, but this fact cannot explain a falling-off in orders for extended delivery. This is due largely to existence of stocks. There are sufficient cars to prevent further accumulations, but hardly enough to move what steel has been piled up. While general conditions, therefore, have not been favorable to price changes, makers of wrought steel pipe have sprung a surprise by advancing prices $4 a net ton. Eighth-inch merchant pipe is advanced 2½ points, or $5 the ton. This is said to be the first important price advance that the Steel Corporation has made in six years that had not first been made by independent producers. While no announcement has been made by Canadian pipe mills, there is some likelihood that Canadian prices will be revised. Advances made some weeks ago, it is said, were overdue. Material has increased in price since then, and it has been an expensive process to obtain supplies of skelp.

This advance in tubular goods is the only important price movement of the week in American markets. Canadian mills and dealers report little change. Owing to partial lifting of embargo, fair supplies of galvanized sheets are now available, and prices are quoted $6.60 to $6.75. In ingot metals, tin is active and an advance of a cent is announced by Montreal dealers. Old Country advices indicate the upward move in tin is due largely to speculation and not indicative of market buying movement.

Reduction in domestic pig iron prices $3 a ton to $36.30, has brought out some business. Pittsburgh reports a decline in pig iron, but that the process will be gradual. Foundry iron, selling at $32.50 a week ago, has sold in small lots at $30. It is predicted that pig iron will, by January, land eventually at $22 and $25, Pittsburgh. At present there is practically no inquiry in that market.

Advices from American centres indicate that there are those who believe that the period of great activity on the other side is to be followed by one of industrial depression; that this is the nautral reaction necessary to correct inflated conditions. The belief seems to be gaining ground that this reaction may be expected within very few months. General trade outlooks do not seem as favorable as in July. New enterprises, it is said, are somewhat discouraged and cost of labor, the standards set by the victory of striking miners, are said to have an influence toward conservative tendency. There has been no decline in steel prices, but premiums for early shipment are disappearing, and basic prices, while showing strength at present, may yield before the new year. Steel ingot production is now on a basis of 70 per cent. of capacity, double the average rate of 1921, and 20 per cent. higher than 1912 and 1913.

Toronto

October 25

THAT October will make the best showing of any month in the past two years, is the opinion of jobbers in the iron and steel business. September was shaping up well until war clouds began to gather, when there was a decided falling off, or a pause, until definite solution emerged in the Near East situation. Since then, business has shown strength. That there may be a slowing up in certain seasonal work does not seem to be viewed with alarm, for there is always seasonal work, whether it be winter or summer, and in many lines it is anticipated that the demand will continue. Deliveries from American mills are still difficult, but stocks in hand are sufficient to take care of immediate demand. Urgent call on import steel is, of course, handicapped by the shipping problem, but it is expected that requirements will be met in time to save the situation.

Iron and Steel.—Demand for merchant bars reveals orders of better size than in the hand-to-mouth process of the early summer. It is evidently felt that actual possession is a greater advantage than any remote prospect of price decline. The mill price $2.65 remains unchanged and warehouses are still quoting $3.25 to $3.40. Some reports indicate lower figures, say $3.15, but this is by no means an evidence that prices are softening or that revisions may be made shortly. It is attributed to competition which is particularly keen in this market, and to the lack of any stabilizing organization or influence.

In galvanized sheets, the market is said to have better tonnage owing to partial lifting of embargoes which permitted some deferred shipments to come through. The demand is strong and jobbers quote on a range of $6.60 to $6.75.

Boiler tubes are active. Prices are firm, but an advance of 5% by the mills, does not, as yet, seem to have affected jobbers' quotations. Prices follow:

Iron bars	3 25	3 40
Steel bars	3 25	3 40
Reinforcing bars	3 25	3 40
Steel hoops		4 75
Tire Steel		3 50
Spring steel	7 00	14 00
Band steel, No. 10 gauge and 3-16 in base		3 90
Small shapes		3 50
Sheets, black, No. 28		5 50
Sheets, blue ann., No. 10		4 50
Canada plates, dull, 52 sheets		5 75
Canada plates, all bright		6 75
Galvanized Sheets, No. 28		6 60

Old Materials.—Dealers report inactivity, with neither furnaces nor foundries featured, to any extent, in the buying and with very little offering. The report received in this market, that Montreal was paying $25 per gross ton for No. 1, machine cast iron, was not taken seriously by large dealers. While not denying that the figure may have been paid in a very special case, they rather incline to the opinion that $21.50 was nearer a level buying price. They say there is very little prospect of radical change in Toronto prices at the present time. Dealers' buying prices follow:

Copper, light	9 00
Copper, crucible	12 00
Copper, heavy	12 50
Copper wire	11 50
No. 1 composition	9 00
New brass cuttings	6 00
Red brass turnings	6 50
Yellow brass turnings	5 25
Light brass	4 50
Medium brass	6 00
Scrap zinc	3 50
Heavy lead	4 50
Tea lead	3 00
Aluminum	11 00
Boiler plate, per gross ton.	9 00
Heavy melting steel	10 00
Axles (wrought iron)	20 00
Rails (scrap)	11 00
Malleable	10 00
No. 1 machine cast iron	18 00
Pipe, wrought	7 00

Pig Iron.—Recent reduction of domestic pig $3 per ton to $36.30 is reported to have loosened up a fair amount of business, but there is still evident a feeling that better prices are approaching, due to supplies that are accumulating in American markets. These, however, are not being moved, and it requires money to carry any considerable amount. Pittsburgh reports reductions, but at that, no great market has developed, and buyers display an impression that lower

levels must be reached before there is marked activity. Considerable Scotch and English pig is making its appearance, but it is considered doubtful if this can hold as American and domestic furnaces get back to normal conditions, and prices ease still further. It is not likely that the Steel Company will blow in its furnaces on foundry pig iron until after the first of the year. They now have one furnace operating on basic pig for their own steel requirements.

It may be interesting to Canadian pig iron buyers to learn that in spite of their imposition of 75 cents a ton on pig iron, large quantities of English pig are still going into the United States. Something like 31,119 tons came from one district alone last month, and shipments are still going forward on a large scale in spite of improved American production. English furnace authorities say that business from this continent, together with enlarging enquiry from other countries is absorbing their output and leading to scarcity on the English market. Additional furnaces will have to be lighted and production increased.

"In exports of both pig iron and steel," states The London Syren, "we are doing more trade than any country, though we are still a long way from the limits of our capacity. America is handicapped by tremendous transport distances and her home demand is always near to her output. The dollar premium, must, further, stand in the way of exports whilst the United States pursues her present policy. The world's steel and engineering requirements were never so great as they are now, and never within modern times was there so little foreign competition for the business."

Further advance in wrought steel pipe is predicted. American mills announce a reduction of 2 points in their discounts, each point meaning an increase of about $2 per ton. Eighth-inch merchant pipe was advanced in price 2½ points or $5.00 a ton. The demand for pipes has been abnormal, owing to activity in the building industry, and some mills are reported to be eight weeks behind in orders. Owing to the fact that the United States has differences in climate by which building operations may be continued in some sections all year round, the demand there has more stability, while in Canada, winter enforces a slowing-up process.

Non-Ferrous Metals.—Although foundries and galvanizing plants are fairly busy, nothing of any size is coming through in this department. Tin has shown remarkable firmness during the past week, due almost entirely, it is said, to manipulative factors in the Old Country and that, therefore, buying is showing a conservative tendency. Copper remains quiet. Current prices:

Lake copper	17 25
Electrolytic copper	17 00
Castings, Copper	17 00
Tin	37 00
Antimony	8 50
Spelter	8 75
Antimony	8 50
Aluminum	22 00

Montreal

October 25

DEMAND continues good in all lines and October will show up as one of the best months of this year. Steel plates and boiler tubes have been particularly well to the fore lately and stocks are at present quite reduced. The delay in securing new tonnage from the mills is considerable and there may possibly be a shortage of these commodities in the near future. Shafting is due for an increase soon owing to the mills having advanced the price by 25c per 100 lbs. and this in due course will be put into effect by the jobbers.

Galvanized and Black Sheets.—The situation is much easier than it has been all summer, in regard to supplies, which condition has been brought about by a softening in the demand and increased quantities arriving from Old Country mills. Prices are continuing steady, however, and no change is anticipated. In fact, the replace value of galvanized sheets has considerably advanced, due to the recent increase in the value of spelter. Therefore, any weakening of the market price which should naturally follow, owing to the increased supplies available now, will not happen owing to the action of the spelter market. Current prices:

Iron bars, base	3 15 to 3 25
Steel bars, base	3 15 to 3 25
Reinforcing bars, base	3 15 to 3 25
Steel hoops	4 00
Tire steel	3 25 to 3 40
Spring steel	7 00
Band steel, No. 10 gauge and 3-16" base	3 65 3 75
Small shapes	3 40
Sheets, black, No. 28	4 40
Sheets, blue, ann., No. 10	4 00
Canada plates, dull, 52 sheets	5 50
Canada Plates, all bright	7 00
Galvanized Sheets, No. 28	6 50

Pig Iron.—There has been no change in either the pig iron or steel situation here during the past week, other than that No. 1 machine cast iron has become scarce, and it is said as high as $25 00 per ton has been paid. The situation in the United States is easing somewhat, and premiums for prompt delivery are becoming almost obsolete. Certain producers are accepting lower prices for their products than has been the case during the past two or three months. Pig iron has also shown some reductions, more particularly in Buffalo, Pittsburgh and the Valley.

The demand for pig iron in Montreal seems to show slight improvement, more particularly on the part of smaller users, but these are being cared for by imported English and Scotch brands which continue to sell below the equivalent of Canadian-made products. Notwithstanding this contention, it is stated that importers of English and Scotch iron do not contemplate putting in any considerable stock for winter use, because of the downward trend of the American and Canadian markets which might go to such an extent as to make it difficult for importers to sell their stocks at profit. Current prices:

Algoma, No. 1, car lots on tracks, nominal quotation		38 65
Summerlee, 30-ton lots, dock	35 00	....
Carron, 30 ton lots	35 00	....
Do., 5 ton lots, ex. warehouse	40 50	....

Old Material.—Some scarcity has developed in the more active departments. No. 1 machine cast iron, for example, went to high levels during the week. It is stated that $25 was paid. Available supplies seem to be somewhat limited. Advices from American centres indicate a feeling that prices are at high level and some material is coming into the market that was held by speculators who had hoped for further advances. Dealers' buying prices:

Copper, light per 100 lbs.	9 00
Copper, crucible	11 50
Copper, heavy	11 25
Copper Wire	11 25
No. 1 composition	9 00
New brass cuttings	6 00
Red brass turnings	6 50
Yellow brass turnings	5 25
Light brass	4 50
Medium brass	6 00
Scrap zinc	3 50
Heavy lead	4 50
Tea lead	3 00
Aluminum	11 00
Boiler plate, per gross ton	9 00
Heavy melting steel	10 00
Axles (wrought iron)	20 00
Rails (scrap)	11 00
Malleable	10 00
No. 1 machine cast iron	25 00
Pipe, wrought	7 00
Car wheels	17 00
Steel Axles	15 00
Machine shop turnings	4 00
Stove plate	16 00
Cast boring	4 00

Non-Ferrous Metals.—Tin markets have developed strength during the week. London reports that prices have touched new high levels almost every day, but the upswing is said to be the result purely of professional manipulation. Those likely to be affected by this are stepping slowly and cautiously for fear of setback. London reports that American consumers have not been large purchasers of late. Montreal jobbers are quoting tin at $37.50, an advance of one cent in the week, while spelter has advanced a quarter. On the other hand coppers are quoted a quarter easier. Current prices:

Lake Copper	17 50
Electrolytic Copper	17 25
Castings, Copper	17 00
Tin	37 50
Lead	7 25
Spelter	9 25
Antimony	7 25
Aluminum	22 00

Pittsburgh

October 25, 1922

THE PAST two weeks have been the dullest the finished steel markets have seen this year. Buying for far forward or extended delivery dwindled to small proportions before the end of September, but there remained a fair volume of activity in the prompt market, that activity having now disappeared likewise.

Production of steel ingots continues at a rate of about 36,000,000 or 37,000,000 tons a year, or say 70 per cent. of capacity, and approximately equal to the rate in June and July, while it is nearly double the average rate in 1921, and is 20 per cent. above the rate in 1912 and

1914, the two biggest tonnage years before the war.

Shipments of steel are approximately equal to production. Car shortages continue. Car supplies are not so light as to cause additional steel to accumulate, and not so heavy as to allow the steel previously accumulated to be shipped. A little headway has been made in this matter.

Tubular Goods Advance

Under date of October 19, the National Tube Company (Steel Corporation) advanced its prices on all welded tubular goods two points, or approximately $4 a net ton, with the single exception that ⅛ inch merchant pipe was advanced 2½ points. The basing discount on merchant pipe changes from 68 to 66 per cent. The advance includes line pipe, O. D. pipe and oil country goods generally, also steel boiler tubes.

The advance came as a complete surprise to the trade. No particular expectation had been entertained that any price action would occur at this time. It is substantially accurate to say that this is the first important price advance the Steel Corporation has made in six years that had not first been made by independents. In 1920, the corporation refrained entirely from following independent advances, while in the advancing movement that began last March, it has trailed behind independents. In some quarters it is suggested that this divergence from the usual policy may be due to the corporation expecting a period to begin soon in which prices will be under pressure, so that it is well to make an advance when it can be made, and allow more leeway for the market to decline in future. The independents, of course, follow the advance just made.

Except for this incident in tubular goods, prices of steel products for far-forward deliveries are entirely unchanged. Delivery premiums that have been ruling in bars, plates and sheets are decreasing farther. One can get quite early delivery of bars at 2.15c, against 2.25c recently, of plates at 2.25c or less, against 2.50c a month ago, and of sheets at 3.60c against 3.75c. For delivery at mill convenience bars, shapes and plates are 2.00c. Independents are not going below 3.50c on sheets and can make moderately early deliveries at that figure. The Steel Corporation's price is 3.35c but this is nominal since the corporation is sold out until it opens its books for the new year.

Good Stocks on Hand

The extreme dulness in the finished steel market does not indicate that consumption has decreased. Rather it represents the natural reaction due to buyers having been particularly free in their purchases all this year, presumably under the stimulus of the coal strike and the expected transportation disability. The coal strike was expected to be the greatest in the history of the coal industry and it was, but it caused only a slight decrease in steel production, and that only for a few weeks. It was not until after July 15 that steel production decreased to the rate that obtained April 1, when the coal strike started.

For months, it was impossible to believe that steel was being consumed at the full rate in which it was being bought and delivered, and the present stagnation in the market is, therefore, naturally to be attributed to the existence of stocks and not to consumption having decreased. Very likely consumption will increase in the next three months in the usual seasonal way.

Expect Period of Depression

As to the more distant future, the general trade prognostications are not nearly as favorable as they were in July. Ever since the notable victory of the striking coal miners over the operators and the general public, there has been a strong contingent arguing that there was inflation which would discourage new enterprise and would be followed by a general and important industrial depression when the course of inflation had been fully run. Generally speaking, this opinion has been almost universal, but this consensus did not mean a great deal on account of the widely different times various observers assigned for the duration of the inflation. Just now, the upper hand seems to be held by those who expect reaction in a very few months. There is difference of opinion as to how long the reactionary conditions will continue, but not much difference, because there is a remarkable hesitancy on the part of most men to form any definite opinion at all on this point.

As to the particular item of steel prices, the remaining premiums for prompt or early shipment will in all probability disappear in a very few weeks. Eventually basic prices, for extended delivery, will yield, but it is an open question how soon, whether within a few weeks, or not until the new year. Much depends on the size of order books of some of the independent mills. Some other independents have fair sized order books, while the Steel Corporation is well booked up. Some mills may soon reach the point of being unable to continue operating at the present rate on their old orders and then the question will be whether to protect the remaining orders on books or cut prices to secure new business.

Coke and Pigs Easier

Last week's report noted the first break in Connellsville coke prices, furnace coke having declined from $12 to $10.50. It has now declined to $8.00. This is still an altogether unreasonably high price. Even if the $8.00 average price that was seen in January and February was below cost of production, it was no more than a fraction of a dollar below, and the entire production cost was not in wages. The wage scale has been increased by somewhat over 40 per cent.

Pig iron, which began softening recently, is now definitely declining, but it shows no haste in seeking a reasonable level. Basic pig iron, which was offered a week ago at $30, valley, has since commanded that figure in actual purchase of some size. Foundry iron, which was available a week ago at $32.50, has sold in several small lots at $30. Bessemer remains at an asking price of $33. There is practically no inquiry in the market, which means of course that prices will recede slowly unless some furnaceman injudiciously undertakes to make a drive to build up an order book. In a soft market it requires actual demand to put prices down. Pig iron was about $19 for basic and foundry and $19 for Bessemer last January and February, when coke was $3.00. Since then freight rates on raw materials have been reduced, while wages at blast furnaces have gone up 20 per cent. Pig iron will probably land eventually at between $22 and $25 but it may take until January or later to get there.

MACHINE TOOLS FOR CANADIAN NATIONAL

Canadian National Railways, in addition to considerable purchases of machine tools and other equipment for St. Malo and Moncton Shops, have purchased for their western lines the following:—

1—36 in. Bertram heavy vertical drilling machine.

1—51 in. Bertram vertical standard Boring and turning mill.

1—Pond Type re-built engine lathe.

4—Canada Machinery Corporation lathes 24 x 44.

1—Alfred Herbert No. 4 capstan turret lathe.

1—Hammett radius link grinder.

2—Southwark hydraulic spring testing machines capacity 35 tons.

1—Model "E" power driven pipe bending machine.

1—Underwood portable crank pin turning machine.

3—Pipe cutting and threading machines

1—Kearney and Trecker No. 3 Universal milling machine.

Steps may be taken shortly to modify the existing regulations of the American Interstate Commerce Commission, which now requires all open-top cars to be loaded with coal when traveling away from the mines. Manufacturers are complaining of the shortage in this respect and as the bituminous coal situation has been greatly relieved it is felt that many cars of this type might be diverted to meet the needs of other industries. The handling of the Western crops has created a pronounced car shortage both in Canada and the United States and the increasing requirements for rolling stock at this time of the year makes the possibility of embargoes on many roads only a question of time unless some measure of relief is given the car situation.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Toronto price:—

Silicon, 2.25% to 2.75%	36 30
Algoma, No. 1, Montreal	38 65
Summerlee, Scotch, Montreal dock	35 00
Summerlee, Warehouse, 5-ton	40 50
Carron, Montreal docks	35 00
Grey forge Pittsburgh	32 77
Lake Superior, charcoal, Chicago	36 15
Standard low phos., Philadelphia	38 00
Bessmer, Pittsburgh	35 27
Basic, Valley furnace	30 00

METALS

	Montreal	Toronto
Lake copper	$17 50	$17 25
Electrolytic copper	17 25	17 00
Castings, copper	17 00	17 00
Tin	37 50	37 00
Spelter	9 25	8 75
Lead	7 25	7 50
Antimony	7 00	9 00
Aluminum	22 00	22 00

Prices per 100 lbs.

BILLETS

F. O. B. Pittsburgh

	Per gross ton
Bessemer billets, 4 in. x 4 in. and larger	40 00
Open hearth billets	40 00
O. H. sheet bars	40 00
Forging billets	45 00
Bessemer rods	46 50

IRON AND STEEL

Per 100 lbs. to large buyers

Iron bars, base, Toronto	$3 25	3 40
Steel bars, base, Toronto	3 25	3 40
Small shapes, base		3 50
Iron bars, base, Montreal	3 15	3 25
Steel bars, base, Montreal	3 15	3 25
Reinforcing bars, base	3 35	3 40
Steel hoops		4 50
Tire steel, base		3 50
Spring steel	7 00	14 00
Band steel, No. 10 gauge and 3-16 in. base		3 90
Chequered floor plate ¼" and heavier	6 25	7 00
Chequered plates ¼-in. and heavier, sunken diamond		5 40
Bessemer rails, heavy, at mill		2 35

PITTSBURGH MILL

Steel bars	2 00	2 15
Tank plates	2 00	2 25
Structural shapes		2 10
Steel hoops	2 90 to	3 25

F. O. B. Chicago Warehouse

Steel bars	2 80
Structural shapes	2 90
Plates	2 90
Small shapes under 3-in.	2 90

PLATES

Plates 3-16 in.	$3.85	$3 60
Plates, ¼ up	3 50	3 40

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$ 4 40	$5 50
Sheets blue ann., No. 10	4 00	4 50
Canada plates, dull, 52 sheets	5 25	5 75
Can. plates, all bright	6 50	6 60
Galvanized sheets, No. 28	6 75	6 60
Queen's Head, 28 B.W.G.	7 25	
Fleur de Lis, 28 B.W.G.	7 00	
Gorbal's best, No. 28, U. S. G.	6 10	
Colborne's Grown, No. 28		
Premier	6 85	6 35
Premier 10¾ oz.	6 85	6 75
Zinc sheets	9 75 10 25	11 00

FREIGHT RATES

Pittsburgh to Following Points	Per 100 lbs. C.L.	L.C.L.
Montreal	52	65½
St. John, N. B.	76	96
Halifax	77½	97
Toronto	34	48½
Guelph	34	48½
London	34	48½
Windsor	31½	45½
Kingston	48½	61

Current surcharge 1 per cent.

OLD MATERIAL

Dealers' Average Buying Prices

	Montreal Per Ton	Toronto Gross
Boiler plate	$ 9 00	$ 9 00
Heavy Melting Steel	10 00	11 00
Axles (wrought iron)	20 00	16 00
Rails (scrap)	11 00	11 00
Malleable scrap	10 00	11 00
No. 1 Machine cast iron	22 00	18 00
Pipe, wrought	7 00	6 00
Car wheel	17 00	16 00
Steel axles	15 00	15 00
Mach. shop turnings	4 00	6 00
Stove plate	16 00	14 00
Cast boring	4 00	6 00
Copper, light	9 00	9 00
Copper, crucible	11 50	12 00
Copper, heavy	11 25	12 50
Copper, wire	11 25	11 50
No. 1 machine composition	9 00	9 00
New brass cuttings	6 00	6 00
Red brass turnings	6 50	6 50
Yellow brass turnings	5 25	4 85
Light brass	4 50	3 50
Medium brass	6 00	4 50
Scrap zinc	3 50	4 00
Heavy lead	4 50	4 50
Tea lead	3 00	3 00
Aluminum	11 00	11 00

COLD ROLLED STEEL

(At Warehouse)

Rounds and squares	$4 75 base
Hexagon and flats	$5 75 base

COPPER PRODUCTS

Prices per lb.

	Montreal	Toronto
Copper bars, 1¼ to 2 in.	30-31	.28
Brass Tube		.30
Plain sheets, 16 oz. in. 30 x 72	31-32	.29
Copper sheet, tinned, 16 oz.	39-41	.36
Copper sheet, planished, 16 oz. base	44-46	.41
Braziers', in sheets, 6 x 4 base	.30	.29
Copper tubing, seamless		.33
Brass rod		.22

LEAD SHEETS

Roll Lot Prices

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$9 15	$11 50
Sheets, 3½ lbs. sq. ft.	9 05	11 50
Sheets, 4 to 6 lbs. sq. ft.	8 90	10 00

Cut sheets, ¾c. per lb. extra

Cut sheets to size, 1c. per lb. extra

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	20
Brass sheets, 24 gauge and heavier base	23
Brass tubing, seamless	28

WROUGHT PIPE

Price List No. 56. August 23, 1922.

Standard Buttweld Pipe S/C

Size	Steel Blk.	Steel Galv.	Gen. Wrot. Iron Blk.	Gen. Wrot. Iron Galv.
⅛ in.	6 00	8 00	....	....
¼ in.	3 96	6 00	7 20	9 30
⅜ in.	3 96	6 00	7 20	9 30
½ in.	5 02	6 55	7 31	8 93
¾ in.	6 10	7 82	8 86	10 70
1 in.	8 50	14 22	12 58	15 30
1¼ in.	11 50	15 18	17 02	20 70
1½ in.	13 75	8 15	20 35	24 75
2 in.	18 50	24 42	27 38	33 30
2½ in.	29 25	38 61	....	....
3 in.	38 25	50 49	....	....
3½ in.	49 68	64 40	....	....
4 in.	58 86	76 30	....	....

Standard Lapweld Pipe S/C

Per 100 feet.

Below dividing line—price per foot.

Size	Steel Blk.	Steel Galv.	Gen. Wrot. Iron Blk.	Gen. Wrot. Iron Galv.
2 in.	22 20	27 75	31 08	37 00
2½ in.	32 76	41 54	46 80	56 16
3 in.	42 84	54 32	61 20	73 44
3½ in.	50 60	66 24	72 68	89 24
4 in.	59 95	78 48	86 11	105 73
4½ in.	68 58	87 63	1 04	1 24
5 in.	79 92	102 10	1 21	1 45
6 in.	1 04	1 32	1 57	1 88
7 in.	1 38	1 79	2 02	2 45
8L in.	1 45	1 88	2 13	2 58
8 in.	1 67	2 16	2 45	2 97
9 in.	2 04	2 62	2 97	3 59
10L in.	1 89	2 43	2 75	3 33
10 in.	2 43	3 13	3 54	4 28

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4-in. and under, close and short, 55 per cent.

4½-in. and larger, close and short, 45 per cent.

4-in. and under running thread, 35%.

Standard couplings 4-in. and under 25%.

Do., 4½-in. and larger 5 per cent.

MALLEABLE FITTING LIST

1 in. elbow	.32	.53
2 in. elbow	1.05	1.70
1 in. tee	.43	.70
2 in. tee	1.45	2.40
1 in. coupling R. & L.	.33	.53
1 in. locknut R. & L.	.15	.23

Discount to dealers—70 per cent.

BOILER TUBES

Size	Lapweld Toronto	Seamless Montreal	Lapweld Montreal
1 in.		19 00	
1¼ in.		23 00	
1½ in.		23 00	
1¾ in.		23 00	
2 in.	18 00	20 00	19 00
2¼ in.	20 00	23 00	21 50
2½ in.	21 50	26 00	22 50
3 in.	27 50	32 00	28 50
3½ in.	30 50	37 00	33 00
4 in.	39 00	47 00	42 00

Prices per 100 ft., Montreal and Toron

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, 7-16 and up	30
Carriage bolts, ⅜ in. and smaller 6 in. and shorter	40
Coach and lag screws	45
Stove bolts	72½
Wrought Washers	60
Do., corru. head	60
Machine bolts, 7-16 and over	35
Machine bolts, ⅜-in. and less	35
Blank bolts	35
Bolt ends	35
Machine screws, fl. and rd. hd., steel cut thread	37½ & 10
Machine screws, o. and fil. hd., steel cut thread	30
Machine screws, o, and fil. hd., brass cut thread	15
Standard couplings, 4-in. and under, brass cut thread	30% 30
Nuts, square, blank off net list	$1.00
Nuts, square, tapped off net list	50c.
Nuts, hex., blank off net list	50c.
Nuts, hex., tapped net list	
Copper rivets and burrs, list less	32c.
Burrs only, list plus	10%
Iron rivets and burrs	47%
Boiler rivets, base ¾ in and larger	$5.75
Structural rivets, as above	5 65
Wood screws, O. & R., bright	80
Wood screws, flat, bright	82½
Wood screws, flat brass	77½
Wood screws, O. & R., brass	75
Wood screws, flat, bronze	72½
Wood screws, O. & R., bronze	70

NAILS AND SPIKES

Wire nails, base	$3 65
Cut nails, base	4 35
Miscellaneous wire nails	72½%

MILLED PRODUCTS

(Prices on unbroken packages)

Set screws	65
Square and hexagon head cap screws	60
Round head cap screws	20
Fillister head cap screws	35
Flat head screws	25
Button head cap screws	20
Studs	45
Semi-finished nuts up to and including 9/16 in.	70
Semi-finished nuts ⅝ to 1¼ in.	65
Semi-finished nuts 1⅜ to 2 in	35
Coupling bolts	35
Taper pins, No. 2 to No 5	65
Taper pin No. 6 and over	10
Planer bolts without fillet	10
Planer bolts with fillet	Net
Patch bolts	Plus 10%
Hollow set screws	20
Thumb screws	50
Thumb nuts	70

CARBON DRILLS AND REAMERS

	Discount.
S. S. drills, wire size	60
Can. carbon cutters	plus 10
Standard drills, all sizes	60
3-fluted drills, plus	10
Jobbers and letter sizes	60
Bit stock	50
Ratchet drills	25
S. S. drills for wood	10
Wood boring brace drills	50
Electricians' bits	30
Sockets	50
Sleeves	30
Taper pin reamers	25
Drills and countersinks	20
Bridge reamers, carbon	50
Centre reamers	Net
Taps, machine screw	50 to 60
Taps, hand, sizes up to 1"	30 to 60
Chucking reamers	20 off
Hand reamers	20
High speed drills, list	40
Can. high speed cutters	plus 10
American	plus 40

FILES AND RASPS

Globe	60/5
Vulcan	50
P. H. and Imperial	60/5
Nicholson	40
Black Diamond	40
Heller	40
Jowitts	net
J. Barton Smith, Eagle	55
McClelland, Globe	50
Delta Files	20
Disston	40
Disston	50
Great Western-American	50
Kearney & Foote, Arcade	60/5

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

PROOF COIL CHAIN

B. B. B. CHAIN

⅜ in., $16.45; 7-16 in., $14.00; ½ in., $12.95; 5-8 in., $13.15; ¾ in., $12.75; ⅞ in., $12.25; 1 in., $11.85; 1⅛ and 1¼ in., $10.55. Fire weld chain same sizes respectively are $14.00; $11.50; $10.40; $10.55; $10.15; $9.75; $9.35; and $8.25.

ELECTRIC WELD COIL CHAIN B.B.B.

⅛ in. $20.00; 3-16 in. $16 50; ¼ in. $15.50; 5-16 in. $12.70.

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	30%
Standard	30 and 10%
Cut leather lacing, No. 1	1.75
Leather in side, (Lacing)	1.50

RUBBER BELTING

Standard 36 ....28% Best grades 28%

TAPES

Chesterman Metallic, 50 ft.	$5 00
Lufkin Metallic, 603, 50 ft.	3 17
Admiral Steel Tape, 50 ft.	3 00
Admiral Steel Tape, 100 ft.	4 50
Major Jun. Steel Tape, 50 ft.	3 75
Rival Steel Tape, 50 ft.	4 00
Rival Steel Tape, 100 ft.	8 75
Reliable Jun. Steel Tape, 50 ft.	5 25

PLUMBING SUPPLIES

Plumbers' oakum, per cwt.	6 00
Solder, strictly	$0 22½
Solder, guaranteed	0 24
Soldering coppers, lb.	0 62½
White lead, pure, cwt	13 20
Red dry lead, 100-lb. kegs, per cwt.	10 75
Wood alcohol, per gal.	1 75
Whiting, plain, per 100 lbs.	3 00

ROPE AND PACKING

Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope ¾ and larger, base	0 21
British Manila rope	0 19
New Zealand hemp	0 19
Jute packing, fine	15c
Jute packing, coarse	11c

OILS AND COMPOUNDS

Castor Machine Oil, per lb.	34½
Royalite, per gal. bulk	20
Palacine	23
Machine oil, per gal.	39
Black oil, per gal. (Summer)	19
Cylinder oil, Capital	69½
Petroleum fuel oil bbls., net	10.80
Turp., single bbls., gal.	1 95
Linseed oil, raw, single bbls.	1 02
Premier gasoline	31 00
Fuel oil, bbls., gal.	11 80

WASTE

XXX Extra	16
Atlas	18
Peerless	21
X Empire	13
XX Grand	15
Ideal	18
Superior	20
X Press	11½
X L C R	14

Colored

Lion	12
Fancy	13½
Standard	10½
Popular	9
No. 1	13
Keen	7½

Wool Packing

Arrow	24
Anvil	16
Axle	20

Washed Wipers

Select White	18
Dark colored.	13
Mixed Colored	14

This list subject to trade discount

PLATING SUPPLIES

Polishing wheels, felt	$3 25
Polishing wheels, bull-neck	1 60
Emerey in kegs, Turkish	7½
Pumice, ground	04½
Emery glue	26
Tripoli composition	08
Crocus composition	12
Emery composition	11
Rouge, silver	60
Rouge, powder, nickel	35

Prices per lb.

ANODES

Nickel	40 to .45
Copper	.38 to 22
Zinc	.16 to .12½

PLATING CHEMICALS

Acid boracic	.20
Acid, hydrochloric	.03¾
Acid, nitric	.10¼
Acid, sulphuric	.03¾
Ammonia, aqua	.20
Ammonium, Carbonate	.15
Ammonium, chloride	.18
Ammonium, hydrosulphuret	.75
Ammonium, sulphate	.10
Arsenic, white	.18
Copper carbonate, anhy.	.26
Copper, sulphate	.08
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.14
Nickel carbonate	.32
Nickel sulphate	.14
Potassium sulphide (substitute)	.40
Silver chloride (per oz.)	.85
Silver nitrate (per oz.)	.65
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.32
Sodium hyposulphite	.08
Sodium phosphate	.10
Tin chloride	.50
Zinc chloride, C. P.	.30
Zinc sulphate	.06

Prices per lb. unless otherwise stated

News From the Industrial Field

B. F. Sturtevant Co. of Canada have recently increased their capital stock from $50,000 to $200,000.

Sudbury.—The sale of 500,000 acres of timber lands to a Philadelphia syndicate by the Algoma Central Railway is announced. The timber limits are along the Algoma line between Oba and Hearst, and it is said that the purchasers intend to erect a large pulp and paper mill on the property.

Calgary, Alta.—With oil developments in Northern Montana now being undertaken on a wide scale, various American companies are taking steps to secure extensive leases on the Canadian side of the line. One concern has obtained 31,000 acres in Southern Alberta, and others are considering the leasing of such substantial acreages.

New Process Gear unit of the Willys Corporation at Syracuse, N. Y., is in the market. Recently a sale was made for $1,904,000 to T. W. Warner, vice-president of Durant Motors, Inc., but this was subsequently unconfirmed. Several new bidders, one the Dana Syndicate and another representing Baltimore capitalists, have appeared. The plant is one of the finest in New York state and was employed in production of motor car gears.

Levis, Que.—The Levis-St. Lambert Highway, which will be the second national highway directly connecting Quebec to Montreal, will be completed next fall. The length of the road will be about 180 miles, and over 90 miles are now partially completed. The cost o the road will be over $1,500,000, compared to over $3,000,000 for the Quebec-Montreal highway. The Quebec section of the road has nearly 40 miles completed, while the section, Levis to St. Antoine de Tilly, Lotbiniere, has now been finished.

By the close of the shipping season, the British Empire Steel Corporation will have shipped 700,000 tons of iron ore to Germany and established a market with the large steel plants there. Two blast furnaces are being operated and as soon as the St. Lawrence season closes, a third will be blown in. A moderate amount of export steel business has developed in addition to an improved domestic trade, and it is likely that railway demand for cars and other material will further contribute to the activity of the industry. According to the president, Roy Wolvin, the first half of the year was unsatisfactory, due to conditions in the steel industry, but general conditions had greatly improved.

J. B. Foote, of Foote Bros. Gear and Machine Co. of Chicago, died suddenly last week.

Byron Lederer, president of the Birmingham Motors, Peterboro, Ont., died suddenly from an acute attack of heart failure while staying at the King Edward Hotel, Toronto, early this week. Mr. Lederer was 50 years of age, single, and came from Brooklyn, N. Y., to preside over the Canadian activities of the Birmingham Motors.

Windsor, Ont.—A plant for the manufacture of liquid chlorine is at the present under construction by the Canadian Salt Company. It will have a capacity of ten tons a day. This is the first plant of its kind to be erected in Canada. The Company is also making additions to its evaporator plant and has installed fuel economizers in their boiler room.

Edmonton, Alta.—The Provincial Government announces that American capital has been secured to open and develop the Butterfield iron ore deposits discovered about a year ago on the shores of Lake Athabasca. If iron ore is found in Alberta in large quantities, this, together with the proximity of coal, would presage a steel industry for the future.

Quebec, Que.—Timber cutting in the province of Quebec this fall will return to the normal average of the last ten years, which was 1,000,000,000 feet, according to a statement made by the Hon. Honore Mercier, Minister of Lands and Forests of the Provincial Government. It was explained in this connection that there have been years in the period when the cutting was higher but the figure mentioned is considered the normal one.

Montreal, Que.—Various reasons are quoted for the fact that the American dollar has been at a discount in Canada, but the one which is mostly attributable, according to banking officials and financiers, is general prosperity in Canada. It was thought that the market had been engineered and the American dollar forced below par, but this is refuted by exchange brokers as being an impossibility, owing to the strength of the American banks. It is also said that the new American tariff might have something to do with the exchange. The present grain movements and huge tourist traffic have a bearing on the fluctuations of the American exchange as also has the Canadian borrowings in New York.

Montreal.—Large cargoes of incoming coal and outgoing grain are combining to bring an unusual number of ships to Montreal over seventy sea-going vessels in port on September 7, 1921, and it is probable that the latter figure will be exceeded. Many steamers commence to load grain practically as soon as their coal cargoes are discharged, and to facilitate the grain movement, local elevators are being operated at full speed, night and day.

Port Arthur, Ont.—Announcement has been made of the purchase of 66,500 acres of timber and surface rights on Isle Royale from the Island Copper Company by the Minnesota Forests Products Company of Duluth. It is stated that development work will commence at once, the Island Copper Company to work the copper properties and the Minnesota Company to take the timber. There is a large quantity of pulpwood, cedar, birch and maple, the latter being of excellent quality, and which may be used for veneer.

Edmonton, Alta.—The Northwest Lumber Company's big mill has closed down after competing a cut of about 15,000,000 board feet, and the D. R. Fraser plant, which is still running, will add 5,000,000 feet to the Edmonton output. Some of the smaller mills in the Lesser Slave Lake district have also had a good season. There is a good demand for Alberta spruce this year, particularly from the United States, where it has the reputation of being more easily handled and freer from knots than the mountain spruce.

Dr. A. C. Humphries, Stevens Institute of Technology, Hoboken, N. J., president of the American Institute of Consulting Engineers, will be the principal speaker at the dinner in connection with the fourth annual meeting of the University of Toronto Engineering Alumni Association, Oct. 27 and 28. The annual meeting will be held in Room 22, Chemistry and Mining Building, Oct. 28 and the annual re-union dinner, Convocation Hall (rear,) Saturday evening.

In an American bleachery plant, recognizing the equal partnership idea as between capital and labor as an experiment, the $1,250,000 capital is assumed by the 600 employees, and every penny of profit is shared according to the investment of each. Managerial control is distributed in the same way. As a result, there have been no strikes, increased production, lower overhead, negligible labor turnover, smaller loss through carelessness and lessening of labor monotony.

That Sir Henry Thornton, new head of Canadian National Railways, is leaving England on the best of terms with labor is evident from the fact that, in connection with functions marking his departure, leaders of railway trades unions have arranged for a large farewell gathering.

Lackawanna Tubes Limited, Welland, which took over the plant of the Welland Machine and Foundries, and proposed installing a plant to make boiler tubes, has been making slow progress toward operation. The men behind this organization are said to represent large Pittsburgh interests.

Welland.—Welland Packing Company with capital of $100,000, has purchased a site in Crowland Township and has started the erection of a packing plant. The machinery for this new industry has already arrived and it is expected that the plant will be in operation early in December.

The self-oiling feature can be enhanced in the case of bearings operating under unusually severe conditions by adding a small quantity of finely divided graphite to the lubricant. The graphite, of course, mixes with the oil in the pockets of the metal and provides a most efficient self-lubricating surface.

St. John, N. B.—In order to increase the capacity of its mill here from 60 to 80 tons of sulphite pulp a day, the Nashwaak Pulp and Paper Company is reconstructing practically every department. New improvements include a boiler system, Jenssen acid system, new screens and modern improvements to their drying system.

Lubrication of worm gear drives is most essential for resisting wear. Abrasion is generally due to over-heating, and this condition can be avoided by running the worm in a bath of oil. The oil not only carries away the heat, but likewise forms a film on the threads and teeth which actually prevents the two metallic surfaces coming into direct contact.

Employees of the Works Department, Dominion Government, claim to have grievances which they have drafted into resolution form, as a step toward protest to Ottawa. They want redress in the matter of salary, claiming that it should be stabilized to include the bonus now allowed and that employees with private incomes equal to their wages, should be asked to resign.

The function of bearing metal is solely to prevent, or minimize damage due to failure of lubrication. Under normal conditions the babbitt has little, if any, influence on the operation of a machine and its virtues become apparent only when lubrication is suspended. Its value is, therefore, in direct ratio to its ability to eliminate, or reduce, the wear or damage which follows a suspension of lubrication. Any other standard of value is meaningless.

British Columbia Industries Active; Iron and Steel Project Up to Ottawa

VICTORIA, B. C.—Interests behind British Columbia's new $15,000,000 iron and steel project now declare that it is for the Ottawa Government to say whether or not the plan shall become a reality. The Provincial Government has agreed to guarantee one-third of the bonds issued provided that the Federal and Imperial Government do likewise.

Advices have been received from the British Board of Trade, indicating that it will support the proposition under certain conditions, one of them being that the Ottawa administration stand back of it. It asks as one of the conditions on which it will support the bonds of the company that its investment be spent in Great Britain in the purchase of plant and equipment, and it also requests that its financial advances be considered as a first lien on the assets of the plant.

Meanwhile there has been speculation as to the location of the proposed steel mills. Kamloops, an important railway centre in the interior of the province, is being considered. Vancouver, because of its proximity to rail terminals and the fact that the city is the manufacturing metropolis of the province, has certain advantages. Vancouver Island, on account of its possession of huge deposits of coal and its proximity to iron and limestone deposits, is particularly favored. Statements have been made that Union Bay, a coal port on the east coast of Vancouver Island, has been selected as a site, but these are without confirmation.

Pulp and paper mills have maintained their usual output and they are now supplying California, and Orient and Australia as well as domestic markets. Two or three new mills are likely to be established in the near future. The largest of these is the Wigwam Pulp & Paper Company plant, which is to be built at Elko in the Kootenay district at a cost of about $13,000,000. The Prince Rupert Holding Company has been organized to take control of the Prince Rupert Pulp & Paper Company, which has been in financial difficulties and this is taken as an indication that a resumption of construction is contemplated. Hon. T. D. Pattullo, Minister of Lands, is now in Great Britain negotiating with financial interests with a view to having British capital invested in British Columbia timber and pulp mill enterprises.

General industrial conditions throughout British Columbia have shown improvement lately, and prospects are bright for a fairly active winter. The lumber business, which is regarded as an accurate barometer of general trade conditions in the province, is again on a firm footing and production has reached an exceptionally high level. Demand for lumber in the eastern provinces and states has been well sustained this season. As a result of the big crop on the prairies, Coast lumbermen expect to sell extensively to the prairie territory during the next few months. Unprecedented building activity in the East has absorbed all the lumber that can be shipped, although the grain movement and other factors have caused a rather serious shortage west of the Rocky Mountains This has resulted in the routing of more lumber than ever by way of the Panama Canal.

Owing to the high tariff fixed for nitrate soda shipped into the United States, the plant of the American Nitrogen Products Company at Lake Buntzen, near Vancouver, is being converted into a nitric acid plant. Between four and five million dollars may be invested in the plant extensions to be made, according to C. E. Graf, head of the organization. The plant has been equipped to take nitrogen from the air by electricity, being the only establishment its kind on the continent, with the exception of a small plant at La Grande, in the state of Washington.

British Columbia wholesalers and shippers are trying to induce Eastern Canadian manufacturers to make greater use of steamships in sending freight to British Columbia. They point out that on articles such as pianos, where time taken in delivery is not an essential factor, the freight rates by steamship are about one-fifth of the rail rate. A special advantage to British Columbia in the shipping of goods from the East via Panama Canal is that the system provides tonnage for the shipment of British Columbia products, such as lumber, to the Eastern markets. In the past, there has been plenty of cargo for the East, but not enough westbound to make it worth while for ship operators to send out their vessels.

The depressed state of the copper market has been a discouragement to heavy output of that metal, but production has been on a generally high standard notwithstanding, and the installation of new electrolytical processes at the plants of the Consolidated Company at Trail will result in important advances in zinc and lead yield this year. Silver is expected to reach a new peak and gold, largely as a result of the phenomenal success of the Premier in the Portland Canal district, will have one of the best years in history. Continued high cost of labor and machinery and lack of transportation facilities are deterrents to mining activity on the part of the small companies with limited capital, but the larger corporations are going ahead with their operations and are even carrying out important extensions

Any Machine You Want—From Stock
From our large stock of full lines of Iron and Woodworking Machinery, Boilers, Engines, Contractors' Machinery, Electric Motors, Saws, Shingle and Lathe Mill Machinery, etc. You may depend upon your order being shipped promptly and intelligently. Remember, also, that the Williams' Price always means a saving and that the Williams' Guarantee means "after-sale" satisfaction.
Our regular monthly Machinery List is full of bargains. Shall we put your name on our mailing list?
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HALIFAX ST. JOHN MONTREAL WINNIPEG VANCOUVER
If its Machinery—Write "Williams"

DOES BETHLEHEM STEEL WANT BALDWIN PLANT?

THAT the Bethlehem Steel Corporation may establish a branch plant in Canada is the report current during the past few days in Toronto iron and steel market. No very definite information is available as to the extent of direct or indirect negotiations, but the Baldwin plant, now idle, has had persistent mention in that connection. Captain Hugh C. Paynter, president Baldwins Canadian Steel Corporation, when asked for a statement, declared that he had absolutely nothing to say and that he preferred not to discuss the matter in any shape or form. This still leaves the matter open to speculation.

The Baldwin plant, after about two years' operation in the production of tin plate and black sheets, closed down a few weeks ago. It was claimed that difficulties in securing shipment of materials, such as sheet bars, from the United States under present conditions, had much to do with the shut down. The Baldwin plant represents an investment of $4,000,000.

Increasing importance of the Canadian market is fully recognized by the large steel corporations of the United States. Notable evidence of this exists in the huge plant now being erected by the U. S. Steel Corporation at Ojibway near Windsor, Ont. This is said to be a duplicate, practically, of their Gary plant.

If the Bethlehem interests have a Canadian plant in view, they have undoubtedly satisfied themselves as to the possibilities here. In the production of black sheets they would have their own sources of supply in sheet bars and other essentials, and this would seem to ensure positive quality.

One difficulty, it is said, that has often beset industries of this kind, producing in one country, but buying materials in another country, is the fact that buyers and sellers of these materials have been competitors in the ultimate market. It is claimed that quality has, therefore, been too easily a matter of manipulation by interests in control of materials. Just to what extent this problem entered into the operations of the Baldwin plant, or whether it entered at all, cannot be ascertained. If it is a consideration, a self-contained, independent organization would be well-equipped to apply the remedy.

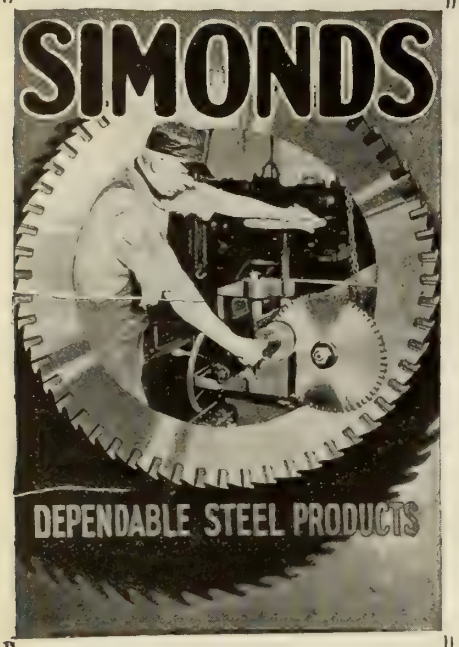
The Bethlehem Steel Corporation will spend immediately $15,000,000 on its newly acquired Lackawanna Steel Company plant in Buffalo. Eugene G. Grace, president of the corporation, made this announcement after a two days' inspection of the property. "Conditions of the steel industry have improved so rapidly in the last six months that there is to-day sufficient business to warrant 100 per cent. operation in all the Bethlehem Steel Company's plants, including the Lackawanna property," Mr. Grace said. "The problem of labor to operate the present local plant, and at the same time to make improvements and additions to the property, is a controlling factor."

Enquiry at the Toronto office of the United States Steel Products Co., who might be supposed to know something of proposed activities involving large steel interests, revealed no light on the rumored move by Bethlehem. The latter, with the recent passing out of the Consolidated Steel Corporation, ceased to have direct representation in Toronto.

A plant for manufacture of asbestos products, the first of its kind in Canada, is being erected at Asbestos, Que., to cost $100 000. At present the raw material is shipped out of the country and imported as a finished product.

About 1,800 men are working on the construction of the Welland ship canal. The approach of cold weather will necessitate shutting down on those sections where concrete work is being carried on.

The royalty on asbestos in the Province of Quebec has been reduced from $5.00 to $2.50 per ton. This concession was made at the request of a number of asbestos mine owners and others interested in the industry.



Inserted Tooth Metal Saws

Greater production and economy are reasons why Machine Shops are equipping their metal cutting machines with Simonds Inserted Tooth Saws. Fitted with High Speed Steel Teeth in an especially fine steel plate, these saws cut rapidly without dulling easily.

The Simonds "00" style Inserted Tooth metal saw cuts only 3/16 inch kerf.

Write for prices and catalog.

Simonds

Canada Saw Co. Ltd.

"The Saw Makers"

MONTREAL, QUE.
ST. JOHN, N.B.
VANCOUVER, B.C.

BUSINESS PAPERS

(Continued from page 24)

time to time by periods of depression brought on by unskilful and inadequate use of financial facilities. Though crops might be good and business fair, a sudden tightening of money could precipitate hard times by interrupting the ordinary process of business.

With the advent of the Reserve Banks, and the creation of a reservoir out of which money could flow to meet sudden emergencies, American business was freed from this danger and assured at all times of sufficient liquid funds to transact its operations.

The Reserve System did not create new stores of gold or silver; it did not make money out of thin air, or change the fundamental laws of finance in a single particular It simply perfected, and improved our financial machinery.

Improve Industry's Mechanism

In similar manner the nation should strive to improve and perfect the mechanism of industry. There is no more excuse for over-buying or over-production than there was for money panics. Depression through over-production proceeds from lack of facilities for adapting production to the demands of the market. Depression through over-buying proceeds from lack of facilities for ascertaining the public's wants and from fear of a sudden halt in supplies.

The Department of Commerce, has already attacked the problem of providing a proper organization for bringing the manufacturer, the retailer and the public into closer touch. The effort thus begun should be encouraged and supported. It is not enough that statistics and estimates should be available; the business man must be trained to use them and to base his activities upon accurate knowledge of conditions rather than upon his own surmise of what those conditions are. Here is a field where the business papers can be of supreme usefulness to their readers, and to the nation.

TENSION AND WORKING STRAINS

(Continued from page 21)

slack strand 60 pounds in order to give the necessary 60 pounds of pulling power, and the bearing must stand a load of 180 pounds, just twice the load in the other case noted above.

The maximum load on the fastener in each case is the tension of the tight strand of the belt. In the extreme case of the poor belt described, the fastener would have to withstand 120 pounds per inch of width. Efficient belt hooks under many tests, have shown a strength never less than 400 pounds per inch of belt width and it is easy to understand why they carry the full belt load and do not put out. Even in a poor belt carrying its rated load (which as a matter of fact is not possible with such a poor belt) there is a margin of safety of 400-120 or 280 pounds.

In the chart the length of the bars represents the total strength of efficient belt lacing in a one-inch belt. The black area shows the proportion of this which is actually required to transmit the rated horse power to the belt, while the white area shows the margin of strength remaining as a safety factor.

C. G. E. PROTESTS TAX BILL

Further explanation of the attitude of protest by the Canadian General Electric Co., Toronto, with reference to their city assessment and of their inclination to move to a smaller centre is found in their appeal to the Court of Revision. The company has had a fixed assessment for 20 years of only $150,000. This arrangement expires with the present year. So the company will have to pay taxes on the present approximate values in 1923. Toronto assessors fix these at $349,621 for land, $685,000 for buildings, and $692,771 for business assessment. Instead of paying $10,000 a year as in the past, the company will now have to pay, provided the assessment is confirmed, about $66,000.

It is claimed by the company that the assessment is excessive and that, owing to commercial depression, the plants were not being operated to capacity and, consequently, the business could not stand the heavy increase. Counsel, in presenting the case for the company, to the court, said that it was employing about 1,200 men only now, but in normal times it would have 5,000 employees. He requested that the assessment be based on the present output of the plants. In reply to questions by the court, counsel said the company would be pleased to advise the Assessment Department when the plants were again operating at normal capacity. He maintained that he had made a reasonable request in asking for a reduction, and intimated that the business would not stand the heavy increase in taxation that must follow the confirmation of the new assessment. If no relief were granted, the management of the company would seriously consider the question of removing the entire plant from Toronto, possibly to Peterboro, or some other point, where it would be given reasonable assessment and moderate taxation.

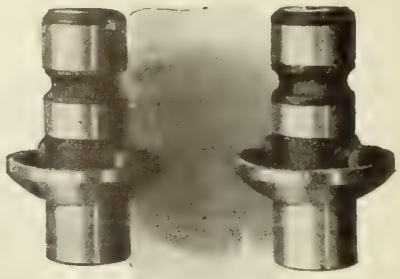
BENCH GRINDER WITH SKATE ATTACHMENT

The Prescott Emery Wheel Co., has recently brought out an attachment that may be fitted to their bench grinders, for the grinding of skates without removing them from the shoes. It is possible to slide the fixture along a smooth surface which assures a uniform grinding of the skate blade. The holder is so constructed that skates of any make can be successfully held and sharpened whether on or off the boot.

Canada Forge Co's. plant in Welland, which has been closed for the past two years, may resume operations shortly. Activity in locomotive and car construction would mean much to this industry.

Make a Turret Lathe of Your Engine Lathe

Jarvis Collets convert an engine lathe into a turret lathe by simply using one of the Jarvis Quick Change Chucks, which allows the use of any number of different tools.



Acquaint yourself now with Jarvis High Speed Tapping Devices and Quick Change Chucks and Collets.

The booklet will be a worthy addition to your Mechanical Library.

It is interesting—

It is free—

It is yours for the asking—

The Jarvis High Speed Tapping Device is superior to any other.

It has a ball drive and ball reverse, making easiest action, with no clinching or binding.

Reverse motion faster than the drive.

Specially designed Chucks make special taps unnecessary.

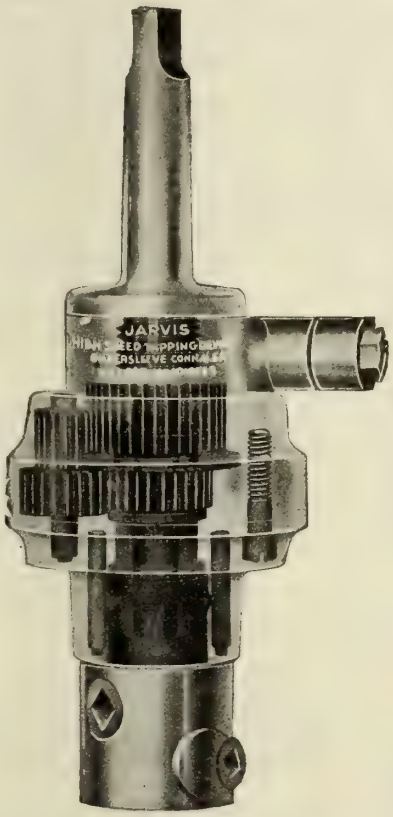
Tap breakage reduced to the minimum.

It makes no difference whether the tap is forced against the work in a Drilling Machine, or the piece is pushed towards the tap in a Speed Lathe.

Two Styles of Chucks.

Seven Sizes of Tappers.

Range of Tapping from 0 to 2 inches inclusive.



Jarvis Tappers and Quick Change Chucks

And collets are developed to such a degree of perfection that the Geometric Tool Company recommends and furnishes them as a fitting adjunct to their line of threading tools.

Where one hole is drilled, reamed, counterbored, tapped and a stud set, or any two of these operations are done with one spindle, the Jarvis Quick Change Chucks pay for themselves in a very short time. Changes are made without stopping the Drilling Machine or Lathe.

There is no burring from constant use to interfere with the easy entrance or operation of the Collet.

Jarvis Quick Change Chucks and Collets consist of a Chuck or locking member and a sufficient assortment of collets for any job.

Any standard Drill Chuck can be fitted to the Morse Taper Collets.

Combination Tapping Device and Quick Change Chuck

In place of the regular chuck, the Tapping Device is equipped with a Quick Change Chuck, forming a Combination Tapping Device and Quick Change Chuck. This is the combination much in demand.

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This is possible if you use ONLY "Maple Leaf" stitched cotton duck belting. It has a positive gripping surface which hugs the pulley. Costs less than leather, rubber or balata.
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Advertisements for this section must be in our composing room Tuesday morning prior to day of issue

In order that the announcements of your wants, machinery for sale, etc., etc., shall not be delayed, please try to have them in our office with the Tuesday morning mail.

Canadian Machinery

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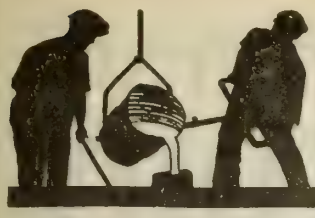

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Nickel and Monel Metal.

The Robert Mitchell Co., Ltd.
64 Belair Ave., MONTREAL.
Light Grey Iron.

Canadian Steel Foundries, Ltd.
MONTREAL, QUE.
Steel and Ferro-Alloy.

Langley & Austin,
GALT, ONT.
Copper, Bronze, Brass and Aluminum.

Maxwells, Limited
ST. MARYS, ONT.
Light Grey Iron, Tinning same a specialty.

The Eureka Planter Co., Ltd.,
WOODSTOCK, ONT.
Specialty Light Grey Iron.

Lindsay Foundry and Pattern Works, Limited
Victoria Avenue, LINDSAY, ONT.
Grey Iron and Semi-Steel to 75 tons.

Dominion Engineering Works, Limited
MONTREAL, QUE.
Grey Iron and Semi-Steel to 75 tons.

Smith's Falls Malleable Castings, Limited
SMITH'S FALLS, ONT.
Malleable.

Imperial Foundry Company
2167 St. Clair Ave., TORONTO, ONT.
Grey Iron Castings. Phone Junction 7935.

International Malleable Iron Company, Limited
GUELPH, ONT.
Malleable.

Getting The Business
You Can Do Likewise
A Few Panels For Sale
APPLY
Canadian Machinery & Mfg. News
143 University Avenue,
TORONTO, CAN.

BRANTFORD BRASS FOUNDRY COMPANY
BRANTFORD, ONTARIO
FOUNDRY AND OFFICE 20 LEONARD ST
June 20th., 192-

The MacLean Publishing Co., Limited
Toronto, Ont.

Gentlemen;-

We wish to inform you that we have had quite satisfactory results from our advertisement in Canadian Machinery and Manufacturing News, which runs under the classified heading, "Where to Buy your Castings".

Yours Truly,
Brantford Brass Foundry Company.
Per David McNabb

Canadian Machinery BUYERS DIRECTORY

If what you want is not here, write us, and we will tell you where to get it. Let us suggest that you consult also the advertisers' index— last page of book, after having secured advertisers' names from this directory. The information you desire may be found in the advertising pages. This department is maintained for the benefit and convenience of our readers. The insertion of our advertisers' names undr proper headings is gladly undertaken, but does not become part of an advertising contract.

ABRASIVE DISCS
Lion Grinding Wheels, Limited, Montreal, Que.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John, London, S.E., Eng.

ABRASIVE MATERIALS
Lion Grinding Wheels, Limited, Montreal, Que.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John, London, S.E., Eng.

ACETYLENE, DISSOLVED
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Toronto.
Liquide Air Company, Toronto.

ANCHOR BELTS
Steel Co. of Can. Ltd., Hamilton, Ont

ANGLE BARS
Steel Co. of Can. Ltd., Hamilton, Ont.

ANVILS
Atkins & Co., Inc., E.C., Indianapolis, I.

ANCHOR BOLTS
Steel Co. of Can., Ltd., Hamilton, Ont.

ARBORS
Atkins & Co., Inc., E. C., Indianapolis,
Brown & Sharpe Mfg.Co., Providence,R.I.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.

BELLS, BRASS, BRONZE and STEEL
Canada Foundries & Forgings Co., Welland, Ont.
Canadian SKF Co., Toronto, Ont.

BARS, BORING
Armstrong Bros. Tool Co., Chicago, Ill.
Bertram & Son Co., td., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

BARS, BORING, PORTABLE
Underwood Corp., H. B., Philadelphia.

BARS, STEEL
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
British Empire Steel Corporation, Montreal, Que.

BEARINGS, BALL
Canadian SKF Co., Toronto, Ont.

BEARINGS, ROLLER
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

BELT CEMENT
D. K. McLaren, Limited, Montreal,
McLaren Belting Co., J. C., Montreal, Que.

BELT DRESSINGS AND FILLERS
Dom. Belting Co., Ltd., Hamilton, Ont.
D. K. McLaren, Limited, Montreal,

BELT FASTENERS
Bristol Company, Waterbury, Conn.
D. K. McLaren, Limited, Montreal,
McLaren Belting Co., J.C., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

BELT HOOKS
Bristol Co., Waterbury, Conn.
D. K. McLaren, Limited, Montreal,

BELT LACING
Bristol Company, Waterbury, Conn.
D. K. McLaren, Limited, Montreal,
McLaren Belting Co., J. C., Montreal.

BELT LACING, STEEL
Bristol Company, Waterbury, Conn.

BELT LACING MACHINES
D. K. McLaren, Limited, Montreal,
McLaren Belting Co., J. C., Montreal, Que.
Petrie, Ltd., H. W., Toronto. Ont.

BELTING, CHAIN
Can. Link-Belt Co., Toronto, Ont.
Fittings, Limited, Oshawa, Ont.
Jones & Glassco, Montreal, Que.
real, Que.
Renold (Hans) of Canada, Ltd., Mont-

BELTING, FABRIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Dom. Belting Co., Ltd., Hamilton, Ont.
D. K. McLaren, Limited, Montreal,
McLaren Belting Co., J. C., Montreal, Que.

BELTING, LEATHER
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Can. Fairbanks-Morse Ltd., Montreal, Q.
D. K. McLaren, Limited, Montreal,
McLaren Belting Co., J. C., Montreal, Que.

BELTS, ABRASIVE
Oakey & Sons, Ltd., John, London, S.E., Eng.

BENDING MACHINES, POWER
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bertrams Ltd., Edinburgh, Scotland.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

BILLETS, BLOOMS and SLABS
Steel Co., of Can. Ltd., Hamilton, Ont.

BLAST GATES
Rockwell & Co., W. S., New York, N.Y.

BLOCKS
Wright Mfg. Co., Lisbon, Ohio.

BORING TOOLS
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.

BUCKET CARRIERS, Pivoted
Can. Link-Belt Co., Toronto, Ont.

BUFFERS
Pryibil Machine Co., New York, N.Y.

BUFFING OR POLISHING MACHINES
(See Polishing and Buffing Machines)
Blount Co., J. G., Everett, Mass.
Herbert, Limited, Alfred, Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pryibil Machine Co., New York, N.Y.
U. S. Electrical Tool Co., Cincinnati, O.

BUILDING MATERIALS
Bertram & Son Co., Ltd., The John Dundas, Ont.

BURNERS, OIL AND GAS
Rockwell Co., W.S., New York City.

BURRS
Steel Co. of Can. Ltd., Hamilton Ont.

CABINETS, OIL
S. F. Bowser & Co., Ltd., Toronto, Ont

CALIPERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Starrett Co., L. S., Athol, Mass.

CHUCKS, DRILL AND TAP
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canadian SKF Co., Toronto, Ont.
Cushman Chuck Co., Hartford, Conn.
Geometric Tool Co., New Haven, Conn.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg., New Britain, Conn.

CHUCKS, LATHE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Cushman Chuck Co., Hartford, Conn.
Geometric Tool Co., New Haven, Conn.
Gisholt Machine Co., Madison, Wis.
Herbert, Limited, Alfred, Toronto, Ont.
Ker & Goodwin Machine Co., Brantford, Ont.
Pryibil Machine Co., New York, N.Y.
Skinner Chuck Co., New Britain, Conn
Union Mfg. Co., New Britain, Conn.

CHUCKS, MAGNETIC
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CHUCKS, PLANER
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cushman Chuck Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

CHUCKS, TAPPING
William L. Procunier, Chicago, Ill.

CHUCKS, VERTICAL BORING MILL
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

CLAMPS, MACHINISTS'
Brown & Sharpe Mfg. Co., Providence,
Starrett Co., L. S., Athol, Mass.

CLEANERS, METAL, WASTE, GENERAL
Oakley Chemical Co., New York, N. Y.

CLOCKS
Chicago Watchman's Clock Co., Chicago.
Hardinge Bros., Limited, Toronto, Ont.

CLOCKS, TIME
Gisholt Machine Co., Madison, Wis.

CLOCKS, WATCHMEN'S
Chicago Watchman's Clock Co., Chicago, Ill.
Hardinge Bros., Limited, Toronto, Ont.

CLUTCHES, FRICTION
Can.-Link-Belt Co., Toronto, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.

COAL AND ASH HANDLING MACHINERY
Can.-Link Belt Co., Toronto, Ont.
Rocklefson Elevator Works, Galt, Ont.

COAL-STORAGE SYSTEMS
Can. Link-Belt Co., Toronto, Ont.

COLLARS, SHAFT OR SET
Canada Foundries & Forgings Co., Welland, Ont.
Can. Link-Belt Co., Toronto, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

COLLETS
Butterfield & Co., Inc., Rock Island, Que.
Geometric Tool Co., New Haven, Conn.
Hardinge Bros., Inc., Chicago, Ill.
Hendley Machine Co., Torrington Conn.
Kearney & Trecker Co., Milwaukee, Wis
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

COMPOUNDS, CLEANING
Oakley Chemical Co., New York, N.Y.

For list of Dealers see the last page of This Buyers Directory

BLOCKS, CHAIN (See Hoists, Hand)
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

BLOCKS, DIE
Canada Foundries & Forgings Co., Welland, Ont.

BLOCKS, PILLOW
Can. Link-Belt Co., Toronto, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

BLOWERS
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

BOLT AND NUT MACHINERY
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Montreal, Que.

BOLT AND NUT MACHINERY, Automatic
National Acme Co., Cleveland, Ohio

BOLTS AND NUTS
British Empire Steel Corporation, Montreal, Que.
National Acme Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont

BOLT THREADING DIE HEADS
Landis Machine Co., Inc., Waynesboro, Pa.

BOLTS, TRACK
Steel Co. of Canada, Ltd., Hamilton, Ont.

BORING and TURNING MILLS, Vertical
Bertram & Sons Co., Ltd., The John Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

BORING, DRILLING and MILLING MACHINES, Horizontal.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
Herbert, Limited, Alfred, Toronto, Ont.
Landis Tool Co., Waynesboro, Pa.
Vertical
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

CAMS
Canada Foundries & Forgings Co., Welland, Ont.

CAN-MAKING MACHINERY
(See Sheet Metal Working Machinery)
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Bliss Co., E. W., Brooklyn, N. Y.
Smooth Mfg. Co., Jersey City, N. J.

CEMENTS, IRON CENTERING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.

CHAINS (See Sprockets and Chains)
Reynold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg Co., Lisbon, Ohio.

CARD CLOTHING
D. K. McLaren, Limited, Montreal.

CASTINGS, ALUMINUM, BRASS, BRONZE, COPPER, DIE-MOLDED, FERRO-ALLOY, IRON, SEMI-STEEL, STEEL.
See "Where to buy your castings" Section Page number may be found by turning to Advertisers' Index.

CHAINS, DRIVING
Can. Link-Belt Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont
Jones & Glassco, Montreal, Que.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

CHASERS
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, a.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CHUCKING MACHINES
Acme Machine Tool Co., Cincinnati, O
Brown & Sharpe Mfg. Co., Providence, R. I.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

BUYERS' DIRECTORY

COMPOUNDS—CUTTING, DRILLING, GRINDING, SCREW CUTTING
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Oakley Chemical Co., New York, N.Y.

COMPRESSORS, AIR AND GAS
Can. Fairbanks-Morse Co., Ltd., Montreal.

CONES, FRICTION
Norton Co., of Can. Ltd., Hamilton, Ont.

CONNECTING RODS AND STRAPS
Canada Foundries & Forgings Co., Welland, Ont.

CONTRACT WORK
Dominion Engineering Works, Limited, Montreal, Que.
Victoria Foundry Co., Ltd., Ottawa, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

CONVEYORS AND ELEVATORS (SEE ELEVATORS)
Jones & Glassco, Montreal, Que.

COTTERS
Steel Co. of Canada, Ltd., Hamilton, Ont.

COUNTERBORES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

COUNTERS, REVOLUTION
Starrett Co., L. S., Athol, Mass.

COUNTERSHAFTS
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Johnson Machine Co., Carlyle, Man.
Kempsmith Mfg. Co., Milwaukee, Wis.

COUNTERSINKS
Butterfield & Co., Inc., Rock Island, Que.
Pratt &Whitney Co., of Canada, Ltd., Dundas, Ont.

COUPLERS, CAR AND LOCOMOTIVE
Can. Steel Foundries, Montreal, Que.

COUPLINGS
Steel Co. of Canada, Ltd., Hamilton, Ont.

COUPLINGS, SHAFT
Can. Link-Belt Co., Toronto, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

CRANES, ELECTRIC
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can.-Link-Belt Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Northern Crane Works, Walkerville, Ont.
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.

CRANES, LOCOMOTIVE
Can. Link-Belt Co., Toronto, Ont.

Bertram & Son Co., td., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Northern Crane Works, Walkerville, Ont.

CRANK PIN TURNING MACHINE
Underwood Corp., H.B., Philadelphia, Pa.

CUTTERS, GEAR
Brown & Sharpe Mfg. Co., Providence, R. I.

Butterfield & Co., Inc., Rock Island, Q. Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CUTTERS, HIGH SPEED
Atkins & Co., Inc., E. C., Indianapolis.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CUTTERS, MILLING
Brown & Sharpe Mfg. Co., Providence, R. I.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.

CUTTERS, STAY BOLT
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.

CUTTING-OFF MACHINE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Starrett Co., L. S., Athol, Mass.

CUTTING OFF MACHINES, PIPE (SEE PIPE-CUTTING AND THREADING MACHINES)
Landis Machine Co., Inc., Waynesboro, Pa.

CUTTING-OFF TOOLS
Armstrong Bros. Tool Co., Chicago, Ill.

CUTTING OIL FILTERS (SEE OIL FILTERING SYSTEMS
Bowser, S. F. & Co., Ltd., Toronto.

CUTTING, OXY-HYDROGEN
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

DETACHABLE CHAIN
International Malleable Iron Co., Guelph, Ont.

DIAMONDS, BLACK AND ROUGH
Can. Desmond-Stephan Mfg Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

DIAMOND TOOLS
Can. Desmond-Stephan Co., Hamilton,
Wheel Trueing Tool Co., Windsor, Ont.

DIAMOND CROSSINGS
Can. Steel Foundries, Montreal, Que.

DIAMONDS, IMPORTERS
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Co., Windsor, Ont.

DIES, SCREW AND THREAD CUTTING
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.

DIES, SHEET-METAL AND SUB-PRESS (See Tool Work)
Brown, Boggs & Co., Ltd., Hamilton, Ont.

DIES, FORGING
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

DIES, SELF-OPENING, ADJUSTABLE
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Landis Machine Co., Inc., Waynesboro,
National Acme Co., Cleveland Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DIES, THREADING-OPENING
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DIVIDING HEADS
Burke Machine Tool Co., Conneaut, Ohio.
Hendey Machine Co., Torrington, Conn.
Kearney & Treacker Co., Milwaukee, Wis.

DOGS, LATHE AND MILLING MACHINE
Armstrong Bros. Tool Co., Chicago, Ill.

DRAFTING MATERIALS
American Lead Pencil Co., New York City, N.Y.

DRESSERS, GRINDING WHEEL
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ont.
Norton Co., of Can., Ltd., Hamilton.
Wheel Trueing Co., Windsor, Ont.

DRESSING TOOLS
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Co., Windsor, Ont.

DRILL HOLDERS
Armstrong Bros. Tool Co., Chicago, Ill.

DRILLING MACHINES, BENCH
Burke Machine Tool Co., Conneaut., Ohio.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Hardinge Bros., Inc., Chicago, Ill.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, ELECTRIC AND HAND
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, GANG
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

DRILLING MACHINES, HEAVY DUTY
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
Herbert, Limited, Alfred, Toronto, Ont.

BORING, DRILLING AND MILLING MACHINES, (HORIZONTAL.)
Gisholt Machine Co., Madison, Wis.
Herbert, Limited, Alfred, Toronto, Ont.

DRILLING MACHINES, Multiple Spindle
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
National Acme Co., Cleveland, Ohio.

DRILLING MACHINES, Pneumatic
Cleveland Pneumatic Tool Co., Toronto. Ont.

DRILLING MACHINES, PORTABLE
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, RADIAL
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Herbert, Limited, Alfred, Toronto, Ont.
Wiliams Machinery Co., A. R., Toronto,

DRILLING MACHINES, SENSITIVE
Burke Machine Tool Co., Conneaut, O.
Herbert, Limited, Alfred, Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Williams Machinery Co., A. R., Toronto.
Wisconsin Electric Co., Racine, Wis

DRILLING MACHINES, TURRET
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wisconsin.
Williams Machinery Co., A. R., Toronto.

DRILLING MACHINES, VERTICAL
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Herbert, Limited, Alfred, Toronto, Ont.

DRILLS, CENTRE
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DRILLS, ELECTRIC
U. S. Electrical Tool Co., Cincinnati, Ohio
Black & Decker Mfg. Co., Ltd., Montreal, Que.

DRILLS, HIGH SPEED TWIST
Butterfield & Co., Inc., Rock Island, Que
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Cleveland Twist Drill Co., Cleveland, O.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DRILLS, RATCHET
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

DRILLS, TWIST AND FLAT
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.

DROP FORGINGS
Steel Co. of Canada, Ltd., Hamilton

DUMB WAITERS
Roelofson Elevator Works, Galt, Ont.

DUST HANDLING EQUIPMENT
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

ELECTRIC DRILLS AND GRINDERS
Black & Decker Mfg. Co., Ltd., Montreal, Que.
U. S. Electrical Tool Co., Cincinnati, Ohio.

ELECTRIC STEAM GENERATORS
Dominion Engineering Works, Limited, Montreal, Que.

ELECTRICAL INSTRUMENTS
Bristol Co., Waterbury, Conn.

ELECTRICAL SUPPLIES
Atkins & Co., Inc., E. C., Indianapolis.
Diamond State Fibre Co., Toronto, Ont.

ELECTRIC TOOLS
U. S. Electrical Tool Co., Cincinnati, Ohio.

ELEVATORS AND CONVEYORS
Can. Link-Belt C., Toronto, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.

ELEVATORS, FREIGHT AND PASSENGER
Roelofson Elevator Works, Galt, Ont.

EQUIPMENT, ELEVATOR SAFETY
Jones & Glassco, Montreal, Que.

EMERY WHEELS (See Grinding Wheels)
Lion Grinding Wheels, Limited, Montreal, Que.
Atkins & Co., E. C., Indianapolis, I.
Norton Co., of Canada., Ltd., Hamilton.

ENGINES, CAPSTAN
Kennedy & Sons, Wm., Owen Sound, Ont.

ENGINEERS, MECHANICAL
Dominion Engineering Works, Limited, Montreal, Que.
Gisholt Machine Co., Madison, Wis.
Hamilton Gear & Machine Co., Toronto,

EXPANDERS, TUBE
Jardine & Co., A. B., Hespeler, Ont.

FANS, ELECTRIC
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

FANS, EXHAUST
Can. Blower & Forge Co., Ltd., Kitchner, Ont.

FANS, VENTILATING
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

FIBRE
Diamond State Fibre Co., of Can. Ltd., Toronto, Ont.

FILES AND RASPS
Nicholson File Co., Port Hope, Ont.
Simmons Canada Saw Co., Montreal, Que.

FILLER, IRON (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J.

FIRE ESCAPES
Roelofson Elevator Co., Galt, Ont.

FITTINGS, PIPE
International Malleable Iron Co., Guelph.
Fittings, Limited, Oshawa, Ont.

FLEXIBLE SHAFTS
Strand & Co., N. A., Chicago, Ill

FLUXES, WELDING
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd, Toronto
Liquide Air Company, Toronto, Ont.

FORGING MACHINERY
Acme Machinery Co., Cleveland, Ohio
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown Boggs & Co., Ltd., Montreal.
National Machinery Co., Tiffin, Ohio.
Steel Co. of Canada, Ltd., Hamilton.

FORGINGS, DROP
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Ltd., Toronto, Ont.

FORGINGS, HAMMER
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Hepburn Ltd., John T., Toronto, Ont.

FOUNDRY EQUIPMENT
Rice Lewis & Son, Ltd., Toronto, Ont.

FOUNDRY SUPPLIES
Rice Lewis & Son, Ltd., Toronto, Ont.

FROGS, SPRING OR RIGID
Can. Steel Foundries, Montreal, Que.

FURNACES, ELECTRIC
Rockwell Co., W. S. New York City.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

FURNACES, HEAT TREATING COAL
Rockwell Co., W. S., New York City.

FURNACES, HEAT TREATING OIL AND GAS
Bellevue Industrial Furnace Co., Detroit, Michigan.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Rockwell & Co., W. S., New York, N.Y.

FURNACES TEMPERING AND ANNEALING
Bellevue Industrial Furnace Co., Detriot, Mich.
Brown & Sharpe Mfg., Co., Providence R. I.
Rockwell Co., W. S., New York City.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

FURNACES AND OVENS, ELECTRIC
Rockwell & Co., W. S., New York, N.Y.
Starrett Co., L. S., Athol, Mass.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

BUYERS' DIRECTORY

GAGES, MEASURING (See Tool Work)
Brown & Sharpe Mfg. Co., Providence, R. I.
Greenfield Tap & Die Corp., Galt, Ont.
Lufkin Rule Co., Windsor, Ont.
Starrett Co., L. S., Athol, Mass.

GAGES, RECORDING
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GAGES, SPECIAL MEASURING
(See Tool Work)
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GAGES, THREAD
Brown & Sharpe Mfg. Co., Providence R. I.
Herbert, Limited, Alfred, Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

GALVANIZING
Fittings, Limited, Oshawa, Ont.

GAS, COAL COMPRESSED
L'Air Liquid Society, Toronto, Ont.

GAS, COMPRESSED
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

GASKETS
Diamond State Fibre Co. of Ca., Ltd., Toronto, Ont.
Smooth Mfg. Co., Jersey City, N. J

GAUGES VACUUM AND PRESSURE
Taylor Instrument Co. Toronto, Ont.

GEAR BLANKS
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.
Dominion Engineering Works, Limited, Montreal, Que.

GEAR COUNTERS
Hart Mfg. Co., R. A., Battle Creek, Michigan.

GEAR CUTTING MACHINES
Bertram & Sons Co., Ltd., The John, Dundas, Ont.

Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Fellows Gear Shaper Co., Springfield, Vt.
Whiton Machine Co., D. E., New London, Conn.

GEAR TESTING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.

GEARS, CAST
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Hull Iron & Steel Foundries, Hull, Que.
Dominion Engineering Works, Limited, Montreal, Que.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

GEARS, CUT
Brown & Sharpe Mfg. Co., Providence, R. I.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Gardner & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto, Ont.
Hepburn Ltd., John T. Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

GEARS, DRESSED
Kennedy & Sons, Wm., Owen Sound, Ontario.

GEARS, FORGED
Canada Foundries & Forgings Co., Welland, Ont.

GEARS, HERRINGBONE
Hamilton Gear & Machine Co., Toronto, Ont.

GEARS, RAWHIDE (See Gears, Cut)
Hamilton Gear & Machine Co., Toronto.

GEAR, SILENT CHAIN
Gardner & Son, Robt., Montreal, Que.
Can. Link-Belt Co., Ltd., Toronto, Can.
Hans Renold of Canada, Ltd., Montreal, Quebec.

GEARS, WORM
Hamilton Gear & Machine Co., Toronto.

GENERATORS, ACETYLENE
L'Air Liquide Society, Toronto, Ont.

GOGGLES, SAFETY
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto
Liquide Air Company, Toronto.

GRAB BUCKETS
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Cleveland Twist Drill Co., Cleveland, O.

GREASE CUPS, PRESSED STEEL AND BRASS
Can. Winkley Co., Ltd., Windsor, Ont.

GREASES, LUBRICATING
Canadian SKF Co., Toronto, Ont.

GRINDERS, ELECTRIC
Black & Decker Mfg. Co., Ltd., Montreal, Que.
U. S. Electrical Tool Co., Cincinnati, Ohio.

GRINDERS TOOL POST
U. S. Electrical Tool Co., Cincinnati, Ohio

GRINDING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Norton Co., of Canada, Ltd., Hamilton.

GRINDING MACHINES, ABRASIVE BELT
Norton Co. of Can. Ltd., Hamilton, Ont.

GRINDING MACHINES, AUTOMATIC
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, BENCH
Blount Co., J. G., Everett, Mass
Geometric Tool Co., New Haven, Conn
Landis Tool Co., Waynesboro, Pa
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co. of Canada, Ltd., Hamilton, Ont.
Pratt & Whitney Co. of Canada, Ltd.,

GRINDING MACHINES, CENTER
Wisconsin Electric Co., Racine, Wis

GRINDING MACHINES, CUTTER AND REAMER
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, CYLINDRICAL
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.
Norton Co., of Canada, Ltd., Hamilton

GRINDING MACHINES, DIE
Geometric Tool Co., New Haven, Conn
National Acme Co., Cleveland, O
National Machinery Co., Tiffin, Ohio

GRINDING MACHINES, DRILL
Bellevue Industrial Furnace Co., Detroit, Mich.
Bertram & Son Co., Ltd., The John, Dundas, Ont.

GRINDING MACHINES, ELECTRIC
Strand & Co., N. A., Chicago Ill

GRINDING MACHINES, FLOOR AND TOOL
Blount Co., J. G., Everett, Mass
Herbert, Limited, Alfred, Toronto, Ont.
National Acme Co., Cleveland, Ohio
Norton Co. of Canada, Ltd., Hamilton, Ontario.
Greenfield Tap & Die Corp., Galt, Ont.
U. S. Electrical Tool Co., Cincinnati, Ohio

GRINDING MACHINES, INTERNAL
Garlock Machinery Ltd., Toronto, Ont
Greenfield Tap & Die Corp., Galt, Ont.
Cleveland Pneumatic Tool Co., Toronto Ont.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES PORTABLE
Strand & Co., N. A., Chicago, Ill.

GRINDING MACHINES, SNAGGING
Blount Co., J. G., Everett, Mass.
Norton Co., of Can. Ltd., Hamilton Ont
U. S. Electrical Tool Co., Cincinnati, Ohio.

GRINDING MACHINES, SURFACE
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, THREAD
Pratt & Whitney Co., of Canada, Ltd.,

GRINDING MACHINERY, TOOL POST
Gisholt Machine Co., Madison, Wis.
Grenfield Tap & Die Corp., Galt, Ont.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES, UNIVERSAL
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Herbert, Limited, Alfred, Toronto, Ont.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co., of Canada, Ltd., Hamilton Ontario.

GRINDING WHEELS
Lion Grinding Wheels, Limited, Montreal, Que.
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Norton Co. of Can., Ltd., Hamilton, Ont.

GUN-BARREL MACHINERY
Steinle Turret Machine Co. Madison, Wisconsin.

HACK SAWS, POWER
Atkins & Co., Inc., E C., Indianapolis, Indiana.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass

HAMMERS, CHIPPING
Cleveland Pneumatic Tool Co., Toronto, Ont.
High Speed Hammer Co., Rochester.

HAMMERS, DROP
Bertram & Son Co., Ltd., The John Dundas, Ont.
Pliss Co., E. W., Brooklyn, N.Y.
Brown Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

HAMMERS, ELECTRIC
Brown, Boggs & Co., Ltd., Hamilton, Ont.

HAMMERS, PNEUMATIC
Can. Steel Foundries, Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto Ont.

HANGERS, SHAFTING
Canadian SKF Co., Toronto, Ont.
Brown & Sharpe Mfg Co., Providence, R I
Hamilton Gear & Machine Co Toronto.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

HOBBING MACHINES
Shore Instrument Co., Jamaica, N Y

HARDENING, CASE-HARDENING AND TEMPERING
Parkes Company, Wallace, Hamilton
Gisholt Machine Co., Madison Wis
Cleveland Pneumatic Tool Co., Toronto Ont

HAMMERS, POWER
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont
Jardine & Co., A. B., Hespeler, Ont
Petrie, Ltd., H. W., Toronto, Ont.

HOBS
Brown & Sharpe Mfg Co., Providence, R I
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

HOISTS, ELECTRIC
Can. Link-Belt Co., Toronto, Ont.
Can Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont
Shepard Electric Crane & Hoist Co., Montour Falls, N Y

HOISTS, HAND
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont
Wright Mfg Co., Lisbon, Ohio

HOISTS, PNEUMATIC
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont

HOLDERS-ON, PNEUMATIC
Cleveland Pneumatic Tool Co., Toronto Ont.

HYDRAULIC MACHINERY
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

IGNITERS, GAS ENGINE
Canada Foundries & Forgings Co., Welland, Ont.
Burke Machine Tool Co., Conneaut, O

INDICATORS, SPEED AND TEST
Brown & Sharpe Mfg. Co., Providence, R.I.

INSULATION
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.

IRON BARS
Steel Co. of Canada, Ltd., Hamilton, Ont.

JACKS, HYDRAULIC
Norton, A. O., Boston, Mass.

JACKS, PLANER
Armstrong Bros. Tool Co., Chicago, Ill
Starrett Co., L. S., Athol, Mass.

JAPANNING AND VARNISHING OVENS
Brantford Oven & Rack Co., Brantford, Ont.

JIGS AND FIXTURES (SEE TOOL WORK)
Fisher Motor Co., Ltd., Orillia, Ont.
Gisholt Machine Co., Madison, Wis.

KEYSEATING MACHINES
Morton Mfg Co., Muskegon, Mich
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

KEYS, MACHINE
Can. Drawn Steel Co., Hamilton, Ont
Morton Mfg Co., Muskegon, Mich.

KNIVES, MACHINE
Atkins & Co., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

KNURL HOLDERS
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

LATHE ATTACHMENTS
Hendey Machine Co., Torrington, Conn.

LATHE TOOLS
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn

LATHES, AUTOMATIC AND SEMI-AUTOMATIC
Gisholt Machine Co., Madison, Wis.
Herbert, Limited Alfred, Toronto, Ont
National Acme Co., Cleveland, Ohio
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, BENCH
Hardinge Bros., Inc., Chicago, Ill.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

LATHES, BORING
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, CHUCKING (SEE LATHES, HORIZONTAL TURRET, AND LATHES, VERTICAL TURRET)
Acme Machine Tool Co., Cincinnati, O
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
Herbert, Limited, Alfred, Toronto, Ont
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, ENGINE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hendey Machine Co., Torrington, Conn
Herbert, Limited, Alfred, Toronto, Ont

LATHES, EXTENSION AND GAP
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison Wis
Herbert, Limited, Alfred, Toronto, Ont
National Acme Co., Cleveland, O
Steinle Turret Machine Co., Madison, Wis.

LATHES, PRECISION
Hardinge Bros., Chicago.

LATHES, RELIEVING
Hendey Machine Co., Torrington, Conn.

BUYERS' DIRECTORY

LATHE, UNIVERSAL HAND
Brown & Sharpe Mfg. Co., Providence, Rhode Island.

LATHE, SPEED AND HAND
Blount Co., J. G., Everett, Mass.

LATHES, SPINNING
Pryibil Machine Co., Torrington, Conn.

LATHES, VERTICAL TURRET
Bertram & Son, Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

LATHES, WOOD TURNING
Blount, Co., J. G., Everett, Mass.
Can. Fairbanks-Morse Co., Ltd., Montreal.

LEAD PIPE
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

LEATHER FILLET
D. K. McLaren, Limited, Montreal.

LINOLEUM MILL MACHINERY
Bertrams, Ltd., Edinburgh, Scotland.

LIQUID AIR PLANTS
L'Air Liquide Society, Toronto, Ont.

LOCKERS, CLOTHES
Dennis Wire and Iron Works, London, Ont.

LUBRICANTS
Oakley Chemical Co., New York, N.Y.

LUBRICATING SYSTEMS
Bowser, S. F., & Co., Ltd., Toronto, Canada.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Ltd., Welland, Ont.
Ker & Goodwin Machine Co., Brantford, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R. Toronto Ont.

MANGANESE STEEL
Can. Steel Foundries, Montreal, Que.

MANDRELS, EXPANDING
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MANDRELS, SOLID
Greenfield Tap & Die Corp., Galt, Ont.
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Pratt & Whitney Co., of Canada. Ltd., Dundas, Ont.

MEASURING MACHINES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MECHANICS' FINE TOOLS
Lufkin Rule Co., Windsor, Ont.

METALS, ALLOY
Canada Metal Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.

METAL WORKERS
Parker Co., Charles, Meriden, Conn.

MICROMETER CALIPERS
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Rice Lewis & Son, Ltd., Toronto, Ont.

MILLING ATTACHMENTS
Burke Machine Tool Co., Conneaut, O.
Hendey Machine Co., Torrington, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.

MILLING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Burke Machine Tool Co., Conneaut, O

MILLING MACHINES, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence, R. I.
Hardinge Bros., Inc., Chicago, Ill.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

MILLING MACHINES, BENCH
Burke Machine Tool Co., Conneaut, O.
Hardinge Bros., Inc., Chicago, Ill.

MILLING MACHINES, HAND
Brown & Sharpe Mfg. Co., Providence
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MILLING MACHINES, HORIZONTAL PLANER TYPE.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Kearney & Trecker Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto.

MILLING MACHINES, PLAIN
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, O.
Hendey Machine Co., Torrington, Conn
Herbert, Limited, Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.

MILLING MACHINES, THREAD
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MILLING MACHINES, UNIVERSAL
Brown & Sharpe Mfg. Co., Providence,
Hendey Machine Co., Torrington, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.

MILLING MACHINES, VERTICAL
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, O.
Herbert, Limited, Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg Co., Milwaukee, Wis
Williams Machinery Co., A. R., Toronto.

MILLING TOOLS, ADJUSTABLE HOLLOW
Geometric Tool Co., New Haven, Conn.

MOTORS, ELECTRIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Roelofson Elevator Co., Galt, Ont.
Williams Machinery Co., A. R., Toronto,
Wisconsin Electric Co., Racine Wis.

NAILS AND STAPLES
Canada Metal Co., Ltd., Toronto, Ont.

NIPPLES
Canada Metal Co., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton,

NITROGEN
Carter Welding Co. Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

NUT TAPPERS
(See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
National Acme Co., Cleveland, Ohio.

NUTS, FINISHED and SEMI-FINISHED
Galt Macine Screw Co., Galt, Ont.
National Acme Co., Montreal, ue.

NUTS (Up to 4-in.)
Steel Co. of Canada, Ltd., Hamilton.

NUTS, S.A.E., PLAIN AND CASTELLATED
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

OIL FILTERING AND STORAGE SYSTEMS
Bowser, S. F., & Co., Ltd., Toronto,

OIL STORAGE ENGINEERS
Bowser, S. F., & Co., Ltd., Toronto,

OIL HOLE COVERS
Can. Whitney Co., Ltd., Windsor, Ont.

OILS, SOLUABLE
Brantford Oven & Rack Co., Brantford, Ontario.

ORNAMENTAL IRON AND WIRE WORKS
Roelofson Elevator Works, Galt, Ont.

OXYGEN
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

OXY-ACETYLENE APPARATUS
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Atlas Press Co., Kalamazoo, Mich.

PAINT SPRAYERS
Spray Engineering Co., Boston, Mass.

PAPER MILL CONVEYORS
Bertram Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd., Montreal, Que.

PAPER MILL MACHINERY
Dominion Engineering Works, Limited, Montreal, Que.

PATTERNS, WOOD AND METAL
Fittings, Limited, Oshawa, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.
Victoria Foundry Co., Ltd., Ottawa.

PHOSPHOR TIN
Canada Metal Co., Ltd., Toronto, Ont.

PHOTOGRAPHIC DUPLICATING MACHINES
Photostat Corp., Providence, R. I.

PIPE BENDING MACHINES
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Underwood Corp., H. R., Philadelphia, Pa.
Williams Machinery Co., A. R., Toronto.

PIPE CUTTING AND THREADING MACHINES
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Petrie, Ltd., H. W., Toronto, Ont.

PIPE
Canada Metal Co., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.

PIPE FITTINGS
Canada Metal Co., Toronto, Ont.
International Malleable Iron Co., Guelph Ont.

PIPE AND NIPPLE THREADING MACHINES
Landis Machine Co., Inc., Waynesboro, Pa.

PIPE FITTERS' TOOLS
Rice Lewis & Son, Ltd., Toronto, Ont.

PIPE THREADING DIE HEADS
Landis Machine Co., Inc., Waynesboro Pa.

PISTON-RING MACHINES
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

PLANING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morton Mfg Co., Muskegon, Mich.
Williams Machinery Co., A. R., Toronto.

PLANING MACHINES, ROTARY
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Herbert, Limited, Alfred, Toronto, Ont

PLATE ROLLS
Bertram & Son Co., Ltd., The John, Dundas, Ont.

PNEUMATIC TOOLS
Cleveland Pneumatic Tool Co., Toronto

POLISHING AND BUFFING MACHINES
Lion Grinding Wheels, Limited, Montreal, Que.
Blount Co., J. G. Everett, Mass.
Brown & Sharpe Mfg. Co., Providence.
Pryibil Machine Co., New York, N.Y

PRESSED STEEL PARTS
American Pulley Co., Philadelphia, Pa
Fisher Motor Co., Ltd., Orillia, Ont.

PRESSES, ARBOR
Atlas Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

PRESSES, DROP AND FORGING
Brown, Boggs & Co., Ltd., Hamilton
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

PRESSES, FOOT AND HAND
Brown, Boggs & Co., Ltd., Hamilton

PRESSES, HYDRAULIC
Bertram & Son Co., Ltd., The John Dunidas, Ont.
Cleveland Twist Drill Co., Cleveland, O
Perrin Ltd., W. R., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

PRESSES, POWER
Bliss Co., E. W., Prooklyn, N. Y.
Brown, Boggs, & Co., Ltd., Hamilton
Hepburn Ltd., John T., Toronto, Ont
Stoll Co., Inc., D. H., Buffalo, N.Y

PRESSES, SCREW
Brown, Boggs & Co., Ltd., Hamilton

PROFILING MACHINES
Prtt & Whitney Co., of Canada, Ltd Dundas, Ont.

PROTRACTORS
Brown & Sharpe Mfg. Co., Providence
Lufkin Rule Co., Windsor, Ont.

PROPELLERS
Kennedy & Sons, Wm., Owen Sound Ontario.

PULLEYS, CORK INSERT
American Pulley Co., Philadelphia, Pa

PULLEYS, METAL AND FIBRE
American Pulley Co., Philadelphia, Pa.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.
D. K. McLaren Co., Limited Montreal, Que.

PULP AND PAPER MILL EQUIPMENT
Dominion Engineering Works, Ltd., Montreal, Que.

PUMPS, HYDRAULIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Dominion Engineering Works, Ltd Montreal, Que
Hepburn Ltd., John T., Toronto, Ont

PUMPS, LUBRICANT AND OIL
Bowser, S. F., & Co., Ltd., Toronto.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Hepburn Ltd., John T., Toronto, Ont.

PUMPS, POWER
Bowser, S. F., & Co., Ltd., Toronto.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hepburn Ltd., John T., Toronto, Ont.

PUNCHES, CENTER
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

PUNCHES, HAND
Brown Boggs & Co., Ltd., Hamilton.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Jardine & Co., A. B., Hespeler, Ont.

PUNCHES, POWER
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

PUNCHING MACHINES, HORIZONTAL
Bertrams Ltd., Edinburgh, Scotland.

PYROMETERS, ELECTRIC
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Hiram Walker & Sons Metal Products Co., Walkerville, Ont.

RACKS, CUT
Hamilton Gear & Machine Co., Toronto.

RACKS, STORAGE
(See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ontario.

REAMER HOLDERS
Simonds Canada Saw Co., Montreal, Q.

REAMERS, ELECTRIC
U. S. Electrical Tool Co., Cincinnati, Ohio.

REAMERS, EXPANDING
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

REAMERS, SOLID
Butterfield & Co., Inc., Rock Island, Q.
Morse Twist Drill & Machine Co., New Bedford, Mass.

REAMERS, TAPER
Brown & Sharpe Mfg. Co., Providence, R. I.
Butterfield & Co., Inc., Rock Island, Q.
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canad, Ltd., Dundas, Ont.

RECORDERS, TEMPERATURE
Taylor Instrument Co., Rochester, N. Y.

RECORDERS, TIME
Gisholt Machine Co., Rochester, N. Y.
Taylor Instrument Co., Toronto, Ont.

REGULATORS, TEMPERATURE
Taylor Instrument Co., Toronto, Ont.

RIVETS AND BURRS
Parmenter & Bulloch Co., Gananoque, Ont.
Steel Co., of Canada, Ltd., Hamilton,

RIVET-MAKING MACHINERY
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
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See last page of directory.

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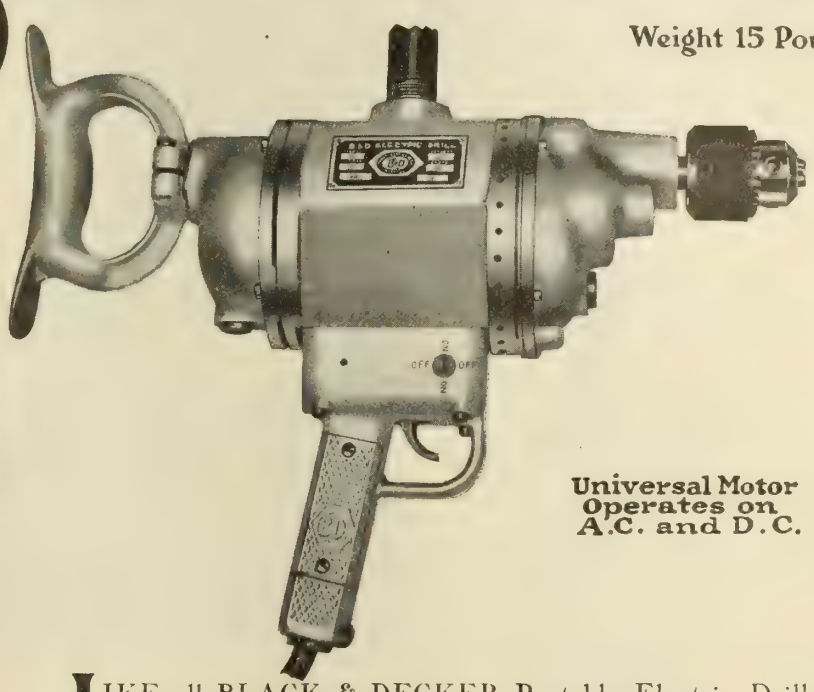

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BLACK & DECKER National Credit Service enables any reliable person in Canada to purchase Black & Decker equipment from his jobber on terms that permit the equipment to pay for itself.

THE BLACK & DECKER MFG. CO.
LIMITED
344 St. James Street
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A. J. HOPKINS, Manager

Miniature catalogue will be supplied on request.

From a British Engineer

A prominent British engineer brings to light some interesting data on the causes of hack saw breakage which closely parallels the experience of The L. S. Starrett Co. The following figures are based on conditions in four large works:

Causes of Hack Saw Breakage

Faulty blades.....	3.2%	Wrong blade for the job.....	17.3%
Gross carelessness on the part of the operator.....	29.4%	Wrong speed on stroke	21.6%
		Wrong pressure.....	28.5%

Ignorance or carelessness on the part of the user is responsible for most of the blade breakage. If each workman has a copy of the Starrett Hack Saw Chart (any number sent free on request) in in front of him—he can't go wrong on the blade to use for each different type of work.

And if those in charge of the shop thoroughly understand the use of hand and power hack saws, there will be mighty little breakage caused by wrong speed or pressure. "Hack Saws and their Use" covers the subject completely and is used as a reference in thousands of plants today. Every production manager and foreman should have this valuable work on the least understood tool in the shop. A copy will be sent free on request. At the same time ask for Catalogue No. 22 "3" and Supplement describing the new Starrett Tools.

THE L. S. STARRETT CO.

The World's Greatest Toolmakers
Manufacturers of Hacksaws Unexcelled
ATHOL, MASS.

12-446

STARRETT TOOLS

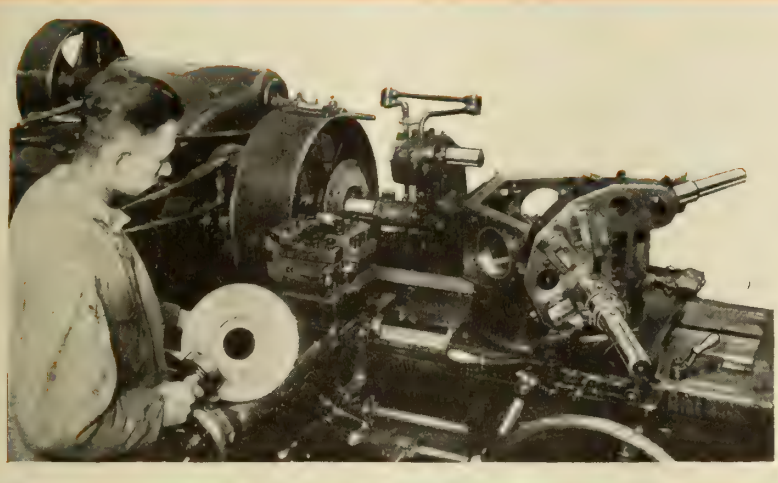
STARRETT HACK SAWS

Starrett Hack Saws

CANADIAN MACHINERY
AND MANUFACTURING NEWS

Vol. XXVIII. No. 18 | Published Weekly by the MacLean Publishing Company, Limited, Toronto, Ont. | Nov. 2, 1922 | $4.00 a Year Subscription Price

READ AND PASS TO	Check	See Page	READ AND PASS TO	Check	See Page



Solving Boring Production Problems

WE SUPPLY THE WORLD WITH EXPANSION BORING TOOLS AND EXPANSION REAMERS

Davis

Expansion Boring Tools and Reamers

STYLE "V" TOOL

STYLE "E" TOOL
Pilot is Hardened and has Oil Grooves

THE POSSIBILITIES and advantages of Davis Expansion Boring Tools and Reamers in your boring operations are clearly indicated in their uniform, successful performance in those plants, where maximum efficiency is maintained—fully meeting all production demands, at a saving in costs of 25 per cent. to 50 per cent.

There is no guess work or uncertainty as to the results these tools will produce; their merit is recognized in thousands of shops where they have fully demonstrated their efficiency and adaptability.

Practical cutter expansion to compensate for wear or to bore any size within range of tool, is obtained by means of micrometer adjustment, graduated in .001—insuring absolute accuracy in boring or reaming any class of metal, at a guaranteed saving of 25 per cent. in costs.

The illustration shows some special types of boring tools maintaining maximum production in one of the largest plants in the country.

LET US HELP YOU
SOLVE YOUR OWN PRODUCTION PROBLEMS

With 19 years of constant effort devoted to the exclusive manufacture of boring and reaming equipment and with a competent staff of engineers, we are qualified in offering suggestions on boring and reaming equipment for any production requirements. Take advantage of our free engineering service and send in sketches of your work for our recommendations.

Our literature on Expansion Boring Tools and Reamers will interest you. Ask us to send bulletin No. 350 and R 532.

Davis Boring Tool Company
Incorporated

3736 FOREST PARK BOULEVARD
ST. LOUIS, MO., U.S.A.

Established 1903

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John Bertram Sons Co.
DUNDAS

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MONTREAL

LARGEST EXCLUSIVE MANUFACTURERS OF EXPANSION BORING TOOLS AND EXPANSION REAMERS

Little Giant

NUTS, rods and pipes are frequently located in almost inaccessible places. When replacements are necessary the man without a "Little Giant" Pipe Wrench is sadly handicapped. The Little Giant grips and lets go quickly and surely, and with it a much greater turn can be accomplished.

In running pipe lines close to walls, ceilings or corners the labor cost is apt to be high. It can be lowered by using the LITTLE GIANT WRENCH. The jaw opening can be thrust on to the pipe, rod or nut as easily as a pair of pliers. It grips instantly, gives a far greater turn and requires less muscular effort by reason of the extra long handle.

There are but three drop forged hardened steel parts in the LITTLE GIANT. It has two to four times the service life due to extra sets of teeth.

Hundreds of users have written us enthusiastic letters concerning LITTLE GIANT performance. You'll add to their number once you see it in action.

Simpler—
Stronger—
Lasts Longer—
only 3 parts

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OF CANADA, LIMITED — GALT, ONTARIO

U. S. Plant: Greenfield Tap & Die Corporation, Greenfield, Mass., U. S. A.
London Office: Greenfield Tap & Die Corp., 139 Queen Victoria St., London, E. C. 4.

GTD Screw Plates, Taps, Dies, Reamers, Gages, Pipe Tools, Twist Drills, Milling Cutters

Where they tap nuts by the ton

Records Are Kept of Tap Performance

These show that Pratt & Whitney Taps score highest on two counts. Time between resharpenings is longer than ordinary. They can be sharpened and resharpened and still retain their original size long after other taps have gone to the scrap pile.

The "Con-eccentric land," an exclusive Pratt & Whitney feature — coupled with superior workmanship and rigid inspection both of the steel and the taps — are the secret of their long life.

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Pratt & Whitney Taps are **cheaper** to use than others. It's true whether you are tapping one or one million holes a day.

the taps they use are stamped

PRATT AND WHITNEY

201

Photo by courtesy of our customer

BLISS

Quality and Quantity Production

ALMOST the entire production of a large Western Screw Company is manufactured by the upset process. Heads for the variety of products are then trimmed by BLISS Presses. On the day the photograph was taken five girls, trimming hexagon heads on large bolts, secured these respective scores: 25,700, 25,300, 25,200, 24,100, 22,100.

This is another illustration of BLISS Presses successfully meeting the test of rapid, continuous, accurate production. BLISS Machinery is machinery plus knowledge and experience. It insures you economical production.

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No. 37

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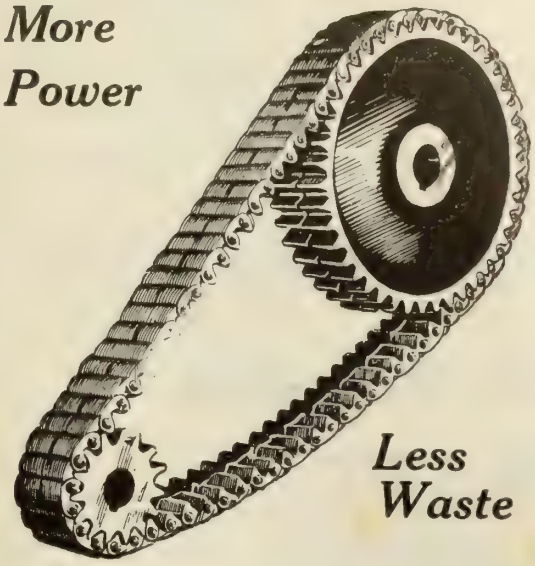
More Power



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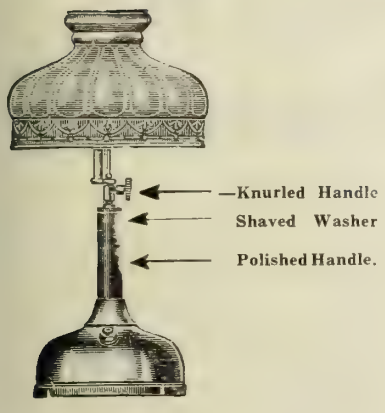
"The Best in Finish and Quality that we have ever had"



An outstanding instance of the wide range of uses to which Diamond Fibre can be put is provided by the Coleman Lamp Company of Toronto. It being imperative that only the best material procurable should be used in the manufacture of their lamps, they turned to Diamond Fibre as the material for the knurled and polished handles and shaved washers—important parts of their lamp construction. That their policy was justified is shown by the following extract from a letter they wrote us:

> "We wish to take this opportunity of thanking you for the prompt service that you have been giving us on our recent orders and for the splendid quality of fibre that you are supplying us for our factory. The tubes that you have furnished us are the best in finish and quality that we have ever had."

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Many of your competitors have saved considerable expense annually by substituting Diamond Fibre for other material. Why not you? Is it not worth investigating?

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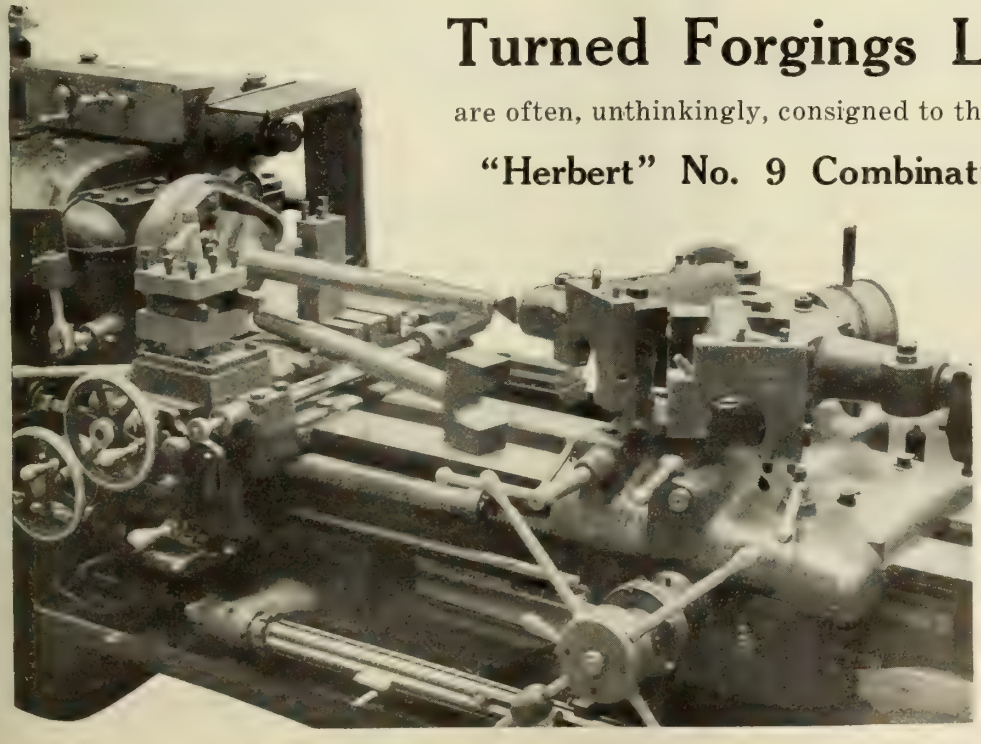
DIAMOND STATE FIBRE COMPANY of Canada, Limited

Toronto, Ontario

Turned Forgings Like These---

are often, unthinkingly, consigned to the Engine Lathe when the

"Herbert" No. 9 Combination Turret Lathe



will produce them even in quite small quantities much more economically. Here's a case in point. The piston rods shown are about 24″ long under the head, which is 7½″ across the corners. The long plain portion is 2⅛″ diameter and the machining time is 30 minutes.

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Fifty years' experience has taught us how to incorporate these virtues in every style and size of file.

You make no mistake when you specify one of these standard brands.

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HUNDREDS of repair jobs that formerly kept rolling stock idle for weeks, and even months, are now speedily, economically and permanently effected by the oxy-acetylene process.

Dominion Oxygen Service contributes largely to the facility by which these jobs are completed. A service that places an unlimited supply of Dominion Oxygen and Prest-O-Lite Dissolved Acetylene of uniformly high quality, in safe, easily-handled cylinders with leak-proof valves, in the shops where and when it is needed.

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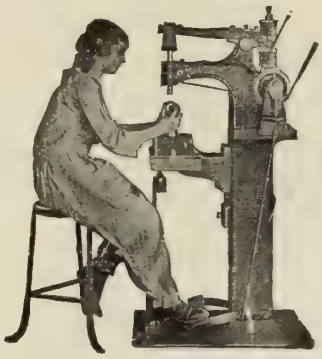
D34

The Hammer With The Human Stroke



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Heads 'em tight or loose, flush, countersunk, or finishes heads any shape desired, and at the rate of:
A rivet a second, sizes up to 3/16".
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And on special order we build machines to handle rivets up to 1½" with proportionate rapidity.
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Besides riveting, the High Speed Riveting Hammer does all kinds of peining, swaging, upsetting, etc.
Send us sample assembly parts with rivets or sketch of your work,
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Let us shoulder your riveting problems.
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THE HIGH SPEED HAMMER COMPANY, INC.

ROCHESTER, N.Y.

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For Long Service—

After all, you could no doubt buy any number of presses that would give the same production the first few weeks of operation.

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Engineers and Iron Founders

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CLECO PRESSURE SEATED AIR VALVES

Style PO

Style PO: Parallel Valve has "waste port" to bleed the air from hose after valve is shut off, sizes ¼" ⅜" ½" ¾" 1" 1¼" 1½" and 2" Standard Pipe Thread Outlets.

Style A

Style A: 30-degree Angle Valve, sizes: ½" and ¾". Outlets Standard Pipe Thread.

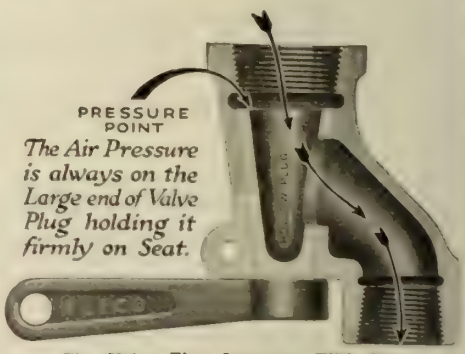
Style RA

Styles A, RA and SL also have waste ports to bleed air from hose.

Style RA: 90 degree Angle Valve sizes ¼" ⅜" ½" and ¾". Inlets and outlets are standard pipe thread.

Style SL

Style SL: The inlets and outlets are the same size and in alignment. Sizes ¼" ⅜" ½" ¾" 1" 1¼", 1½" and 2" standard pipe thread outlets.



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Requires no attention after installation.

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Riveting Hammers, Chipping Hammers, Sand Rammers, Air Drills, Grinders, Corner Drills, Bowes Hose Couplings, Cleco Air Valves, etc.

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Write for Illustrated Bulletin No. 50

CLEVELAND PNEUMATIC TOOL CO., of Canada Ltd.

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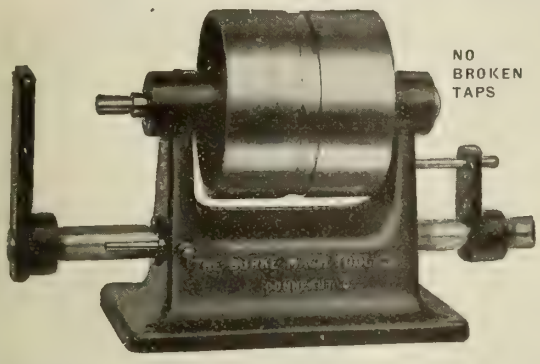
Repair Parts Are Practically Unknown



BURKE TAPPERS are simple to operate. It is not necessary to tie up the production of another and higher priced machine as when using a tapping attachment—they are complete in themselves. Production is limited only by the speed at which tap can be run and the ability of the operator to place the work on the machine. There are no parts to rapidly wear out, frictions are of gray iron and last indefinitely—in fact, repair parts are practically unknown.

THE BURKE MACHINE TOOL CO.
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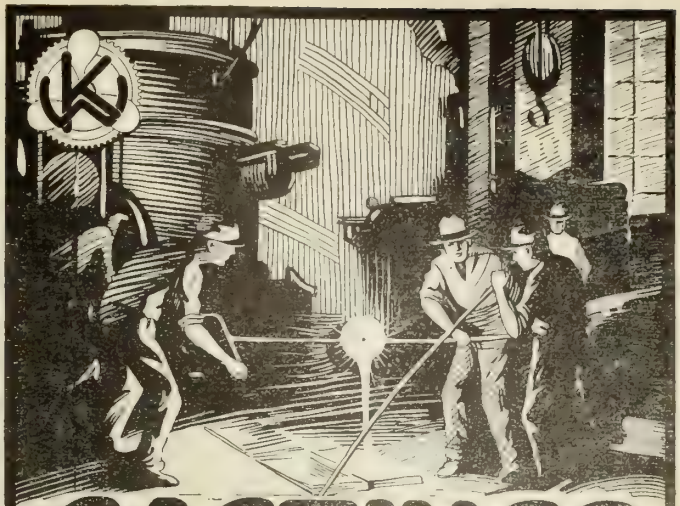
Write for the name of the dealer located in your city.



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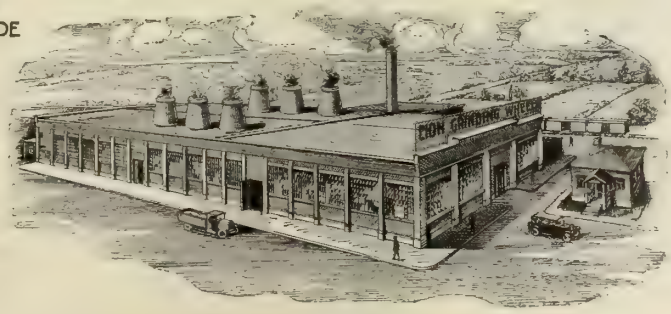
MANUFACTURERS OF HIGH GRADE GRINDING WHEELS

ALU-LION

For Grinding High Tensile Material



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The Wheels You Will Eventually Buy. Why Not Now?

LION GRINDING WHEELS Ltd.

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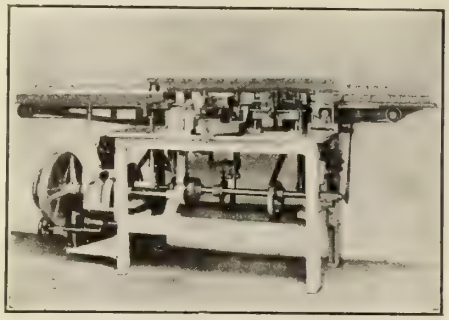
Agents for Prov. Quebec
J. R. Baxter & Co., Ltd.
Montreal

THE JOHNSON FRICTION CLUTCH

as used on the

WEEKS AUTOMATIC LABELER

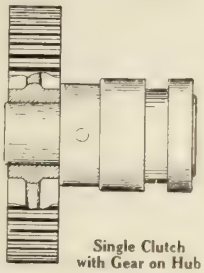
For Oval, Round and Square Bottles



The No. 2 single Johnson Friction is located on the drive shaft direct from ¼ h. p. motor. Clutch is adjusted to drive the machine but will slip when bottle is caught which prevents breakage.

Courtesy: F. W. Horstmann Co., Irvington, N. J.

There is only one clutch that can readily be made to meet so many varied conditions — the Johnson Friction Clutch. A product of great merit. Built in nine sizes from ¼ to 20 h.p. Can be run at high speed without vibration.



Single Clutch with Gear on Hub

Write for "Yellow Friction Control" Catalog.

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WELDING AND CUTTING

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SEAMLESS STEEL TUBING AT BARGAIN PRICES

Being anxious to clear out our stock of steel tubing, we offer the material shown at less than mill cost. This is an exceptional opportunity. Secure the best sizes NOW.

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100 ft. 2⅛" O.D. ⅛" wall.	30 ft. 3" O.D. 3-16" wall.

Subject To Prior Sale

5c *per lb.*

F. O. B. Warehouse Toronto

We have some welded steel tubing at very low prices, so that if you do not see what you require in this list, write us for complete information.

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MANGANESE-STEEL SPECIAL WORK

Frogs, Diamond Crossings, Crosses, Switches, Mates and Complete Intersections to meet any traffic requirements.

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Tapping ¼" open hearth steel couplings for a magnet drive with a ⅝"-18 thread isn't exactly child's play. There are 16 holes in each piece and, like all work of this class, it must be accurate. The boy shoves the work right along —one complete piece every 80 seconds—720 holes per hour.

He's using the

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SAFETY TAPPING ATTACHMENT

the only device on the market having a balanced reversing mechanism, eliminating all side pull or torsion.

The Safety Friction allows the operator to run the tap right to the bottom and use the bottom of the hole for a stop, without fear of tap breakage. **The reverse speed is twice that of the forward.**

If you've tapping to do get the details of the Procunier line. Learn the working value of our **Tapping Attachments, Tap Holders and the** popular Procunier Patented "Double Jaw" Chuck which drives the tap by the square and true by the round. Let us show you how they reduce production costs.

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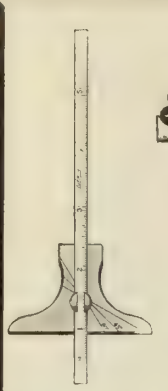

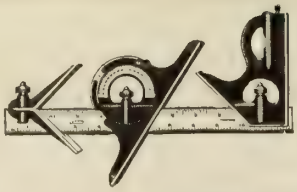

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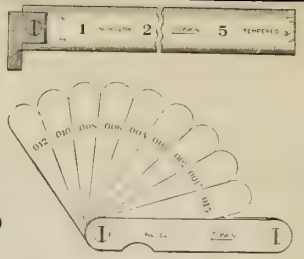
MECHANICS' TOOLS
APPEAL TO EVERY PROGRESSIVE MECHANIC

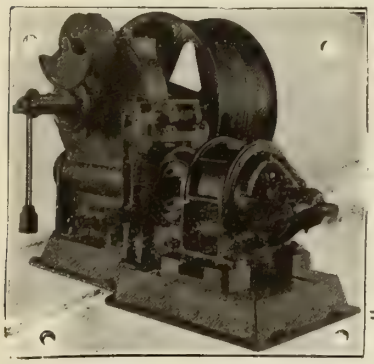


Accurate, and having all the other essential qualities of precision tools; also many improvements which mean better work, easier done.

Their nicety of design and finish appeal to the eye. Their performance day in and day out will hold your approval.

Ask your dealer to show you a LUFKIN Send for Catalogue of Mechanics' Tools.

THE LUFKIN RULE CO. OF CANADA, LTD. WINDSOR, ONT.



Automatically Safe and Economical

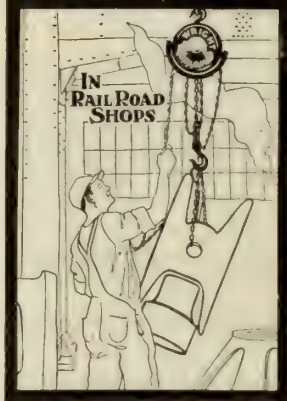
ROELOFSON DIRECT CONNECTED FREIGHT ELEVATORS

Simplicity in design cuts repair bills to an absolute minimum and ensures consistently satisfactory service. Smooth running and fast, noiseless, self-oiling, dust-proof and with brake that acts automatically, they are thoroughly dependable and economical. Capacity 1,000 lbs. to 10,000 lbs.

Write for particulars of our full line of Electric, Hydraulic and Hand Power Freight and Passenger Elevators.

Roelofson Elevator Works
GALT, ONT.

WRIGHT HOIST



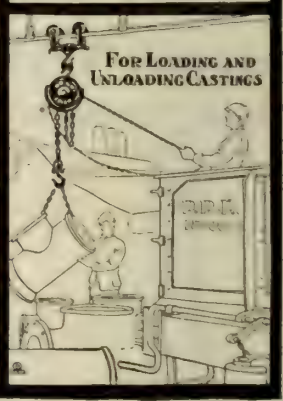
The only thing Wright hoists refuse to hoist is production costs, and it keeps that down with the same reliability that it uses in the lifting and maintenance of efficiency to the maximum. Its safety lock will hold it there with absolute surety.

Make us prove it. We're Willing.

WRIGHT MANUFACTURING COMPANY

CANADIAN DISTRIBUTORS:

The A. R. Williams Machinery Co., St. John, Halifax, Toronto, Winnipeg, Vancouver, Montreal.



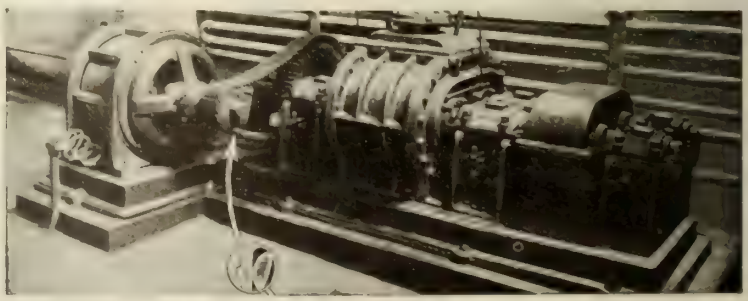
THE MORSE CHAIN CO.
are the
Largest Manufacturers in the world
of
High Speed Silent Chains

The superiority of Morse Rocker Joint Silent Chain has never been seriously questioned.

They speed up production, cut belt expense and overtime wages.

Catalogue Free.

Jones & Glassco (Reg'd)
Canadian Agents
Montreal - - Toronto



25 H.P. Morse Silent Chain to Positive Blower.

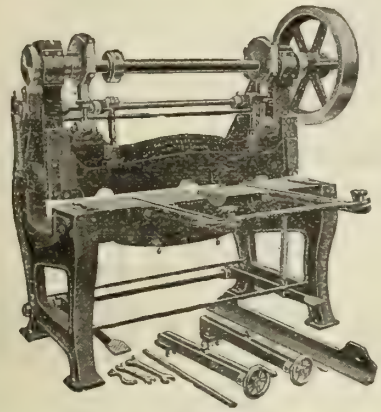
If interested tear out this page and place with letters to be answered.

BROWN-BOGGS

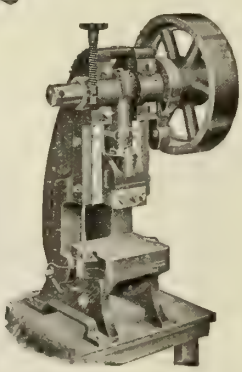
B B

It's Worth Looking For

Made from only the highest quality materials and by men who are specialists at their trade; the manufacture of **"B-B"** tools is watched step by step; the same careful attention being given to every detail, big or little.



No. 449—Shear

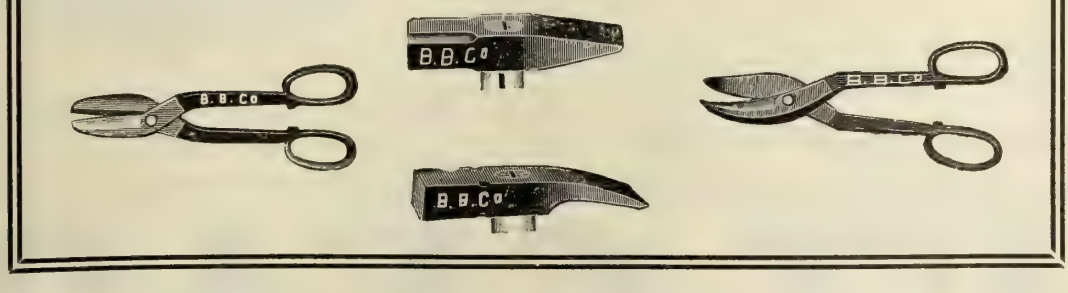


No. 10—Bench Press

One last final inspection is followed by the most rigid tests which leave no possibility of doubt as to efficiency and endurance. Then — and not until then — is the "B-B" Trade Mark stamped upon them as a guarantee of "B-B" quality. Like many other Canadian manufacturers, you, too, will find it a mark well worth looking for.

The "B-B" line consists of machines and tools for sheet metal, tinsmiths' tools and machine dies, shears and punches of every description. Consult us freely if you desire information.

SMALL TOOLS: Snips, Hammers and other small tools give longer service when stamped with the "B-B" trade mark. Insist upon the genuine.



TORONTO OFFICE:
Holbrook Building

A. B. WALKER
Representative

THE BROWN-BOGGS CO. LIMITED
HAMILTON, CANADA.

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—the name of a service supplying approximately 1,000,000 tons of pig iron annually in all required grades to the merchant iron trade.

M.A. HANNA & CO.

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143 University Ave., Toronto, Ont.

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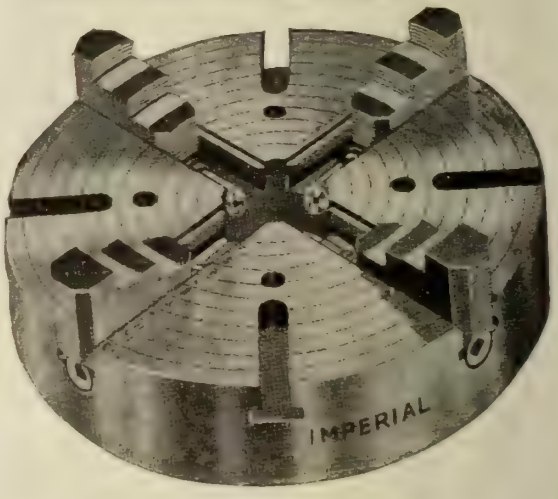
Highly Endorsed by Canada's Best Manufacturers

Sturdy long-wearing "Made-in-Canada" Chucks that are making good everywhere.
Specify them in your next order.



Ker & Goodwin Machinery Co.
BRANTFORD, Ont. LIMITED

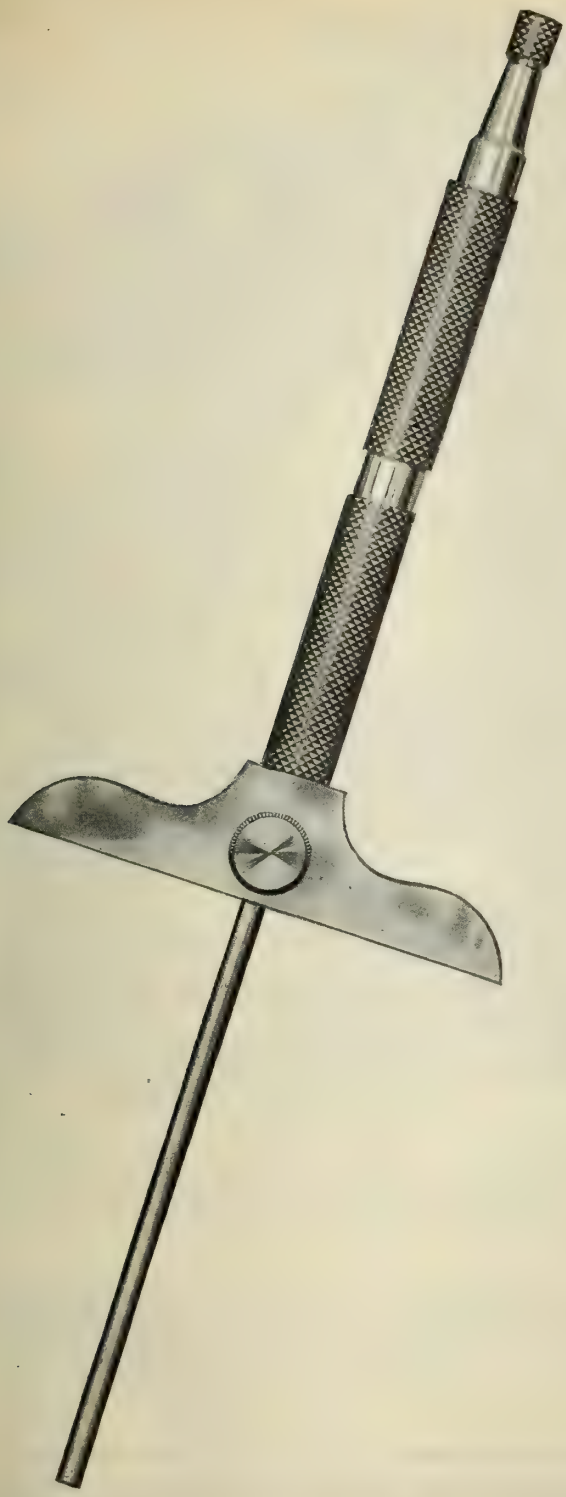
CUT GEARS

Theoretically Correct

PROMPT SERVICE

ROBERT GARDNER & SON
LIMITED
52 NAZARETH ST., MONTREAL, P.Q.

RAWHIDE CONDENSITE CELORON OR METAL



For quick measurements

The new Starrett Spring Depth Gage No. 48 is proving immensely popular with machinists and mechanics. Its convenience is obvious. A spring inside the barrel of the tool forces the rod downward until stopped by the bottom of the hole or recess to be measured. Then a quick turn of the clamp screw locks the rod in position and the gage is securely set with an instantaneous accurate measurement. Capacity of three inches—base is two and one-half inches long (a longer and better base than on the average gage). Base and contact end of measuring rod are hardened and ground. Starrett quality throughout.

Write for Catalog No. 22"3" and the Supplement describing the new Starrett Tools.

THE L. S. STARRETT CO.
The World's Greatest Toolmakers
Manufacturers of Hacksaws Unexcelled
ATHOL, MASS.

Use Starrett Tools

If what you need is not advertised, consult our Buyers' Directory and write advertisers, listed under proper heading

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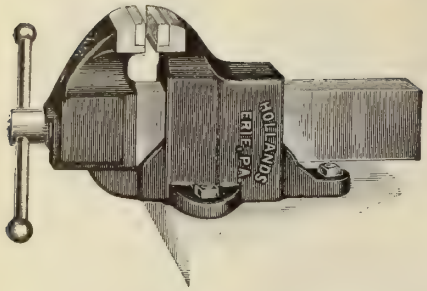
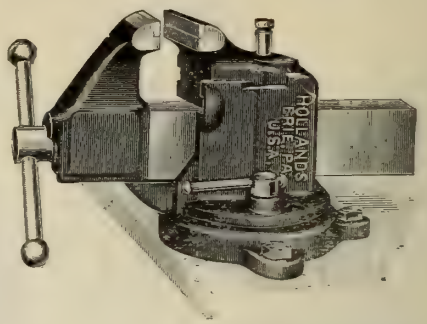


Have a record of thirty-five years of satisfactory service.

If your dealer cannot supply you, write direct for circular No. 25.



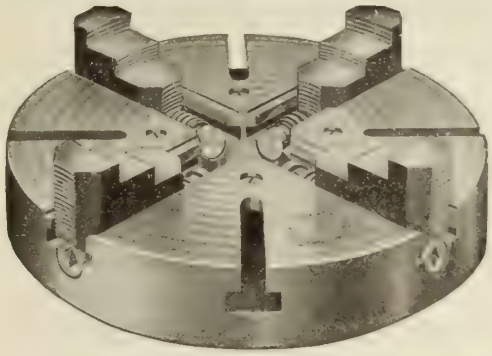
HOLLANDS MANUFACTURING CO.

Established 1887 **Erie, Pa., U. S. A.**

ALL STEEL

INDEPENDENT CHUCKS

are not an experiment—they have come to stay. They are a necessity with the modern machinery and high-speed steel cutting tools.



THE UNION STEEL BODY CHUCKS

are well designed and have all the elements of strength and durability for which they are designed. We make other types in steel also, including the Geared Scroll Chucks and the Geared Scroll Combination—all designed for heavy work and hard usage.

Union Manufacturing Company

New Britain, Conn.

New York Office: 26 Cortlandt Street

Makers of a complete line of chucks

Metal Spinning Lathes

Tools and Accessories for Round and Oval Work

A range of sizes from 15 to 60-inch swing. Illustration is 22-inch Ball Bearing Lathe with 6-inch Oval Chuck and Compound Rest.

P. Pryibil Machine Company

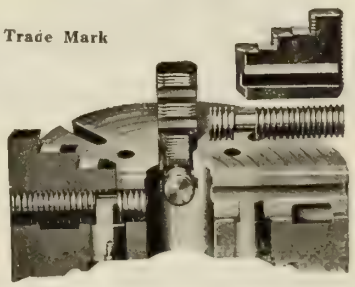
New York City

Established 1859

SKINNER STEEL BODY INDEPENDENT CHUCK

POWERFUL-STURDY-DEPENDABLE-ACCURATE

Trade Mark



For production, where exceptional gripping power is required, where heavy cuts are often necessary and large pieces are held, this type of chuck will render most satisfactory service.

Although the Skinner Steel Body Chuck has been in use for years, we have never known of one breaking in service. It is the heaviest, strongest Independent Chuck made.

Body—Cast Steel. Jaws—Extra wide. Adjusting screws—Large diameter.

Illustrated literature and catalogue on request.

THE SKINNER CHUCK COMPANY

NEW BRITAIN, CONN., U.S.A.

Established 1887

New York Office: 34 Reade Street.

San Francisco Office: Rialto Building.

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If what you need is not advertised, consult our Buyers' Directory and write advertisers, listed under proper heading

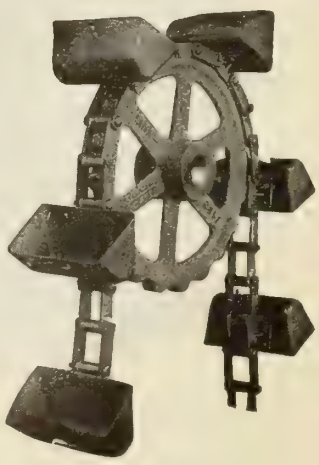
There is no *better* combination than ≻FLINT-RIM≺ Wheels and Link-Belt Chains

THEY fit each other snugly. There is no sliding or slipping as the links seat themselves against the teeth. And they continue to fit each other snugly, because the flint hard surfaces prevent wear.

Measure values in length of service, and you will find there is no *cheaper* combination than ≻FLINT-RIM≺ wheels and Link-Belt chains.

This trade mark ≻——≺ identifies Link-Belt product

Send for Catalog and full particulars.



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CANADIAN LINK-BELT COMPANY LIMITED

TORONTO-Wellington & Peter Streets MONTREAL-10 Gauvin Lane

LINK-BELT

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HENDEY

24" Crank Shaper

So well designed and so well made is this 24-inch HENDEY Gear Driven Crank Shaper that it can safely be used for work where, heretofore, it has been necessary to use a much larger shaper. Its abundance of power and stability are an assurance of greater production. A special feature is an extension table, made to align accurately with the fixed table. Then, too, in the matter of price, this 24-inch machine shows a saving over a larger shaper.

Write for the Hendey Booklet.

The Hendey Machine Company

Torrington, Conn., U. S. A.

Canadian Agents:

A. R. Williams Machinery Co., Toronto, Halifax, Montreal, St John, Winnipeg and Vancouver
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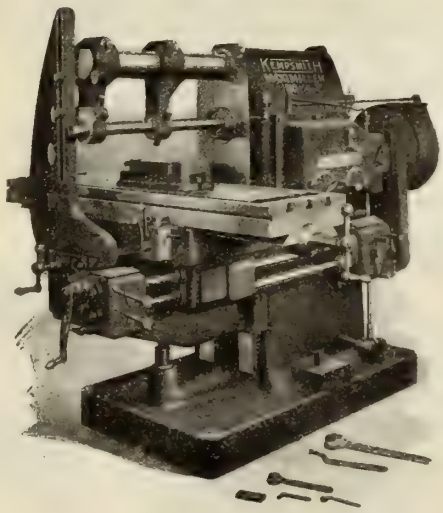
Hendey 24-inch Crank Shaper

THE

MAXIMILLER

FOR

PERMANENT PRODUCTION PROFITS



BECAUSE:

RIGID CONSTRUCTION!
AMPLE POWER!
POWER RAPID TRAVERSE!
(in all directions)
CENTRALIZED CONTROL!
GEARS RUN IN OIL!

Built by

KEMPSMITH MFG. CO., MILWAUKEE, U.S.A.

Builders of Cone-Geared Head and Production Type Milling Machines.

Send for Circular

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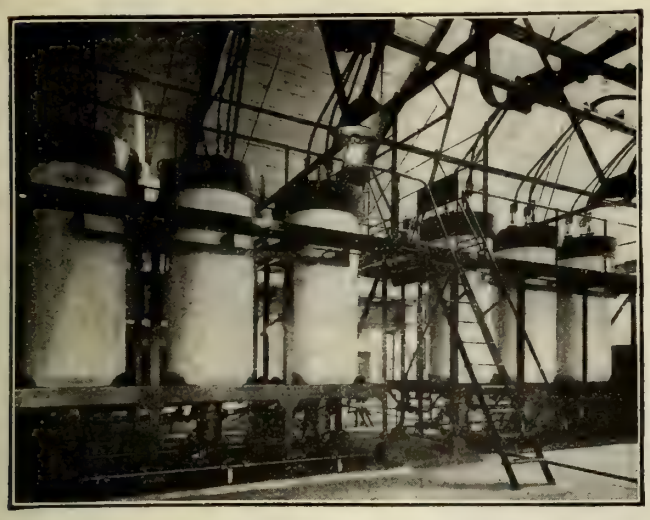

Two 3 phase Kaelin Electric Steam Generator Units for 6600 volts, designed and built by us for the Laurentide Co., Limited. Capacity of units shown, 7000 boiler horsepower, all controlled by a single operator on each shift.

The generator shown at the left is typical of sizes from 75 to 400 boiler horsepower for 3-phase power. Note its compactness and convenience.

"Can our idle power be made to conserve our coal pile?"

It's worth finding out and we have the answer.

A number of plants producing or purchasing power but not using it fully at week-ends or other periods are turning this surplus energy into heat by means of

The Kaelin Electric Steam Generator

(Patents applied for)

thus securing remarkable reductions in their bills for coal or other fuel.

The saving in labor is also quite important. Altogether, the generator often pays for itself within a short time.

We build these generators in sizes from 5 to 3,500 boiler horsepower, for pressures up to 200 lbs.; also in sizes from 5 to 75 boiler horsepower for low pressure steam heating.

When desired, any of these generators may be equipped with automatic pressure or surplus power control.

Write for Quotations.

Hydraulic Department:

I. P. Morris Hydraulic Turbines and Centrifugal Pumps. The Larner-Johnson Hydraulic Valve in sizes up to 20 ft. diameter. Large Gate and Pivot Valves.

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Dominion Engineering Works, Limited

Telephone: Melrose 700

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Cable Address: "Domworks, Montreal"

Western Representative: R. F. MATHER, London Building, Vancouver, B.C. (M-74)

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Accuracy

Endurance

Morse Twist Drill & Mach. Co.
New Bedford, Mass., U. S. A.

"It's your Order, because your Company has a PHOTOSTAT"

"This is a job where delivery is paramount. And, in every case, I have made it a point to find out what kind of equipment the bidder had in order to make good his promise.

"Your company has a piece of equipment on which I have learned to rely. I know what the PHOTOSTAT is and what it can do. I know you will not have to lose any time tracing. You can make PHOTOSTAT copies and get started on your shop work right away. In other words you'll be days ahead and I also know that there can't be any mistakes in PHOTOSTAT copies.

"Yes, sir, you tell your chief he can thank the PHOTOSTAT for this order. I know you'll make delivery with that machine to help you."

PHOTOSTAT prints cost cents. Compare this with what it costs for a draftsman to make a tracing, a stenographer to copy a page, or an artist to reproduce a layout. The experiences of many users, written in letter form, are contained in our booklet, "A Good Word for the PHOTOSTAT."

Write for your copy to-day.

Photostat Corporation

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Executive Office : Providence, Rhode Island

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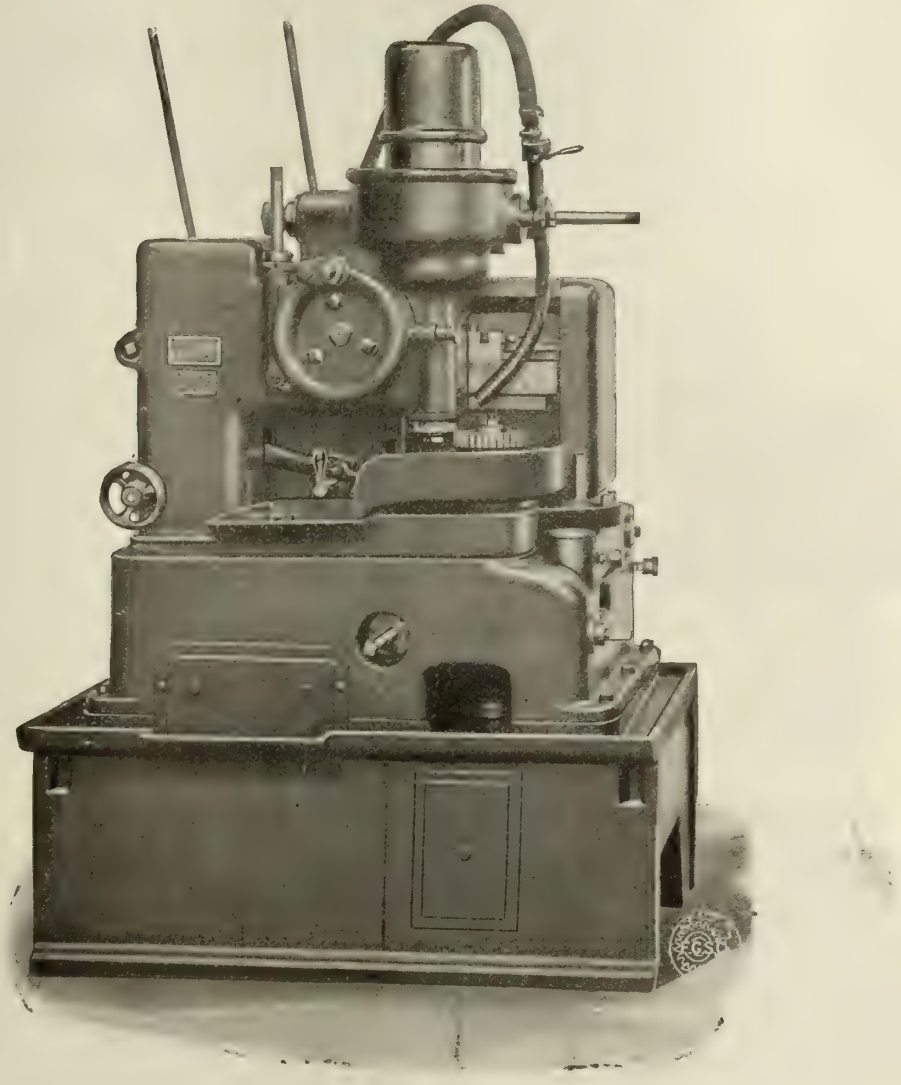
CUT GEAR COSTS
WITH THE
New Production Gear Shaper



The new production Gear Shaper, illustrated, has been designed to cut gear costs. It incorporates every feature necessary in a gear cutting machine to obtain this result, and still one of the outstanding features of the Gear Shaper principle—accuracy—has been maintained.

It is designed to cut one gear at a time and at a speed which eclipses all other methods.

All operating levers are at the front of the machine, permitting a number to be bolted together and operated as a unit, one 6 H.P. motor furnishing ample power for 10 machines

It incorporates to the fullest extent the three principal requirements of production—high speed, accuracy and simplicity of operation.

See illustrated article in all technical magazines.

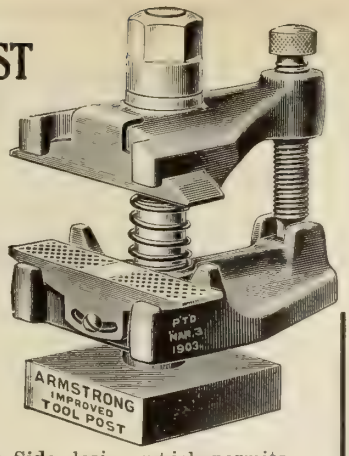
Send for our booklet, "A New Development in Gear Cutting," which has been prepared for the benefit of Engineers and Production Managers interested in the best gear cutting equipment available.

Write for your copy now.

THE FELLOWS GEAR SHAPER COMPANY,
SPRINGFIELD, VERMONT, U.S.A.

Foreign Agents:—Alfred Herbert, Ltd., Coventry, England; Societe Anonyme Alfred Herbert, Paris, France; Societa Anonima Italiana Alfred Herbert, Milan, Italy; Alfred Herbert, Ltd., Yokohama, Japan; Societe Anonyme Alfred Herbert, Barcelona, Spain; Societe Anonyme Belge Alfred Herbert, Brussels, Belgium; Alfred Herbert (India) Ltd., Head Office, Calcutta, India.

AN IMPROVED LATHE TOOL POST



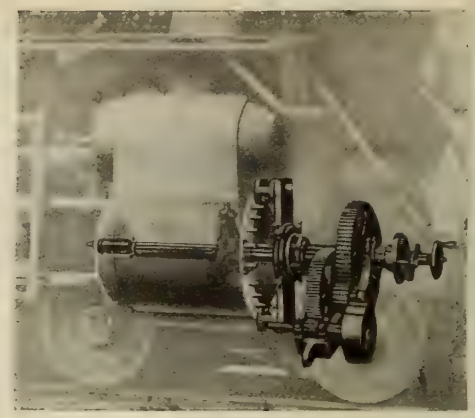
This Armstrong Lathe Tool Post has many improvements on the ordinary tool post. Being stronger and stiffer it will not slip or chatter which means more accurate work. The rocker jaws adjust themselves on parallel lines, giving a great range of adjustment without loss of holding power. An important feature is the **Open Side** design which permits rapid and convenient change and adjustment of tools. It is, moreover, peculiarly adapted to working close to the chuck, there being no side projection. The Body Parts and Jaws are Drop Forged of Steel, hardened; other parts are Bar Steel.

CANADIAN AGENTS: A. R. Williams Machinery Co., Toronto, St. John, Halifax; **Williams & Wilson,** Montreal.

ARMSTRONG BROS. TOOL CO.
STRONG "THE TOOL HOLDER PEOPLE" STRONG
305 N. FRANCISCO AVE. CHICAGO U.S.A.

UNDERWOOD PORTABLE TOOLS

Figure What You'll Save On One Job Alone



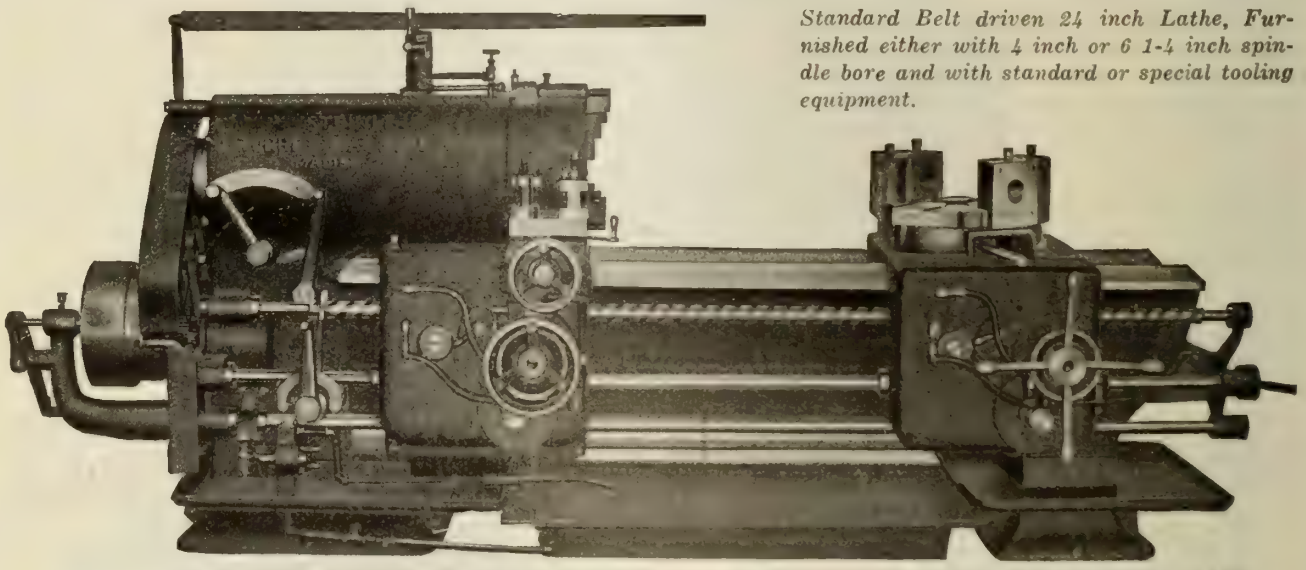
THERE'S no sense in taking down your engine every time it needs boring when all that is necessary is to remove the cylinder covers and piston and take the

Underwood Portable Boring Bar for *Stationary Engines or Locomotives*

right to the job. You can appreciate what a saving of time and labor this is—just figure what it will save you on one job alone and then write for catalogue.

H. B. Underwood Corporation

1025 Hamilton St., - Philadelphia, Pa., U.S.A.



Standard Belt driven 24 inch Lathe, Furnished either with 4 inch or 6 1-4 inch spindle bore and with standard or special tooling equipment.

STEINLE TURRET LATHES FOR BAR OR CHUCKING WORK

Send us drawings of your work so that our Engineering Department can estimate STEINLE production, or ask to have a qualified representative call upon you to determine what work can be produced to advantage on our machines.

STEINLE TURRET MACHINE COMPANY

MADISON, WISCONSIN, U.S.A.

A Typical Landis Performance

Greater Production and Economy were found by the Jackwill Mfg. Co. of New York, when they installed a battery of 5 Landis Threading Machines.

The one shown, a 2-in. Pipe and Nipple Threading Machine turns out with one operator, every eight hours, 900 2-in. nipples, threaded 1½in., 11½ threads to the inch.

This is a typical Landis performance, the honors of which are divided between the machine itself and the Landis Die, which like the machine, will give maximum service at minimum cost.

By comparison, a Landis Die has a life 20 times that of any other, with lathe tool cutting principles superior to that of the hobbed type die.

Be guided by the proven performance of more threads per dollar.

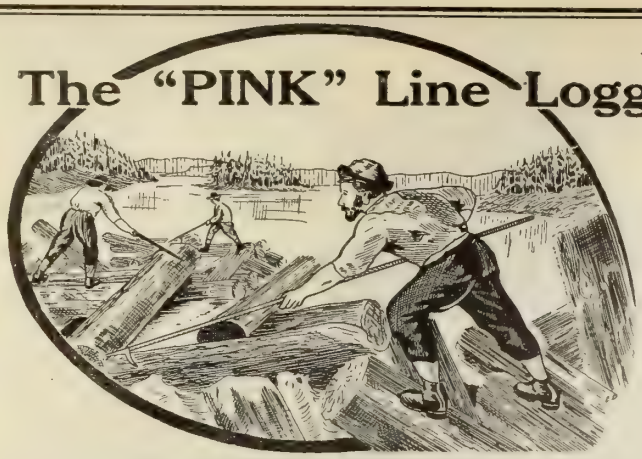
Write for details

LANDIS MACHINE COMPANY, Inc., Waynesboro, Penna., U.S.A.

LANDIS

CANADIAN AGENTS:—A. R. Williams Machinery Co., Halifax, St. John, Winnipeg, Vancouver. Williams & Wilson, Montreal. F. F. Barber Machinery Co., Ltd., Toronto.

The "PINK" Line Logging Tools and Handles



MADE-IN-CANADA Products---Headquarters for British Empire for all Lumbering Tools

In every lumber camp in Canada you'll find PINK'S famous lumbering tools. They are the favorites there and have won the esteem of all woodsmen through their superior merit. They are world-renowned and are extensively used in Australia, New Zealand and other countries where the lumbering industry thrives.

EXPORTERS TO EUROPE

We export the same good quality of lumbering tools that have made PINK'S TOOLS a by-word in the matter of good tools in all Canadian lumber camps. Enquiries cordially solicited.

Thomas Pink Co., Limited

PEMBROKE, ONT., CANADA

NICHROLOY

Pyrometer Tubes
Protecting Tubes
Combustion Tubes

HEAT-RESISTING CASTINGS

UNUSUAL SHAPES OUR SPECIALTY

Made in Canada

Hiram Walker & Sons Metal Products

WALKERVILLE, ONTARIO. Limited

Buried in the Work and Broke!

Next time a tap breaks below the surface of a large casting, don't let some makeshift method of removing it injure the thread and waste half an hour of valuable production time. Instead—

Walton it Out in a Jiffy

And save the casting.

Special analysis steel fingers of the Walton Extractor drop into the flutes of the broken tap—and grip. Then a few turns of a wrench applied to the squared end of the Extractor backs out the buried tap.

Sixty-day trial offer proves the Walton Extractor pays for itself. Write.

The Walton Co.

Hartford, Conn.

NORTHERN MADE IN CANADA CRANES & HOISTS

NORTHERN CRANE WORKS, LTD.

WALKERVILLE - - ONTARIO

Northern Type D Electric Hoists.

If interested tear out this page and place with letters to be answered.

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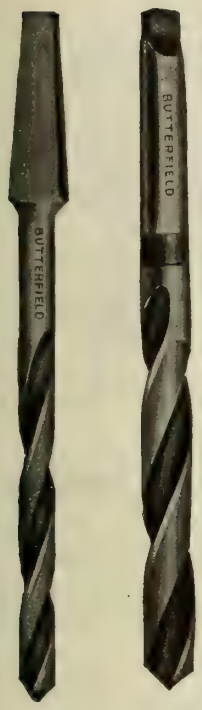

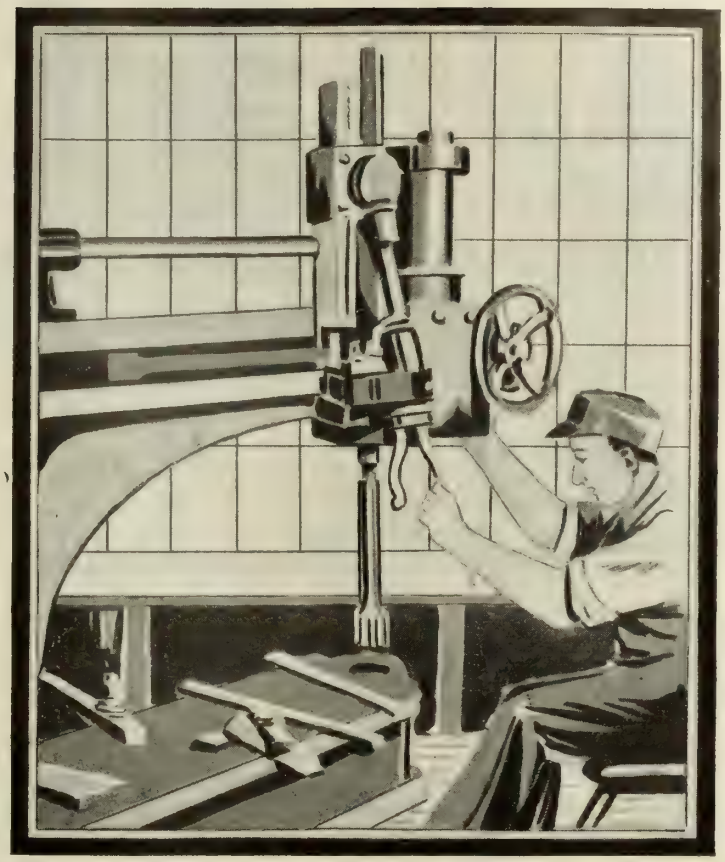

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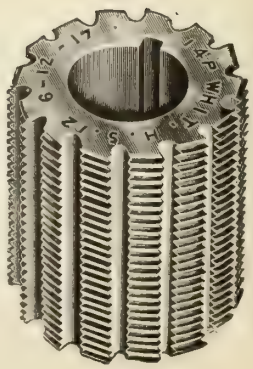

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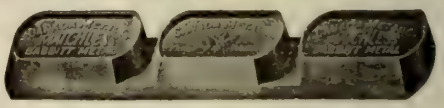

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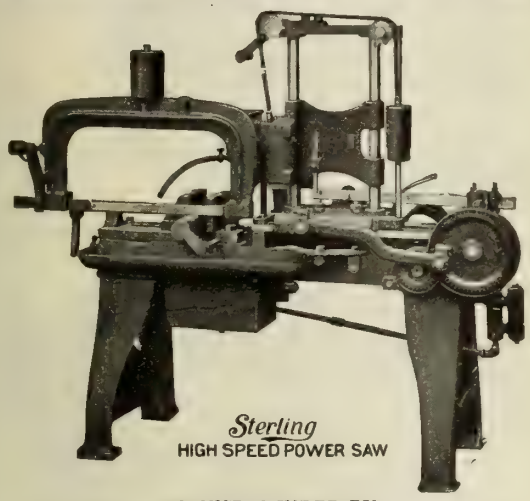

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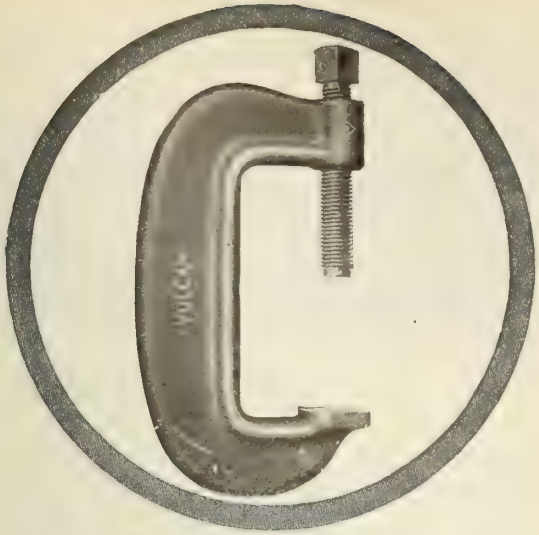

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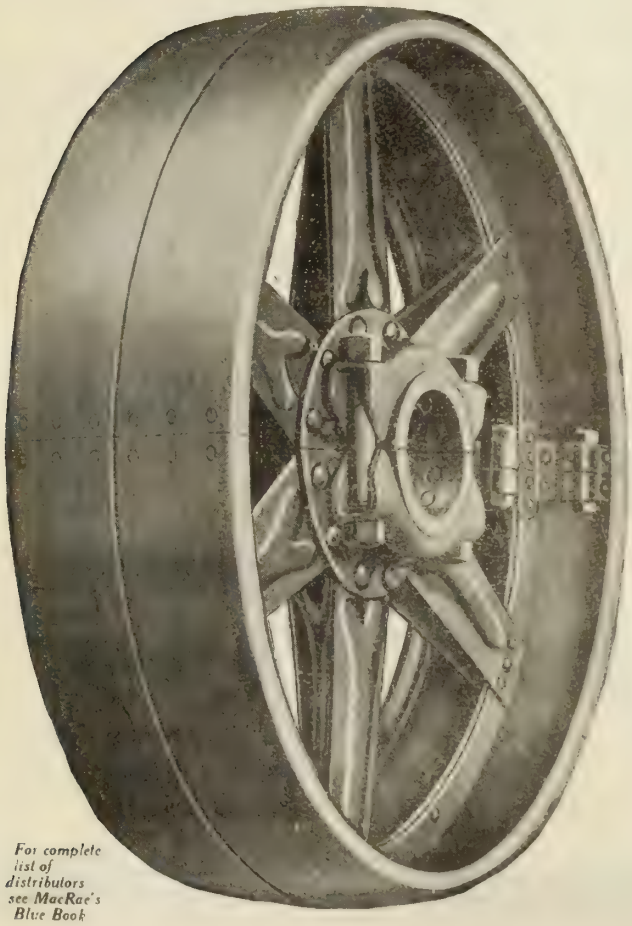

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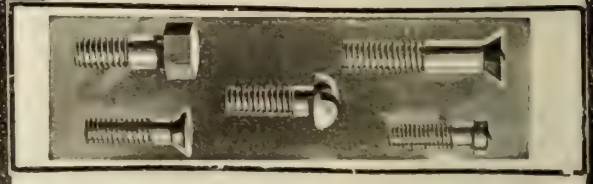

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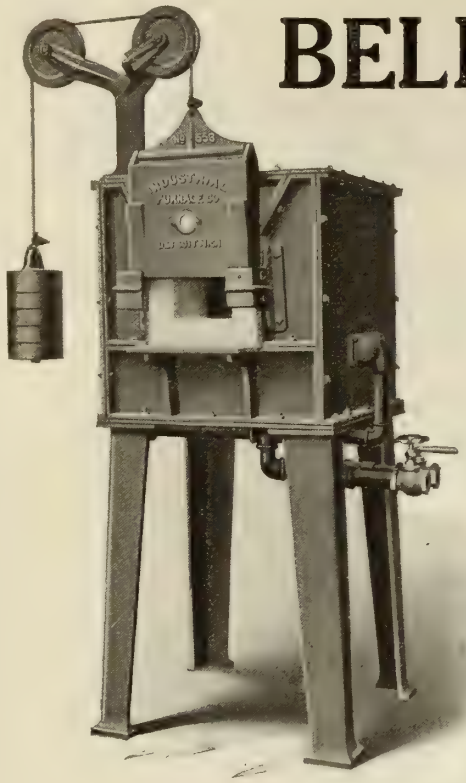

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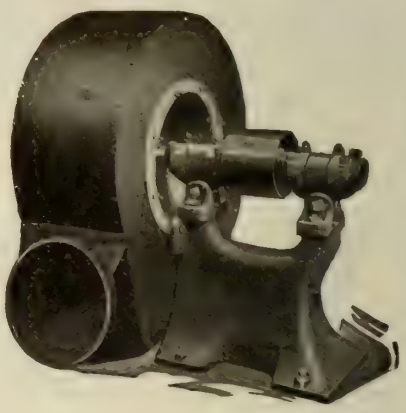

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CANADIAN MACHINERY
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MANUFACTURING NEWS

VOL. XXVIII, No. 18 NOVEMBER 2, 1922

Operative Construction of Levers and Treadles

Outlining Various Designs to Meet Specific Requirements—Providing for Adjustment—Locating for Convenience of Operation —Lever Operated Clamping Fixtures—Effect of Vibration

By FRANK H. MAYOT

HAND lever and foot treadle construction, design and location is a subject of vital importance to everyone engaged in machine manufacture and to all who use the same, for in any machine where a lever or treadle is not properly located time is lost in the operation of that particular machine and certainly if a lever in constant use is located "five feet from where you aint," about half the time some form of dissatisfied expression will be used against the maker of such a product.

Machinery of different types present their own problems of design and with this in mind a number of constructions are presented herewith which are typical of what are in use, covering an extensive field in a suggestive manner that they may help in the solving of that question "What to use?" While the entire range of hand lever and foot treadle design has not been covered a sufficient number are shown to make it apparent that there are ways and means to place these units where needed.

Plain Lever Design

Figure 1 shows a treadle and lever of familiar design and points to be observed in the construction of these apart from that of having sufficient strength of material and the proper leverage to perform the work at hand are few but important. In designing a foot treadle a feature often overlooked is the advisability of surating the flange A where the foot rests to prevent the foot from slipping off, also any outstanding projections against which the knee or shin of an operator will be struck are to be avoided, while of course a long boss where it rocks on a shaft is desirable to prevent excess side motion, as any play or looseness in the bearing will be multiplied considerably at the end of a long foot treadle. To counteract this it is sometimes desirable to have a yoke which straddles a long foot treadle near its outer end to prevent such side play. A hand lever should have the hand grip well rounded at the top as an operator is apt to place the palm of the hand over the top of the lever when operating the same. Various means are employed for attaching units which are to be operated by hand levers or foot treadles in place. A hole B is provided in the particular treadle shown in which a connecting rod is attached; the hand lever C pivots on a bearing at D while a yoke is attached by a stud at E in the make-up of this particular construction.

Varied sections of material are used in making both levers and foot treadles, this depending to some extent on the specific purpose for which used but more often on the temperament of the designer. If but one lever or treadle is to be made and this of cast iron the section of the lever would probably be made as shown at F, this being of rectangular cross section with the corners slightly rounded. The edges of this might be rounded as shown at X. The same lever would probably be made of the section shown at H if used in machine construction of standard design where a large number of castings were to be made from one pattern, as this oval type would be as suitable as a rectangular section and be neater in appearance and lighter in weight. The rib section shown at G is sometimes used although this requires more work to make the pattern and the castings obtained from such a pattern would require more cleaning. However, where very light weight is desired it is often used.

Toggle Action

A striking example of a lever operating a toggle action is shown in Fig. 2; here the lever A which pivots on a rocker shaft D pushes the link C to which it is connected through the medium of the rocker shaft D, a stud E connects link C to a pair of links F which are in turn attached by a stud G to a sliding block H. It will be evident that operating lever A causes shaft D to revolve as the lever is keyed thereto at J and K. This in turn causes link C to operate link F thus moving the sliding block H. A pull on the lever in the direction of the arrow X causing the block to be pushed in the direction of the arrow Y. In this particular construction of lever it will be noticed that the lower end of the lever is made to

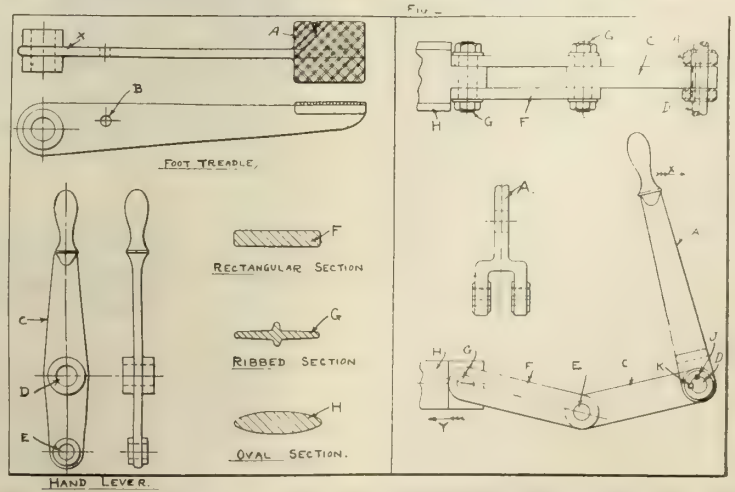


Fig. 1.—Left: plain foot and hand lever construction. Fig. 2: Hand lever and toggle construction for operating slide.

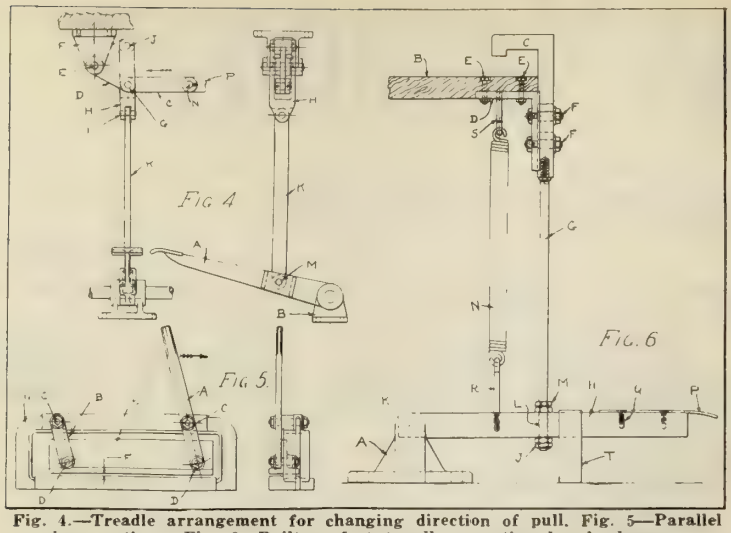


Fig. 4.—Treadle arrangement for changing direction of pull. Fig. 5—Parallel lever action. Fig. 6—Built-up foot treadle operating bench clamp.

straddle link C, reference to the sectional view clearly illustrating this feature.

A rather interesting development in the study of levers is brought out by a consideration of the features of construction shown in Fig. 3. In the center of this illustration a square paper trimming knife is shown; this is a hand operated machine in which an operator pulls on a long lever A which causes a knife B to descend and cut a stack of paper or other material. This is accomplished through the medium of another lever C, which is operated by a connecting rod D through the medium of a connecting link E. It is the action of E in conjunction with D and C which should be closely followed out in the following description.

Referring to the view at the upper left which shows the action of these three units, C pivots at F, and revolving shaft G causes link H, which is fastened to G, to pull on connecting rod D which is attached to C at J. This causes knife B to be pulled down through the medium of a connecting stud K, all of which arrangement it will be noted is direct lever action depending upon the lever ratios for the multiplication of power. At the upper right of this illustration is shown a construction used in an improved design of machine where lever C pivots at F and in the same manner as that at the left it operates knife B through the medium of stud K, pulled down by a connecting rod J. This connecting rod is for the same purpose as D at the left, except that connecting rod J is made adjustable, being threaded at both ends with right and left hand threads and made of hexagonal shaped steel bar stock. Attached to the shaft G is the same type of lever H but herein lies the basic difference, for in addition to H a connection L is used; this is shaped so it will clear the shaft G and is so set that lever H when pulled in the direction of the arrow will pass in an arc underneath shaft G, thus a greater travel of H will be necessary to pull down rod J, and in turn knife B, the same distance as in pulling down the same with a construction such as is shown at the left. Thus the power obtained from this design with mechanism of the same size will be greatly multiplied over that of the other construction. This action can be utilized to good advantage for the particular purpose shown, as the power required for making the cut is much greater near the bottom of the knife stroke than at the beginning of the stroke where the knife is being simply brought down to commence cutting.

Another feature which is of great importance to an operator should be observed in this connection; this is that lever A is adjustable radially on shaft G, it being tightened thereon by a nut M, co-acting surations radially made in the inner face of this lever engaging surations in a flange N, which is permanently keyed to the shaft, insuring that the lever will be securely held at the various radial positions where set to suit the particular class of work being operated on. A weight P attached to the opposite end of this shaft G counterbalances this entire mechanism so that the operator merely pulls over the lever to do the cutting and the entire mechanism returns through the medium of this weight. This example clearly illustrates the advantage of proper relative lever design to bring out the maximum utility of the mechanism at the most natural position for operation with the least amount of effort on the part of the operator.

A foot treadle construction whereby the direction of pull is changed to a right angle pull in an opposite plane from the lower action is shown by Fig. 4. This is sometimes called an end pull and its operation is such that by pushing down foot treadle A which is held to the floor by a bracket B, connecting link C is pulled in the direction of the arrow with a downward and endwise movement. This is accomplished by having a triangular shaped piece D pivotly connected at E in the bracket F, which is attached to the underside of the machine or to other suitable place where this action would be employed. The connecting link C is attached by a stud at G to D and yoke H is also attached by a stud at J to the upper end of this triangular piece D, while connecting this yoke H and the foot treadle A is a connecting bar K, it being attached in place by a pin L, at the upper end and a pin M at the lower end. Thus a downward pull on K causes D to pivot upon E as a center, thus moving C at right angle to K in a circular motion which may be changed to a straight motion by having link C connected at N to a sliding member, which would be indicated as P.

It will be observed from Fig. 4 that this entire arrangement of connections are universal in their action, sufficient pivot points being provided so that all tendency to cramp the levers is eliminated. As the downward movement of A operates K with a rocking movement,

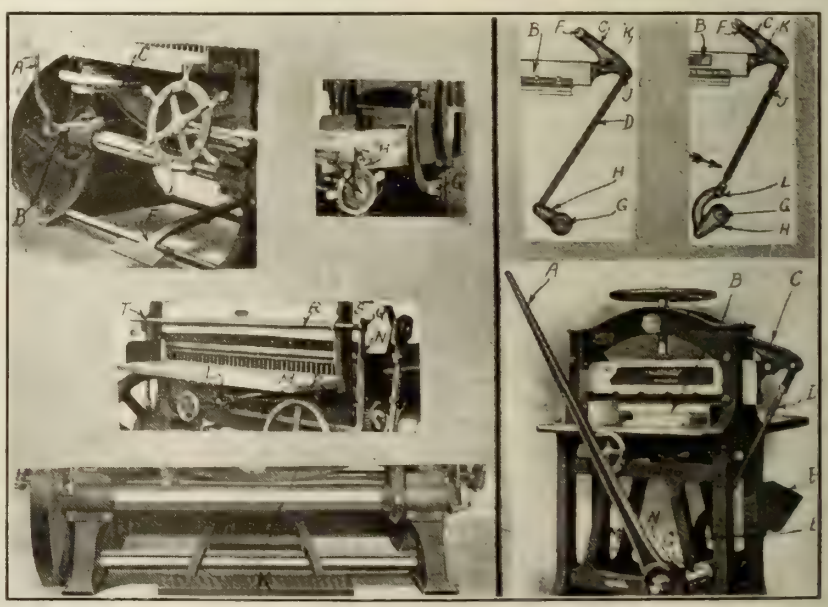


Fig. 7: A group of foot and hand lever constructions. Fig. 3: Right: two methods of proportioning lever action in a cutting machine.

which in turn operates H with a rocking movement, the lower end of K, where stud M enters the hole, being bell-mouthed to allow K to rock sideways slightly. This is a very powerful and desirable construction where a powerful action at right angles to the foot action is desired.

Parallel Action

Figure 5 shows a parallel lever action. To be effective this requires two links of equal centers, and in this construction the lever A in connection with the link B both having centers C and D of equal distance apart, operate a block E by swinging the same down parallel to the base and giving it a sideways movement. It will be evident that an operator in using this grips lever A and pulls it in the direction of the arrow which causes E to be carried downward thus causing material to be compressed between the two surfaces at F. Block E is mounted to A and B by studs at D while studs C hold the lever and link to the frame structure.

A complete example of a foot treadle operating bench clamp is shown in Fig. 6. One of the features of this construction is that, with the exception of the cast iron floor bracket A, everything is built up from steel so as to quickly construct the arrangement without waiting for patterns and castings. Casting A could also have been made from a block of steel except that it happened to be on hand. Referring to this clamping arrangement B indicates a bench while C is the clamp. This clamp is held to an angle bracket D which is held to the bench by two bolts E. C is held in D by two shouldered studs F with nuts thereon. A groove being cut in D to guide C, elongated slots being cut in C to allow it to travel up and down where the shouldered studs go through. A connecting rod G is attached to the lower end of C and this rod also passes through a steel bar H, two nuts J on the lower end of G enable H to push down G, thereby operating the bench clamp C. This bar H is connected at K while the hole L is made large so as to allow the bar G to be free to float slightly in H. Two check nuts M force rod G up when the bar H is pulled back by spring N, as the foot is removed from the foot treadle of which the bar H forms a part, plate P held thereto by screws Q, completing the foot treadle. The spring end is attached to H at the lower end by hook R while the hook G at the upper end holds it in place under the bench.

An additional feature of this construction is that a bracket T made of bar steel forged U shaped is attached to the floor, this forms a double purpose as it guides the bar or foot treadle H, preventing side movement or excessive play of the same, and also limits the up-motion of clamp C by treadle H coming in contact with its upper surface of this bracket. In use the operator merely pushes down on P and thus work is clamped between the bench and C, while removing his foot from the treadle allows the spring N to return the entire mechanism to its starting point.

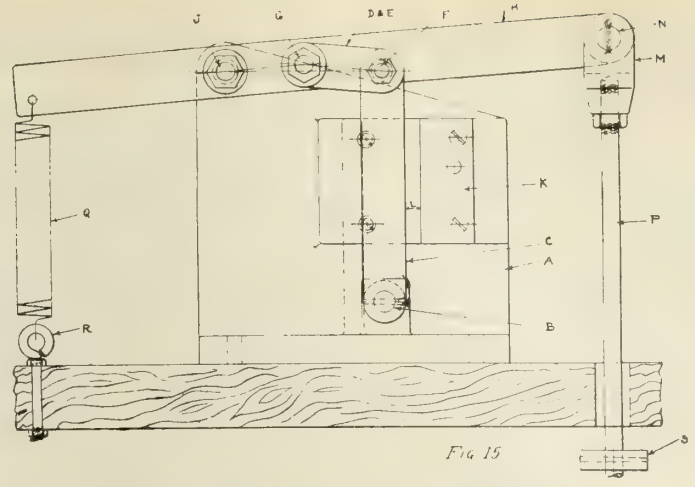


Fig. 15.—Toggle action lever and squeezing fixture.

Broad Foot Rest

An interesting group of lever constructions are shown by Fig. 1, these are intended to be suggestive of what are in use in machine design. The upper left hand corner shows a view in which a lever A is attached to a shaft B, this is held in place by a key and set-screw. Another lever is shown at C while the hand wheel D is also in effect, a lever being constructed with handles, making it of a pilot wheel construction. A foot treadle E is also shown in this connection making four features in all and it will be noticed that the end of this treadle is flanged out to provide a broad foot rest. In the upper right corner is shown a construction employing two levers, F being a plain rocking lever shaped so that the handle will set vertical on the machine and stand away from the frame while the bearing with shaft G is attached close to the machine frame. The other lever H is connected to a shaft J so that it operates in a radial manner and by means of a ratchet controls a radial feeding arrangement.

In the lower view is shown a foot treadle K. This is constructed so that it will reach about half the width of the entire machine, it is ribbed and is light weight, the width being desirable so that an operator can step on the foot treadle from most any position in front of the machine. It should also be noted in this connection that the upper portion of this corrugated treadle is made removable so that as the corrugations wear down another corrugated plate may be attached. The view in the center shows a rocking lever L and in addition a construction is shown which while it cannot be termed a hand lever

(Continued on page 53)

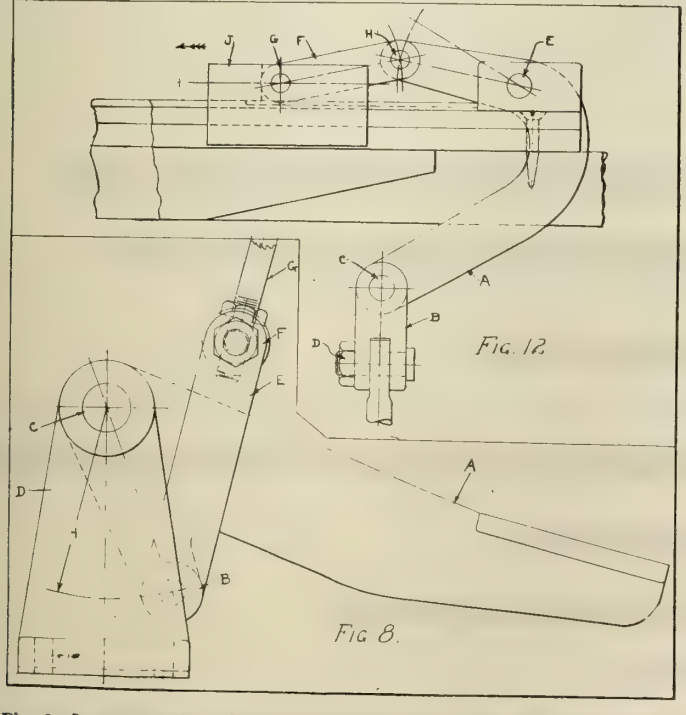


Fig. 8—Lower: toggle action foot treadle with floor stand. Fig. 12.—Top: toggle action operated by foot treadle.

Heating and Ventilation in Relation to Health

System of Forced Ventilation Not Sufficient—Air Should be Thoroughly Cleansed—Natural Renovating of Out-of-Doors System—Impure Air Responsible for Many Diseases

IN connection with the crusade that is being carried on in many parts of the country by heating and ventilating engineers to educate the public to a proper appreciation of the necessity for adequate ventilation of their public and other buildings including their homes, a careful review of the subject will prove interesting reading to the engineer and layman alike.

"While it is admitted," states an authority on this subject, "by all thinking people that ventilation must promote health, it is not realized to what extent the converse of this statement is true; that is to what extent ill health is caused by insufficient or ineffective ventilation."

Macfie, in his recently published work, "Air and Health," says: "Air containing merely the CO_2 and moisture usually contained in vitiated air will not produce the effect of vitiated air, and vitiated air, therefore, must contain an additional constituent. This additional constituent, though undetected by chemists, is probably detected by the nose, for it is well known that air is oppressive and harmful not so much in proportion to the amount of CO_2 and moisture it contains as in proportion to its smelliness. The very fact that the nose is so sensitive to such odors would seem to suggest their harmfulness."

Outer air contains, of course, more or less dust which when admitted to a building tends to settle. Dr. Prudden observes that even ordinarily efficient systems of ventilation do not carry off any considerable proportion of the dust particles from closed still rooms . . . and when by a system of forced ventilation we cause large volumes of dust-laden air from out-of-doors to pass through them, we are actually, so far as micro-organisms are concerned, cleansing the air and sending it out much freer from germs than when it entered, these having slowly settled as the air makes its way from the entrance to the exit of the ventilating openings. When we consider the comportment of dust particles in closed rooms, we see at once that the great renovating and cleansing agencies which are so efficient out-of-doors are, except on special occasions, absent, namely, the winds and strong air currents and the more or less frequent and prolonged wettings . . . . A rainfall, to a certain extent, tends to free the air of its germs by washing them down. We should always remember that bacteria do not become detached from the surfaces or materials on which they grow or are lodged while these are in a moist condition. The most obvious means to prevent the accumulation of dust within enclosures is to remove it from the entering air.

While the harmful effect of foul air may not be immediate further than its effect on one's comfort or mental acuteness, it is generally conceded that frequent and protracted exposure to such air, as in the case of poorly ventilated school and factory buildings, results physiologically in a lowering of the vitality of the occupants, rendering them more susceptible to disease and considered economically, results in a lessened efficiency on the part of the occupants.

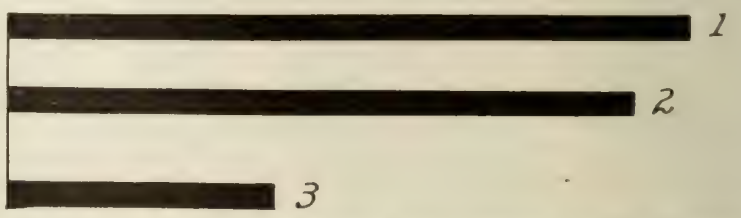
Tuberculosis and pneumonia are most prevalent among persons living or working in unventilated rooms. These diseases are caused by specific bacteria which, for the most part, gain access to the air passages by adhering to particles of dust which are inhaled. To bad air we attribute much of the anaemia, the pallor, the neurasthenia, the general ill-health of factory workers and most persons engaged in sedentary indoor occupations. Very moderate amounts of dust particles in sensitive persons cause a degree of irritation of the respiratory organs as either to deprive them of robust health or predispose them to the acquirement of various diseases which with unirritated lungs they would readily resist.

"As to the bacteria," says a prominent physician, "there are unfortunately a few species which, when they once find lodgment in one place or another in the organs of respiration, may grow and multiply, and successfully resisting all the protective agencies of the body, set up distinct, persistent and even fatal disease. These forms of bacteria which can or in these regions commonly do this, are insignificant in number in comparison with the harmless species with which dust is usually swarming. But few as they are they have an extreme significance. If it were not for these few species of disease-producing bacteria people could afford to be as indifferent as they are to dust and its dangers. . . "

It has been pointed out among the causes of atmospheric vitiation and discomfort that high temperature and humidity have much to do with the oppressiveness of the atmosphere in occupied spaces. As to desirable and practicable relative humidities in rooms occupied in winter by persons in health, taking into consideration the cost of maintaining a high relative humidity in cold weather and the trouble from condensation on windows, a temperature range from 40% to 50% according to the weather rather than a higher relative humidity.

Humidity in Manufacturing Plants

Pure air is fully as important in influencing production as warm fingers. Adequate ventilation, therefore, is as vital a factor in summer as in winter. Curiously enough, humidification has developed in the minds of most mill men as a purely mechanical proposition. Proper attention has not been given by factory men to the indirect effect of humidity which is upon the working capacity of the operative. Unbiased British officials and certain American engineers have demonstrated that, considered both immediately and ultimately, the direct or mechanical value of humidity works on parallel lines with the indirect or operative-working-capacity effect, and that the best results in dividends are secured



(1) and (2)—Percentage of factory force absent in two successive years before adopting scientific ventilation. (3)—Reduction during third year, after installing proper ventilation.

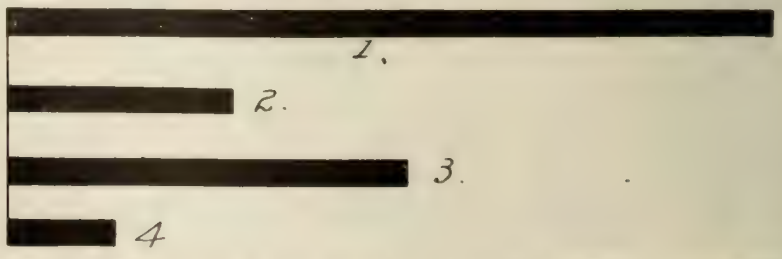


Chart showing reductions in deaths in large hospital due to improved ventilation. (1)—Percentage of deaths in surgical ward before and (2) after installing proper scientific ventilation. (3) Percentage of deaths in other wards before and (4) after installing proper ventilation.

by considering direct and indirect (mechanical and personal) effects together, in other words taking the resultant of the two working factors.

In certain buildings, where the results of changing from poor to good ventilation have been carefully observed, a marked improvement in the general health of the occupants has been manifest. The gain effected is not to be measured alone by the days' absence saved, but by the greater vitality and efficiency of the entire working force. Even though there be no method of ventilation provided, the mere abundance of space per occupant secures a certain air change owing to the fact that no partitions, floors or ceilings are perfectly tight, hence the greater the space per occupant the greater the surface of surrounding walls, etc., and the greater the accidental air leakage of spontaneous ventilation as some put it.

Prof. Winslow, of the Mass. Institute of Technology, in a paper on "The Cash Value of Factory Ventilation," mentions that: "Efficient production requires skilled and practical workers, in good physical condition, applying themselves, with energy and enthusiasm, to their tasks. Irregularity of attendance, and the physical sluggishness and nervous inattention which accompany lowered vitality, mean direct money loss to the employer of labor, as well as a burden on the community at large."

Perhaps nothing has focused the attention of the general public on the necessity of fresh air so much as the crusade now being waged against tuberculosis. Dr. Woods Hutchinson, in his book, "Preventable Diseases," brings out in a most vivid manner the wonderful changes wrought in the prevention and treatment of this disease. He advises us to learn to sit or sleep in a gentle current of air all the time we are indoors. If ventilation could be had for little or no cost above that for heating alone, there would not be the "hue and cry" against it on the part of those whose "pocket nerve" is touched. The fact, however, that in cold climates adequate ventilation costs money should not be allowed to stand in the way of its more general compulsory adoption. Those who are most in need of it are, as a rule, less able to demand it, hence the necessity of the strong protecting the weak through the enactment of legislation to secure to children in schools, to adults in public buildings and to workers in factories and shops, an adequate volume of pure fresh air. It is not pleasant to consider that in crowded, unventilated rooms the air must be breathed and rebreathed, nor is it pleasant to consider the other causes of atmospheric vitiation within enclosures as pointed out.

Tempering is shown to be that process wherein the hardness of a piece of steel is let down or tempered to remove the brittleness and make it tough.

LOCALIZING THE HEAT IN HARDENING PRACTICE

THE immersion method is the best for many classes of work. The reasons are the elimination of scale, the good control of heat and the rapidity of the operation, which thus localizes the heat and keeps it from spreading to adjacent parts. The commonest form of material for the heating bath is lead. It is best to secure lead fairly free of tin to prevent particles of the lead from adhering to the work. Pig lead is furnished for hardening purposes, which is very pure. The slight extra cost will be warranted by a minimum of lead sticking to the work. Even pure lead will stick to the work unless the hardener keeps the surface of the lead free of dross and well covered with charcoal.

It is always best to skim the lead surface soon after it melts in the morning and then cover with lump charcoal of ½ inch to 1½ inch size. As the charcoal burns away it should be renewed. The skimming operation should likewise be conducted after the noon hour. The burning of the charcoal forms a gas which excludes oxygen from the surface of the lead, thus preventing dross or lead oxide from forming. If the lead pot is unused for a period of say ½ hour, a metal cover should be placed over the pot. This will cause the charcoal to last longer.

Neutral salt baths are used to a great extent for local heating. The operation of heating by immersion is the same as for lead. The surface of the bath, however, need not be protected. The heat conductivity of salt being less than lead, it will require a greater time of immersion to heat the work.

Numerous kinds of metallic salts can be utilized for heating steel. Their melting points are so diversified that combinations may be made which can be kept molten at any temperature from 400 deg. F. to the melting point of the steels, and their volatilization will be slight. The writer recommends the following mixtures of barium chloride and potassium chloride to give the least amount of loss of salt by volatilization at temperature indicated.

Temp. Deg. F.	Bar. Chlor. Per Cent.	Pot. Chlor. Per Cent.
1300—1400	12	88
1400—1500	25	75
1500—1600	37	63
1600—1700	50	50
1700—1800	70	30
1800—1900	88	12
1900—2400	100	0

Other neutral salts, used both for tempering and hardening, heating by immersion, are equal parts of potassium nitrate and sodium nitrate for temperature ranges from 400 deg. F. to 1075 deg. F. Sodium chloride (common salt) or a mixture of sodium chloride and potassium chloride for temperatures from 1200 deg. F. to 1650 deg. F. Calcium fluoride or magnesium fluoride for temperature ranges from 2700 deg. F. to 2900 deg. F.

Carburizing or nitridizing salts are used for local heating. They not only leave the work clean but also add a skin hardness of a few thousandths to the surface. These salts are commercially available. The most used is the commercial 76 per cent. sodium cyanide, 27 per cent. sodium cyanide next, and then 98 per cent. sodium cyanide. There are many cyanide salts under various trade names. These materials are in the main satisfactory. As they are generally advertised to give off no poisonous fumes, they seldom contain sufficient amount of cyanide to warrant long life. This defect is sometimes an advantage as certain combinations of neutral salts with cyanide salts give, at certain temperatures, a minimum of volatilization. This prevents undue loss of the cyanide gas.

The cyanide process of P. W. Shimer and G. B. Shimer is being used to a greater extent. Roughly this process consists of adding a strongly cyanided salt to a neutral salt; the neutral salt merely acting as a vehicle. An important feature of salt baths for local heating is the film of molten salt which adheres to the work on its removal from the bath and which prevents oxidation of the work in transference to the quench. The quenching medium usually dissolves or scatters the salt immediately. Torches and specially designed furnaces are sometimes used to heat certain sections, but are not generally used to economical advantage.

POINTS FOR HACK SAW USERS

A contemporary gives the following advice on the use of hack saws: Don't strain the blades more than is required to keep them taut, as an over-tightened blade will not endure the addition of the working stress. At the same time, a slack blade is equally liable to be broken. The pressure put on a new, sharp saw should be much lighter than what is advisable when the teeth have begun to wear, as new teeth, if crowded too hard, are liable to dig in and break. The pressure should also be proportioned to the thickness of the saw. The safe rule is to maintain that pressure which keeps the blade cutting, and such a speed that the blade does not become overhot. A lubricated saw can be run much faster than a dry saw, but the cooling liquid must be copious and applied directly at the point of cutting. It should be noted that insufficient pressure, by allowing the teeth to skid over the work without cutting, causes the teeth to glaze and dull quickly. Also, that teeth once overheated become too soft to cut any more.

Truing of a wheel is the name given to the operation which has for its purpose the removal of material from the cutting surface of the wheel, so that the resulting surface is geometrically true. It is not necessarily a sharpening operation, but aims solely to produce a true cutting surface.

Self-Contained Coal Dryer, Pulveriser and Blower

Cheap Grade of Coal Used to Advantage—Any Desired Rate of Delivery—Preliminary Drying Process Unnecessary—Complete Combustion—Small Proportion of Paraffin Used

CONSERVATION of fuels is perhaps a matter that will more vitally concern the next rather than the present generation, but it is one that ought to occupy a prominent place in our scientific and industrial research work to-day. Cheapness of production, however, is an important present-day problem and one to which we must bend our untiring energies if we are to maintain our prestige and position in the world's commerce. Not the least factor in the cost of production is the item of fuel costs. With individual plants consuming over a thousand tons of coal per week and others using hundreds of tons of oil, the cost of fuel must bulk very largely in the annual balance sheet.

Of the various fuels available, pulverised coal would seem to offer many advantages from the point of view of cheapness. In the United States pulverised coal as a fuel has received much consideration and it has been widely adopted in many large power house plants. At the River Rouge boiler plant of the Ford Motor Co. the four supposed largest boilers in the world are fired by pulverised coal and blast furnace gas. This method of firing was only adopted after an exhaustive survey of all possible types and it would seem to indicate that there are potentialities in powdered coal that will well repay the careful consideration of fuel users.

In the cement industry it has been standard practice for many (about 60) years for firing rotary kilns. Whatever may be the impression regarding this fuel for other applications, such as boiler houses and furnaces, there can be no two opinions on its superiority for cement work.

In the utilization of powdered coal as a fuel there have been in the past both advantages and disadvantages. Among the latter were the costliness of the pulverising plant, the inadvisability of storing the powdered product for use, and difficulty in dealing with the ash. If these can be eliminated or at any rate considerably depreciated, there would seem to be a wonderful future for powdered coal. The advantages it claims are cheapness of fuel, extraction of most of the heating value, low labor costs, and the fact that low grade coal can give good results.

In the past a powdered fuel plant has not only been costly to install but equally costly to maintain and run, entailing, as it does, a coal dryer, with its auxiliary furnace, a tube mill or other pulverizer, elevators, conveyors, separators, bins and bunkers for storage, fans, etc. With the new invention named the Atritor all the disadvantages mentioned above are said to be eliminated. This machine dries, granulates, pulverises to any degree of fineness and delivers the fuel into the combustion chamber all in one continuous process as and when wanted, at any desired rate of delivery without any auxiliary plant whatever other than a feeding arrangement for the coal.

The first Atritor was put into commission about 12 months ago. During the intervening period this machine and two others have been subjected to very rigorous tests in the course of much experimental work. The machine as designed is known as the No. 10 size and it is guaranteed to give, with an actual power consumption of 30 h. p. an output of 1,800 lbs. of coal per hour pulverised from ¾-in. lumps to a fineness such that 95 per cent. will pass through a 100 x 100 mesh screen. A larger machine is also in contemplation.

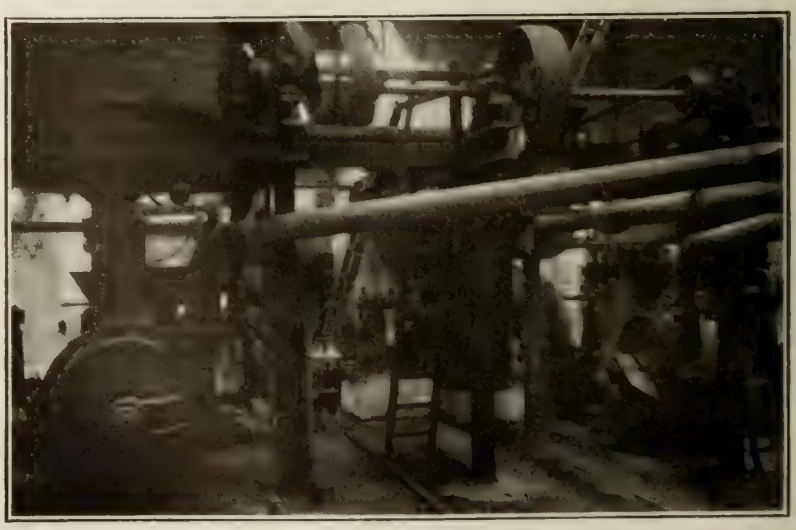
A typical Atritor installation as applied to two 140 ft. x 8 ft. rotary cement kilns is shown in the illustrations herewith and consists of two Atritors driven by 40 h. p. electric motors, each with a 10-ton raw coal hopper for feeding and an elevator for keeping the hoppers full, with a screw container from the elevator to one hopper. It is recommended that 40 h. p. motors be installed for driving this size of machine, though it will give full output when grinding coal not exceeding ¾ in. in any direction at 30 h. p.

An installation similar to that shown is capable of burning over 800 tons of cement per week. It is, however, advisable to have a third Atritor as a standby in case of breakdown through any cause. It is a simple matter to arrange the delivery pipes with flap valves so that any of the machines can deliver its product at the piont desired. The cost of pulverising coal by the Atritor system at Stockton is about 62c per ton, while by the old installation it was about $1.25 per ton.

Another decided advantage of the Atritor system of burning the fuel immediately is the fact that a lower grade of coal can be used with consequent decreases in cost. With the old type of plant a large part of the volatile combustible matter in the coal is lost during the drying operations and storage. The approximate difference between the lowest grade coal it was possible to utilize by the old system and the coal which can be burned quite satisfactorily by the Atritor system is about $2 per ton delivered at the works. The total costs for fuel burnt in the kiln, that is delivered at the works, handled and pulverised and propelled into the kiln are, therefore, $2.65 per ton by the old installation against $2.40 per ton by the Atritor.

The advantages of the Atritor system for pulverising coal may be summed up as follows:—

1. It is a small, self-contained unit for drying, pulverising and propelling the fuel direct into the combustion chamber ready for burning, in one continuous process.
2. It will deliver any quantity at any rate desired as and when wanted up to its capacity of 1,800 lb. per hour.
3. It is continuous in action and dis-



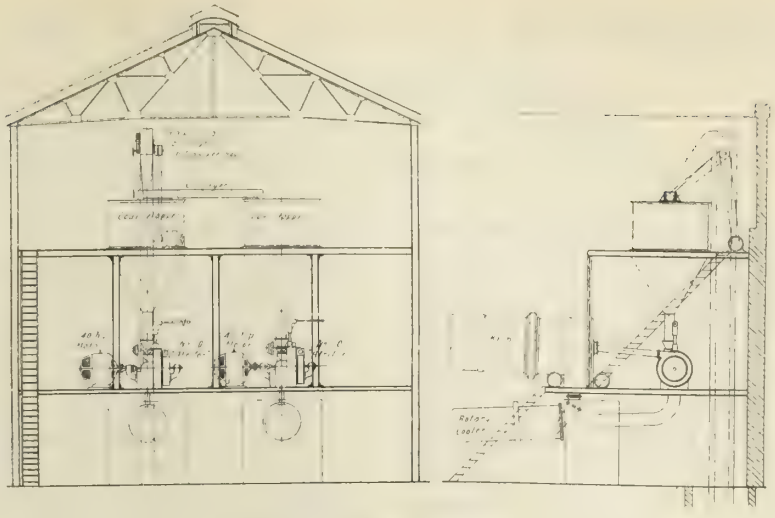
General installation of Atritor unit.

Photos and data through courtesy of Alfred Herbert, Ltd., who are the licensees and manufacturers.

penses with the necessity for storage bins.

4. It can be started and stopped at will.
5. The drying and pulverising go on together and the product is burned immediately without opportunity to absorb moisture after pulverisation. This is important as powdered coal is extremely hygroscopic.
6. The whole of the combustible contents of the coal pass into the furnace and are burned. There is no opportunity for the volatiles to be lost. This is a very important point as considerable waste of volatiles takes place during drying and storage under the old system.
7. It entirely supersedes the elaborate, expensive and dusty plant hitherto employed for the purpose.
8. There is no necessity for any subsidiary plant other than a feeding device for the raw coal.
9. The cost of the installation is low. The power consumed is low. The cost of maintenance is extremely low. The labor cost is low.
10. It is entirely dustless in operation.
11. The moisture contents of the coal make no difference to the working of the machine or to the resultant product.
12. The hot air supply for drying can be drawn from any convenient source of waste heat.
13. No smoke or soot is formed and no combustible matter left in the ash.
14. Pulverisation may be carried to any degree of fineness desired.
15. A high temperature can be obtained very quickly.
16. By the addition of a minute amount of paraffin (a patented process) (.07 per cent. by weight of coal pulverised) the time for heating up is reduced by 75 per cent. A rotary kiln is ready for use 40 minutes after lighting up.
17. The addition of paraffin also enables coal which is unburnable when ground by other means to be successfully burned by this system.
18. There is no heat wasted nor waste of fuel when damping down.
19. There are no screens used and therefore no clogging of material.
20. An efficient metal separator is incorporated in the inlet end of the machine. This dispenses with the use of a magnetic separator.

Interior of Atritor showing arrangement of pulverizing pins.



Layout of Atritor installation.

The addition of paraffin during pulverisation has produced such almost extraordinary effects that the process has been patented. The requisite amount for firing up is .07 per cent. by weight of fuel burned or about 1½ pints per hour to 1,800 lbs. of coal. The paraffin can be shut off when full heat is attained, or it can be kept on when pulverising very inferior coal in order to assist in maintaining the temperature.

The mechanical features of the Atritor consist generally of: (a) A hopper with variable screw feed driven by cone pulleys and worm gearing and level operated slide, for regulating the flow of raw coal. (b) A coal chute and metal separator in which any material of heavier specific gravity than coal is thrown out and thus prevented from injuring the machine. (c) Hot and cold air supply ducts. (d) A casing with fixed pegs of extremely hard metal in concentric rings on both sides. (e) A rotor disc with similar pegs on each side and rejector pegs on one side. (f) A suction and blower fan cased in a scroll. In the scroll are auxiliary air ports.

The coal feeds through the slide and screw and falls towards the centre of the machine where it is met by a strong current of cold air which is being drawn through an adjustable opening in the front of the machine. The air draught is adjusted to the amount of coal feed so that all the coal is pulled into the machine but anything heavier than coal rejected, falling down to the air inlet, thus dispensing entirely with the necessity for a magnetic separator. The pull of the fan and centrifugal force throw the coal through the intermeshing rings of pegs in the first disintegrating chamber, called the first effect.

The coal particles are then drawn by suction towards the centre again through the chamber known as the second effect. It will be noticed that the rings of pegs go completely across the first effect, so that the coal has no loophole to escape their smashing action. In the second effect, the rotating rings of pegs only go across half the chamber, leaving half the volume free except for stationary pegs. The innermost ring on rotor is composed, however, of pegs which go completely across the chamber and enter a recess in the casing on the other side. This ring acts as a rejector for coal particles that may be still too large for use. In addition a set of eddy currents are set up towards the centre on the side of the casing and towards the periphery up the side of the rotor disc. The circulation thus set up in the second effect completes the pulverisation until the particles of coal are so impalpable that they are drawn by the fan and propelled into the furnace.

For full capacity of 1,800 lbs. per hour with only 5 per cent. residue on 100 x 100 screen the slide under the hopper should be full open and the screw feed on the fastest rate. Hot air should be drawn in at a temperature of round about 450 deg. to 600 deg. C. At this temperature coal of a high moisture content will be completely dried in its passage through the machine. The auxiliary air ports in the casing on the delivery side should be shut. If for any purpose the required output is to be less than the above, the slide should be closed first and the cold air inlet regulated so that no coal is rejected by the metal separator. For a still smaller output the screw should feed at a slower rate and the slide worked in conjunction. The cold air will have to be adjusted until coal is not thrown out by the separator. This may necessitate the opening of the auxiliary air ports to give sufficient air for combustion.

A safe rule when using a hack saw is to maintain an even pressure and to keep blade cutting.

Adjustable Boring Tools an Aid to Production

Quantity Output Requires Effective and Accurate Tools—Economy to Use Roughing and Finishing Tools—Hard Scale Soon Destroys the Cutting Edge—Close Adjustment

IN THE construction of machinery, especially of the finer variety, the boring of holes of all lengths and diameters proves to be one of the greatest factors in the problem of production. Where manufacturing is carried on in a big way and the question is largely one of quantity as well as quality, it is of essential importance that adequate and reliable facilities be provided for the proper performance of the work. When the quantity of output is small and the character of the work is of comparatively wide range the solution of providing efficient tools and equipment is rather difficult, owing to the possible excessive cost of tools.

However, where the requirements demand the continuous operation of a certain tool for long periods, the problem becomes less complicated, as it is more economical to provide special equipment and tools for the particular operation. In the boring of holes, large and small, the service of a boring bar is almost imperative. In many shops the practice of using forged boring tools on much of the lighter work still exists and on the larger parts the home-made boring bar with the inserted bit continues to serve the purpose, but the modern production plant to-day has adopted more up-to-date methods in the machining of holes and interior surfaces.

For the most efficient work it is necessary that the equipment used meet the specific requirements of the work in hand. Where the volume is sufficient it is invariably advisable to have a boring bar for each size and length of hole; this practice may be advantageously modified in the case of moderate production to tools having a wider range of application.

For the general run of lathe work a short threaded end is usually adopted for placing on the end of a bar that is held in the tool post, and which may be adjusted to the desired length of hole. These end pieces may be adapted to boring through or blind holes. When possible it is an advantage to provide a steady bush in the lathe spindle, in which a pilot on the front end of the bar enters before the tools come in contact with the work; this gives added rigidity to the bar and increases the accuracy of the boring operations.

When bars and cutters are in constant service allowance must be made for wear and regrinding of the tool bits. In many bars manufactured for this class of work provision is made in the bar for accurate setting of the tools to the desired size. This is usually accomplished by means of an adjustable wedge fitting between the two inner ends of the tool bits. Some bars are equipped with a graduated screw by which the setting of the tools can be accurately and quickly made.

The accompanying illustration shows a boring tool set-up on a turret head operating on a variety of work in a large manufacturing plant. The boring operations on this particular piece are held to close limits on two separate diameters. Separate tools are used for roughing and finishing each diameter, thus insuring maximum efficiency and greatest production. These boring tools are expanded to compensate for wear by means of a micrometer adjustment, the graduations permitting of setting to thousandths of an inch, making possible the use of the fastest speeds within reason. Both cutters in these bars are expanded uniformly on the wedge principle and are rigidly locked. The pilots are hardened and ground and provided with oil grooves, the lubrication assisting the free movement of pilot in the bushing and adding to the rigidity of the bar under the action of the cut.

One of the principal factors in the maintenance of cutting tools is the presenting of a clean surface to the finishing or sizing cutters. It is always advisable to have separate cutters for roughing and finishing. The wear on the former will often be excessive, especially where scale on casting or forging is met with. The more frequent grinding on roughing tools necessitates greater replacement but this is more than compensated by the increased production when finishing tools are not brought in contact with hard scale. The wear on the sizing tools will be very slight and very often a light touch with a hand stone will maintain a keen edge for a considerable time.

COPPER AND BRASS

High brass, low brass and copper may be quenched after annealing if desirable. Muntz metal and leaded brass however, should be air cooled. In the case of the muntz metal rapid cooling markedly alters the miscrostructure and the temper of the metal in an undesirable way. In the case of leaded brass quenching results in "sweating" of the lead.

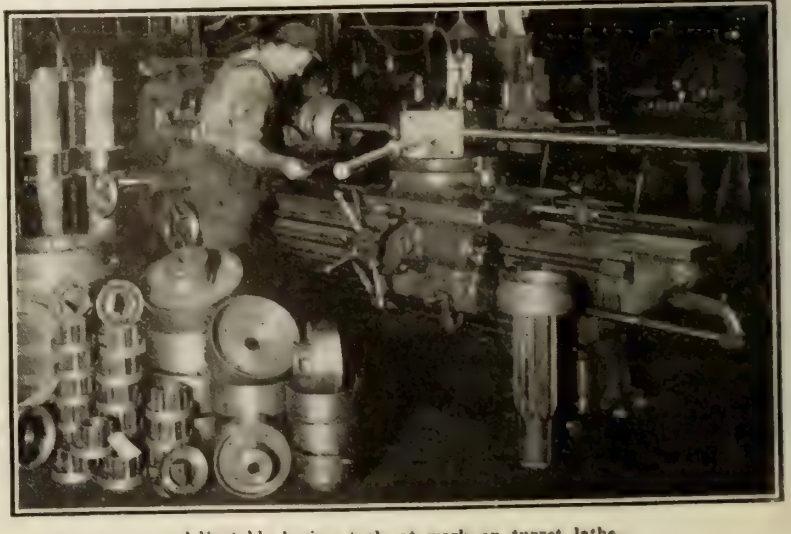
Copper and brass containing 90 per cent. or more of copper show only a slight difference in actual hardness after annealing at various temperatures above 900 deg. F. High brass on the other hand, shows a large difference in hardness under similar treatments. For this reason high brass is adapted to such uses as require fine graduations of temper.

Corrosion does not necessarily favor the development of season-cracks in stressed brass. Very severe corrosion and pitting caused by the prolonged action of various acids and other corrosive agencies had no cracking effect on stressed brass.

It has long been recognized that the presence of a hard and strong constituent in an alloy may strengthen it by opposing the "flow," or slip, of the weaker constituent.

TRANSMISSION POINTERS

Short drives and vertical belt drives should be avoided, or used only in cases of emergency, as they necessitate very taut belts. The moment a vertical belt stretches under strain, it loses its grip on the machine pulley beneath. The short horizontal drive requires very tightly set beltings with side pull on the shaft hangers out of all proportion to the normal strain for which the bearings are adapted.



Adjustable boring tools at work on turret lathe.

Illustration through courtesy of the Davis Boring Tool Co., St. Louis, Mo.

Questions and Answers

Canadian Machinery and Manufacturing News would have its readers feel that its resources for gathering special information, such as they may require, are freely at their service. Their questions will receive immediate consideration. On the other hand, should they feel that they are in a position to add to the information given in these columns upon any subject, their co-operation will be greatly appreciated. Desired information is first sent by mail to enquirers. Names will be supplied upon request.

Manufacturer.—We are placing a floor surfacer on the market and should like to know whether inspection of the apparatus by the Hydro-Electric Commission is essential. I understand the fee for inspection is $75, with a fee of $10 for re-inspection the second year. This strikes me as a rather high figure. What is the object of this inspection? Is it compulsory?

Rules and regulations embodied in the Ontario Power Commission Act of 1916-1918 and authorized by Order-in-Council, provide that design and construction of certain electrical machinery, apparatus, appliances, devices, material or equipment must be approved by the Hydro-Electric Power Commission before they may be used or disposed of in the province of Ontario. The purpose of these regulations is much similar to that applying to steam boiler inspection. The object is to provide a standard for the design and construction of electrical materials, devices and fittings, of all kinds, the proper observance of which would eliminate, in the use of such material, devices and fittings, as far as is practicable and reasonable, risk of injury to persons and property and also of fire. In short, the regulations are a safeguard against defective design, construction, workmanship, installation and operation on apparatus employed by unskilled users, largely in office, shop or home service. Manufacturers and vendors of such apparatus are also required to see that it is not used in connection with sockets of too low rating, and all electrical installations shall be so located or protected that damage will not be likely to result to persons, property, or equipment.

Manufacturers or owners of patent rights must make application to the Hydro-Electric Power Commission for test and approval of the apparatus they desire to market within the province, and in order to be assured that the manufacturer will construct his product in exact duplicate of the samples approved the Commission makes periodic tests and inspections by way of re-examination and label service. The label consists of a suitable marking, indicating that the apparatus has been inspected.

All of the large electrical goods companies, such as Canadian General and Westinghouse are, of course, subject to these regulations; there are no exceptions. They do not apply to the same extent to large power-house installations having skilled engineers in charge. The fees range from $45 to $300 according to the apparatus and the amount of work involved in the inspection. Where the costs do not aggregate the amount of preliminary fee, the balance is returned to the submittor. The fees cover only one examination and one set of tests on one device, system, method or material. A request for further examination or set of tests is considered to be a new application and may require payment of a second preliminary fee.

Would suggest that inventors of electrical apparatus, or those proposing to market same, secure a copy of rules and specifications for test and approval of electrical material, devices and fittings, issued by Hydro-Electric Power Commission of Ontario.—Ed. Canadian Machinery.

Blast Furnace Operator.—What were the amounts paid by the Federal Government to Ontario furnaces on pig iron made from domestic ore from 1896 to 1905?

The total amount paid was $1,335,379.76, divided as follows:—Algoma Steel Company, $190.754.05; Antikokan Iron Co., $47.703.19; Canada Iron Corporation, $204.897.96; Deseronto Iron Co., $10 029.60; Hamilton Blast Furnace Co., $98,126 66; Hamilton Steel and Iron Co., $783,227.22; Standard Chemical Co., $641.03. For pig iron production made from foreign ores, the amount paid in bounty was $1 830.161 58. In addition, the Ontario Government paid $125,000 in bounties to miners of domestic ore between 1896 and 1905. During the 26 years from 1896 to 1921, out of a total of 17 512 562 tons of ore smelted Ontario supplied 15.5%, and foreign ores 84.5%. There were, evidently, not sufficient supplies of native ores available. Prof. G. C MacKenzie of the Metallurgical Institute, Montreal, observed recently that if all of the 17,512 562 tons of domestic and foreign ores smelted in 26 years had been of domestic origin, the bounties paid at the rate of 54 cents per ton—on a total of 2,705,720 tons of domestic ores smelted in 26 years—might have amounted to $9,400,000, which compares with the sum of $43,977,000 estimated to have been expended in foreign labor and supplies on imported ores. "In other words," he says, "the old bounty acts were good business, but the moneys expended were not sufficient to offset the amount sent out of the country for the purchase of foreign labor and supplies."—Ed. Canadian Machinery.

Foundryman.—In your market reports I notice that under the heading of scrap metals you quote only dealers' average buying prices. Why do you not quote dealers' selling prices as well?

Dealers' buying prices are what are chiefly required in the main activities of the metal market. Machine shops and manufacturers generally, have large quantities of scrap to dispose of. They desire to know at what prices they may dispose of it. On the other hand, iron foundries are small buyers, in comparison with blast furnaces. In fact, many foundries buy their scrap iron locally. Another fact is the grading of the metal. There are numerous grades, representing differences of opinion, as to what may be required for certain purposes. The dealer must be informed on this matter before he can quote. The question of individual credits is another feature of the business, and also the location of the purchaser in relation to source of supply. A large dealer explains the matter briefly by stating that "every case in which scrap is being bought from us by the small local foundry, has to be considered on its merits; that is why we can quote no price that will apply to the requirements of the market as a whole."—Ed. Canadian Machinery.

Laporte.—Kindly inform me where possible to procure a one-half horsepower engine.

Enquirer has not stated whether steam or gas engine is required or for what purpose. The Elgin Gas Motor Co., Elgin, Ill., make a half horsepower gas engine such as used for washing machines, churns, etc. It is handled in Canada by the A. R. Williams Machinery Co. A half-horse rotary steam engine is made by John Whitfield Co., 33 Sherbourne St., Toronto.

Dressing is the process of cleaning or resurfacing the cutting surface of a wheel. It breaks up the surface so that the wheel may cut properly. Dressing is a sharpening operation and does not necessarily true a wheel.

Manufacture and Treatment of High-Speed Steel

Charge Should be Heavy and Clean—Tungsten Turnings to be Added Gradually—Furnaces Must be Carefully Examined After Each Heat—Forging the Ingots—Making Large Cutters

By H. K. OGILVIE

THE following notes deal chiefly with the manufacture of high-speed steel in the basic-lined electric furnace. Although the crucible is still largely employed as a melting medium the method is of little technical interest, being entirely a melting operation as no refining is possible, and a small amount of sulphur is generally absorbed by the metal. Although this element is not quite so dangerous as in ordinary carbon steel it is nevertheless advisable to keep it under about 0.06 per cent.

The labour and fuel costs are extremely high, but the plant and overhead charges are much lower than in the case of the electric process. The cost per ton of sound billets, however, certainly is in favour of the small electric furnace, even when the latter is only working nine or ten hours per day. The steel properly made by the two methods seems to be equally good, and this is important, as the material cost is only a small proportion of the total cost of an average form tool.

Most of the crucible steel is cast into small ingots weighing up to a few cwts. each, and so long as the alloys have been completely melted there should be little segregation and few surface defects. When forged into bars for turning tools, small cutters, and drills, the structure should be fairly homogeneous and uniform throughout. It sometimes happens, however, that small particles of tungsten compound are not completely melted, particularly when tungsten powder is used. These form extremely hard spots having a Brinell hardness generally over 600 when tested with 1-millimetre ball and a load of 30 kilogrammes, and they persist throughout the subsequent operations and may completely destroy a fine-toothed cutter working on the otherwise soft material. It is thus desirable to introduce the tungsten by means of ferro-tungsten or by the use of a tungsten-chromium alloy.

Melting the Charge

The electric furnace is commonly used for melting this class of steel, and the charge may consist entirely of high-speed steel scrap together with a small amount of turnings. The latter should be heavy and clean and are placed under the electrodes and on top of the scrap until a bath is formed. Where a large amount of tungsten steel turnings have to be used up it is preferable to add them gradually to the charge after it has been melted, but it is very much more economical to use only good scrap, that is, heavy clean scrap, with a tungsten content, and to reject light and rusty turnings.

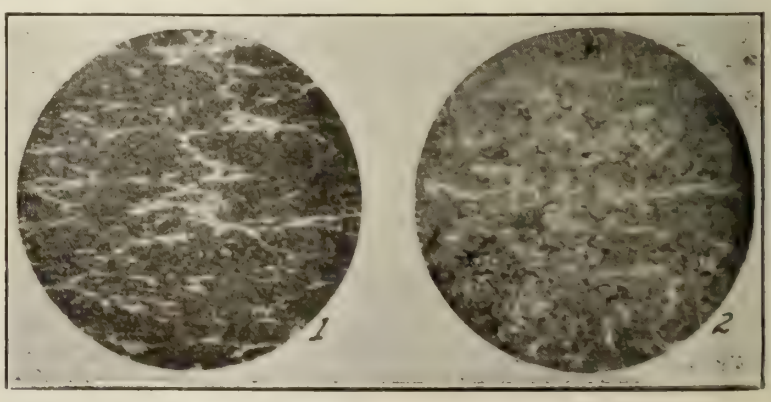
To attempt to make good high-speed steel from turnings alone, or where the greater part of the charge consists of turnings, is not, in this country, commercially possible. One cannot determine with accuracy the percentage of elements present, and this may necessitate the addition of large amounts of expensive alloys. If the turnings are clean and oily the carbon in the metal when melted will probably be too high: if they are rusty it will be too low with considerable loss of chromium in the slag. The latter will be saturated with oxides and must be removed from the furnace, as time cannot be spent in reducing these into the steel. Even when using heavy clean turnings which can very seldom be obtained in bulk, the loss will be at least 10 per cent. With average turnings bought from a scrap agent the loss may be 20 per cent. or more. Added to this is the difficulty of melting the turnings without breaking the circuit or damaging the bottom, together with the increased repairs necessary to the banks of the furnace. On account of the high current and electrode costs every suggestion which tends to shorten the length of each heat should be encouraged, consistent with making good steel but in any case the time should not exceed 4½ hours for a 3 or 4 ton furnace.

When good scrap is charged the melting slag is comparatively clean and need not be removed, and the sample for analysis can be drawn as soon as the bath has been stirred up. During the next hour, while waiting for the content of carbon, tungsten, chromium, and vanadium, a heavy lime slag should be carried without getting the metal too hot. Probably a small amount of lump ferro-silicon may require to be thrown into the bath to deoxidise the steel completely, and slag should be kept as white as possible, taking care that it is heavy enough to prevent the coal or ground electrode which is sprinkled on it from passing through into the metal. During this time most of the sulphur is removed from the steel.

Reducing the Oxides

The electrode coolers should fit closely enough to prevent the space between them and the electrodes acting as a chimney and drawing a stream of cold air through the furnace having due regard at the same time to the slight variation in diameter of the electrodes themselves. With badly fitting electrode coolers, apart from the heat lost and the increased repairs necessary to the roof, the length of time required to reduce the oxides in the slag is prolonged whilst the consumption of electrode per heat is surprisingly increased. The doors should be heavy and a good fit. Double arches may be used with the best silica brick inside the furnace and ordinary firebrick on the outside, the latter withstanding rapid charge of temperature much better. A bricklayer accustomed to this class of work can keep down the costs of repairs enormously, and will seldom interfere with the normal working of the furnace.

As in every other class of melting, attention must be paid to the furnace bottom and banks after each heat, particularly at the top of the banks where siliceous material from roof and walls tends to gather. In the case of furnaces having a bottom electrode where the bottom is often considerably weakened by iron spikes or metal to increase its conductivity, it is very important to completely remove any metal from pockets left after tapping the furnace. These should be carefully filled up with magnesite or dolomite mixed with a little



basic slag and allowed to partially fuse. Where a furnace of the Heroult type is in use probably the best method of making the bottom is that employed for the basic open-hearth furnace, using oil burners if no other means of reaching the necessary temperature are available. Layers of good quality burnt dolomite mixed with a little basic slag are fitted on until half the thickness is reached.

After saturating the bottom with slag and "setting back," the operation is continued, using layers of magnesite together with sufficient slag to render it just viscous at the maximum temperature obtainable until within a few inches of the necessary thickness. The top layers are completed with dolomite and slag and the furnace is finally held at a white heat for some hours by introducing coke between the electrodes.

Obtaining Analysis

By the time the metal has been melted the percentage of carbon, tungsten, and chromium should only be slightly reduced but most of the vanadium will have been removed. The necessary amount of crushed ferro-tungsten and ferro-chromium is added as soon as the analysis is obtained, and the temperature of the steel is gradually increased. When the bath is in good condition enough ferro-manganese is thrown in to give about 0.2 per cent. manganese, and five minutes later the ferro-vanadium may be added in a bag and well rabbled under the slag. The furnace should be tapped within the next ten minutes if the samples are quiet and the temperature sufficiently high, and no additions of aluminum or any deoxidising compounds should be made to the ladle or moulds. Occasionally at this stage when getting the metal hot enough to tap, the steel, in some of the smaller furnaces especially suddenly becomes wild, and if cast will rise over the tops of the moulds even when considerable quantities of carbon, silicon, manganese, and vanadium are present. It is useless to attempt to deoxidise the steel with additions of ferro-silicon, etc., and the only method which has given successful results in the hands of the author is to cool the steel without any addition until after thorough rabbling samples taken at regular intervals show the metal be sound.

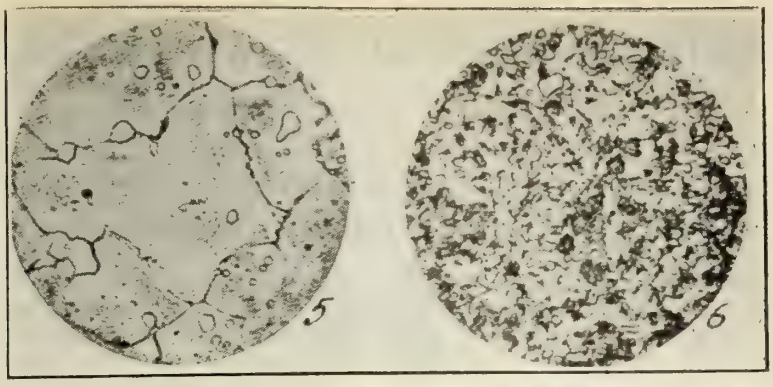
It may be necessary in some cases to allow cooling to proceed until the steel commences to solidify round the banks. As this gas trouble has been quite widely known for a number of years, the author is rather surprised that so little mention of it has appeared in any of the home or foreign technical publications. Why high carbon steel containing up to 1 per cent. of silicon and melted with every possible precaution should, without any visible indication, suddenly become so wild as to flow out of the test ingot requires some explanation, when the slag is apparently in good condition and practically free from oxide of iron. It is difficult to believe that the trouble is due to oxide of iron, which can scarcely exist in such large quantities in the presence of elements having a greater affinity than iron has for oxygen. Also a sample ingot, badly honeycombed, after forging and rolling, showed apparently thorough welding of the gas holes, and gave impact and bend tests equal to sound steel of similar composition. At the same time there is undoubtedly a reaction between the gases and the silicon and manganese prese with the steel is sufficiently cooled with consequent slight reduction of these elements, but during the time the metal is hot and wild there is no greater oxidation of silicon manganese, or vanadium than normally takes place with sound steel under approximately the same conditions. Also the milder the steel to be made the more liable is the trouble to occur, taking into account the slightly higher casting temperature of the low carbon steel. This may or may not be due to the fact that no carburising material is added when the melting slag is removed.

While the temperature seems to be extremely important the method and rate of generating heat appears to be more so. No such trouble is met with in a furnace such as the Rennerfelt, where heating is done almost entirely by radiation, or in basic Siemens practice, where equal temperatures are attained so far as can be judged by the fluidity of the steel. The metal in the electric furnace is always hotter when the first slag requires removal than it is when ready to tap the furnace, and when a clean slag is put on and fused a small amount of ferro-silicon is sufficient to render the steel quite free from any tendency to rise in the mould. Yet as the refining proceeds and the slag becomes practically free from effective oxides, the danger of gas trouble appears to increase. In this way it is similar to overpoled electrolytic copper which, while theoretically free from oxygen, swells and evolves gases on solidifying. Although this gas trouble does not often happen with high-speed steel, attention is drawn to the fact that it is by no means unknown in arc furnaces.

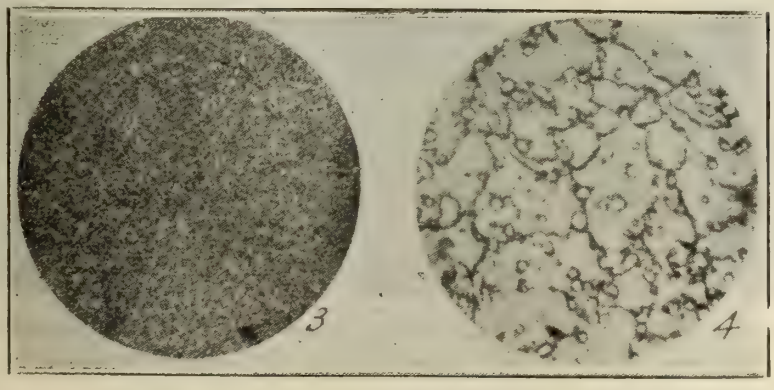
It is important to remember that this class of steel oxidises in the sample spoon more quickly than carbon steel, and allowance should be made for this when judging the temperature of the metal. No instrument gives very consistent results in practice when attempting to measure the temperature of molten steel, but it is very seldom that the usual pouring of film tests when carried out under same conditions each time fail to give extremely good results. Where there is some doubt it is better to get the steel into the ladle too hot than too cold, especially if there is any device attached to the latter to regulate the speed of casting.

The ingots for each melt should not vary greatly in size, and octagon moulds are to be preferred. Castings should be done from the top of the mould, having the metal in the ladle hot enough to permit the slag to rise to the surface, and as small a nozzle should be used as will pour the whole heat at such a rate that lapping of the ingots is just avoided and no crust permitted to form on the surface of the steel as it rises in the mould. This allows the ingot to solidify in the most natural manner, preventing the formation of large tungstide ne wo and keeping the pipe down to a minimum.

(To be continued.)



5—35 Seconds at 1300 deg. C., x 1000. 6—Just raised to 1300 deg. C., x 1000.



3—9 Slotting cutter, x 60. 4—5 seconds at 1300 deg. C., x 1000.

Result of Several Tests Made on Welded Cylinders

Method of Making Seamless Pipe—Process of Welding Girth Seams—Practice Followed in Testing the Welds—Results of Observations—Determining the Factor of Safety

By PROF. E. A. FESSENDEN and S. J. BRADFORD

FROM samples cut out of this cylinder for physical tests the actual mean thickness of the weld itself was carefully measured, and for welds made in ¼-in. plate the average thickness was found to be 0.350 in. Hence the actual stress withstood by the acetylene-welded seam during the test without any sign of failure was 24,500 lbs. per sq. in. This amounts to 8,590 lb. per linear inch of acetylene-welded seam. The stress which caused final failure of the forge-welded seam was one-half of this or 4,295 lb. per linear inch of seam.

Four samples were cut from one of the circular flange-steel blanks such as used for making the dished heads. The results obtained when tested for tensile strength are presented in Table 1.

Ultimate Strength

The ultimate strength of the plate tested was thus somewhat below that specified for flange steel as set forth in the Boiler Code of The American Society of Mechanical Engineers, where the requirement is given as 55,000 to 65,000 lb. per sq. in. The elastic limit, or yield point, is above the requirement which states that at the yield point the stress shall have a minimum value of one-half the ultimate tensile strength, i.e., 27,500 to 32,500 lb. per sq. in. The fractures were typical flange-steel fractures showing a very fine grain. The amount of elongation and the reduction in area were not determined.

Three samples containing sections of the acetylene-welded longitudinal seam were cut out of the cylinder and subjected to tension tests. Professor Patterson's report upon these specimens gave the results presented in Table 2.

The average ultimate strength was slightly above the value of 28,500 lb. per sq. in. specified by the Boiler Code of The American Society of Mechanical Engineers, for properly made forge welds (p. 45, Par. 186, edition of 1918). The average ultimate strength per linear inch of acetylene-welded seam was 10,097 lb. The fractures occurred in every case through the body of the weld itself, practically at the center line of the seam. In every case the fracture started with a crack which grew larger as the tension was increased. The final fracture did not occur suddenly and with a strong pronounced snap, as would be the case with a good flange steel, but was slow and gradual, as might be expected from a loosely knit, coarse, granulated material, and was very similar to that obtained when a piece of putty is pulled in two. The elongation was not measured, but if any occurred it was very slight indeed. There was no apparent reduction of area. The fractured heads indicate approximately the boundaries of sections later cut out for microscopic and metallurgical examination. The section containing the leak in the forge weld which caused final failure was cut into small pieces for examination and designated as specimens

TABLE 1 TENSILE STRENGTH TEST OF CYLINDER NO. 1 SPECIMENS

Sample	Dimensions in.	Area sq. in.	Load, lb. Yield point	Load, lb. Ultimate	Tensile strength, lb. per sq. in. Yield point	Tensile strength, lb. per sq. in. Ultimate
A	0.243×2.00	0.486	17,000	24,500	35,000	50,400
B	0.242×2.01	0.486	17,580	25,100	36,200	51,750
C	0.241×2.01	0.484	17,690	25,180	36,500	52,000
D	0.242×2.025	0.491	16,950	25,520	34,500	52,000
	Average				35,425	51,538

TABLE 2 TENSION TEST OF CYLINDER NO. 1 SPECIMENS

Sample	Dimensions at weld, in.	Area at weld, sq. in	Ultimate load lb.	Tensile strength lb. per sq in.
E	0.362×1.452	0.526	13,800	26,250
F	0.335×1.504	0.504	15,820	32,000
G	0.354×1.734	0.614	17,810	29,000
	Average			29,083

Extract of a paper presented at a recent meeting of the American Society of Mechanical Engineers. The first part appeared in the Oct. 19th issue.

Fig. 9—Final shape of cylinder No. 3 head, showing failure of forge weld.

Fig. 8—Head of cylinder No. 2, showing scale cracks indicating distortion.

PO, PI, PE and PZ. These samples were cut in the order given reading from left to right in Fig. 6, PE being the small sample containing the crack which caused final failure.

The construction of cylinder No. 2 is shown in Fig. 7. The shell was made of seamless-steel pipe approximately 0.34 in. in thickness. The heads were of dished form, with a straight cylindrical flange of the same external diameter as the shell and about 1¾ in. long. The heads were welded to the shell by the acetylene torch with the convex face outward. The cylinder was set up for testing like cylinder No. 1 and marked off into sections. Outside diameters (in inches) were measured only in the horizontal plane, before and during the test, as follows:

Observations of Test

Between sections	1-2	2-3	3-4	4-5	5-6
Before test ...	12.65	12.73	12.78	12.78	12.73
At 2,550 lb. per sq. in.	13.08	13.05	13.05	13.05	13.05

The following observations were made during the test at the pressures indicated:

600 lb. per sq. in. Faint cracking sounds heard at end of section.

1,200 lb. per. sq. in. Scale cracks were observed in the forge scale on each head at the sharp bend where the flange is formed on the head. These scale cracks are shown very clearly in Fig. 8, and indicate that sufficient deformation of the convex head to crack the scale had occurred.

2,000 lb. per sq. in. A very slight leak through the acetylene-welded circumferential seam joining the cylinder head to the end of section 1. This leakage was so slight, more in the nature of barely perceptible seepage, that during the entire test not more than three or four drops of water escaped.

2,550 lb. per sq. in. A small leak occurred where a ½-in. extra heavy pipe coupling was acetylene welded to the shell in section 5 of the cylinder.

2,600 lb. per sq. in. The leak observed at 2,550 lb. per sq. in. where the coupling acetylene welded to the shell in section 5 became so large as to constitute complete failure.

The progressive approach toward the truly hemispherical head was quite apparent.

The factor of safety, computed on the same basis as for cylinder No. 1, may be taken as one of the following figures: (a) If failure is considered as occurring when the first indication of deformation was observed (the cracking sounds heard near the head of section 6), the factor of safety is 3.24. (b) If the vessel is considered to have failed at the first apparent leakage, the factor of safety is 10.81. (c) On the basis of the maximum internal pressure reached, the factor of safety is 14.06.

Assuming the effective thickness of the weld to be the same as that of the shell material, i.e., 0.34 in., the stress in the circumferential seam at a pressure of 2,000 lb. per sq. in., when the first very slight leakage was observed, was 17,700 lb. per sq. in. on the basis of the original mean diameter of the shell. This amounts to 6,020 lb. per linear inch. On the same basis and the maximum pressure reached during the test, the stress on the seam was 23,000 lb. per sq. in. or 7,830 lb. per linear inch of seam.

Two test pieces containing circumferential-seam samples were cut out for tension tests. Careful measurements of the actual mean thickness of the seam gave an average value of 0.442 in. Using this figure instead of the nominal thickness of 0.34 in., the stresses withstood by the seam during the test were as follows: At the first slight seepage, 13,620 lb. per sq. in. of seam; For the maximum pressure, 17,690 lb. per sq. in. of seam. A number of samples were cut from this cylinder for tension tests. They were located as follows: Sample H was cut from the head of section 1. This sample may be located by reference to Fig. 8. It contained the letters GC shown at the top of the head. The very small seepage leak was also in this sample. Sample I was similar to sample H and was cut out of the head at the end of section 6. Sample J was a circumferential section cut out of the shell. The location was about 5 in. to the right of the coupling that caused final failure. Sample K was a longitudinal sample cut from the shell at a point about 6 in. away from the coupling that caused final failure and on the back side of the cylinder.

Professor Patterson's results for the tension tests of these samples are given in Table 3. For the shell material the elastic limit and the ultimate strength were each above the value specified for boiler-plate steel in the Boiler Code of The American Society of Mechanical Engineers. The elongation and reduction in area were not measured but were considerably less in amount than were obtained for the flange steel used for the heads in the tests described in connection with cylinder No. 1. The fractures were fine-grained.

The average ultimate strength of the acetylene-welded seams was slightly below that specified by the Boiler Code for good forge-welded joints. On the basis of the average ultimate strength of the acetylene-welded seam, it would require a load of 12,010 lb. per linear inch of seam to detach the head from the shell. The fractures of the acetylene-welded joints exhibited in general the same characteristics as were described for the acetylene-welded joints of cylinder No. 1, except that in sample H the welding material pulled away from the head, opening up the spot where the slight leakage occurred. At this point the color was somewhat darker than for the remainder of the fracture. All the indications thus point to poor adhesion at the junction of the head and the welding material, probably due to oxidation.

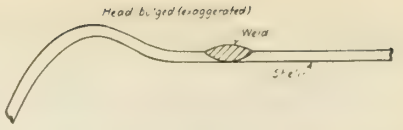


Fig. 10—Distortion of head at the end of section 1 of cyl. No. 4.

The shell was made of the same kind of seamless pipe as that used in the shell of cylinder No. 2, but about 6 ft. long. The heads were similar to those used in cylinder No. 1 and were forge welded to the shell in the same manner. The ends of the shell were crimped over to reinforce the forge weld, and like the other two cylinders, the shell was marked off into sections. The outside diameters (in inches) of the shell measured in the horizontal plane before and during the test were:

Between sections	1-2	2-3	3-4	4-5	5-6
Before test ..	12.64	12.76	12.81	12.81	12.75
At 550 lb. per sq. in. ..	12.66	12.76	12.83	12.81	12.75
At 1,300 lb. per sq. in. ..	12.70	12.76	12.81	12.80	12.75

The following observations were made during the test at the pressures indicated:

200 lb. per sq. in. The concave head in the end of section 1 began to show where the head had been somewhat flattened (presumably) during the process of forge welding to the shell.

550 lb. per. sq. in. The concave head in the end of section 1 completely reversed in curvature.

1,000 lb. per sq. in. The concave head in the end of section 6 became convex. The distortion of the head in the end of section 1 had increased markedly.

1,300 lb. per sq. in. The head at section 1 was stretching rapidly and slight leaks appeared through the forge-welded joint at both heads.

1,380 lb. per sq. in. Complete failure resulted from excessive leakage through the forge weld joining the head to the shell at end of section 1. The leakage was so great that it was not possible to increase the pressure further with the pump available.

(To be continued.)

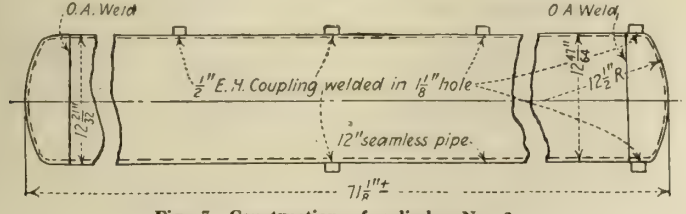


Fig. 7—Construction of cylinder No. 2.

Practical Ideas From Practical Men

DRILLING JIG FOR MACHINE LOCK NUTS

By Robert Mawson

When machining various parts by such operations as boring, reaming and counterboring it is often necessary to machine the hole to a certain pre-determined depth. Under these conditions the tool used for the operation is provided with a collar or similar medium which comes against the head of the guide bushing or similar surface so that all the holes machined with the tool in the various pieces will be similar as regards the depth of hole. The usual design for the shank of the boring tool is to make a threaded portion on which is screwed a nut or in some cases two nuts that may be adjusted to obtain the desired setting.

In Fig. 1 is shown the type of lock nut employed when only one nut is used which is considered the better method as the shank can be made with a shorter length of thread and as there is only one nut to make, the tool is somewhat cheaper. The chief advantage is the fact that the tool can be adjusted much quicker than the two-nut type as it is only necessary to slacken a set-screw and turn the nut on the thread of the shank to the new position.

In our designing department we design a large number of tools such as here noted to be used in the shop and in order to produce the lock nuts cheaply and interchangeably, though this is not of very vital importance except for tools which we sell with the jigs and fixtures made for outside concerns. We made the jig illustrated in Fig. 2. This tool is made with a cast iron body counterbored on one side 1⅜ in. diameter and ½ in. deep. Feet are provided at the top and bottom which are machined square with the center line of the casting and bored hole. These feet are made of sufficient height so that when the jig rests on the machine table the guide bushings are clear of the surface. The rear of the jig body is also machined so that the washer under the binding knob A will come against a finished surface.

Through the center of the jig is machined a ⅞ in slot B so that the clamp C will set in without interference. Bushings are provided in the tool to drill the two 3/16 in. holes and also slip bushings to drill the hole for the "L" tapped hole and also the ¼ in. clearance hole for the screw. The position of these holes may be seen by referring to the detail of the nut and comparing this with the assembled jig.

To use the jig the clamp C is first removed from the tool and the nut to be drilled slid on the plug F which is a good sliding fit inside the thread of the piece. The clamp is then slid into position being located with a shoulder on the pin G which it will be observed is provided with a shoulder on the outer end so that the clamp can be held securely in place. The knob A is then tightened and this action draws back the pin and the shoulder already noted coming in contact with the clamp pressure then exerted on the nut holds it securely in the jig.

Referring again to the nut it will be noticed that a binding slot has been machined at the upper end and it is necessary that the binding screw holes be drilled in a certain relative position to this slot. This is obtained with the screw H which is turned down at the inner end to ⅛ in. to fit this slot and the nut is therefore placed so that this screw will set into the slot of the nut to be drilled. The 3/16 in. hole is then drilled in the piece and the binding screw hole drilled for the screw and the ¼ in. hole machined, changing the slip bushings for the operations and the hole also tapped with "L" 16 threads per inch with the guide bushing removed.

The jig is then reversed and a 3/16 in. hole drilled opposite to the first hole machined with the jig resting in the new position on the machine table. The advantage of this jig is that the piece is easily and positively located by means of the machined plug which fits the inside diameter of the threaded nut, and the part is also quickly fastened into position with the clamp and knob operated screw so that no wrenches are necessary for its manipulation. It is therefore all that a drilling jig should be and has proven a time saver in service and should furnish ideas for machining other elements that can be followed by tool designers in other plants.

A DRILLING KINK

By G. Blake

During the writer's visit to an engineering establishment, he noted a man operating a drilling machine, drilling ¾ in. dia. holes in a cast iron frame about 6½ in. thick. The man had difficulty in getting rid of the drilling (i.e.) the small chips of cast iron. He was using a short length of ⅜ in. bore brass tube and endeavoring to blow the chips out of the hole, putting one end of the tube in his mouth and locating the other end of the tube in the hole and blowing as hard as possible. In addition to not getting the chips out of the hole he was causing a small cloud of very fine dust to float about which is not a desirable thing from a health point of view. When drilling small, deep holes it is

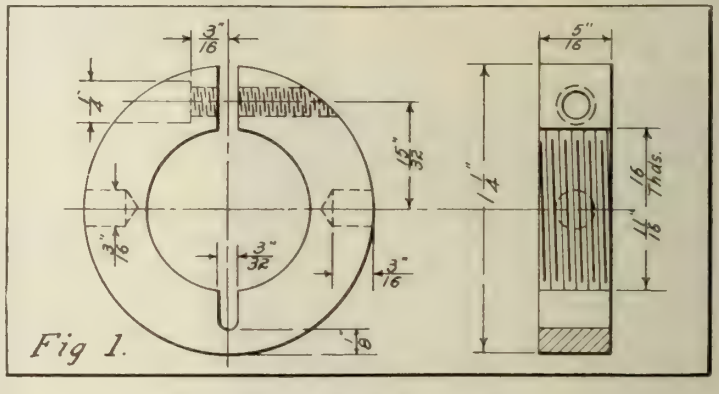


Fig. 1.—Type of lock nut for which jig was made.

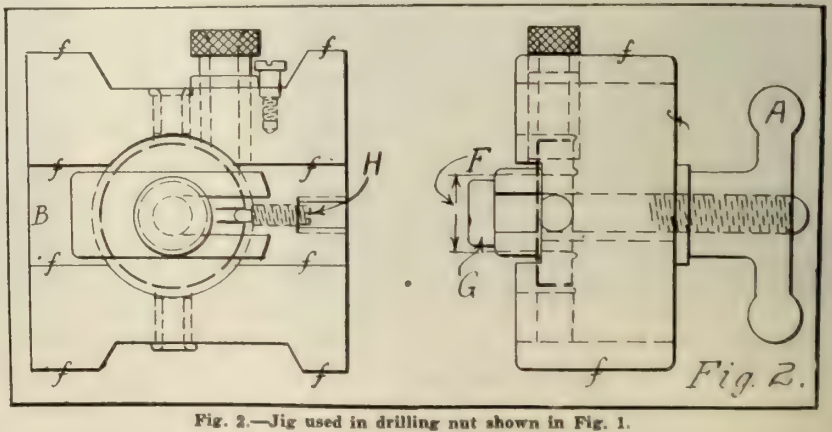


Fig. 2.—Jig used in drilling nut shown in Fig. 1.

best to provide oneself with a piece of silver steel, say from 3/16 in. to 5/16 in. dia. and about 12 in. long or longer, if the holes to be drilled are over 9 in. in depth, and have the end of the steel rod magnetized, this if inserted in the hole will get over the trouble in a few moments as the chips will cling to the magnetized rod. This small item should be included in every driller's kit.

LIFE OF EMERY WHEELS

By G. Blake

Generally when the emery wheel of the floor grinder is worn down to the flanges, it is scrapped as being of no further use. In the works where the writer is engaged, when the emery wheel has been worn down to the flanges, Fig. 1, it is taken off and the standard flanges removed and another pair of flanges smaller in diameter mounted as shown in Fig. 2; by this means the wheel is used as far as will permit with safety. In these days of rigid economy, a considerable saving in emery wheel cost will be effected if the above method is used. It is essential that the emery wheel be quite free on the spindle; if it is tight this increases the tendency of the wheel bursting. If possible when using the worn wheel the speed should be increased so as to maintain the standard peripheral speed of approx. 5,500 ft. per minute; if this is not done, the wheel will wear much faster as it gets smaller in diameter. After the wheel has been used as indicated in the above manner, it still has its usefulness, transfer it to your foundry to be broken in small pieces for rubbing down castings after being removed from the mould. It should be observed that the diameter of the flanges in all cases must be 1/3rd the diameter of the wheel.

PARTING TOOL FOR RING SEGMENTS

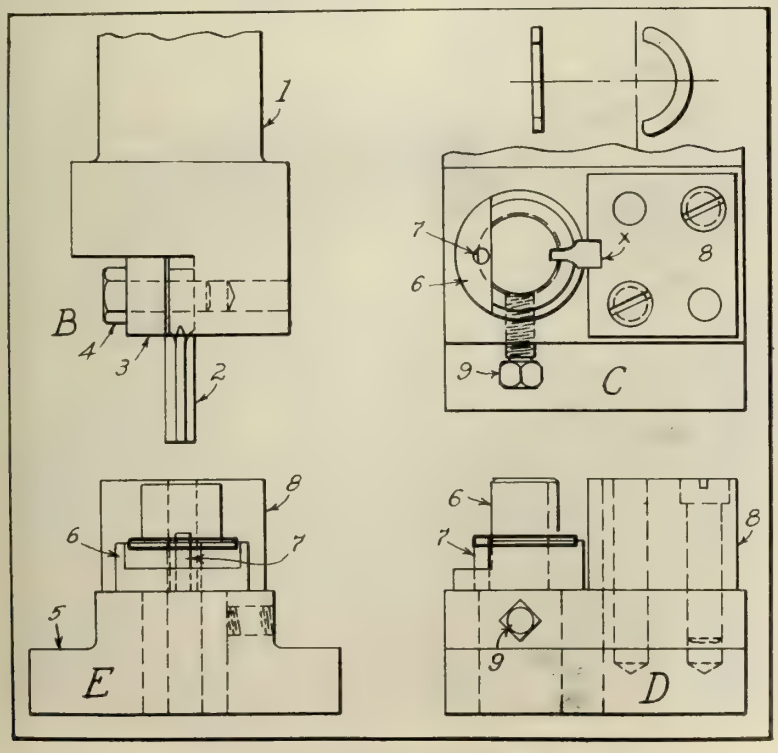
By F. H.

An interesting construction used for making segments from round rings which have been cut from tubing is shown by the accompanying illustration, where a completed part is shown in the upper right hand corner. This is a die construction in which the method of locating the work and backing up the cutting off punch is rather unusual.

Referring to the illustration this shows five views of which A and B are views of the punch holder and punch used for making the cut while C, D and E are views of the die. Referring to the punch holder, this is made of round machine steel it being indicated as 1 while 2 is the punch for cutting off, where it will be noted that the cutting off punch rounds the ends of the segments. This punch is held in position by a strap 3 and two screws 4, the punch holder being grooved to receive the punch which is made of rectangular-shaped tool steel.

In the die 5 is a steel block in which is attached a round piece 6 made from bar tool steel which acts as a cutting die. In this is located a pin 7 which is used for locating the work after the first cut is made. In addition a block 8 attached to 5 by screws and dowels is used, this has a groove cut in it at X, its purpose being to back up punch 2 which travels up and down in this groove thereby keeping the punch and die in alignment.

The ring from which the segments are to be cut (two in number) is placed over the upper end of 6, locating pin 7 being removed at this time. The punch press is then operated in the usual manner and the ring is split. After completing a batch of these rings in this manner the pin 7 is put back in place, the segment rings are again put over the end of 6 with the slot previously cut straddling the locating pin 7 after which the press is again operated which causes the punch to make the cut, and the resulting product is the segment shown in the upper right hand corner of the illustration, with both ends mounted. A square head screw 9 is used to hold the cutting die 6 in position and as the punch travels in the groove in 6 and is backed up by the groove in 8, correct alignment of the punch and die is assured at all times.



Parting tool for ring segments.

WHERE DID I PUT IT?

By D. A. H.

How many times do shop men ask that question? Hundreds of small shops have no tool room and no exclusive storage space; a foreman or other executive in such a shop has his hands full anyway and when he has to remember where some little tool that was used for Jones' job three years ago was put, he is really up against it.

One such executive got tired of wasting his time hunting in the lower shed or going through the drawers in the old desk or rummaging in the loft next the patterns or searching the shelves back of the boiler room. He could not work the management for anything better but these things had to be stored somewhere and someone had to hunt them up when they were wanted at a later date — as they always are, most unexpectedly. So he made out a list, kept in a note book under different headings such as "special tools," "sample pieces," "drawings," "fixtures for contract jobs," "discarded jigs, may be used elsewhere," etc., etc., and the book he titled "Where Did I Put It?"

Then when anything not active was put away, its location was recorded in the book. Days and days of expensive, exasperating hunting were saved by this practice. Efficiency men will say that such a method is starting at the wrong end, and so it is, but we on the firing line know what working under conditions of limited capital is and this homely method really passes the acid test of such conditions. Scores of harassed executives could follow this procedure with beneficial results.

CATALOG

The Bristol Co., of Waterbury, Conn., has just issued a new and revised catalog on their varied line of pyrometers. In addition to listing the instruments the book contains a number of specimen charts taken from actual installations. There are also several pages devoted to plans illustrating the correct method of installing the recording apparatus. The application of the fire ends is clearly described and demonstrated by a number of photos and line drawings, showing their adaptation under different conditions.

New Things in Shop Equipment

AUTOMATIC CENTERING MACHINE

Designed for use in the field of large production, the automatic centering machine has two heads which center work at both ends in one operation, and in addition has an automatic drill feed mechanism operated in conjunction with a magazine. Clamping of the work is also done mechanically so that after the set up it is only necessary to keep the magazine supplied with work and take away the finished parts. The work is removed from the magazine by transfer slides, placed in the vise, clamped, centered and then released into the work box independent of the services of an operator.

The feed to the drills is automatic, being operated by the same cam O which operates the transfer slides. This cam is driven by a small motor (shown in the rear view) and a set of change gears provides the means of adjusting the drilling time to suit the nature of the work. During the centering operation the drills are automatically withdrawn twice, so as to clear them of chips, and allow oil to enter the drilled hole. Each spindle has a maximum feed movement of 7/8 in., which may be reduced by a regulating lever to 7/16 in. with any variation between to suit the size of drills or the nature of the work. The machine may be run through its cycle of operations by hand to check the set up. A crank handle fitting the squared end of a shaft in the change gear box is supplied for this purpose.

In order to hold the drilling depth to any dimension desired, adjustable stops R are provided which are mounted on the head and bear against the ends of the work to limit the forward movement of the spindles. In certain cases it is necessary to have the center holes the same distance apart regardless of variations in the length of work. For this purpose the adjustable stops are positioned to engage lugs on the drill heads, thus holding the spindles to a predetermined forward movement.

The drills are driven by individual motors mounted in the head and geared so as to provide a speed of 1,200 or 1,800 r.p.m. Changing gears or locking the spindle for the removal of drills is easily taken care of by knobs on the top of the drill heads. The magazine A, and work supports are mounted on the head castings so that it is only necessary to move the heads along the bed to accommodate various lengths of work. The sides of the magazines are easily adjusted for diameters of work as they are slotted and held by simple square head screws.

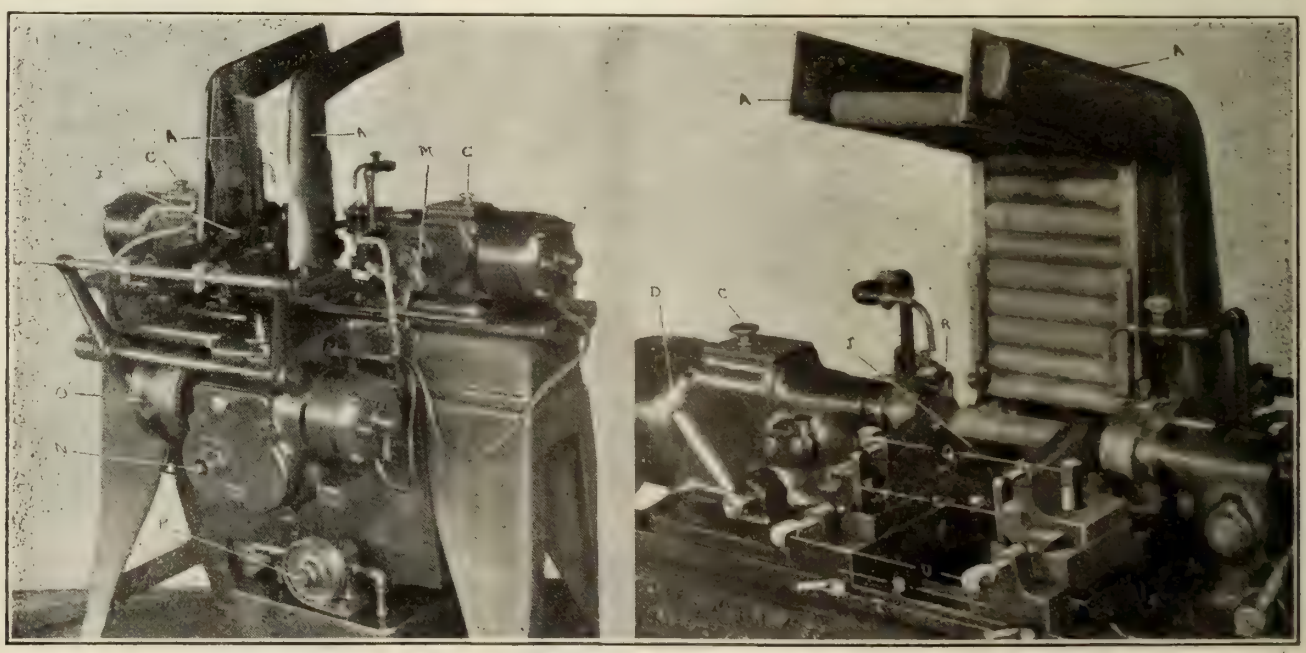
The work is supported by V jaws during the centering operation. These jaws are provided with adjusting screws so that they may be set to any desired diameter while an automatic compensating arrangement takes care of minor variations in the diameter of the work. The work is clamped in the V jaws by transfer plates J on the slides which remain in contact during the drilling. By simple adjustments of the V jaws it is possible to drill holes out of center on one or both ends, such as holes for driving pins used in grinding, short oil holes, etc. Facing or chamfering tools may also be used in place of drills if desired. Different transfer plates taking care of various diameters of work, are easily mounted in place. Four sets of these plates cover the range of the machine.

Oil is supplied to the drills from a geared pump P running at a constant speed. The tank is located underneath the bed and the oil drains into it from all parts of the machine including the work box. The work box is taken off for cleaning and removing the finished work. The work pieces are ejected directly into the box and when the box is removed while the machine is running a deflector hinged on the bed can be latched in position to catch the work.

The machine has a capacity of work from ¼ in. to 1½ in. in dia., and from 2½ in. to 18 in. in length, with a net weight of 1,020 lbs. It requires a floor space of 4 ft. 6 in. by 2 ft. 6 in. This machine centering has been developed and placed on the market by the Pratt and Whitney Co., New York.

TILTED THREADING MACHINE

A new type of threading machine, in which the spindles are tilted and which can be adapted to both internal and external threading has just been placed on the market. The machine has a capacity when working on internal threads of ¾ in. dia. U.S.S. threads. It is equipped to provide both forward and reverse movements to the spindles. The six spindles are located at an angle of 30 deg. from the vertical to facilitate



Left: Rear view of the automatic centering machine. Right: Close-up of magazine and feeding mechanism.

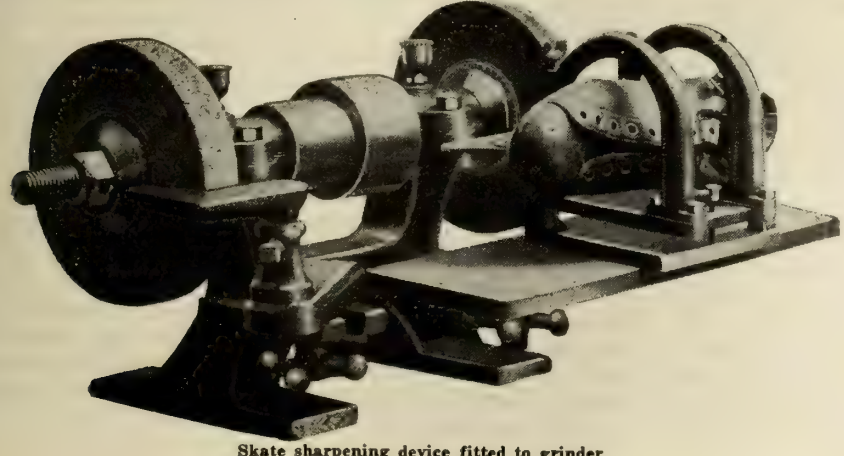
likewise permit of using self-clamping jigs. The tapping spindles are provided with spring collets. Four changes of speed are provided with double speed reverse action automatically taking place when desired depth of thread is reached. The design permits of continuous operation as the arrangement of the work-holding fixtures permit of loading six while tapping is proceeding on the other six. The work is moved up to the taps by means of a foot treadle. The row of jigs can be moved along the bed so as to bring them in line with the tapping spindles. Oil is forced individually to each spindle. Bronze bearings are used throughout and thrust points are fitted with ball thrust bearings. It is claimed that production may be maintained at the rate of 1,500 pieces per hour. For outside threading the capacity is threads of 1 in. dia. Self-opening dies are used and machine can be adapted to cutting either right- or left-hand threads. The machine requires a floor space 66 x 41 in., and is made by the Holmes Engineering Co., Oshkosh, Wis.

ROTARY MILLING MACHINE TABLE

A rotary table, controlled by the regular feed levers of the machine, including the traverse, has been developed recently and placed on the market. The table is driven from the feed drive shaft through a telescopic shaft and two pairs of steel bevel gears that drive a 2½-in. steel worm meshing with a 20-in. worm wheel. The sixteen regular feeds may be used to operate the rotary table. The design of the mechanism makes it impossible to engage more than one power feed at a time. These controls make the attachment especially serviceable for continuous milling. The table is 24 in. in dia., but work of a larger size may be accommodated. The table is graduated the entire 360 deg. These table attachments are made by the Toledo Milling Machine Co., Toledo, Ohio.

SPECIAL BENCH GRINDER

The accompanying illustration shows a skate grinding attachment that has been fitted to a grinding wheel and placed on the market recently. It is intended for use in small machine shops for service throughout the winter months. The device is designed so that the skate may be ground either while attached or detached from the boot. The holder may be moved freely along the table which insures uniform grinding of the skate blade. This device has been developed by the Prescott Emery Wheel Co. of Prescott, Ont.



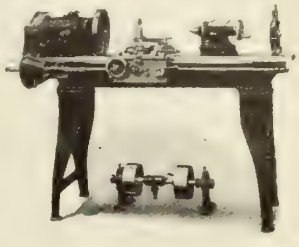
Skate sharpening device fitted to grinder.

SIX SPINDLE CHUCKING MACHINE

An automatic machine that is particularly serviceable for handling a product that can be held in a chuck, as castings, forgings and short pieces of bar stock, and which requires a number of separate and distinct operations as turning, facing, chamfer, form, drill, bore, ream, thread or any other regulation lathe work, has just been placed on the market. The machine will handle five pieces of work at one time. There are six spindles, five always in working position, the sixth being in the loading and unloading position. When a finished piece reaches the loading position the machine automatically stops so that inattention of the operator will not cause work to make a second cycle of operations. The machine may be started immediately, work proceeding on the five working spindles while the sixth is being reloaded. As many as twenty-one cutting tools may be used at the one time. The machine has a speed range of from 28½ r.p.m. to 440 r.p.m., divided into 24 speeds. This permits of any spindle being run at any one of three different speeds. In addition to the variable spindle speeds there are 17 different feeds for the cutting tools. It is possible to arrange the spindle and feed speeds so as to give the greatest productive speed for the work in hand. A hole of small diameter can be bored at a high rate of spindle and cutting speed while at the same time the outside circumference might be turned at the best speed for that operation. Tool holders are designed to receive standard tool bits. Machine requires a floor space of 93 x 46 in. It is operated by a 5 h.p. motor; carriages and tool slides are fitted with rapid traverse or reverse. The machines have been developed by the Baird Machine Co., Bridgeport, Conn.

12-INCH ENGINE LATHE

The small engine lathe here described has just been placed on the market. The lathes may be supplied either with the cone pulley or the all-steel geared head, both of these being driven either by belt or motor. The cone pulley headstock is of the enclosed type which rigidly supports the two bearings and maintains alignment. The back gears are extra wide face and thoroughly protected. The single pulley drive geared headstock is fully enclosed and the steel gears run in an oil bath. Six spindle speeds are provided for. The driving pulley of the geared headstock is fitted with a friction clutch operated by a shifting bar extending the length of the lathe. The hollow spindle is extra large and made of carbon steel. All bearings are accurately ground to size and run in phosphor bronze adjustable and easily replaceable bearings of more than ample load capacity. These lathes are equipped with positive tooth faced reversing clutches, by means of which both the longitudinal and cross feed and the direction of the head screw may be instantly reversed without engaging or disengaging gears stopping the lathe, shifting belts or reversing the spindle rotation. The tailstock is of improved offset type. Tailstock spindle is of large diameter, accurately ground and fitted to reamed hole. Tail centre is self ejecting. The carriage, which is extra wide and heavy, has a long bearing on the bed, and is gibbed both in front and rear. The compound rest has an exceptionally wide bearing with adjustment to compensate for wear. The circular base is graduated. All gears in the apron are of steel and bronze bushed. Apron gearing is so arranged that operator may readily shift from thread cutting to the use of either the traverse or cross feed without the shifting of gears. All lathes may be furnished with gap beds which are well braced and proportioned to be as strong in the gap as in any other portion of the bed. The gap bridge is accurately located by taper pins and rigidly held by cap screws. Special motor and countershaft support are provided for motor-driven cone headstock. A swing bracket assures constant tension in the drive belt. In addition to the regular equipment the lathe may be furnished with taper attachment, milling attachment, etc. These machines are built in 10, 12 and 14-inch sizes and are made by the Oliver Machinery Co., Grand Rapids, Mich.



12-inch engine lathe.

CANADIAN MACHINERY
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Export By Canadian Lines

IS EXPORT traffic moving as freely as it should through Canadian ports and via Canadian lines? There is said to be a much larger Canadian tonnage moving through American ports than should be. Canadian lines, it is reported, are refusing to meet competitive conditions and are strictly adhering to rates established by the Atlantic Conference, whereas certain lines operating out of New York and other American ports frequently name rates materially lower.

Manufacturers are making some investigation in the matter. If existing conditions make route via American ports more favorable, steps should be taken immediately to place the fullest kind of information before the Government. The primary object behind the development of Canada's Merchant Marine was the encouragement of export business. If American rates are so very attractive as to draw patronage from this side of the line, then a readjustment of some kind would appear to be necessary.

The day when Canadian raw materials had to be exported to the other side to be converted into finished products, and then resold in Canada to be retailed, is gradually passing. The day when Canadian ports and shipping should be able to handle Canadian export products, has surely arrived.

An Industrial Incubator

BELLEVILLE has an industrial incubator. It is a building in which space is made available to enterprises in their infancy. There they install their machinery and establish business headquarters. Whether the concern is of local origin or comes from outside, is of no significance. The building represents the combined interest of a number of business men in the development of the city industrially.

A similar "beehive" was opened years ago in Walkerville, where several important enterprises had their Canadian origin, gradually outgrew available space, and are now located in larger plants throughout the city. Others took their places in the building. The idea probably originated in Walkerville, and was so successful that Belleville has adopted it with good results. The proposition has never had to go begging and the companies now occupying the structure represent a fine addition to the city's roster of manufactories.

This is a plan that lends itself to the encouragement of legitimate enterprises looking for location. With such a building at its disposal, the city's cards are immediately upon the table. It does away with the necessity of a standing policy on free sites, fixed assessments and bonuses that are too frequently held out as inducements to prospects looking for much and eventually giving little. Here is a central location, with all conveniences and facilities. If the enquiring firm means business, it is a comparatively easy matter to place it in the way of securing essentials to machinery installation and early operation.

Such a building is adapted to the ambitions of most municipalities. It enables small industries to develop on a minimum cost basis, and very often does away with the necessity for expensive separate structures, temporarily at least. Having once found its stride, and realized that its development entitles it to larger quarters, an industry may build to suit its requirements, thus making room in the incubator for another infant.

Railroads May Order Cars

PROSPECT of early buying activity on the part of the railroads will be welcome news to industry generally. There are reports to the effect that orders for about six thousand box cars are in process of development as a starter. In fact, manufacturers declare that they have had preliminary enquiries as to available materials and it is felt that the long deferred buying urge is about to take actual shape.

There are many plants throughout the country that owe their existence to the fact that Canadian railroads are like those of other countries in one particular at least, and that is in essentials of upkeep or efficiency. These plants were developed on the idea that where there are something like 200,000 cars in actual use, some are junked each year, additions have to be made annually to replace these and to meet the growing requirements of the country. Yet, some plants have been running on short rations because the railroads are not buying.

A box car requires several tons of castings and forgings, a refrigerator car calls for a large amount of heavy galvanized sheetings and other materials, to say nothing of heavy steel plates, bars, lumber, paint and special apparatus requiring the employment of much skilled and unskilled labor. It needs no imagination to see that a wave of economy on the part of the railroads cannot be long drawn out without leaving some industries high and dry.

Car shortages are in sight. In Canada the roads are said to be shy, to-day, about 8,000 cars. In the United States, the shortage is placed at 130,335 cars. This immense carrying deficit makes it a difficult matter to secure prompt return of Canadian cars in the United States or to effectively resist the leakage of Canadian cars to the other side. Some action may be taken by manufacturers to see what can be done about it, but in the meantime it would seem to be good policy to build more cars.

Improved Shipping Conditions in Steel Centres

Cars Do a Little Better Than Take Care of Production—Situation By No Means Well In Hand—Decline in Canadian Pig and Ingot Production—Montreal Advances Boiler Tubes

SEASON DECLINE IN GALVANIZED SHEETS

SHIPMENTS are running a trifle above production, is the report from Pittsburgh. Steel accumulations are beginning to move slowly. Canadian industry has been handicapped by delayed shipments. One large concern, having a contract for construction of refrigeration cars and for repair of a large number of American freight cars was confronting a shut-down a few days ago. No material was coming forward. Today, conditions have improved, but the service is far from normal. Canadian mills depending upon daily arrivals of certain material report that difficulties appear to multiply rather than grow less. Some of the embargoes have been lifted on American roads and those existing are now regarded as relatively unimportant.

Ingot production continues on a 70 per cent. operating rate. Ingot production in Canada for September was 35,787 as against 59,201 in August. Pig iron production in the same month was 24,974, while in August the amount was 27,123. September production was less than that of the same month last year by 40.8 per cent. There are said to be 16 idle blast furnaces in Canada at present. Steel Company of Canada are contemplating the reconstruction of their B furnace and expect to blow it in on foundry iron Dec. 1.

Many of the American steel mills are reporting labor shortages, owing to high wages paid by contractors who are rushing buildings before inclement weather arrives. Advance of wages has been discussed, but the feeling seems to be that winter conditions will produce adequate hands for inside work. Another wage advance at present seems ill-advised. There have been no changes in prices on bars and plates at American mills, and Canadian warehouse prices remain firm. There has been a seasonal readjustment of price on sheets, owing to larger supplies coming into the market from Old Country producers and also from American mills, and also as the result of slackening activity in roofing operations. Black sheets, No. 28, are now quoted at $5.10; blue annealed, $4.20; galvanized, $6.40. Hamilton mill prices on premier galvanized sheets are $5.40 to $5.60. In non-ferrous ingot metals there have been notable price changes recently. Owing to speculative activity in the British market, tin has advanced until Canadian dealers who were quoting $37.00 a week ago now announce a price at around $40.00; spelter, used in galvanizing, has advanced from $8.75 to $9.50, while lead is now quoted at $8.75, an advance of one and a quarter.

Machine tool demand shows some improvement, but conditions here still reveal a somewhat spasmodic trend. Activity in woodworking machinery reflects better business in the furniture factories and sawmills. The report that the railways are making some enquiry looking to the placing of orders for about 6,000 freight cars is a matter of considerable interest to many departments of industry.

Toronto

November 1, 1922.

LAST quarter business in Toronto iron and steel market, should it maintain October's record, will give a fairly satisfactory ending to a year that has been marked by many retarding influences. Not the least of these have been labor troubles which caused some apprehension as to supplies and shipments of material. Car shortages are now developing on Canadian lines, and may prove a handicap to industry generally. There has been no railway buying apart from that arising from immediate needs, but reports among manufacturers indicate that there is likelihood of a loosening up on freight car construction for both National and C. P. R. lines. This would bring activity to a large number of plants that have been carrying on with more or less difficulty. The building activity has been the basis for considerable business, but this is bound to slacken with the arrival of cold weather. Already there has been a slight falling off in galvanized sheets used for roofing purposes. Price reductions in this department may be said to be seasonal.

Iron and Steel.—Business continues to show a good volume, and prices remain steady. Supplies of sheets have improved by reason of the fact that fair quantities have recently arrived from the Old Country, and shipments from the United States have come through in fair volume. Black sheets, No. 28, quoted last week at around $5.50, are now at $5.10; blue annealed sheets, No 10, are down from $4.50 to $4.20, while galvanized sheets, No. 28, are down from $6.60 to $6.35 and $6.45. Hamilton mill price on premier galvanized sheets is $5.40 to $5.60. This adjustment of price is generally made at this time of the year. It will also probably have the effect of moving stocks that jobbers have no desire to carry

There is some activity in boiler tubes, and while Montreal announced an advance of one cent a foot, some Toronto jobbers have as yet taken no action, giving as one reason the fact that new stocks have not yet arrived. However, an advance of about 10 per cent. is imminent. This would bring 2-inch lapweld, now $18, to $19.80; 2¼-inch to $22; and 3-inch to $30.25. Toronto dealers are quoting the following prices on sheets and bars:

Iron bars	3 25	3 40
Steel bars	3 25	3 40
Reinforcing bars	3 15	3 25
Steel hoops		4 75
Tire Steel		3 50
Spring steel	7 00	14 00
Band steel, No. 10 gauge and 3-16 in base		3 90
Small shapes		3 50
Sheets, black, No. 28		5 50
Sheets, blue ann., No. 10		4 20
Canada plates, dull, 52 sheets		5 75
Canada plates, all bright		6 75
Galvanized Sheets, No. 28	6 35	6 45

Pig Iron.—Demand is largely from hand to mouth, the feeling having developed that further reductions are in sight. Price for domestic remains at $36.30. There are reports that British pig iron is being marketed in Eastern Ontario towns at from $33 to $35. Some trouble is reported in connection with the use of imported pig, in that certain grades have become mixed in transport and, when foundries have no means of chemical analysis, the chance they are taking is obvious. However, this is not a general condition, but might better be attributed to accident in shipment. Buffalo reports No. 1 foundry at $30.50, and malleable at $31. Steel Company of Canada will blow in its foundry furnace about Dec. 1.

Old Material.—This market maintains a decided lack of feature. No large quantities are moving in any direction, and it is reported that furnaces are holding off for lower prices. This seems to be a natural tendency in view of easing prices on pig iron. Shipping difficulties are also apparent in the movement of old materials. Dealers' average buying prices:

Copper, light	9 00
Copper, crucible	11 50
Copper, heavy	11 50
Copper wire	11 00
No. 1 composition	9 00
New brass cuttings	7 00
Red brass turnings	7 00
Yellow brass turnings	5 25
Light brass	4 50
Medium brass	6 00
Scrap zinc	3 50
Heavy lead	4 50
Tea lead	3 00
Aluminum	11 00
Boiler plate, per gross ton.	9 00
Heavy melting steel	10 00
Axles (wrought iron)	20 00
Rails (scrap)	11 00
Malleable	10 00
No. 1 machine cast iron	18 00
Pipe, wrought	7 00

Non-Ferrous Metals.—Tin, spelter and lead have shown activity during the past week. Tin, subject to speculative influences in England, where something like a corner exists, has advanced from $37 to $40.00; spelter, in demand for galvanizing is quoted at $9.50, an advance from $8.75; while lead is quoted at $8.00, an advance of one-half. Current prices:

Lake copper	17 25
Electrolytic copper	17 00
Castings, Copper	17 00
Tin	40 00
Lead	8 00
Spelter	9 50
Antimony	8 50
Aluminum	22 00

Notwithstanding the advance in welded steel pipe by American mills, no advance has been announced by the Canadian mills. Difficulties in obtaining supplies of skelp, owing to car shortages, have multiplied if anything.

Demand for brass and copper products begins to show the advance influence of the Christmas season. Some firms in these lines have already added to their working forces.

Steel shipments from American centres have shown no improvement during the past few weeks. The situation is not likely to be improved by the shortage that is developing on Canadian roads.

Montreal

November 1

MARKET conditions during the present week show no change of any importance except in regard to boiler tubes. Due to the strong demand which has lately prevailed resulting in the depletion of stocks to a large extent, coupled with the extended delay of obtaining replenishment from mills, prices have advanced by about a cent a foot and may be subject to another advance of the same extent in a short time. The demand for all products keeps up to the level of the past few weeks and as predicted, October will go out as one of the banner months of this year.

Black and galvanized steel sheet situation has firmed up a little lately in the Pittsburgh district and an advance of around $2.00 per ton has gone into effect. Blue annealed steel sheets have also been advanced to the same extent. Deliveries are a disappointing feature in regard to these commodities from U. S. mills. The Leading Interest is now indicating 3 to 4 months' shipment on new orders. Some of the independents can improve upon this but their prices are on a higher level.

The last direct boats for Montreal this season will be leaving British ports within the next ten days and, therefore, importations of sheet products from the Old Country mills will be curtailed until the opening of St. Lawrence navigation next spring. As the additional cost of freight via the winter port will offset all the advantages of buying in that market, the demand will, therefore, be directed almost entirely to sources of supply in the U. S. Local prices:

Iron bars, base	3 15 to 3 25	
Steel bars, base	3 15 to 3 25	
Reinforcing bars, base	3 15 to 3 25	
Steel hoops	....	4 00
Tire steel	3 25 to 3 40	
Spring steel	....	7 00
Band steel, No. 10 gauge and 3-16" base	3 65	3 75
Small shapes	....	3 40
Sheets, black, No. 28	....	4 65
Sheets, blue, ann., No. 10	....	4 00
Canada plates, dull, 52 sheets	....	5 50
Canada Plates, all bright	....	7 00
Galvanized Sheets, No. 28	....	6 50

Non-Ferrous Metals.—Ingot metals are very strong, especially tin, zinc, spelter and lead. The advance in spelter will probably mean higher prices on galvanized sheets. Copper is dull and unchanged. Local prices:

Lake Copper	17 50
Electrolytic Copper	17 25
Castings, Copper	17 00
Tin	39 50
Lead	7 50
Spelter	9 50
Antimony	7 25
Aluminum	22 00

Pig Iron.—Montreal and district seem to be in a rather quiet condition just now, buyers feeling their way and purchasing for immediate needs only, being under the impression that prices may show some decline in the near future. Your correspondent understands that some fairly large business in the way of car construction is being negotiated and it is hoped that orders will be placed shortly which will give an impetus to the Canadian iron and steel trade, but as yet matters have not progressed sufficiently far to warrant any definite statement in this connection.

Algoma, No. 1, car lots on tracks, nominal quotation		38 65
Summerlee, 30-ton lots, dock	35 00	....
Carron, 30 ton lots	35 00	....
Do., 5 ton lots, ex. warehouse	40 50	....

Machine Tools.—Speaking of the machinery demand here, a dealer states: "We find there is a decided improvement in demand for mill supplies in this territory. Also there is an upward tendency in the price as evidenced by advice of advance in prices received from several different manufacturers. This advance applies not only to supplies but also to machinery. As regards the demand for machinery, there have been more orders placed lately for new tools than for some time past and every condition seems to point to still further improvement."

Another firm reports as follows: "There has been a slight improvement in general conditions in this district. This has been due, to some extent, to the expansion in the pulp and paper business. The new mill at Three Rivers will be operating by the end of this year, and other paper mills are making additions to their plants. Some of the manufacturers have recently advanced prices, but there is still a tendency among some of the dealers to cut prices. This condition exists when the material is in stock."

Pittsburgh

November 1.

CAR SUPPLIES for shipping steel products from mill have increased somewhat more, and shipments on the whole are at least fully equal to current production, while a portion of the steel previously accumulated at mill has been moved. In individual cases a mill may be unable to ship all its product, but in the industry as a whole the shipments have been running a trifle above the production. There are still some embargoes against shipments to certain points, but the embargoes are now relatively unimportant.

Mill operations have undergone no material change since late in September. Ingot production is about 36,000,000 or 37,000,000 tons a year, representing approximately a 70 per cent. operating rate in the steel industry as a whole. Supplies of coal and coke are no longer the dominant factor in regulating the production, and have not been for several weeks. In the majority of cases the state of order books is the controlling factor in operations, there being several important exceptions. One is in pipe, for practically all the pipe mills have demands upon them, chiefly for shipment against orders placed at various times in the past, in excess of what they can meet, and some of the mills are definitely allocating their shipments, in accordance with the quantities of steel the respective customers have previously received from them. Another exception is the sheet operations of the American Sheet & Tin Plate Company (Steel Corporation) which have been below the order book requirements for a long time. In this case the chief factor is shortage of steel, although there is also some shortage of labor.

Another Wage Advance?

There are, in fact, labor shortages at many of the mills, not enough usually to restrict production, but enough to cause much inconvenience. The chief cause is the high rates bid by contractors having buildings they wish to complete within contract time or before the weather gets bad. The matter of making another wage advance, following the 20 per cent. advance that became effective September 1, has been canvassed by some producers, particularly the Steel Corporation. Action has been held in abeyance on account of the possibility that the approach of winter would cause men to leave outside employment and seek mill and furnace employment. It is commonly recognized that another wage advance at this time would be economically unsound.

The majority of the rail mills are now rolling and shipping rails against the large contracts recently booked. This business was secured by the medium of announcing that an advance in price from $40 to $43 would be made at the beginning of October, and that meanwhile contracts would be accepted at the old price, for delivery up to July 1, 1923. Previous reports as to this business did not bring out very clearly the important fact that it was stipulated in the contracts that the deliveries should be at a practically uniform rate from date of contract to the middle of next year. Thus the object of the maneuver, to obtain

winter rollings, was fully accomplished. It is obvious that the idea of there being an acute shortage of steel, in general, is quite out of date, as the railroads were not anxious to begin receiving and paying for rails so soon.

Prices Unchanged

Basis prices for steel products, i.e., prices that include no delivery premium, are unchanged, and indeed there has been no particular change in them since early in September with the exception of the advance in welded tubular goods of about $4 a ton, made under date of October 19, as noted in last week's report.

Premiums on early deliveries of bars, shapes and plates have been diminishing for a month or more and in the past week have almost disappeared, for now it is only on quite small lots or very prompt shipment that any premium needs to be paid. Fairly good deliveries can be secured at the basis price of 2.00c. It is reported that, in one case, 1.95c has been done on bars.

In the matter of sheet prices there is a curious condition. Until a week or so ago all independents were on the basis of 3.50c for common black, or higher, 3.60c being obtainable on fairly early delivery, while there were instances of 3.75c being done. The week's developments include the divergent reports that one or two mills are now seeking attractive orders at 3.35c, which was the price of the Steel Corporation until it became sold out for the year several weeks ago, and that one large tonnage order has been placed at the extreme price of 3.75c, shipment in ten days. Just where the sheet market is going to land is a question. The American Sheet & Tin Plate Company will probably announce a first quarter price within the next fortnight but there is no basis for guessing whether this will be the old price of 3.35c or will be an advanced price, and even when the corporation does make its price it would not follow that the independents would sell at it. The policy of the majority is to get more than the corporation price if they can, and cut the corporation price if they deem it personally advantageous.

Wire remains at 2.45c, nails at $2.70, tin plate at $4.75, hoops at 2.90c to 3.00c, according to width and gauge, and merchant steel pipe at 66 per cent. basing discount.

Stiffening in Coke

After its sharp break from $12 to $8, Connellsville furnace coke has been relatively steady in the past week, only softening a trifle. Odd lots can be picked up at $7.50 while a fair sized lot, particularly for regular shipment over a week or two, would probably command $8. Far from admitting that the prompt market is likely to decline farther, coke operators are talking $9 on contracts to the end of the year, suggesting that there will be a fresh car shortage in December on account of the weather, putting up the spot market from its present level. Blast furnacemen show little disposition to concur with this view, largely no doubt because they find it rather difficult to sell small lots of pig iron for prompt shipment and practically impossible to sell for extended delivery. Hence, instead of its being a question, as formerly, of each idle merchant furnace getting into blast as soon as it could acquire a coke supply, there is a question whether all the furnaces now in operation will continue. Bessemer, quotable at $33, valley, a week ago, has since sold at that figure, while the $30 quotation on basic of a week ago is likewise supported, by one or two sales. Foundry iron is off $2 to $30, on light sales. Prices quoted are f.o.b. valley furnaces. For a time there was practically no valley iron, and the Pittsburgh market was based on what it would cost to bring iron from Buffalo or other points.

INGOT PRODUCTION DECREASED

Production of Canadian steel in September declined by 23,373 long tons from the output of 59,160 tons in August to 35,787 tons in the month under review. The cumulative output during the first nine months of 1921 was 477,588 tons, as compared with the production of 334,835 tons in the corresponding period of the present year. The closing of the steel plant at Sault Ste. Marie accounted in large measure for the decrease in production during September.

Output of basic open hearth ingots for further use declined from 56,997 tons in August to 33,815 tons in September, a decrease of 23,182 tons or 40.7 per cent. A small quantity of electric steel ingots for further use, amounting to 124 tons, was reported for September while none was made for direct sale.

Total production of ingots was less than the output of the corresponding month of last year by 20,540 tons, or 37.7 per cent. The production in the first nine months of 1922 was 319,943 tons, while that of the corresponding period of the previous year was 459,960 tons representing a decrease of 30.4 per cent. The production of steel castings also suffered a decline. The total output in August was 2,204 tons which decreased to 1,848 tons in the month under review. The decline amounted to 356 tons or 16.15 per cent. An opposing tendency developed in connection with basic open hearth castings of which the production increased from 208 tons to 837 tons. On the other hand the output of Bessemer and electric grades declined considerably.

OPERATIVE CONSTRUCTION OF HAND LEVERS

(Continued from page 35)

is nevertheless used for the purpose of replacing a hand lever. In this construction it is desired to operate by hand a connecting bar M for starting or stopping the machine. This is done through the medium of a rocking lever N which pivots on a stud P; attached to the upper end of lever N by a stud Q is a bar R, this bar passes through holes in brackets at S and T. The object of this bar is to permit an operator to take hold of the bar at any point along its length and by pulling to operate connection M through the medium of the lever N, thus controlling the operation of the machine. It will be evident that this is a very neat arrangement to permit of quickly controlling a machine operation from the various positions where an operator is apt to be, it being a design particularly applicable to long machine construction.

A very powerful foot treadle action is shown by Fig. 8. In this instance the foot treadle is indicated as A and this is made in part with a boss extension at B. The foot treadle is supported on the shaft C in a bracket D held to the base of the machine. Attached to this foot treadle at B are two connecting links E, one on each side of the lever, the lower ends being connected to the foot treadle while the upper ends are tied together by a stud F, with nuts and washers thereon. Through this stud passes a connecting rod G, the upper end of which is attached to such units as it is desired to operate. When pushing down this foot treadle the action becomes more powerful as the end B of the lever passes through the lower portion of the arc of the radius H. The action of this foot treadle is such that when the operator starts to push on it this pulls down rod G very rapidly, while at the lower end of the stroke where great power is required G is pulled down only slightly with a long action at the end of the foot treadle.

Many very good examples of foot treadle and lever design are brought out in punch press construction and Fig. 9 shows some of these. In the centre is shown a plain foot lever press in which the lever A is pushed back with a swinging movement thus forcing down ram B and multiplying the power greatly as the lever pivots at C. This foot lever hangs in such a manner that the weight of the lever causes the foot treadle to return to its starting point by gravity. The view to the right shows another foot press action where a foot lever D pivoted at E is connected at F to a connecting bar G which is in turn connected at H to a lever J, which operates the ram K of the press, the pivot for this last lever being at L. It will be noticed in this connection that lever J has a counter-balance weight M to return the foot treadle to its starting point, while a number of pivot holes are provided at E and H to vary the stroke and leverage exerted by the foot treadle D. In the lower left hand corner is shown a foot lever N having a counterbalancing weight P attached thereto; this weight takes the place of a spring, the lever pivoting in a bracket Q while a rod R connects the lever to the operative mechanism above.

(To be continued.)

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Toronto price:—

Silicon, 2.25% to 2.75%	36 30
Algoma, No. 1, Montreal	38 65
Summerlee, Scotch, Montreal dock	35 00
Summerlee, Warehouse, 5-ton	40 50
Carron, Montreal docks	35 00
Grey forge Pittsburgh	32 27
Lake Superior, charcoal. Chicago	36 15
Standard low phos., Philadelphia	38 00
Bessemer, Pittsburgh	34 77
Basic, Valley furnace	30 00

METALS

	Montreal	Toronto
Lake copper	$17 50	$17 25
Electrolytic copper	17 25	17 00
Castings, copper	17 00	17 00
Tin	39 50	40 00
Spelter	9 50	9 50
Lead	7 50	8 75
Antimony	7 25	9 00
Aluminum	22 00	22 00

Prices per 100 lbs.

BILLETS

F. O. B. Pittsburgh

	Per gross ton
Bessemer billets, 4 in. x 4 in. and larger	40 00
Open hearth billets	40 00
O. H. sheet bars	40 00
Forging billets	45 00
Bessemer rods	46 50

IRON AND STEEL

Per 100 lbs. to large buyers

Iron bars, base, Toronto	$3 25	3 40
Steel bars, base, Toronto	3 25	3 40
Small shapes, base		3 50
Iron bars, base, Montreal	3 15	3 25
Steel bars, base, Montreal	3 15	3 25
Reinforcing bars, base	3 15	3 40
Steel hoops		4 50
Tire steel, base		3 50
Spring steel	7 00	14 00
Band steel, No. 10 gauge and 3-16 in. base		3 90
Chequered floor plate ¼" and heavier	6 25	7 00
Chequered plates ¼-in. and heavier, sunken diamond		5 40
Bessemer rails heavy at mill		2 35

PITTSBURGH MILL

Steel bars	2 00	2 15
Tank plates	2 00	2 25
Structural shapes		2 10
Steel hoops	2 90 to	3 25

F. O. B. Chicago Warehouse

Steel bars	2 80
Structural shapes	2 90
Plates	2 90
Small shapes under 3-in.	2 90

PLATES

Plates 3-16 in.	$3.85	$3 60
Plates, ¼ up	3 50	3 40

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$ 4 65	$5 10
Sheets, blue ann., No. 10	4 00	4 20
Canada plates, dull, 52 sheets	5 25	5 75
Can. plates, all bright	6 50	6 60
Galvanized sheets, No. 28	6 75	6 25
Queen's Head, 28 B.W.G.	7 25	
Fleur de Lis, 28 B.W.G.	7 00	
Gorbal's best, No. 28, U. S. G.	6 10	
Colborne's Grown, No. 28		
Premier	6 85	6 35
Premier 10¾ oz.	6 85	6 75
Zinc sheets	9 75	10 25 11 00

FREIGHT RATES

	Per 100 lbs. C.L.	L.C.L.
Pittsburgh to Following Points		
Montreal	52	65½
St. John, N. B.	76	96
Halifax	77½	97
Toronto	34	48½
Guelph	34	48½
London	34	48½
Windsor	31½	45½
Kingston	48½	61

Current surcharge 1 per cent.

OLD MATERIAL

Dealers' Average Buying Prices

	Montreal Per Ton	Toronto Gross
Boiler plate	$ 9 00	$ 9 00
Heavy Melting Steel	10 00	11 00
Axles (wrought iron)	20 00	16 00
Rails (scrap)	11 00	11 00
Malleable scrap	10 00	11 00
No. 1 Machine cast iron	22 00	18 00
Pipe, wrought	7 00	6 00
Car wheel	17 00	16 00
Steel axles	15 00	15 00
Mach. shop turnings	4 00	6 00
Stove plate	16 00	14 00
Cast boring	4 00	6 00
Copper, light	9 00	9 00
Copper, crucible	11 50	11 50
Copper, heavy	11 25	11 50
Copper, wire	11 25	11 00
No. 1 machine composition	9 00	9 00
New brass cuttings	6 00	7 00
Red brass turnings	6 50	7 00
Yellow brass turnings	5 25	4 85
Light brass	4 50	3 50
Medium brass	6 00	4 50
Scrap zinc	3 50	4 00
Heavy lead	4 50	4 50
Tea lead	3 00	3 00
Aluminum	11 00	11 00

COLD ROLLED STEEL

(At Warehouse)

Rounds and squares	$4 75 base
Hexagon and flats	$5 75 base

COPPER PRODUCTS

Prices per lb.

	Montreal	Toronto
Copper bars, 1¼ to 2 in.	30-31	.28
Plain sheets, 16 oz. in. 30 x 72	31-32	.29
Copper sheet, tinned, 16 oz.	39-41	.36
Copper sheet, planished, 16 oz. base	44-46	.41
Braziers', in sheets, 6 x 4 base	.30	.29
Copper tubing, seamless		.33

LEAD SHEETS

Roll Lot Prices

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$9 15	$11 50
Sheets, 3½ lbs. sq. ft.	9 05	11 50
Sheets, 4 to 6 lbs. sq. ft.	8 90	10 00

Cut sheets, ¾c. per lb. extra

Cut sheets to size, 1c. per lb. extra

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	22
Brass sheets, 24 gauge and heavier base	23
Brass tubing, seamless	30

WROUGHT PIPE

Price List No. 56. August 23, 1922.

Standard Buttweld Pipe S/C

Size	Steel Blk.	Steel Galv.	Gen. Wrot. Iron Blk.	Gen. Wrot. Iron Galv.
⅛ in.	6 00	8 00	....	....
¼ in.	3 96	6 00	7 20	9 30
⅜ in.	3 96	6 00	7 20	9 30
½ in.	5 02	6 55	7 31	8 93
¾ in.	6 10	7 82	8 86	10 70
1 in.	8 50	14 22	12 58	15 30
1¼ in.	11 50	15 18	17 02	20 70
1½ in.	13 75	8 15	20 35	24 75
2 in.	18 50	24 42	27 38	33 30
2½ in.	29 25	38 61	.....	.....
3 in.	38 25	50 49	.....	.....
3½ in.	49 68	64 40	.....	.....
4 in.	58 86	76 30	.....	.....

Standard Lapweld Pipe S/C

Per 100 feet.

Below dividing line—price per foot.

Size	Steel Blk.	Steel Galv.	Gen. Wrot. Iron Blk.	Gen. Wrot. Iron Galv.
2 in.	22 20	27 75	31 08	37 00
2½ in.	32 76	41 54	46 80	56 16
3 in.	42 84	54 32	61 20	73 44
3½ in.	50 60	66 24	72 68	89 24
4 in.	69 95	78 48	86 11	105 72
4½ in.	68 58	87 63	1 04	1 24
5 in.	79 92	102 10	1 21	1 45
6 in.	1 04	1 32	1 57	1 88
7 in.	1 38	1 79	2 02	2 45
8L in.	1 45	1 88	2 13	2 58
8 in.	1 67	2 16	2 45	2 97
9 in.	2 04	2 62	2 97	3 59
10L in.	1 89	2 43	2 75	3 33
10 in.	2 43	3 13	3 54	4 28

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4-in. and under, close and short, 55 per cent.

4½-in. and larger, close and short, 45 per cent.

4-in. and under running thread, 35%.

Standard couplings 4-in. and under 25%.

Do., 4½-in. and larger 5 per cent.

MALLEABLE FITTING LIST

1 in. elbow	.32 .53
2 in. elbow	1.05 1.70
1 in. tee	.43 .70
2 in. tee	1.45 2.40
1 in. coupling R. & L.	.33 .53
1 in. locknut R. & L.	.15 .23

Discount to dealers—70 per cent.

BOILER TUBES

Size	Lapweld Toronto	Seamless Montreal	Lapweld Montreal
1 in.	20 00		
1¼ in.	22 00		
1½ in.	21 00		
1¾ in.	24 50		
2 in.	18 00	21 00	19 75
2¼ in.	20 00	24 00	22 25
2½ in.	21 50	27 00	23 25
3 in.	27 50	33 00	29 50
3½ in.	30 50	38 00	34 25
4 in.	39 00	49 00	43 50

Prices per 100 ft., Montreal and Toronto

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, 7-16 and up	30
Carriage bolts, ⅜ in. and smaller 6 in. and shorter	40
Coach and lag screws	45
Stove bolts	72½
Wrought Washers	60
Do., corru. head	60
Machine bolts, 7-16 and over	35
Machine bolts, ⅜-in. and less	35
Blank bolts	35
Bolt ends	35
Machine screws, fl. and rd. hd., steel cut thread	37½ & 10
Machine screws, o. and fil. hd., steel cut thread	30
Machine screws, o, and fil. hd., brass cut thread	15
Standard couplings, 4-in. and under, brass cut thread	30% 30
Nuts, square, blank off net list	$1.00
Nuts, square, tapped off net list	50c.
Nuts, hex., blank off net list	50c.
Nuts, hex., tapped net list	
Copper rivets and burrs, list less	32c.
Burrs only, list plus	10%
Iron rivets and burrs	47%
Boiler rivets, base ¾ in and larger	$5.75
Structural rivets, as above	5 65
Wood screws, O. & R., bright	80
Wood screws, flat, bright	82½
Wood screws, flat brass	77½
Wood screws, O. & R., brass	75
Wood screws, flat, bronze	72½
Wood screws, O. & R., bronze	70

NAILS AND SPIKES

Wire nails, base	$3 65
Cut nails, base	4 35
Miscellaneous wire nails	72½%

MILLED PRODUCTS

(Prices on unbroken packages)

Set screws	65
Square and hexagon head cap screws	60
Round head cap screws	20
Fillister head cap screws	35
Flat head screws	25
Button head cap screws	20
Studs	45
Semi-finished nuts up to and including 9/16 in.	70
Semi-finished nuts ⅝ to 1¼ in.	65
Semi-finished nuts 1⅜ to 2 in	35
Coupling bolts	35
Taper pins, No. 2 to No 5	65
Taper pin No. 6 and over	10
Planer bolts without fillet	10
Planer bolts with fillet	Net
Patch bolts	Plus 10%
Hollow set screws	20
Thumb screws	50
Thumb nuts	70

CARBON DRILLS AND REAMERS

	Discount.
S. S. drills, wire size	60
Can. carbon cutters	plus 10
Standard drills, all sizes	60
3-fluted drills, plus	10
Jobbers and letter sizes	60
Bit stock	50
Ratchet drills	25
S. S. drills for wood	10
Wood boring brace drills	50
Electricians' bits	30
Sockets	50
Sleeves	30
Taper pin reamers	25
Drills and countersinks	20
Bridge reamers, carbon	50
Centre reamers	Net
Taps, machine screw	50 to 60
Taps, hand, sizes up to 1"	30 to 60
Chucking reamers	20 off
Hand reamers	20
High speed drills, list	40
Can. high speed cutters	plus 10
American	plus 40

FILES AND RASPS

Globe	60/5
Vulcan	50
P. H. and Imperial	60/5
Nicholson	40
Black Diamond	40
Heller	40
Jowitts	net
J. Barton Smith, Eagle	55
McClelland, Globe	50
Delta Files	20
Disston	40
Disston	50
Great Western-American	50
Kearney & Foote, Arcade	60/5

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

PROOF COIL CHAIN

B. B. B. CHAIN

⅝ in., $16.45; 7-16 in., $14.00; ½ in., $12.95; 5-8 in., $13.15; ¾ in., $12.75; ⅞ in., $12.25; 1 in., $11.85; 1⅛ and 1¼ in., $10.55. Fire weld chain same sizes respectively are $14.00; $11.50; $10.40; $10.55; $10.15; $9.75; $9.35; and $8.25.

ELECTRIC WELD COIL CHAIN B.B.B.

⅛ in. $20.00; 3-16 in. $16 50; ¼ in. $15.50; 5-16 in. $12.70.

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	30%
Standard	30 and 10%
Cut leather lacing, No. 1	1.75
Leather in side, (Lacing)	1.50

RUBBER BELTING

Standard 36 ....28% Best grades 28%

TAPES

Chesterman Metallic, 50 ft.	$5 00
Lufkin Metallic, 603, 50 ft.	3 17
Admiral Steel Tape, 50 ft.	3 00
Admiral Steel Tape, 100 ft.	4 50
Major Jun. Steel Tape, 50 ft.	3 75
Rival Steel Tape, 50 ft.	4 00
Rival Steel Tape, 100 ft.	8 75
Reliable Jun. Steel Tape, 50 ft.	5 25

PLUMBING SUPPLIES

Plumbers' oakum, per cwt.	6 00
Navy oakum, cwt.	13 00
Solder, strictly	0 25
Solder, guaranteed	0 26½
Soldering coppers, lb.	0 62½
White lead, pure, cwt	13 20
Red dry lead, 100-lb. kegs, per cwt.	10 75
Wood alcohol, per gal.	1 75
Whiting, plain, per 100 lbs.	3 00

ROPE AND PACKING

Packing, square braided	0 38
Packing, No. 1 Italian	0 35
Packing, No. 2 Italian	0 28
Pure Manila rope ¾ and larger, base	0 21
British Manila rope	0 19
New Zealand hemp	0 19
Jute packing, fine	15c
Jute packing, coarse	11c

OILS AND COMPOUNDS

Castor Machine Oil, per lb.	34½
Royalite, per gal. bulk	20
Palacine	23
Machine oil, per gal.	39
Black oil, per gal. (Summer)	19
Cylinder oil, Capital	69½
Petroleum fuel oil bbls., net	10.80
Turp., single bbls., gal.	2 00
Linseed oil, raw, single bbls.	1 08
Premier gasoline	29 00
Fuel oil, bbls., gal.	11 80

WASTE

XXX Extra	16	Atlas	18
Peerless	21	X Empire	13
XX Grand	15	Ideal	18
Superior	20	X Press	11½
X L C R	14		

Colored

Lion	12	Fancy	13½
Standard	10½	Popular	9
No. 1	13	Keen	7½

Wool Packing

Arrow	24	Anvil	16
Axle	20		

Washed Wipers

Select White	18	Dark colored.	13
Mixed Colored	14		

This list subject to trade discount

PLATING SUPPLIES

Polishing wheels, felt	$3 25
Polishing wheels, bull-neck	1 60
Emerey in kegs, Turkish	7½
Pumice, ground	04½
Emery glue	26
Tripoli composition	08
Crocus composition	12
Emery composition	11
Rouge, silver	60
Rouge, powder, nickel	35

Prices per lb.

ANODES

Nickel	.40 to .45
Copper	.38 to 22
Zinc	.16 to .12½

PLATING CHEMICALS

Acid boracic	.20
Acid, hydrochloric	.03¾
Acid, nitric	.10¼
Acid, sulphuric	.03¾
Ammonia, aqua	.20
Ammonium, Carbonate	.15
Ammonium, chloride	.18
Ammonium, hydrosulphuret	.75
Ammonium, sulphate	.10
Arsenic, white	.18
Copper carbonate, anhy.	.26
Copper, sulphate	.08
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.14
Nickel carbonate	.32
Nickel sulphate	.14
Potassium sulphide (substitute)	.40
Silver chloride (per oz.)	.85
Silver nitrate (per oz.)	.65
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.32
Sodium hyposulphite	.08
Sodium phosphate	.10
Tin chloride	.50
Zinc chloride, C. P.	.30
Zinc sulphate	.03

Prices per lb. unless otherwise stated

News From the Industrial Field

E. B. Eddy Co., Hull, Que., are considering the location of a branch factory at Sault Ste Marie, Ont.

Clifton Mining Company, at Porcupine, Ont., have installed a steam plant as an auxiliary to electric power.

Ontario Metal Products, Toronto, have moved from corner of King and Jarvis Sts., to Room 16, at 84 Victoria St. Frank C. Annette is sales representative.

St. Lawrence Supply Co., 167 Commissioner St., Montreal, will handle the packing line of Quaker City Rubber Co., Philadelphia, for the province of Quebec.

Night Hawk Peninsula Mine at South Porcupine are assembling machinery in connection with their new mill. Concrete substructure has been completed. Equipment will be installed next spring.

A new carrying device for the lifting of heavy iron weights or boulders has been invented by Thomas Ashton, a railway shop employee of Edmonton. It consists of a double adjustable chain and clamps permitting either attachment to a steam crane or carrying on a bar.

British Empire Steel, according to a report from Sydney, N. S., will expend $50,000 on plant to increase galvanizing capacity in the wire mill. Demand for domestic and export fence material is increasing. The present capacity of the mill is about 60 tons a day. Proposed additions to be completed early in the New Year will double the output.

St. John, N. B.—Dr. W. H. Collins, director of the Geological Survey, Department of Mines, on his return from a three weeks visit to the various field parties who are at work surveying the mineral industry of Nova Scotia and New Brunswick, is most optimistic. He reports new coal beds the existence of which was unsuspected, and deposits of oil shale in both provinces, associated with coal measures. They are not yet being mined, but constitute the basis of an important future mining industry.

Calgary, Alta.—One of the greatest drives in the history of the Eau Claire Lumber Company, of Calgary, has just been brought to a successful conclusion by the driving of 5,000 000 feet of spruce logs, sixty-five miles down the Bow River from Ghost River, where the logging operations of the company are at the present time conducted. The saw mills of this company are turning out finished lumber at the rate of 50,000 feet a day, and there is already a stock of something like 6,000,000 feet of dressed lumber on hand in the yards.

Canadian-American Alloy Corporation which took over the plant of the Electric Steel and Metals in Welland, has not yet developed productive activity. Eventually this company will, it is said, turn out heavy railway castings and other steel products.

Dominion Iron and Steel Company, Sydney, C. B., recently shipped 1,800 tons of pig iron for Philadelphia and 400 tone of wire for New York. The rods will be re-shipped to Vancouver, B. C., by rail. The pig iron shipment is the first of its kind in several years to be shipped to the United States.

As reflecting general trade conditions ninety-two ocean and coasting vessels were berthed in the wharves at Montreal. This does not take into account vessels from the great lakes. Since the opening of navigation the port has been visited by 1,033 ocean and coasting steamers as compared with 964 vessels arriving during the whole of last season.

Flint Varnish and Color Works of Canada, have erected at West Toronto a plant for the manufacture of lacquers and pyroxylin products from basic raw materials. The plant includes technical laboratories necessary to demonstrate their products in a practical way to manufacturers. The line includes metal lacquers, wood lacquers, bronzing liquids, split leather solutions, waterproof belting cement.

Plant for the reduction of bituminous coal into coke at Sydney, N. S., is being considered by the Government as a safeguard against recurrent coal strikes in the United States. The supply from the proposed Sydney station would be designed especially for central Canada. A similar station may be established in the west if necessary, but it is calculated that British Columbia or Alberta coal either in its natural form or as briquettes, will not come east of Winnipeg.

With a view of co-operating with any municipality in Canada that is desirous of acquiring industries, the secretary of the Federation of British Industries, has issued a statement which says, in part: "Where any overseas Government, Dominion or Provincial, is anxious to promote industries within its borders, we here can probably be of considerable assistance. There are many firms in this country who are following the establishment of home industries overseas with interest. I can assure you that there is an amount of interest taken in the Canadian market which would surprise some critics of the British manufacturer if its full extent were known."

D. M. Fraser, Corman Engineering Co,. Toronto, announce that they have purchased the plant and equipment of the Chapman Double Ball Bearing Company, Sorauren Avenue Toronto. They have taken over the entire Chapman line and added to their regular products. They are going to move shortly into the plant on Sorauren Avenue, but in the meantime have some men there working on demand for Chapman products.

The construction of a new addition to the plant of the Howard Smith Paper Mills at Cornwall, for the manufacture of bleached soda pulp, will likely be started shortly, according to an announcement made at a directors' meeting held last week. Canadian requirements for this product have so far been imported. The new plant when completed will have a capacity of 15,000 tons per year. The soda pulp will be used for mixing with sulphite pulp to go into the manufacture of certain grades of paper.

ADVISES 60-DAY COAL SUPPLY

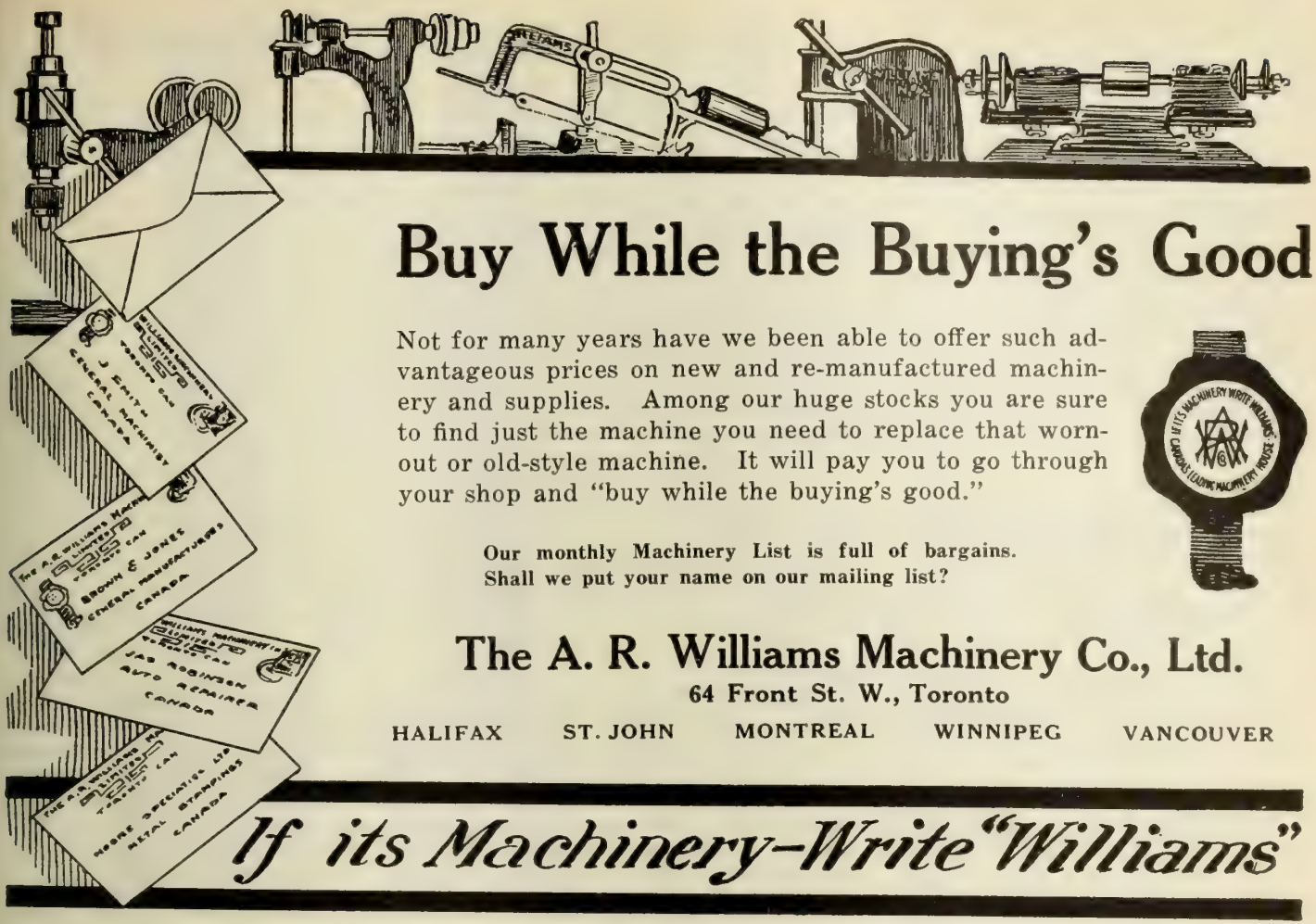
At a meeting of purchasing agents a few days ago. F. J. Carson The Harris Abattoir Co., Toronto, discussed the coal situation in relation to industrial requirements as follows:

"Production appears to have struck a temporary level. The weekly output is now about 9,700,000 tons. This is about the same tonnage as reported at our last meeting in September.

"In the last report I stated that production was increasing and that prices would drop a little, but also drew to your attention, that there was a possibility of a car and motive power shortage. Production did increase slightly and prices drop a little, but the car shortage came sooner than expected and production is now curtailed considerably.

"Central Pennsylvania reports a daily shortage of 800 cars and West Virginia about 50 per cent. of their normal supply. The car shortage, which means less production, and the winter coming on should have a tendency to increase prices and I would suggest covering at once. Steam slack is selling around $3.50 to $4.00 per ton at the mines. Steam run of mine $3 65 to $4 00 per ton; steam lump $4 35 to $4.75 per ton; gas slack $4.00 to $5.00; gas run of mine $4.75 to $5.25; gas lump $5.00 to $5 75.

"It is still a question of transportation, and I would advise carrying a 60-days' supply until we can see improvements on the railroad."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Not for many years have we been able to offer such advantageous prices on new and re-manufactured machinery and supplies. Among our huge stocks you are sure to find just the machine you need to replace that worn-out or old-style machine. It will pay you to go through your shop and "buy while the buying's good."
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If its Machinery-Write "Williams"

GOOD ROADS AND INDUSTRY

That the development of the automotive industry is closely related to increased mileage of good roads in every province, is established in a bulletin recently issued by the Department of Railways and Canals. It is pointed out that the grand total value of automobiles, supplies, accessories and repair parts manufactured in this country increased from $101,196,706 in 1919 to $137,420,351 in 1920. The capital investment necessary in the production of these goods amounted in 1920 to $89,183,306, an increase of 57 per cent. over the year preceding. Over 14,500 persons were engaged in the making of these products, and this group of industrially employed earned nearly $23,500,000 in 1920. There are in Canada seventeen motor vehicle manufacturing plants of which ten make passenger vehicles and seven make trucks; and the motor vehicle supply plants number in all sixty-two. It is said that no less than eighty-five different occupational activities or classifications of skilled labour are necessary in the assembling and completion of one motor vehicle. The making of 94,000 passenger and commercial motor vehicles in Canada in 1920 therefore helped largely to increase the skill as well as the pleasure and profit of a large group of our citizens.

But to the above total of persons dependent upon the automotive industries should be added automobile dealers and their employees. The Automotive Industries Association of Canada report that there were in 1920, 5,522 automobile dealers, employing 43,094 persons, to whom $56,022,200 were paid in wages. Public garages, repair depots, accessory supply stores, and gasoline stations swell the number, so that the employed and their dependents concerned with the manufacture, sale and service of motor vehicles in Canada total approximately a half-million persons.

The total mileages of roads in the various provinces, under control of counties, townships, rural and urban municipalities and provinces are given as follows:—Alberta, 88,500; British Columbia, 15,424; Manitoba, 68,000; New Brunswick, 13,547; Nova Scotia, 15,188; Ontario, 64,198; Prince Edward Island, 3,650; Quebec, 43,877; Saskatchewan, 135,000; Total in Canada 447,384.

BELLEVILLE DISPLAYS PRODUCTS

Belleville.—The made-in-Belleville Exhibition was held in the Belleville Armories four days, October 24-28. His Honor, The Lieutenant-General speaking at the official opening, complimented Belleville in general and the Chamber of Commerce in particular on the number of exhibits and care taken in their preparation. About 70 Belleville firms had exhibits among which were the following in engineering and metal-working lines:

Grand Trunk Belleville shops, exhibit of apprentice drawings, and other work.

National Castings, Ltd., steel, semi-steel, grey iron and aluminum castings.

Marsh Engineering Wks., boilers, contractors' mining and hoisting machinery.

Canadian Alemite Products Co., lubricating systems for industrial and motor car uses.

Canadian Industrial Alcohol Co., alcohol for industrial purposes.

Elliott Machine Co., wood-working machinery; Fruit Machine Co., canning factory machinery; Weed Harvester Co., agricultural machines; Steel Co., of Canada, steel products; American Optical Co., optical goods; Belleville Electric Stampings, electric specialties; Springer Lock Mfg., Co., and Belleville Hardware & Lock Co., builders' hardware; International Burr Co. metal burrs.

The armory was divided into eighty booths all of which were taken up by local concerns. The exhibition was staged by the Chamber of Commerce with the purpose of showing the variety of industrial activities of the city. An elaborate program of entertainment was arranged in connection with the exhibit.

SIXTEEN BLAST FURNACES IDLE

Effect of coal scarcity and transportation difficulty is shown in the fact that the production of Canadian pig iron in September declined 7.92 per cent. from the output of August, according to the Dominion Bureau of Statistics. The August tonnage was 27,123 as compared with 24,974 tons in September. The production was also less than that of September, 1921, by 40.8 per cent. A comparison of the cumulative production during the first nine months, 1922, with that of the corresponding period last year shows a decrease from 457,157 tons to 275,989 tons or 39.6 per cent. The Steel Company of Canada blew in a furnace at Hamilton, after certain repairs; the Algoma Steel Company banked one furnace, while at Sydney one furnace was blown in by the British Empire Steel. At the present time the active furnaces are two at Sydney, one at Hamilton and one at Sault Ste. Marie, a gain of one furnace over the previous month. This leaves 16 blast furnaces idle.

Another development was the slight increase in the several grades of iron produced for sale. The production of basic pig iron increased from 6,577 tons in August 1921, to 7,991 tons or 21.5 per cent. The September production intended for this purpose was also higher than in September of last year by 58.14 per cent. The foundry pig iron produced for sale increased from 6,296 in August to 6,895 tons in September. The output of malleable iron for sale also rose from 281 tons in August to 1,096 tons in the month under review.

The production of ferro-alloys dropped slightly from 1,864 tons in August to 1,834 tons in the following month. The cumulative production in the first nine months of 1922 was 15,178 as compared with 18,698 tons during the corresponding period of the previous year.

ENGINEERS IN ANNUAL RE-UNION

At the fourth annual re-union of the Engineering Alumni Association of Toronto University, Oct. 27 and 28, engineers from all over the Dominion and the United States assembled to renew friendships and visit once more the scenes of their college days. The programme as arranged by the executive of the Alumni, was a complete one, festivities opening on Friday evening with a dinner dance. Saturday morning the year meetings were held at Varsity, all the classes from away back in the eighties down to last year, being well represented.

At the annual dinner held in Convocation Hall, Capt. C. E. MacDonald proposed the toast to the University of Toronto. In replying, Prof. A. T. DeLury of University College, made reference to the Literary and Scientific Club of olden days and said that the Alumni Association was rapidly forming closer bonds between School and the rest of the University.

In replying to the toast to the engineering profession, Dr. A. C. Humphreys, president of the Stevens Institute of Technology, Hoboken, N. J., laid stress on the point that students should be properly prepared in the essentials before commencing an engineering education. Prof. H. E. T. Haultain of S. P. S. proposed the Silent Toast, which was followed by "The School," by W. E. Douglas of the Class of '02, and replied to by Dean Mitchell of the Class of '92. General Mitchell appealed to the Alumni for scholarships saying that it was only by the individual and co-operative efforts of the Association that scholarships could be provided, and that it was in this respect that the alumni could best help the students of to-day.

Should Piston Rods Be Ground?

WHEN the question of the installation of new equipment comes before the management of manufacturing plants to-day, the modern executive requires to be shown the advantages that will be derived by the proposed change of practice before deciding on the best machine for the purpose. Owing to the many factors to be considered it is frequently desirable to exercise a reasonable degree of caution before committing one's self on the adoption of any particular style of equipment.

While there is still some difference of opinion regarding the most efficient method of truing both new and used piston rods, extended tests seem to favor the grinding process. As an instance of the study that has been given to this phase of railway practice the following extract of an article in the Railway Mechanical Engineer may be of interest:

"Notwithstanding the almost universal approval of piston rod grinding, the innate caution of railroad men regarding new devices was strongly illustrated in a large railroad shop recently where it was proposed to install a mchcine to grind piston rods instead of continuing the older method of turning and rolling them. Those who hesitated to install the new machine said that it must first demonstrate its superiority in a comparative test. Accordingly, a new piston rod was turned and rolled as accurately as possible. This rod was then carefully mounted in a piston rod grinder and ground, with the abrasive wheel just lightly touching the rod. The grinding operation was then stopped and observers noted that more metal was removed at certain places on the piston rod than at others and in some places the abrasive wheel did not touch the rod at all.

"Micrometer calipers checked the accuracy of grinding both as regards taper and roundness of the rod. The fact that more metal was removed by grinding at certain places than at others proved conclusively that the rod, as rolled previous to grinding, was not a true cylinder. This was evidently due to the fact that the rod was non-homogeneous, being softer in some spots than in others, with the result that the roll depressed these soft spots unduly. The grinding machine, on the other hand, exerted hardly any pressure on the rod and removed as much metal from the soft spots as the hard, producing a true cylindrical surface.

"In the days of wick packing the accuracy of piston rods did not make so much difference, but now that metallic packing is used almost universally it is evident that this packing cannot hold steam and last for any considerable length of time unless piston rods are accurately round, smooth and, practically speaking, without taper. That these qualifications are best obtained by the use of modern piston rod grinding machines is evident from the many ground piston rods now in daily use and giving satisfactory service."

QUEBEC'S INDUSTRIAL PROGRESS

Quebec ranks as the seventh largest manufacturing centre in Canada. According to the latest census, there are 424 manufacturing establishments of all industrial activities centered in the city. More than half, however, are small in importance, but nevertheless, thorough in equipment. These establishments represent over ninety different lines of production. The principal industries are engaged in the manufacture of boots and shoes and leather tanning of which there are forty-seven. The output of these boot and shoe factories is scattered all over Canada, and principally sold to Ontario and Western jobbers. Machine shops, boiler and other steel and iron plants, come next with forty establishments, and next in order are food producing factories, 27 in number. There are 20 woodworking concerns, which include the manufacture of doors and other essentials in building construction and the manufacture of packing cases, boxes, etc.

The capital invested in Quebec industries, according to statistical information, amounts to $36,927,434.00, employees on salaries and wages, $11,500; salaries and wages paid out per annum $6,979,516.00; cost of raw material used $16,067,679, and value of finished products $38,265,277.00 The population of Quebec City has increased from 68,840 in 1901 to 116,850 in 1921, and the total value of assessable property which was $26,397,309.00 increased to $114,327,947 in 1921.

These figures serve to demonstrate the growth of the city in an industrial sense, and the fact that it is well equipped to make further progress as an important factor in Canadian manufacturing as a whole.

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Hamilton Industries Report Conditions Improving

Steel Company Will Blow in Second Furnace by Dec. 1—Reconstruction Nearing Completion—Using Some Magnetite Ore—Better Demand for Machinery—Railways May Order New Cars

HAMILTON.—Steel Company of Canada, expect to have their B blast furnace going again on foundry iron by December 1st. Their A furnace was blown in early in October on basic pig for the company's steel requirements. This furnace has a daily capacity of three hundred tons. With two furnaces going the company's daily requirement in coal is something like 2,000 tons. The Hamilton plant is now operating on 50 per cent. capacity. This will improve according as supplies of coal become more easily available. It is scarcity of fuel that is not only curtailing the operation of this and other plants, but is impeding the operations of customers and hence affecting the demand for products.

During the recent reconstruction of one of their blast furnaces, Steel Company engineers were confronted with the task of replacing the foundation. This was found to be necessary as the result of serious fissures in the concrete mat which underlies the substructure of brick and concrete. This mat of concrete has a depth of 10 feet and a diameter of about forty-five feet. Below this there is piling to a depth of about 60 feet. This is necessary, as the site is of made ground. The cracking of the mat was unforeseen and its replacement, together with that of the heavy base on which the furnace stands, has been an undertaking of some proportions. The furnace proper and all of the steel work, produced by the John Inglis Co., Toronto, is practically completed.

While the Steel Company are using American ores from the Mesabi range, they have, from time to time, made extensive experiments with Canadian magnetite ores. At the present time, they are using a quantity, about 10,000 tons, of the briquetted magnetite ore produced by the Moose Mountain Mine, in the Sudbury district. This mine has produced many thousands of tons of ore that is said to run over 66 per cent. pure iron, about 4½ per cent. silicon and from .012 down to .006 phosphorous. Some of this ore, during the war, was shipped as far south as Tennessee. Under normal conditions it does not compete with the American ore. It is claimed, however, that it meets commercial requirements.

The Steel Company frequently receive samples of ores from different sections of the country when outcroppings occur. There are many of these; in fact prospectors in the north country state that they know of immense outcrops that they have never taken the trouble to stake. As a rule, samples sent in reveal small percentages of iron. One recently received from Broughton, Que., showed 38 per cent. It was, however, a very small sample, and not taken as is desirable from different sections of the vein. The Steel Company, naturally, are anxious to promote discovery and development of Canadian ores, have done much experimental work, and have encouraged exploration looking to the location of adequate bodies.

Hamilton firms report preliminary enquiries with reference to proposed construction of new rolling stock for the railways. For the Canadian National lines, it would appear that plans are gradually taking shape for the erection of 3,000 freight cars and 700 refrigerator cars, while the C. P. R. may shortly call for 2,000 new freight cars. Developments looking to the actual placing of this business is being watched with considerable interest as it will mean activity in many plants where there is not much doing at present. In this connection, a manufacturer points out that, with about 200,000 cars as a total on Canadian lines, practically nothing has been coming through of extensive repairs, as was regularly the case in prewar days. From latest information received, something like 14,000 "bad order" cars have been reported, and as for the two-week period ending Oct. 1, a shortage of about 8,000 cars was reported. October, however, is always a heavy month, and it will probably be found that the shortage will run above that figure. The fact that the railways have been doing practically nothing in repairs or replacements means much to many industries.

Ford-Smith Machine Co., Hamilton, report, in recent business, the sale of a miller to an Alberta colliery company, which has been installing new machine shop equipment and of two grinders—one a 20-inch water tool type, and the other a 14-inch heavy type—to the Imperial Oil Co., for their proposed Calgary plant.

Brown-Boggs Co., Hamilton, report improved inquiry for punching and shearing equipment, and that the year to date shows a much better record than last year. Toronto office reports the sale of one of their machines and several enquiries during the past few days.

National Steel Car Company, Hamilton, who are said to have considerable work on hand in the repairing of cars for American roads, are reported to be finding it difficult to obtain supplies of material as the result of freight congestion and embargoes on the American side of the line. It is understood that specifications in connection with such a contract, require that, where possible, the materials used be from American mills and shops. About the only Canadian factor in such a contract, it appears, would be the labor.

A. T. Enlow, Dominion Sheet Metal Corporation, Hamilton, reports a strong demand for galvanized sheets and that, up to the present time, no serious difficulty has developed in obtaining shipments of black sheets from American mills. As to the price situation, he looks for a fairly even level for the next few months. with very little movement up or down. The Hamilton mill price on premier galvanized sheets is $5.40 to $5.60. In marketing material of this kind, as between Hamilton and Toronto for example, the motor truck is being used to some advantage in making daily shipments. Many firms are now using this means of transportation where quick delivery is called for.

Smart-Turner Machine Co., Hamilton, report the following recent sales: Two No. 4 double suction centrifugal pumps for the Abso-Pure Ice Co., Hamilton; few small triplex power pumps, ordered by Department of Marine & Fisheries, for delivery to the Dominion Lighthouse Depot, Prescott. A No. 4 belt-driven centrifugal pump, ordered by H. F. Routley, Toronto, for quarry service near Caledonia; one 4½ x 2¾ x 4 duplex, packed-piston pump, to Standard Paving Co., Lindsay; a pair of 8 x 10 x 12 simplex vacuum pumps; an automatic feed pump and receiver equipment with motor-driven centrifugal pump and two motor-driven centrifugal circulating pumps for the Essondale Asylum, Vancouver, B. C., and a 5½ x 6 triplex power pump for Vipond-North Thompson Mines, Timmins, Ont.

Dominion Steel Foundry Co., Hamilton report that two six-ton electric furnaces which they installed two years ago, replacing the ordinary open-hearth furnace, have given satisfactory service. Six heats a day are possible where formerly two and one-half were obtained, and the result has been a more uniform grade of metal. The Hamilton foundry reports a fair amount of business in sight. A branch foundry at Watervliet, N. Y., also equipped with steel furnace, has been exceptionally busy. Activity in car construction would create a larger demand of heavy castings for which the Canadian plant is equipped.

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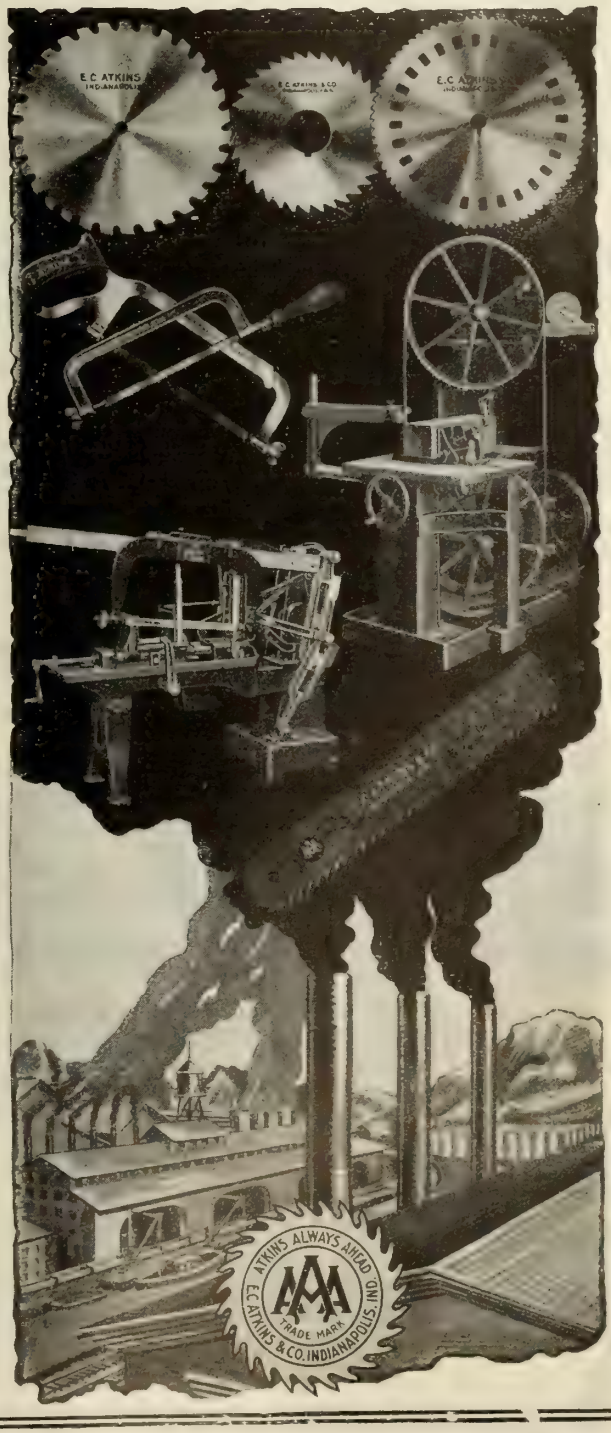

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USE NATIVE ORES TO SOLVE FUEL PROBLEM

Hon. Harry Mills, Minister of Mines for Ontario, is of the opinion that some substitute for coal should be evolved for the more economic operation of industries. He felt confident that such a fuel would be obtained and that one of the greatest existing industrial problems would be solved thereby. Addressing a special meeting of the Board of Trade at Sault Ste. Marie, the Minister of Mines also emphasized the benefits that must accrue to the country generally from the development of low grade iron ore fields of Northern Ontario.

J. A. McPhail, the chairman at the meeting discussed the feasibility of a native blast furnace, based upon the use of low grade ores such as are easily available. He pointed out that the great cost in connection with the steel plant there was the assembling of raw material. For this reason, he said, the largest and best steel plant in the country was only partially operating. "For every dollar there is spent in Canada for wages, two dollars are spent for transportation," he said, "and if the iron ore which is right near our doors could be utilized by our plants think what a difference it would make to that industry. At the present time coal and iron is shipped from the United States almost entirely." Mr. McPhail said he had learned that the ideal steel could be manufactured from a fifty per cent. mixture of magnetic and siderite after they had been treated, and both of these ores existed here in good quantity. In a few years he prophesied the mining and treating of iron ore would be one of the leading industries. If the iron ore fields could not be developed without obtaining a bonus he thought it would show the development could not be done economically, and as Toronto papers prophesied, developments would be stopped. If ore could be proved up in sufficient quantities, however, to warrant the securing of large capital to back the move, Mr. McPhail said the situation would be different.

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STEEL BUSINESS OUTLOOK GOOD

John Mackrell of McGregor & McIntyre, Toronto, reported upon iron and steel conditions to a recent meeting of purchasing agents as follows:—

"The American steel mills at the present time are booked very heavily, with no indication of any letup in receipt of orders. The railroads are the heaviest purchasers, 1,000,000 tons of rails having recently been ordered for delivery the first half of 1923. Orders are coming in regularly for new equipment for railroads, as well as repairs to cars and other rolling equipment.

"Requirements for oil business are also extensive, 100,000 tons of pipe having recently been placed by one concern for pipe line.

"Steel requirements for general building in the States are good, for auto business requirements are considerably more than anticipated earlier in the year.

"The disappointing feature has been the requirements for implement business, but present indications are improving in this respect.

"Delivery of steel at the present time is seriously hampered by embargoes and lack of railway equipment to handle the business, due to recent railway strike. Car shortage for steel is also caused by coal requirements. On this account many mills have large tonnages piled up waiting for cars, and have had to curtail output.

"Prices have been upward for sometime with no indication of retrenchment. The Corporation price at present is $1.85 base Pittsburgh, but independents are demanding from 15 to 25 cents per 100 lbs. more for plates than other shapes. Blue annealed sheets are quoted by the Corporation at $2.50; black sheets, $3.-35, and galvanized $4.35, but Independents are somewhat higher, but delivery much earlier

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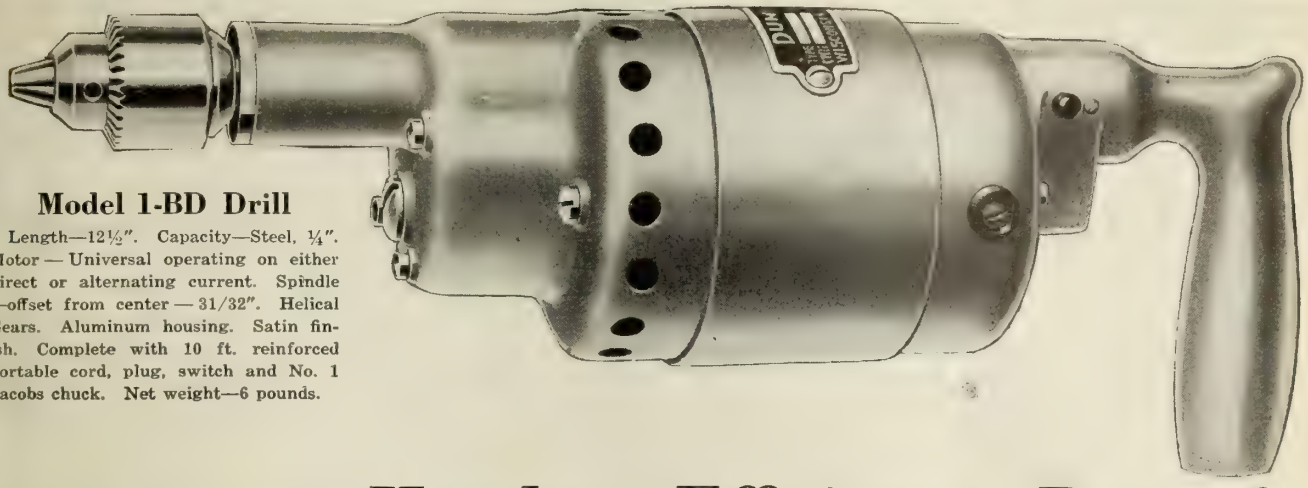

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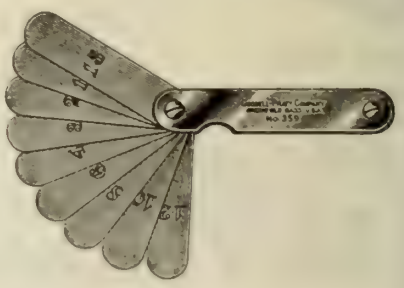

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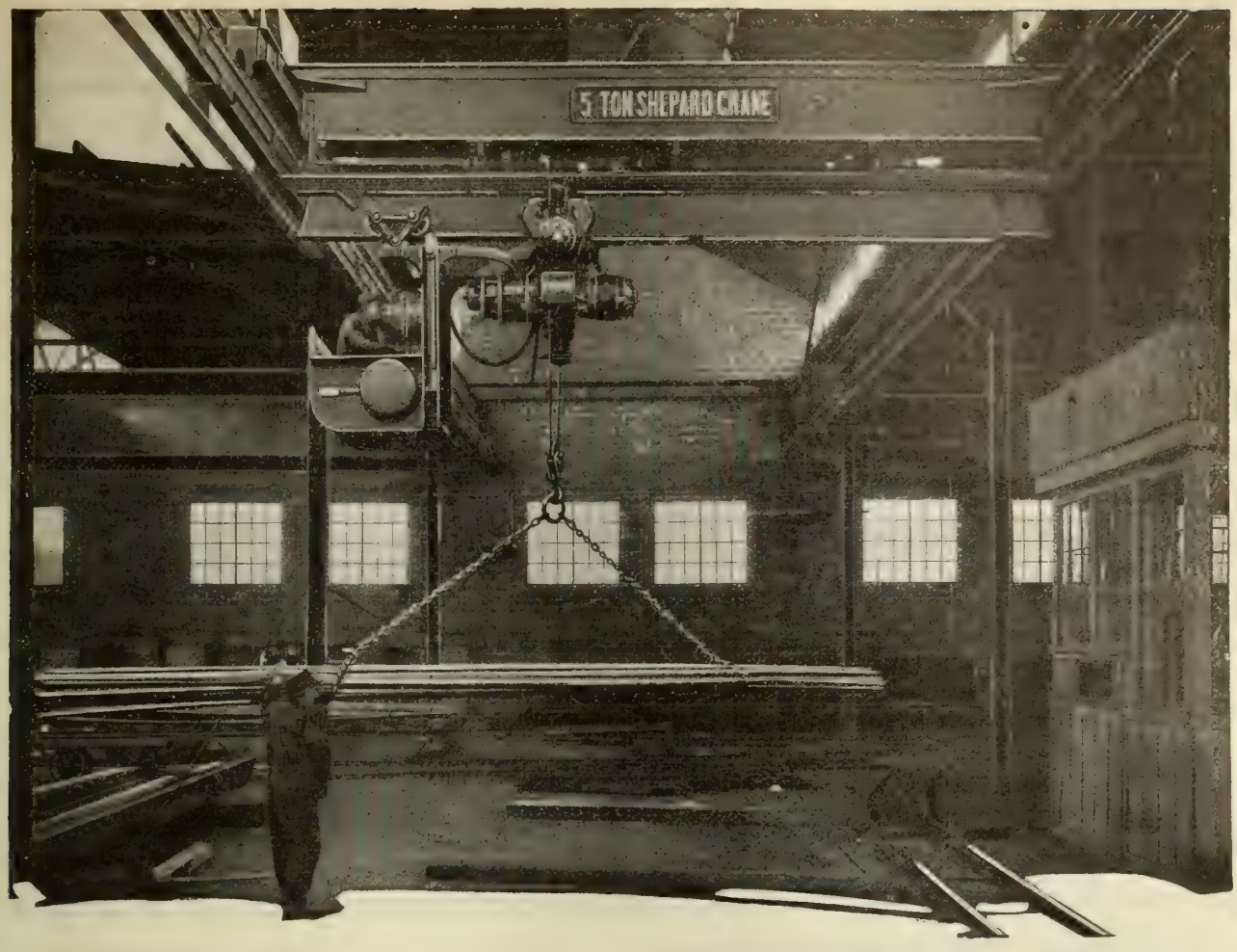

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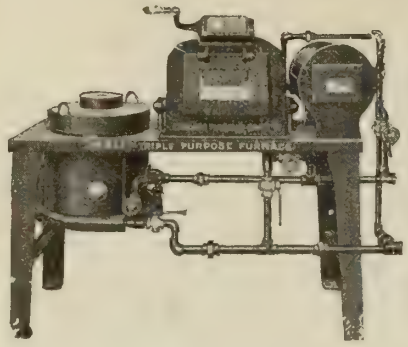

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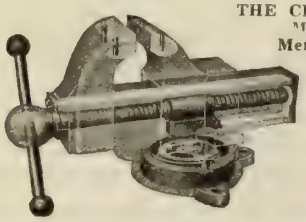

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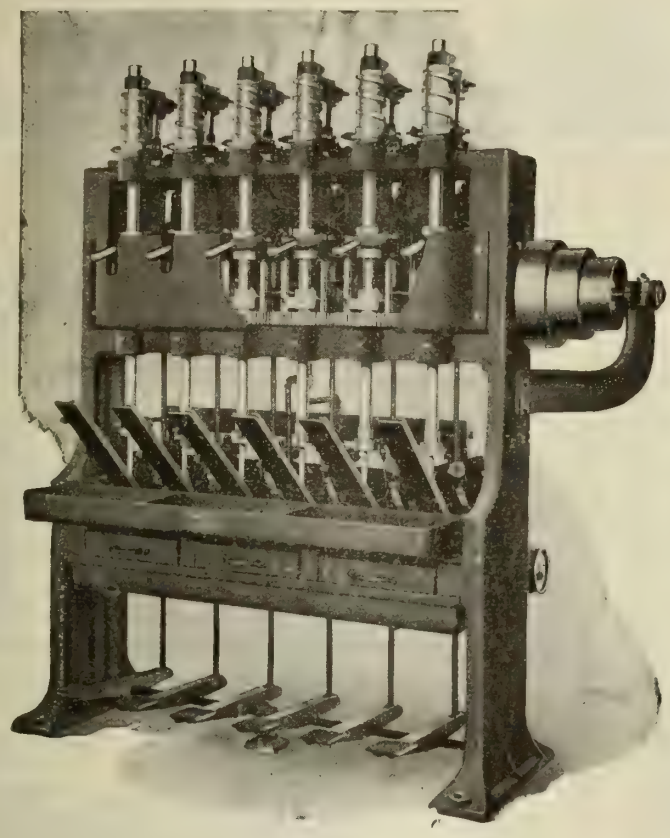

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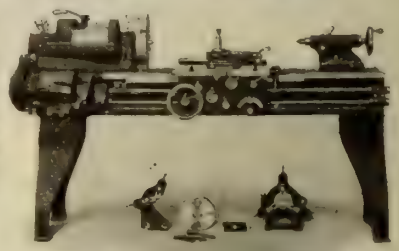

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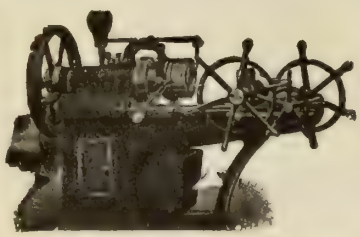

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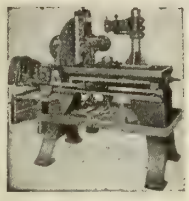

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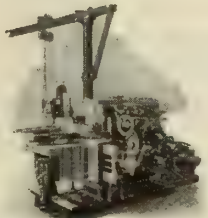
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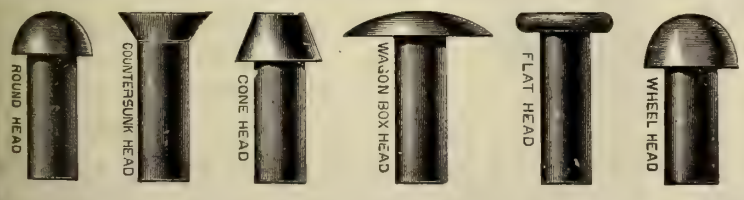

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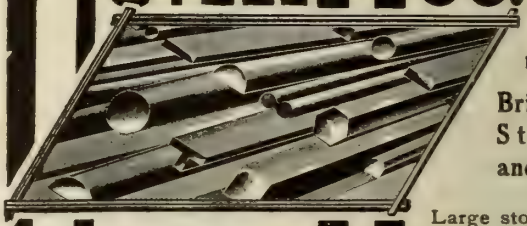

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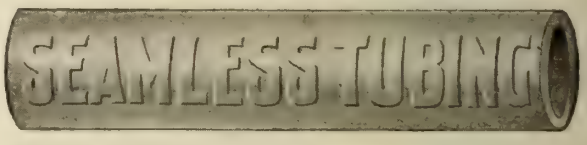

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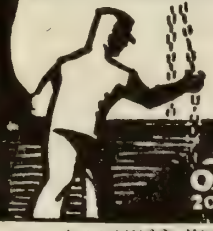

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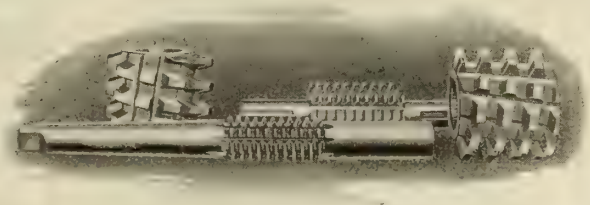

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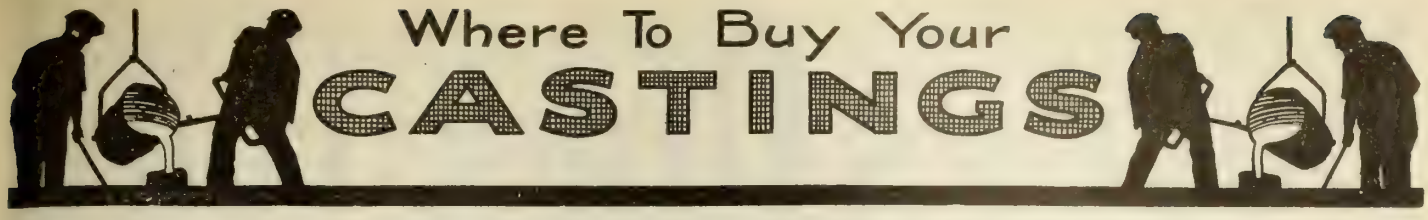
Classified Advertising Section
143-153 University Avenue
TORONTO



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Steel, Malleable and Heavy Grey Iron.
See Advertisement Page 7

Machinery & Foundries, Ltd.
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Canadian Machinery & Mfg. News
153 University Ave., Toronto.

If what you need is not advertised, consult our Buyers' Directory and write advertisers, listed under proper heading

Canadian Machinery BUYERS DIRECTORY

If what you want is not here, write us, and we will tell you where to get it. Let us suggest that you consult also the advertisers' index— last page of book, after having secured advertisers' names from this directory. The information you desire may be found in the advertising pages. This department is maintained for the benefit and convenience of our readers. The insertion of our advertisers' names undr proper headings is gladly undertaken, but does not become part of an advertising contract.

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Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John, London, S.E., Eng.

ABRASIVE MATERIALS
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Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John, London, S.E., Eng.

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Dominion Oxygen Co., Toronto.
Liquide Air Company, Toronto.

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Steel Co. of Can. Ltd., Hamilton, Ont

ANGLE BARS
Steel Co. of Can. Ltd., Hamilton, Ont.

ANVILS
Aikins & Co., Inc., E.C., Indianapolis, I.

ANCHOR BOLTS
Steel Co. of Can., Ltd., Hamilton, Ont.

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Brown & Sharpe Mfg.Co., Providence,R I.
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Kempsmith Mfg. Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.

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Canadian SKF Co., Toronto, Ont.

BARS, BORING
Armstrong Bros. Tool Co., Chicago, Ill.
Bertram & Son Co., td., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

BARS, BORING, PORTABLE
Underwood Corp., H. B., Philadelphia.

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Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
British Empire Steel Corporation, Montreal, Que.

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Canadian SKF Co., Toronto, Ont.

BEARINGS, ROLLER
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

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D. K. McLaren, Limited, Montreal.
McLaren Belting Co., J. C., Montreal, Que.

BELT DRESSINGS AND FILLERS
Dom. Belting Co., Ltd., Hamilton, Ont.
D. K. McLaren, Limited, Montreal,

BELT FASTENERS
Bristol Company, Waterbury, Conn.
D. K. McLaren, Limited, Montreal,
McLaren Belting Co., J.C., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

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Bristol Co., Waterbury, Conn.
D. K. McLaren, Limited, Montreal.

BELT LACING
Bristol Company, Waterbury, Conn.
D. K. McLaren, Limited, Montreal,
McLaren Belting Co., J. C., Montreal.

BELT LACING, STEEL
Bristol Company, Waterbury, Conn.

BELT LACING MACHINES
D. K. McLaren, Limited, Montreal,
McLaren Belting Co., J. C., Montreal, Que.
Petrie, Ltd., H. W., Toronto. Ont.

BELTING, CHAIN
Can. Link-Belt Co., Toronto, Ont.
Fittings, Limited, Oshawa, Ont.
Jones & Glassco, Montreal, Que.
real, Que.
Renold (Hans) of Canada, Ltd., Montreal, Que.

BELTING, FABRIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Dom. Belting Co., Ltd., Hamilton, Ont
D. K. McLaren, Limited, Montreal,
McLaren Belting Co., J. C., Montreal, Que.

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Atkins & Co., Inc., E. C., Indianapolis, Indiana.
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McLaren Belting Co., J. C., Montreal, Que.

BELTS, ABRASIVE
Oakey & Sons, Ltd., John, London, S.E., Eng.

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Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bertrams Ltd., Edinburgh, Scotland.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

BILLETS, BLOOMS and SLABS
Steel Co., of Can. Ltd., Hamilton, Ont.

BLAST GATES
Rockwell & Co., W. S., New York, N.Y.

BLOCKS
Wright Mfg. Co., Lisbon, Ohio.

BLOCKS, CHAIN (See Hoists, Hand)
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

BLOCKS, DIE
Canada Foundries & Forgings Co., Welland, Ont.

BLOCKS, PILLOW
Can. Link-Belt Co., Toronto, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

BLOWERS
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

BOLT AND NUT MACHINERY
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Montreal, Que.

BOLT AND NUT MACHINERY, Automatic
National Acme Co., Cleveland, Ohio

BOLTS AND NUTS
British Empire Steel Corporation, Montreal, Que.
National Acme Co., Montreal, Que
Petrie, Ltd., H. W., Toronto, Ont

BOLT THREADING DIE HEADS
Landis Machine Co., Inc., Waynesboro Pa.

BOLTS, TRACK
Steel Co. of Canada, Ltd., Hamilton, Ont.

BORING BARS, EXPANSION
Davis Boring Tool Co., St. Louis, Mo

BORING TOOLS, EXPANSION
Davis Boring Tool Co., St. Louis, Mo.

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Bertram & Sons Co., Ltd., The John Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

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Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
Herbert, Limited, Alfred, Toronto, Ont.
Landis Tool Co., Waynesboro, Pa.
Vertical
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

BORING TOOLS
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.

BUCKET CARRIERS, Pivoted
Can. Link-Belt Co., Toronto, Ont.

BUFFERS
Pryibil Machine Co., New York, N.Y

BUFFING OR POLISHING MACHINES (See Polishing and Buffing Machines)
Blount Co., J. G., Everett, Mass.
Herbert, Limited, Alfred, Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pryibil Machine Co., New York, N.Y.
U. S. Electrical Tool Co., Cincinnati, O.

BUILDING MATERIALS
Bertram & Son Co., Ltd., The John Dundas, Ont.

BURNERS, OIL AND GAS
Rockwell Co., W.S., New York City.

BURRS
Steel Co. of Can. Ltd., Hamilton Ont

CABINETS, OIL
S. F. Bowser & Co., Ltd., Toronto, Ont

CALIPERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Starrett Co., L. S., Athol, Mass.

For list of Dealers see the last page of This Buyers Directory

CAMS
Canada Foundries & Forgings Co., Welland, Ont.

CAN-MAKING MACHINERY
(See Sheet Metal Working Machinery)
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Bliss Co., E. W., Brooklyn, N. Y.
Smooth Mfg. Co., Jersey City, N. J.

CAR WHEEL BORING TOOLS, EXPANSION
Davis Boring Tool Co., St. Louis, Mo.

CEMENTS, IRON CENTERING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.

CHAINS (See Sprockets and Chains)
Reynold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

CARD CLOTHING
D. K. McLaren, Limited, Montreal.

CASTINGS, ALUMINUM, BRASS, BRONZE, COPPER, DIE-MOLDED, FERRO-ALLOY, IRON, SEMI-STEEL, STEEL.
See "Where to buy your castings" Section. Page number may be found by turning to Advertisers' Index.

CHAINS, DRIVING
Can. Link-Belt Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont
Jones & Glassco, Montreal, Que.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

CHASERS
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, a.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CHUCKING MACHINES
Acme Machine Tool Co., Cincinnati, O
Brown & Sharpe Mfg. Co., Providence, R. I.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

CHUCKS, DRILL AND TAP
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canadian SKF Co., Toronto, Ont.
Cushman Chuck Co., Hartford, Conn.
Geometric Tool Co., New Haven, Conn.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg., New Britain, Conn.

CHUCKS, LATHE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Cushman Chuck Co., Hartford, Conn.
Geometric Tool Co., New Haven, Conn.
Gisholt Machine Co., Madison, Wis.
Herbert, Limited, Alfred, Toronto, Ont.
Ker & Goodwin Machine Co., Brantford, Ont.
Pryibil Machine Co., New York, N.Y.
Skinner Chuck Co., New York, N.Y.
Union Mfg. Co., New Britain, Conn.

CHUCKS, MAGNETIC
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CHUCKS, PLANER
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cushman Chuck Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn
Union Mfg. Co., New Britain, Conn.

CHUCKS, TAPPING
William L. Procunier, Chicago, Ill.

CHUCKS, VERTICAL BORING MILL
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Skinner Chuck Co., New Britain, Conn
Union Mfg. Co., New Britain, Conn.

CLAMPS, MACHINISTS'
Brown & Sharpe Mfg Co., Providence,
Starrett Co., L. S., Athol, Mass.

CLEANERS, METAL, WASTE, GENERAL
Oakley Chemical Co., New York, N. Y.

CLOCKS
Chicago Watchman's Clock Co., Chicago.
Hardinge Bros., Limited, Toronto, Ont.

CLOCKS, TIME
Gisholt Machine Co., Madison, Wis.

CLOCKS, WATCHMEN'S
Chicago Watchman's Clock Co., Chicago, Ill.
Hardinge Bros., Limited, Toronto, Ont.

CLUTCHES, FRICTION
Can.-Link-Belt Co., Toronto, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.

COAL AND ASH HANDLING MACHINERY
Can.-Link Belt Co., Toronto, Ont
Roelofson Elevator Works, Galt, Ont

COAL-STORAGE SYSTEMS
Can. Link-Belt Co., Toronto, Ont.

COLLARS, SHAFT OR SET
Canada Foundries & Forgings Co., Welland, Ont.
Can. Link-Belt Co., Toronto, Ont.
Kennedy & Sons, Ltd., Wm., Owen, Sound, Ont.

COLLETS
Butterfield & Co., Inc., Rock Island, Que.
Geometric Tool Co., New Haven, Conn.
Hardinge Bros., Inc., Chicago, Ill.
Hendley Machine Co., Torrington Conn.
Kearney & Trecker Co., Milwaukee, Wis
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

COMPOUNDS, CLEANING
Oakley Chemical Co., New York, N.Y

BUYERS' DIRECTORY

COMPOUNDS—CUTTING, DRILLING, GRINDING, SCREW CUTTING
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Oakley Chemical Co., New York, N.Y.

COMPRESSORS, AIR AND GAS
Can. Fairbanks-Morse Co., Ltd., Montreal.

CONES, FRICTION
Norton Co., of Can. Ltd., Hamilton, Ont.

CONNECTING RODS AND STRAPS
Canada Foundries & Forgings Co., Welland, Ont.

CONTRACT WORK
Dominion Engineering Works, Limited, Montreal, Que.
Victoria Foundry Co., Ltd., Ottawa, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

CONVEYORS AND ELEVATORS (SEE ELEVATORS)
Jones & Glassco, Montreal, Que.

COTTERS
Steel Co. of Canada, Ltd., Hamilton, Ont.

COUNTERBORES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

COUNTERS, REVOLUTION
Starrett Co., L. S., Athol, Mass.

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Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Johnson Machine Co., Carlyle, Man-
Kempsmith Mfg. Co., Milwaukee, Wis.

COUNTERSINKS
Butterfield & Co., Inc., Rock Island, Que.
Pratt &Whitney Co., of Canada, Ltd., Dundas, Ont.

COUPLERS, CAR AND LOCOMOTIVE
Can. Steel Foundries, Montreal, Que.

COUPLINGS
Steel Co. of Canada, Ltd., Hamilton, Ont.

COUPLINGS, SHAFT
Can. Link-Belt Co., Toronto, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

CRANES, ELECTRIC
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can.-Link-Belt Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Northern Crane Works, Walkerville, Ont.
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.

CRANES, LOCOMOTIVE
Can. Link-Belt Co., Toronto, Ont.

Bertram & Son Co., td., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Northern Crane Works, Walkerville, Ont.

CRANK PIN TURNING MACHINE
Underwood Corp., H.B., Philadelphia, Pa.

CUTTERS, GEAR
Brown & Sharpe Mfg. Co., Providence, R. I.

Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CUTTERS, HIGH SPEED
Atkins & Co., Inc., E. C., Indianapolis.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
& Trecker Co., Milwaukee, Wis
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CUTTERS, MILLING
Brown & Sharpe Mfg. Co., Providence, R. I.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.

CUTTERS, STAY BOLT
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.

CUTTING-OFF MACHINE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Starrett Co., L. S., Athol, Mass.

CUTTING OFF MACHINES, PIPE (SEE PIPE-CUTTING AND THREADING MACHINES)
Landis Machine Co., Inc., Waynesboro, Pa.

CUTTING-OFF TOOLS
Armstrong Bros. Tool Co., Chicago, Ill.

CUTTING OIL FILTERS (SEE OIL FILTERING SYSTEMS
Bowser, S. F. & Co., Ltd., Toronto.

CUTTING, OXY-HYDROGEN
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

DETACHABLE CHAIN
International Malleable Iron Co., Guelph, Ont.

DIAMONDS, BLACK AND ROUGH
Can. Desmond-Stephan Mfg Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

DIAMOND TOOLS
Can. Desmond-Stephan Co., Hamilton,
Wheel Trueing Tool Co., Windsor, Ont.

DIAMOND CROSSINGS
Can. Steel Foundries, Montreal, Que.

DIAMONDS, IMPORTERS
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Co., Windsor, Ont.

DIES, SCREW AND THREAD CUTTING
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.

DIES, SHEET-METAL AND SUB-PRESS (See Tool Work)
Brown, Boggs & Co., Ltd., Hamilton, Ont.

DIES, FORGING
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

DIES, SCREW AND THREAD CUTTING
Morse Twist Drill & Machine Co., New Bedford, Mass.

DIES, SELF-OPENING, ADJUSTABLE
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DIES, THREADING-OPENING
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DIVIDING HEADS
Burke Machine Tool Co., Conneaut, Ohio.
Hendey Machine Co., Torrington, Conn.
Kearney & Treacker Co., Milwaukee, Wis.

DOGS, LATHE AND MILLING MACHINE
Armstrong Bros. Tool Co., Chicago, Ill.

DRAFTING MATERIALS
American Lead Pencil Co., New York City, N.Y.

DRESSERS, GRINDING WHEEL
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ont.
Norton Co., of Can., Ltd., Hamilton.
Wheel Trueing Co., Windsor, Ont.

DRESSING TOOLS
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Co., Windsor, Ont.

DRILL HOLDERS
Armstrong Bros. Tool Co., Chicago, Ill.

DRILLING MACHINES, BENCH
Burke Machine Tool Co., Conneaut,, Ohio.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Hardinge Bros., Inc., Chicago, Ill.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, ELECTRIC AND HAND
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, GANG
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

DRILLING MACHINES, HEAVY DUTY
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
Herbert, Limited, Alfred, Toronto, Ont.

BORING, DRILLING AND MILLING MACHINES, (HORIZONTAL.)
Gisholt Machine Co., Madison, Wis.
Herbert, Limited, Alfred, Toronto, Ont.

DRILLING MACHINES, Multiple Spindle
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
National Acme Co., Cleveland, Ohio.

DRILLING MACHINES, Pneumatic
Cleveland Pneumatic Tool Co., Toronto, Ont.

DRILLING MACHINES, PORTABLE
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, RADIAL
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Herbert, Limited, Alfred, Toronto, Ont.
Williams Machinery Co., A. R., Toronto,

DRILLING MACHINES, SENSITIVE
Burke Machine Tool Co., Conneaut, O.
Herbert, Limited, Alfred, Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont
Williams Machinery Co., A. R., Toronto.
Wisconsin Electric Co., Racine, Wis

DRILLING MACHINES, TURRET
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wisconsin
Williams Machinery Co., A. R., Toronto.

DRILLING MACHINES, VERTICAL
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Herbert, Limited, Alfred, Toronto, Ont.

DRILLS, CENTRE
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont

DRILLS, ELECTRIC
U. S. Electrical Tool Co., Cincinnati, Ohio
Black & Decker Mfg. Co., Ltd., Montreal, Que.

DRILLS, HIGH SPEED TWIST
Butterfield & Co., Inc., Rock Island, Que
Can. Fairbanks-Morse Co., Ltd., Montreal, Que
Cleveland Twist Drill Co., Cleveland, O.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DRILLS, RATCHET
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

DRILLS, TWIST AND FLAT
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont.

DROP FORGINGS
Steel Co of Canada, Ltd., Hamilton

DUMB WAITERS
Roelofson Elevator Works, Galt, Ont.

DUST HANDLING EQUIPMENT
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

ELECTRIC DRILLS AND GRINDERS
Black & Decker Mfg. Co., Ltd., Montreal, Que.
U. S. Electrical Tool Co., Cincinnati, Ohio.

ELECTRIC STEAM GENERATORS
Dominion Engineering Works, Limited, Montreal, Que.

ELECTRICAL INSTRUMENTS
Bristol Co., Waterbury, Conn.

ELECTRICAL SUPPLIES
Atkins & Co., Inc., E. C., Indianapolis.
Diamond State Fibre Co., Toronto, Ont.

ELECTRIC TOOLS
U. S. Electrical Tool Co., Cincinnati, Ohio.

ELEVATORS AND CONVEYORS
Can. Link-Belt C., Toronto, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q

ELEVATORS, FREIGHT AND PASSENGER
Roelofson Elevator Works, Galt, Ont.

EQUIPMENT, ELEVATOR SAFETY
Jones & Glassco, Montreal, Que.

EMERY WHEELS (See Grinding Wheels)
Lion Grinding Wheels, Limited, Montreal, Que.
Atkins & Co., E. C., Indianapolis, I.
Norton Co., of Canada., Ltd., Hamilton.

ENGINES, CAPSTAN
Kennedy & Sons, Wm., Owen Sound, Ont.

ENGINEERS, MECHANICAL
Dominion Engineering Works, Limited, Montreal, Que.
Gisholt Machine Co., Madison, Wis.
Hamilton Gear & Machine Co., Toronto,

EXPANDERS, TUBE
Jardine & Co., A. B., Hespeler, Ont.

FANS, ELECTRIC
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

FANS, EXHAUST
Can. Blower & Forge Co., Ltd., Kitchner, Ont.

FANS, VENTILATING
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

FIBRE
Diamond State Fibre Co., of Can. Ltd., Toronto, Ont.

FILES AND RASPS
Nicholson File Co., Port Hope, Ont.
Simmons Canada Saw Co., Montreal, Que.

FILLER, IRON (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J.

FIRE ESCAPES
Roelofson Elevator Co., Galt, Ont.

FITTINGS, PIPE
International Malleable Iron Co., Guelph.
Fittings, Limited, Oshawa, Ont.

FLEXIBLE SHAFTS
Strand & Co., N. A., Chicago, Ill

FLUXES, WELDING
Carter Welding Co., Ltd, Toronto, Ont.
Dominion Oxygen Co., Ltd, Toronto
Liquide Air Company, Toronto, Ont.

FORGING MACHINERY
Acme Machinery Co., Cleveland, Ohio
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown Boggs & Co., Ltd., Montreal.
National Machinery Co., Tiffin, Ohio.
Steel Co. of Canada, Ltd., Hamilton

FORGINGS, DROP
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Ltd., Toronto, Ont.

FORGINGS, HAMMER
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Hepburn Ltd., John T., Toronto, Ont.

FOUNDRY EQUIPMENT
Rice Lewis & Son, Ltd., Toronto, Ont.

FOUNDRY SUPPLIES
Rice Lewis & Son, Ltd., Toronto, Ont.

FROGS, SPRING OR RIGID
Can. Steel Foundries, Montreal, Que.

FURNACES, ELECTRIC
Rockwell Co., W. S. New York City.
Hiram Walker & Sons Metal Products Ltd., Walkerville, Ont.

FURNACES, HEAT TREATING COAL
Rockwell Co., W. S., New York City.

FURNACES, HEAT TREATING OIL D GAS
Bellevue Industrial Furnace Co., Detroit, Michigan.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Rockwell & Co., W. S., New York, N.Y.

FURNACES TEMPERING AND ANNEALING
Bellevue Industrial Furnace Co., Detriot, Mich.
Brown & Sharpe Mfg., Co., Providence R. I.
Rockwell Co., W. S., New York City.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

FURNACES AND OVENS, ELECTRIC
Rockwell & Co., W. S., New York, N.Y.
Starrett Co., L. S., Athol, Mass.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

BUYERS' DIRECTORY

GAGES, MEASURING (See Tool Work)
Brown & Sharpe Mfg. Co., Providence, R. I.
Greenfield Tap & Die Corp., Galt, Ont.
Lufkin Rule Co., Windsor, Ont.
Starrett Co., L. S., Athol, Mass.

GAGES, RECORDING
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GAGES, SPECIAL MEASURING
(See Tool Work)
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GAGES, THREAD
Brown & Sharpe Mfg. Co., Providence R. I.
Herbert, Limited, Alfred, Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

GALVANIZING
Fittings, Limited, Oshawa, Ont.

GAS, COAL COMPRESSED
L'Air Liquid Society, Toronto, Ont.

GAS, COMPRESSED
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

GASKETS
Diamond State Fibre Co. of Ca., Ltd., Toronto, Ont.
Smooth Mfg. Co., Jersey City, N. J.

GAUGES VACUUM AND PRESSURE
Taylor Instrument Co., Toronto, Ont.

GEAR BLANKS
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.
Dominion Engineering Works, Limited, Montreal, Que.

GEAR COUNTERS
Hart Mfg. Co., R. A., Battle Creek, Michigan.

GEAR CUTTING MACHINES
Bertram & Sons Co., Ltd., The John, Dundas, Ont.

Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Fellows Gear Shaper Co., Springfield, Vt.
Whiton Machine Co., D. E., New London, Conn.

GEAR TESTING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.

GEARS, CAST
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Hull Iron & Steel Foundries, Hull, Que.
Dominion Engineering Works, Limited, Montreal, Que.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

GEARS, CUT
Brown & Sharpe Mfg. Co., Providence, R. I.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Gardner & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto, Ont.
Hepburn Ltd., John T. Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

GEARS, DRESSED
Kennedy & Sons, Wm., Owen Sound, Ontario.

GEARS, FORGED
Canada Foundries & Forgings Co., Welland, Ont.

GEARS, HERRINGBONE
Hamilton Gear & Machine Co., Toronto, Ont.

GEARS, RAWHIDE (See Gears, Cut)
Hamilton Gear & Machine Co., Toronto.

GEAR, SILENT CHAIN
Gardner & Son, Robt., Montreal, Que.
Can. Link-Belt Co., Ltd., Toronto, Can.
Hans Renold of Canada, Ltd., Montreal, Quebec.

GEARS, WORM
Hamilton Gear & Machine Co., Toronto.

GENERATORS, ACETYLENE
L'Air Liquide Society, Toronto, Ont.

GOGGLES, SAFETY
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto
Liquide Air Company, Toronto.

GRAB BUCKETS
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Cleveland Twist Drill Co., Cleveland, O.

GREASE CUPS, PRESSED STEEL AND BRASS
Can. Winkley Co., Ltd., Windsor, Ont.

GREASES, LUBRICATING
Canadian SKF Co., Toronto, Ont.

GRINDERS, ELECTRIC
Black & Decker Mfg. Co., Ltd., Montreal, Que.
U. S. Electrical Tool Co., Cincinnati, Ohio.

GRINDERS TOOL POST
U. S. Electrical Tool Co., Cincinnati, Ohio.

GRINDING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Norton Co., of Canada, Ltd., Hamilton.

GRINDING MACHINES, ABRASIVE BELT
Norton Co. of Can. Ltd., Hamilton, Ont.

GRINDING MACHINES, AUTOMATIC
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, BENCH
Blount Co., J. G., Everett, Mass.
Geometric Tool Co., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co. of Canada, Ltd., Hamilton, Ont.
Pratt & Whitney Co. of Canada, Ltd.

GRINDING MACHINES, CENTER
Wisconsin Electric Co., Racine, Wis

GRINDING MACHINES, CUTTER AND REAMER
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, CYLINDRICAL
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.
Norton Co., of Canada, Ltd., Hamilton.

GRINDING MACHINES, DIE
Geometric Tool Co., New Haven, Conn.
National Acme Co., Cleveland, O.
National Machinery Co., Tiffin, Ohio.

GRINDING MACHINES, DRILL
Bellevue Industrial Furnace Co., Detroit, Mich.
Bertram & Son Co., Ltd., The John, Dundas, Ont.

GRINDING MACHINES, ELECTRIC
Strand & Co., N. A., Chicago, Ill.

GRINDING MACHINES, FLOOR AND TOOL
Blount Co., J. G., Everett, Mass.
Herbert, Limited, Alfred, Toronto, Ont.
National Acme Co., Cleveland, Ohio.
Norton Co. of Canada, Ltd., Hamilton, Ontario.
Greenfield Tap & Die Corp., Galt, Ont.
U. S. Electrical Tool Co., Cincinnati, Ohio.

GRINDING MACHINES, INTERNAL
Garlock Machinery Ltd., Toronto, Ont
Greenfield Tap & Die Corp., Galt, Ont.
Cleveland Pneumatic Tool Co., Toronto Ont.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES PORTABLE
Strand & Co., N. A., Chicago, Ill.

GRINDING MACHINES, SNAGGING
Blount Co., J. G., Everett, Mass.
Norton Co., of Can. Ltd., Hamilton, Ont
U. S. Electrical Tool Co., Cincinnati, Ohio.

GRINDING MACHINES, SURFACE
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, THREAD
Pratt & Whitney Co., of Canada, Ltd., Sound, Ont.

GRINDING MACHINERY, TOOL POST
Gisholt Machine Co., Madison, Wis.
Grenfield Tap & Die Corp., Galt, Ont.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES, UNIVERSAL
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Herbert, Limited, Alfred, Toronto, Ont.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co., of Canada, Ltd., Hamilton, Ontario.

GRINDING WHEELS
Lion Grinding Wheels, Limited, Montreal, Que.
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Norton Co. of Can., Ltd., Hamilton, Ont.

GUN-BARREL MACHINERY
Steinle Turret Machine Co., Madison, Wisconsin.

HACK SAWS, POWER
Atkins & Co., Inc., E.C., Indianapolis, Indiana.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.

HAMMERS, CHIPPING
Cleveland Pneumatic Tool Co., Toronto, Ont.
High Speed Hammer Co., Rochester,

HAMMERS, DROP
Bertram & Son Co., Ltd., The John Dundas, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

HAMMERS, ELECTRIC
Brown, Boggs & Co., Ltd., Hamilton, Ont

HAMMERS, PNEUMATIC
Can. Steel Foundries, Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto Ont.

HANGERS, SHAFTING
Canadian SKF Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Hamilton Gear & Machine Co., Toronto.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

HOBBING MACHINES
Shore Instrument Co., Jamaica, N.Y.

HARDENING, CASE-HARDENING AND TEMPERING
Barnes Company, Wallace, Hamilton.
Gisholt Machine Co., Madison, Wis.
Cleveland Pneumatic Tool Co., Toronto Ont.

HAMMERS, POWER
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

HOBS
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

HOISTS, ELECTRIC
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.

HOISTS, HAND
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

HOISTS, PNEUMATIC
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont

HOLDERS-ON, PNEUMATIC
Cleveland Pneumatic Tool Co., Toronto Ont.

HYDRAULIC MACHINERY
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Kennedy & Sons, Ltd., Wm., Owen

IGNITERS, GAS ENGINE
Canada Foundries & Forgings Co., Welland, Ont.
Burke Machine Tool Co., Conneaut, O.

INDICATORS, SPEED AND TEST
Brown & Sharpe Mfg. Co., Providence, R.I.

INSULATION
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.

IRON BARS
Steel Co. of Canada, Ltd., Hamilton, Ont.

JACKS, HYDRAULIC
Norton, A. O., Boston, Mass.

JACKS, PLANER
Armstrong Bros. Tool Co., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

JAPANNING AND VARNISHING OVENS
Brantford Oven & Rack Co., Brantford, Ont.

JIGS AND FIXTURES (SEE TOOL WORK)
Fisher Motor Co., Ltd., Orillia, Ont.
Gisholt Machine Co., Madison, Wis.

KEYSEATING MACHINES
Morton Mfg. Co., Muskegon, Mich
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

KEYS, MACHINE
Can. Drawn Steel Co., Hamilton, Ont.
Morton Mfg. Co., Muskegon, Mich.

KNIVES, MACHINE
Atkins & Co., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

KNURL HOLDERS
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

LATHE ATTACHMENTS
Hendey Machine Co., Torrington, Conn.

LATHE TOOLS
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

LATHES, AUTOMATIC AND SEMI-AUTOMATIC
Gisholt Machine Co., Madison, Wis.
Herbert, Limited, Alfred, Toronto, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, BENCH
Hardinge Bros., Inc., Chicago, Ill.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

LATHES, BORING
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, CHUCKING (SEE LATHES, HORIZONTAL TURRET, AND LATHES, VERTICAL TURRET)
Acme Machine Tool Co., Cincinnati, O.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
Herbert, Limited, Alfred, Toronto, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, ENGINE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hendey Machine Co., Torrington, Conn.
Herbert, Limited, Alfred, Toronto, Ont.

LATHES, EXTENSION AND GAP
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison Wis.
Herbert, Limited, Alfred, Toronto Ont.
National Acme Co., Cleveland, O.
Steinle Turret Machine Co., Madison, Wis.

LATHES, PRECISION
Hardinge Bros., Chicago.

LATHES, RELIEVING
Hendey Machine Co., Torrington, Conn.

BUYERS' DIRECTORY

LATHE, UNIVERSAL HAND
Brown & Sharpe Mfg. Co., Providence, Rhode Island.

LATHE, SPEED AND HAND
Blount Co., J. G., Everett, Mass.

LATHES, SPINNING
Pryibil Machine Co., Torrington, Conn.

LATHES, VERTICAL TURRET
Bertram & Son, Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

LATHES, WOOD TURNING
Blount, Co., J. G., Everett, Mass.
Can. Fairbanks-Morse Co., Ltd., Montreal.

LEAD PIPE
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

LEATHER FILLET
D. K. McLaren, Limited, Montreal.

LINOLEUM MILL MACHINERY
Bertrams, Ltd., Edinburgh, Scotland.

LIQUID AIR PLANTS
L'Air Liquide Society, Toronto, Ont.

LOCKERS, CLOTHES
Dennis Wire and Iron Works, London, Ont.

LUBRICANTS
Oakley Chemical Co., New York, N.Y.

LUBRICATING SYSTEMS
Bowser, S. F., & Co., Ltd., Toronto, Canada.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Ltd., Welland, Ont.
Ker & Goodwin Machine Co., Brantford, Ont
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R. Toronto Ont.

MANGANESE STEEL
Can. Steel Foundries, Montreal, Que.

MANDRELS, EXPANDING
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MANDRELS, SOLID
Greenfield Tap & Die Corp., Galt, Ont.
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Pratt & Whitney Co., of Canada. Ltd., Dundas, Ont.

MEASURING MACHINES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MECHANICS' FINE TOOLS
Lufkin Rule Co., Windsor, Ont.

METALS, ALLOY
Canada Metal Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.

METAL WORKERS
Parker Co., Charles, Meriden, Conn.

MICROMETER CALIPERS
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Rice Lewis & Son, Ltd., Toronto, Ont.

MILLING ATTACHMENTS
Burke Machine Tool Co., Conneaut, O.
Hendey Machine Co., Torrington, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.

MILLING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Burke Machine Tool Co., Conneaut, O

MILLING MACHINES, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence, R. I.
Hardinge Bros., Inc., Chicago, Ill.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

MILLING MACHINES, BENCH
Burke Machine Tool Co., Conneaut, O.
Hardinge Bros., Inc., Chicago, Ill.

MILLING MACHINES, HAND
Brown & Sharpe Mfg. Co., Providence
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MILLING MACHINES, HORIZONTAL PLANER TYPE.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Kearney & Trecker Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto.

MILLING MACHINES, PLAIN
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, O.
Hendey Machine Co., Torrington, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.

MILLING MACHINES, THREAD
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MILLING MACHINES, UNIVERSAL
Brown & Sharpe Mfg. Co., Providence,
Hendey Machine Co., Torrington, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.

MILLING MACHINES, VERTICAL
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, O.
Herbert, Limited, Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto.

MILLING TOOLS, ADJUSTABLE HOLLOW
Geometric Tool Co., New Haven, Conn.

MOTORS, ELECTRIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Roelofson Elevator Co., Galt, Ont.
Williams Machinery Co., A R., Toronto,
Wisconsin Electric Co., Racine Wis.

NAILS AND STAPLES
Canada Metal Co., Ltd., Toronto, Ont.

NIPPLES
Canada Metal Co., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton.

NITROGEN
Carter Welding Co. Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

NUT TAPPERS
(See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
National Acme Co., Cleveland, Ohio.

NUTS, FINISHED and SEMI-FINISHED
Galt Macine Screw Co., Galt, Ont.
National Acme Co., Montreal, ue.

NUTS (Ub to 4-in.)
Steel Co. of Canada, Ltd., Hamilton.

NUTS, S.A.E., PLAIN AND CASTELLATED
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

OIL FILTERING AND STORAGE SYSTEMS
Bowser, S. F., & Co., Ltd., Toronto,

OIL STORAGE ENGINEERS
Bowser, S. F., & Co., Ltd., Toronto,

OIL HOLE COVERS
Can. Whitney Co., Ltd., Windsor, Ont.

OILS, SOLUABLE
Brantford Oven & Rack Co., Brantford, Ontario.

ORNAMENTAL IRON AND WIRE WORKS
Roelofson Elevator Works, Galt, Ont.

OXYGEN
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

OXY-ACETYLENE APPARATUS
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Atlas Press Co., Kalamazoo, Mich.

PAINT SPRAYERS
Spray Engineering Co., Boston, Mass.

PAPER MILL CONVEYORS
Bertram Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd., Montreal, Que.

PAPER MILL MACHINERY
Dominion Engineering Works, Limited, Montreal, Que.

PATTERNS, WOOD AND METAL
Fittings, Limited, Oshawa, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.
Victoria Foundry Co., Ltd., Ottawa.

PHOSPHOR TIN
Canada Metal Co., Ltd., Toronto, Ont.

PHOTOGRAPHIC DUPLICATING MACHINES
Photostat Corp., Providence, R. I.

PIPE BENDING MACHINES
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Underwood Corp., H. R., Philadelphia, Pa.
Williams Machinery Co., A. R., Toronto

PIPE CUTTING AND THREADING MACHINES
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Petrie, Ltd., H. W., Toronto, Ont.

PIPE
Canada Metal Co., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.

PIPE FITTINGS
Canada Metal Co., Toronto, Ont.
International Malleable Iron Co., Guelph Ont.

PIPE AND NIPPLE THREADING MACHINES
Landis Machine Co., Inc., Waynesboro, Pa.

PIPE FITTERS' TOOLS
Rice Lewis & Son, Ltd., Toronto. Ont.

PIPE THREADING DIE HEADS
Landis Machine Co., Inc., Waynesboro, Pa.

PISTON-RING MACHINES
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

PLANING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Williams Machinery Co., A. R., Toronto.

PLANING MACHINES, ROTARY
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Herbert, Limited, Alfred, Toronto, Ont.

PLATE ROLLS
Bertram & Son Co., Ltd., The John, Dundas, Ont.

PNEUMATIC TOOLS
Cleveland Pneumatic Tool Co., Toronto.

POLISHING AND BUFFING MACHINES
Lion Grinding Wheels, Limited, Montreal, Que.
Blount Co., J. G. Everett, Mass.
Brown & Sharpe Mfg. Co., Providence.
Pryibil Machine Co., New York, N.Y.

PRESSED STEEL PARTS
American Pulley Co., Philadelphia, Pa.
Fisher Motor Co., Ltd., Orillia, Ont.

PRESSES, ARBOR
Atlas Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

PRESSES, DROP AND FORGING
Brown, Boggs & Co., Ltd., Hamilton.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

PRESSES, FOOT AND HAND
Brown, Boggs & Co., Ltd., Hamilton

PRESSES, HYDRAULIC
Bertram & Son Co., Ltd., The John Dunidas, Ont.
Cleveland Twist Drill Co., Cleveland, O
Perrin Ltd., W. R., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

PRESSES, POWER
Bliss Co., E. W., Prooklyn, N. Y.
Brown, Boggs, & Co., Ltd., Hamilton
Hepburn Ltd., John T., Toronto, Ont.
Stoll Co., Inc., D. H., Buffalo, N.Y

PRESSES, SCREW
Brown, Boggs & Co., Ltd., Hamilton

PROFILING MACHINES
Prtt & Whitney Co. of Canada, Ltd., Dundas, Ont.

PROTRACTORS
Brown & Sharpe Mfg. Co., Providence
Lufkin Rule Co., Windsor, Ont.

PROPELLERS
Kennedy & Sons, Wm., Owen Sound Ontario.

PULLEYS, CORK INSERT
American Pulley Co., Philadelphia, Pa.

PULLEYS, METAL AND FIBRE
American Pulley Co., Philadelphia, Pa.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.
D. K. McLaren Co., Limited Montreal, Que.

PULP AND PAPER MILL EQUIPMENT
Dominion Engineering Works, Ltd., Montreal, Que.

PUMPS, HYDRAULIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Dominion Engineering Works, Ltd. Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont

PUMPS, LUBRICANT AND OIL
Bowser, S. F., & Co., Ltd., Toronto.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Hepburn Ltd., John T., Toronto, Ont.

PUMPS, POWER
Bowser, S. F., & Co., Ltd., Toronto.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hepburn Ltd., John T., Toronto, Ont.

PUNCHES, CENTER
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

PUNCHES, HAND
Brown Boggs & Co., Ltd., Hamilton.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Jardine & Co., A. B., Hespeler, Ont.

PUNCHES, POWER
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

PUNCHING MACHINES, HORIZONTAL
Bertrams Ltd., Edinburgh, Scotland.

PYROMETERS, ELECTRIC
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Hiram Walker & Sons Metal Products Co., Walkerville, Ont.

RACKS, CUT
Hamilton Gear & Machine Co., Toronto.

RACKS, STORAGE
(See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ontario.

REAMER HOLDERS
Simonds Canada Saw Co., Montreal, Q.

REAMERS, ELECTRIC
U. S. Electrical Tool Co., Cincinnati, Ohio.

REAMERS, EXPANDING
Cleveland Twist Drill Co., Cleveland, O.
Davis Boring Tool Co., St. Louis, Mo.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

REAMERS, SOLID
Butterfield & Co., Inc., Rock Island, Q.
Morse Twist Drill & Machine Co., New Bedford, Mass.

REAMERS, TAPER
Brown & Sharpe Mfg. Co., Providence, R. I.
Butterfield & Co., Inc., Rock Island, Q.
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canad, Ltd., Dundas, Ont.

RECORDERS, TEMPERATURE
Taylor Instrument Co., Rochester, N. Y.

RECORDERS, TIME
Gisholt Machine Co., Rochester, N. Y.
Taylor Instrument Co., Toronto, Ont.

REGULATORS, TEMPERATURE
Taylor Instrument Co., Toronto, Ont.

RIVETS AND BURRS
Parmenter & Bulloch Co., Gananoque, Ont.
Steel Co., of Canada, Ltd., Hamilton,

RIVET-MAKING MACHINERY
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

BUYERS' DIRECTORY

RIVETING MACHINES
Can. Fairbanks-Morse Ltd., Montreal Q.
High Speed Hammer Co., Rochester, N.Y.
Parmenter & Bulloch Co., Gananoque Ont.

RUDDER FRAMES, STEEL
Can. Steel Foundries, Montreal, Que.

RUBBER MILL MACHINERY
Bertram Ltd., Edinburgh, Scotland.

RULES, STEEL AND WOOD
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Windsor, Ont.

RUST PREVENTATIVES
Oakley Chemical Co., New York, N. Y.

SAND EQUIPMENT
Can. Link-Belt Co., Toronto, Ont.

SAND RAMMERS, PNEUMATIC
Cleveland Pneumatic Tool Co., Toronto.

SAW FRAMES AND BLADES, HACK
Atkins & Co., Inc., E. C., Indianapolis,
Diamond Saw & Stamping Works, Buffalo, N. Y.
Rice Lewis & Sons, Ltd., Tornto, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWING MACHINES, POWER HACK
Atkins & Co., Inc., E. C., Indianapolis,
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

SAW SHARPENING MACHINES
Atkins & Co., Inc., E. C., Indianapolis,
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

SAWS, CIRCULAR METAL
Atkins & Co., Inc., E. C., Indianapolis.
Prybil Machine Co., New York, N. Y.
Gisholt Machine Co., Madison, Wis.

SAWS, HAND
Atkins & Co., Inc., E. C., Indianapolis
Simonds Canada Saw Co., Montreal, Q.

SAWS, HOT AND COLD
Atkins & Co., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Q.

SAWS, HIGH SPEED STEEL
Atkins & Co., Inc., E.C., Indianapolis, I.
Butterfield & Co. Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWS, METAL BAND
Atkins & Co., E. C., Indianapolis, I.

SAWS, METAL CUTTING
Brown & Sharpe Mfg. Co., Providence,
Butterfield & Co., Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.
Starrett Co., L. S., Athol, Mass.

SAWS, SCREW SLOTTING
Atkins & Co., Inc., E., C., Indianapolis.
Butterfield & Co., Inc., Rock Island, Q.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canda, Ltd., Dundas, Ont.

SAWS, SCREW SLOTTING
Atkins & Co., Inc., E. C., Indianapolis.
Butterfield & Co., Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWS, WOOD
E. C. Atkins & Co., Indianapolis, Ind.

SCALES
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Lufkin Rule Co., Windsor, Ont.

SCREENS
Dominion Engineering Works, Ltd., Montreal, Que.

SCREW DRIVERS, OPTICAL, JEWELRY AND NOVELTY
Strand & Co., N. A., Chicago, Ill.

SCREW MACHINE WORK
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Montreal, Que.

SCREW MACHINERY, WOOD AND LAG
Cook Co., Asa S., Hartford, Conn.

SCREW MACHINES
Brown & Sharpe Mfg. Co., Providence, Rhode Island.

SCREW MACHINES, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.

SCREW MACHINE PRODUCTS
National Acme Co., Montreal, Que.

SCREW PLATES
Butterfield & Co., Inc., Rock Island. Que.
Jardine & Co., A. B., Hespeler, Ont.

SCREWS, CAP AND SET
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

SCREWS, SAFETY, SET
Galt Machine Screw Co., Galt, Ont.

SECOND-HAND MACHINERY
See last page of directory.

SEPARATORS, MOISTURE AND OIL
Bowser, S. F., & Co., Ltd., Toronto, Canada.

SEPARATORS, OIL AND WASTE
Bowser, S. F., & Co., Ltd., Toronto.

SHAFTS, FLEXIBLE
Strand & Co., N. A., Chicago, Ill.

SHAFTING
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
Williams Machinery Co., A. R., Toronto.

SHAPES, COLD-DRAWN SPECIAL STEEL
Union Drawn Steel Co., Hamilton, Ont.

SHAPING MACHINES
Hendey Machine Co., Torrington, Conn.
Morton Mfg. Co., Muskegon, Mich.
Williams Machinery Co., A. R. Toronto.

SHEARS HAND
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

SHEARS, POWER
Bliss Co., E. W., Brooklyn, N. Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Stoll Co., Inc., D. H., Buffalo, N. Y.
Williams Machinery Co., A. R., Toronto, Ont.

SHEARING MACHINES, ANGLE, IRON BAR AND GATE
Bertrams Ltd., Edinburgh, Scotland.

SHEET LEAD
Canada Metal Co., Ltd., Toronto, Ont.

SHEET METAL WORKING MACHINERY
Bliss Co., E. W., Brooklyn, N. Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Stoll Co., Inc., D. H, Buffalo, N. Y.

SHEETS, NICKEL, MONEL AND FIBRE
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.

SHEETS, O.P.C.R. & B. A. AND BLUE ANNEALED
Steel Co., of Canada, Ltd., Hamilton, Ont.

SIDE FRAMES, LOCOMOTIVE
Can. Steel Foundries, Montreal, Que.

SLOTTING ATTACHMENTS
Brown & Sharpe Mfg. Co., Providence, R.I.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

SLOTTING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.

SOLDERS
Canada Metal Co., Ltd., Toronto, Ont.

SPECIAL MACHINERY AND TOOLS
Brown Engineering Corp., Ltd., Toronto.
Gisholt Machine Co., Madison, Wis.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.
National Acme Co., Cleveland, O.

SPIKES, RAILWAY AND PRESSED
Steel Co. of Canada, Ltd., Hamilton, Ont.

SPINNING LATHES
Prybil Machine Co., P., New York City.

SPRING, MILLED
Barnes & Co., Wallace, Hamilton, Ont.

SPRINGS, SMALL SPIRAL HELICAL, COMPRESSION, EXTENSION, TORSION AND SPECIAL
Barnes Company, Wallace, Hamilton.

SPRINGS
Barnes Company, Wallace, Hamilton.
Cleveland Wire Spring Co., Clevleand, O.
Steele Ltd., James, Guelph, Ont.

SPRINGS, FLAT STEEL, BRUSH HOLDER, CLOCK, SMALL FLAT SPRINGS
Barnes Company, Wallace, Hamilton.

SPROCKETS AND CHAINS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Renold Hanson of Canada, Ltd., Montreal, Que.

SQUARES
Brown & Sharpe Mfg. Co., Providence, R.I.
Lufkin Rule Co., Windsor, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

STAMPING, METAL
American Pulley Co., Philadelphia, Pa.
Barnes Company, Wallace, Hamilton.
Diamond Saw & Stamping Works, Buffalo, N. Y.
Parmenter & Bulloch Co., Gananoque, Ont.

STAMPS, STEEL
Diamond Saw & Stamping Works, Buffalo, N. Y.

STEEL CONCRETE REINFORCEMENT
Steel Co. of Canada, Ltd., Hamilton.

STEEL PLATE
British Empire Steel Co., Montreal, Que.

STEEL AND IRON BARS
Steel Co. of Canada, Ltd., Hamilton.

STEELS TOOL
British Empire Steel Co. Montreal Q.

STEEL, COLD-ROLLED STRIP
British Empire Steel Co., Montreal, Q.
Barnes Company, Wallace, Hamilton.

STEEL, CRUCIBLE, SPRING
Barnes, Company, Wallace, Hamilton.
British Empire Steel Co., Montreal, Q.

SHEETS, OPEN HEARTH STEEL
Steel Co., of Canada, Ltd., Hamilton.

STEEL, SHAFTING AND FREE CUTTING SCREW
Union Drawn Steel Co., Hamilton, Ont.

STEEL, SHEET
British Empire Steel Co., Montreal, Q.
Rice Lewis & Son, Ltd., Toronto, Ont.

STEEL, STAINLESS
Steel Co., of Can. Ltd., Hamilton, Ont.

STEEL STAIRS
Roelofson Elevator Works, Galt, Ont.

STEELS, ALLOY AND CARBON
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Atkins & Co., Ltd., Wm., Sheffield, Eng
Can. Steel Foundries, Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton, Ont.

STEELS, HIGH-SPEED
Armstrong Bros. Tool Co., Chicago, Ill.
Atkins & Co., Ltd., Wm., Sheffield, England.
British Empire Steel Co., Montreal, Q.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton

STEEL TUBING, CLOSE JOINT AND WELDED
Standard Tube & Fence Co., Ltd., Woodstock, Ont.

STERN FRAMES, CAST STEEL
Can. Steel Foundries, Montreal, Que

STRAIGHTENING MACHINERY
Bertram Ltd., Edinburgh, Scotland.
Williams & Co., Ltd., J. H., Brooklyn, N.Y.

STUDS
Geometric Tool Co., New Haven, Conn.
Galt Machine Screw Co., Galt, Ont

SWAGING MACHINES
Atkins & Co., Inc., E. C., Indianapolis, Indiana.

SWITCHES, RAILWAY
Can. Steel Foundries, Montreal, Que.

TACHOMETERS
Bristol Co., Waterbury, Conn.

TANKS AND PUMPS, OIL
Bowser, S. F., & Co., Ltd., Toronto.

TAP HOLDERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
William L. Procunier, Chicago, Ill.

TAPER PINS
Galt Machine Screw Co., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

TAPES, MEASURING
Starrett Co., L. S., Athol, Mass.
Lufkin, Rule Co., Windsor, Ont.

TAPPING MACHINES AND ATTACHMENTS
Burke Machine Tool Co., Conneaut, O.
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.
Wm. L. Procunier, Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

TAPS AND DIES
Butterfield & Co., Inc., Rock Island, Q.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Herbert, Limited, Alfred, Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

TAPS, COLLAPSING
Geometric Tool Co., New Haven, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.

TEETH, DREDGE BUCKET
Kennedy & Sons, W., Owen Sound, Ont.

THERMOMETERS
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Greenfield Tap and Die Corp., Galt, Ontario.

THREAD-CUTTING TOOLS
Butterfield & Co., Inc., Rock Island, Q.
Greenfield Tap and Die Corp., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

THREAD CUTTING MACHINES
Landis Machine Co., Inc., Waynesboro, Pa.

THREADING MACHINES
Acme Machinery Co., Cleveland, Ohio.
Geometric Tool Co., New Haven, Conn.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Williams Tool Corp., of Can. Ltd., Brantford, Ont.

THREAD LEAD TESTING MACHINES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

THREAD-ROLLING MACHINES
Bliss Co., E. W., Brooklyn, N. Y.

TIE PLATES
Steel Co. of Canada, Ltd., Hamilton.

TIME RECORDERS
International Business Machine Co., Ltd., Toronto, Ont.

TONGS
Hepburn Ltd., John T., Toronto, Ont.

TOOL CASES
Rice Lewis & Son, Ltd., Toronto, Ont.

TOOL HOLDERS
Armstrong Bros., Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis
Bertrams Ltd., Edinburgh, Scotland.

TOOL POSTS, LATHE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Williams & Co., Ltd., J. H., Brooklyn, N.Y.

TOOLS, SMALL
(See Machinists' Small Tools)
Armstrong Bros. Tool Co., Chicago, Ill.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Lufkin Rule Co., Windsor, Ont.
National Machine Tool Co., Racine, Wis.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A.R., Toronto.

TOOL WORK
Brown Engineering Corp., Ltd., Toronto, Ontario.

TORCHES, BLOW
Rice Lewis & Son, Ltd., Toronto, Ont.

TRACKWORK, RAILWAY
Can. Steel Foundries, Montreal, Que.

TRACKWORK, MANGANESE STEEL
Can. Steel Foundries, Montreal, Que.

TRANSMISSION MACHINERY
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound.
Renold, (Hans) of Canada, Ltd., Montreal, Que.

TROLLEYS AND TRAMWAYS
Can. Link-Belt Co., Toronto, Ont.
Northern Crane Works, Walkerville, Ont
Wright Mfg. Co., Lisbon, Ohio.

TROLLEY WHEELS
Langley & Austin, Galt, Ont.

TROWELS, PLASTERING
E. C. Atkins & Co., Indianapolis, Ind.

WRENCHES, MACHINISTS'
Armstrong Bros. Tool Co., Chicago, Ill

TRUCKS
Can. Fairbanks-Morse Ltd., Montreal, Q.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont

BUYERS' DIRECTORY

TUBING, SEAMLESS STEEL, BRASS AND COPPER AND FIBRE
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.

TURRET HEADS
Bertram & Son Co., Ltd., The John Dundas, Ont.

TURRET MACHINES
(See Lathes, Horizontal Turret)
Acme Machine Tool Co., Cincinnati, O.
Cook Co., Asa S., Hartford, Conn.
Gisholt Machine Co. Madison Wis.
Herbert, Limited, Alfred, Toronto, Ont.
National Acme Co. Cleveland O.
Pratt & Whitney Co. of Canada Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin

TURRETS, TOOL POST
Gisholt Machine Co. Madison, Wis.

UNIONS, PIPE
Fittings, Limited, Oshawa, Ont.

VALVES
Canada Metal Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

VISES, DRILLING MACHINE
Burke Machine Tool Co., Conneaut, Ohio.
Charles Parker Co., Meriden, Conn.
Cleveland Pneumatic Tool Co., Toronto, Ontario.
Kempsmith Mfg Co., Milwaukee, Wis.

VISES, PIPE
Charles Parker Co., Meriden, Conn.

VISES, PLANER AND SHAPER
Bertram & Son Co., Ltd., The John Dundas, Ont.
Philip Gies Foundry, Kitchener, Ont.
Hendley Machine Co., Torrington, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.

VISES, WOOD WORKERS'
Charles Parker Co., Meriden, Conn.
Parmenter & Bulloch Co., Gananoque, Ontario.

VOLTMETERS
Bristol Co., Waterbury, Conn.

WAGON LEADERS
Can. Link-Belt Co., Toronto, Ont.

WASHERS, LOCK, SPLIT AND SPRING
Barnes Company, Wallace, Hamilton.

WATER POWER PLANTS
Dominion Engineering Works, Limited, Montreal, Que.

WELDING APPARATUS, OXY-ACETYLENE
L'Air Liquide Society, Toronto, Ont.
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto, Ont.

WELDING APPARATUS
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.

WELDING, ELECTRIC, ARC, SPOT AND BUTT
International Malleable Iron Co., Guelph, Ont.

WELDING MACHINES, OXY-ACETYLENE
Carter Welding Co., Ltd., Toronto, Ont
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.

WELDING, ELECTRIC
McLaren Belting Co., J. C., Montreal. Que.
Steel Co. of Canada, Ltd., Hamilton.

WELDING ROD, TOBIN, MANGANESE BRONZE AND ALUMINUM
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto, Ont.

WELDING SUPPLIES
Carter Welding Co., Ltd., Toronto, Ont
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto. Ont.

WHEELS, INDUSTRIAL
American Pulley Co., Philadelphia, Pa
Hull Iron & Steel Foundries, Hull, Que.
Kennedy & Sons, Wm., Owen Sound, Ontario.

WINCHES, HEADGATE
Kennedy & Sons, Wm. Owen Sound, Ontario.

WINCHES, STOPLOG
Kennedy & Sons, Wm., Owen Sound. Ontario.

IPING PRODUCTS
Sanitary Wiping Products Co., Toronto, Ont.

WIRE
Barnes Company, Wallace, Hamilton.
Canada Metal Co., Ltd., Toronto, Ont.
Dennis Wire & Iron Works, London, Ontario.
Greening Wire Co., B., Hamilton, Ont.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

WIRE, BLACK TEMPERED, MUSIC PHOSPHOR BRONZE AND PREMIER
Barnes Company, Wallace, Hamilton

WIRE, COPPER AND BRASS, FINE AND HEAVY
Steel Co., of Canada, Ltd., Hamilton, Ontario.

WIRE STRAIGHTENING AND CUTTING MACHINERY
Brown, Boggs & Co, Ltd., Hamilton, Ontario.

WIRE, WELDING
L'Air Liquide Society, Toronto, Ont.
Carter Welding Co., Ltd., Toronto, Ont
Dominion Oxygen Co, Ltd., Toronto.

WIRES, SPECIAL
Dennis Wire & Iron Works, London, Ontario.
Greening Wire Co., B., Hamilton, Ont

WOODWORKING MACHINERY
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Williams Machinery Co., A. R., Toronto, Ontario.

WRENCHES, DROP FORGED
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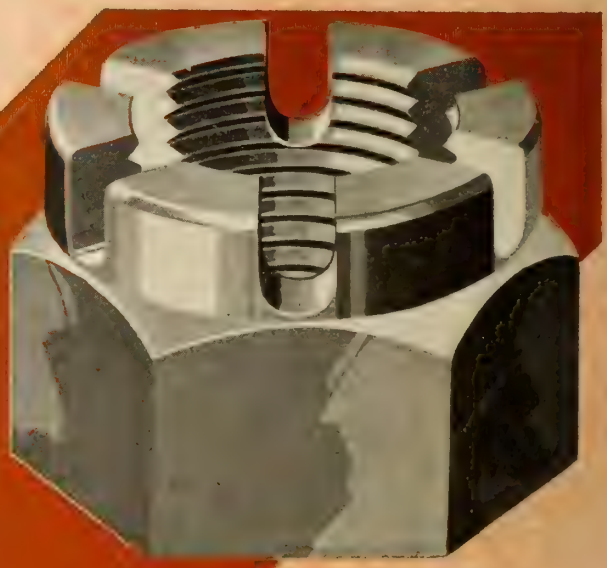

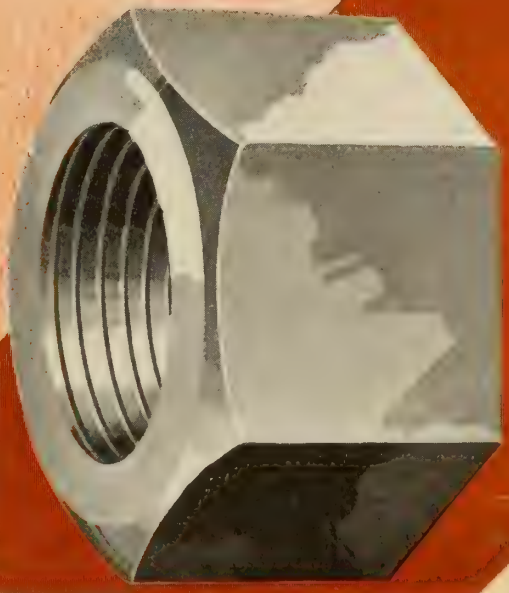

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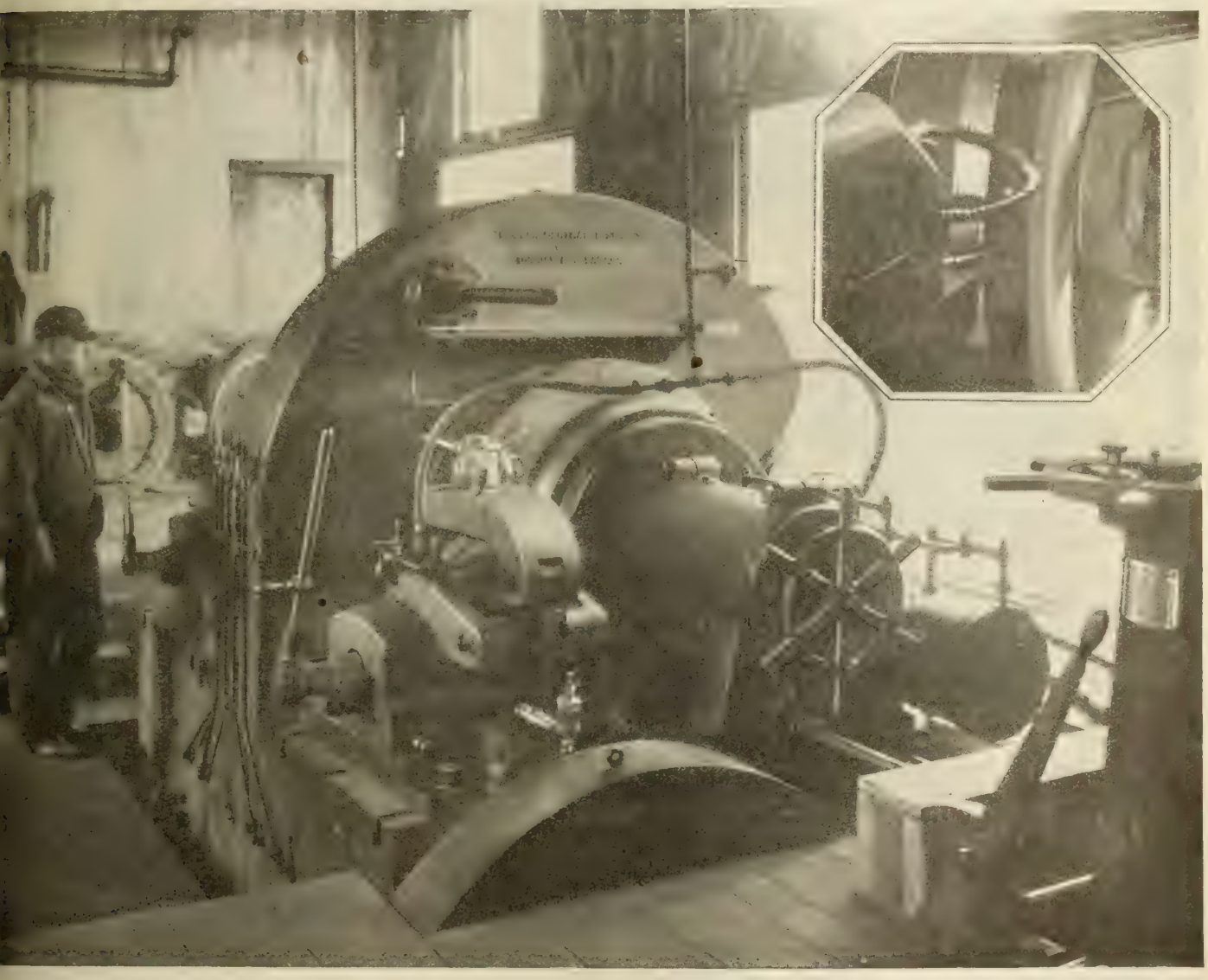

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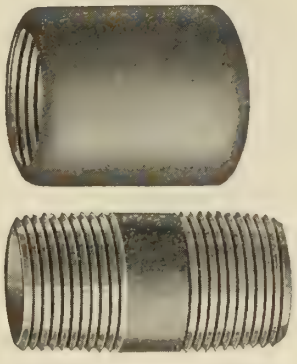

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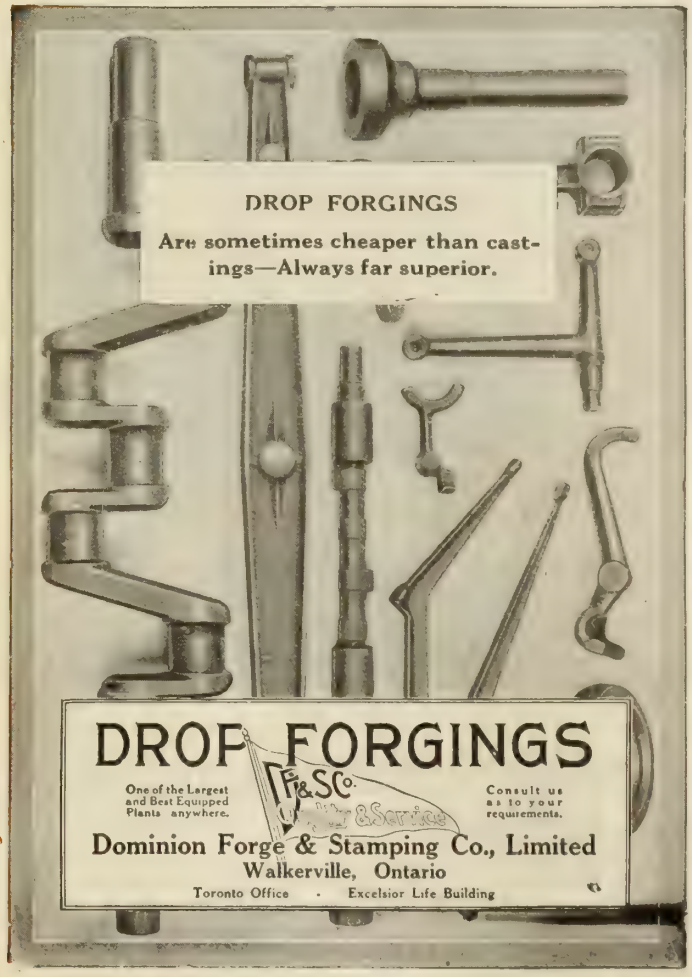
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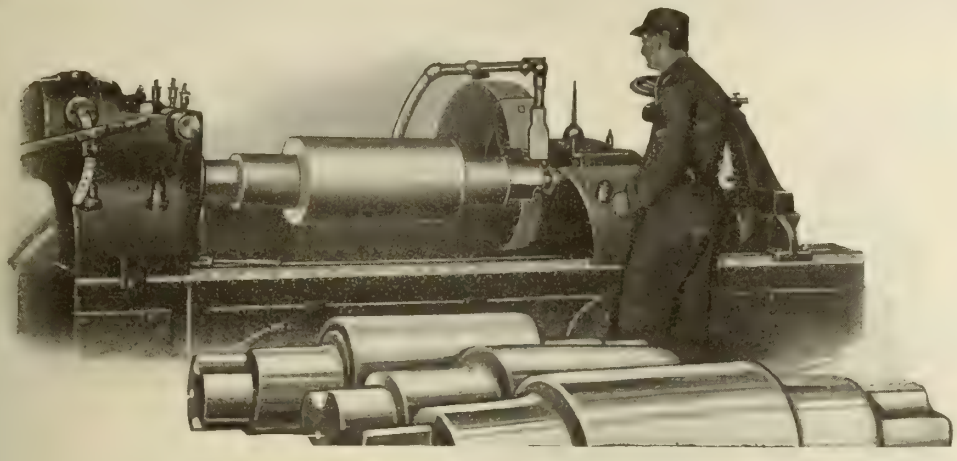

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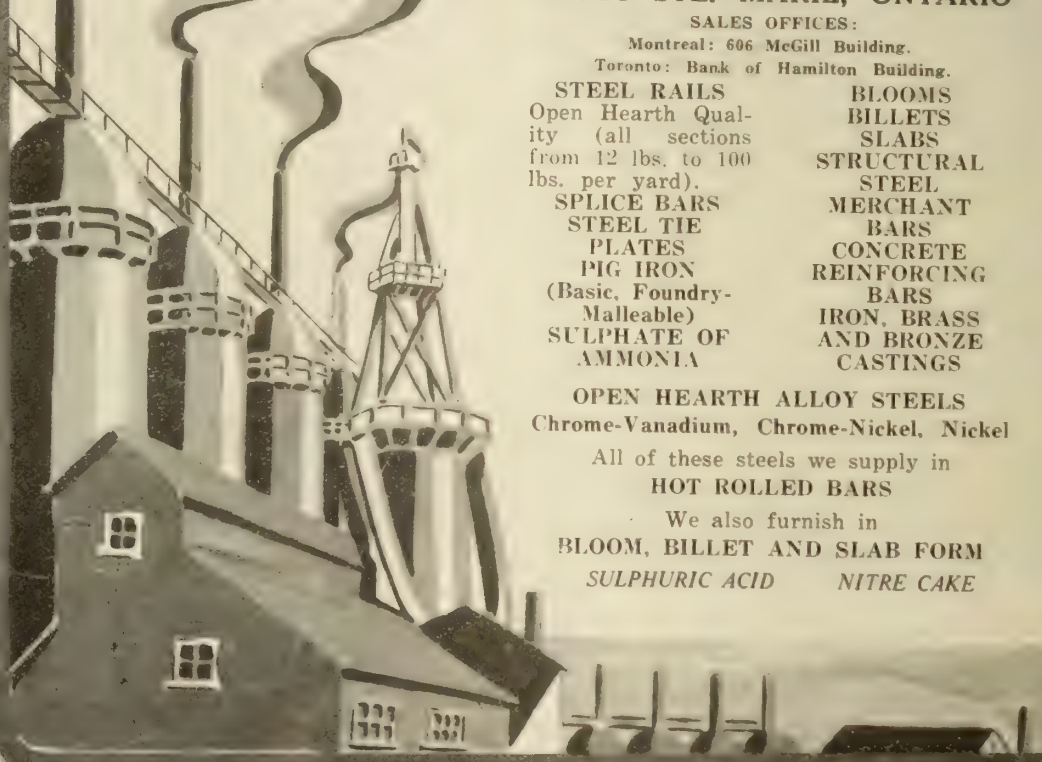

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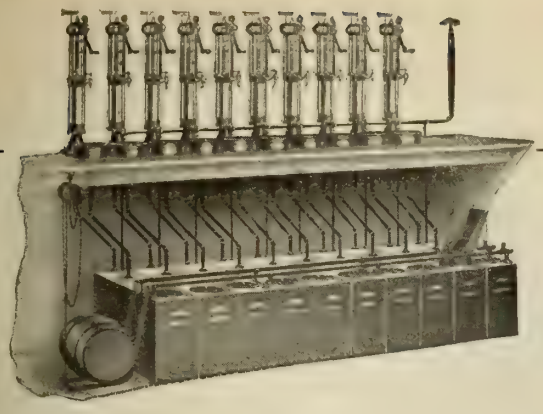

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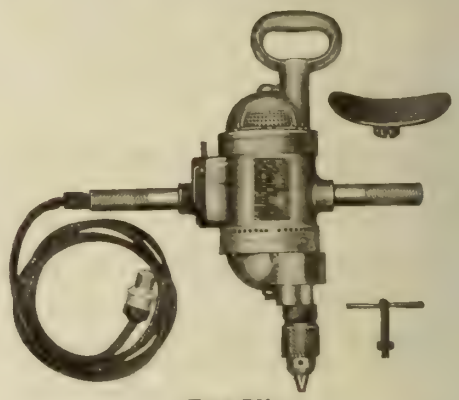

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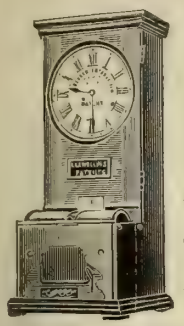

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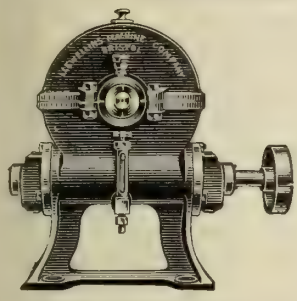

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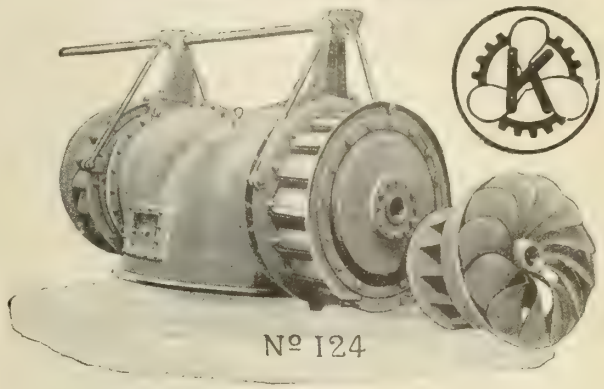

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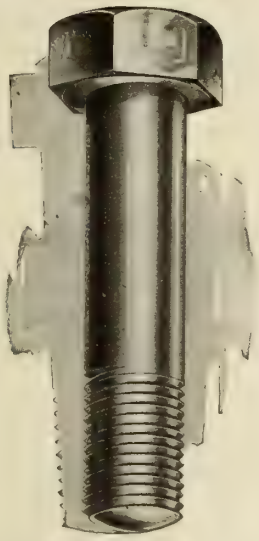

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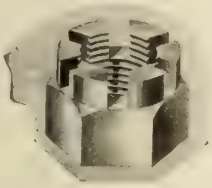

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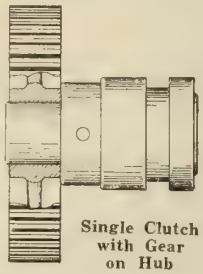

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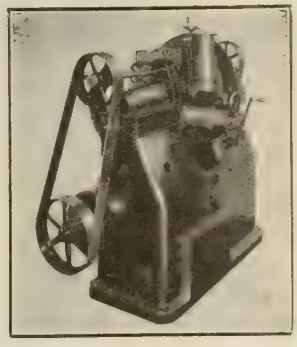

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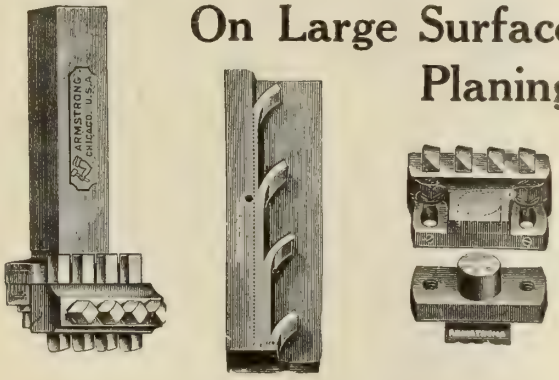

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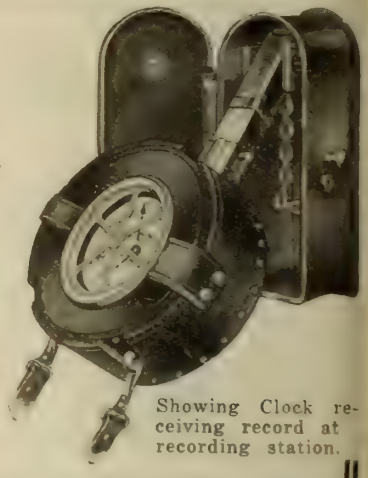

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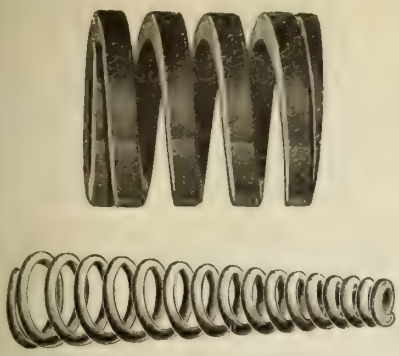

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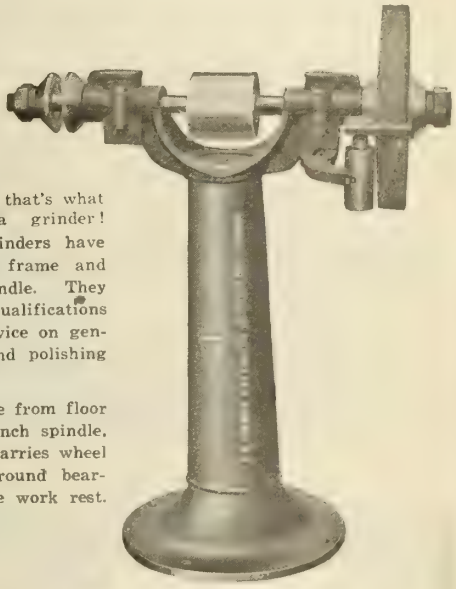

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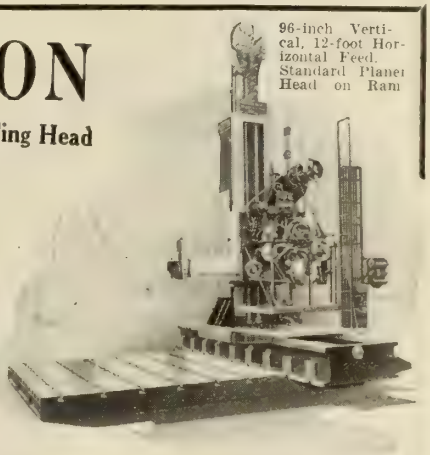

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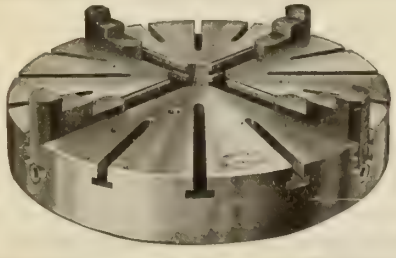

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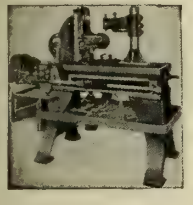

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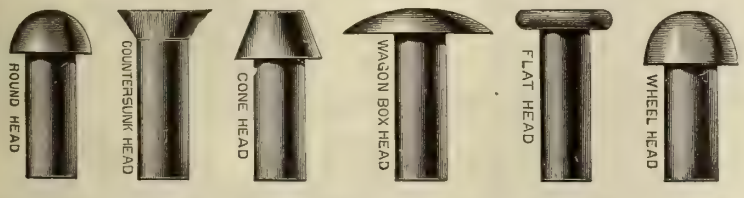

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VOL. NO. XXVIII, No. 19 NOVEMBER 9, 1922

Producing Accurate Gears By Multiple Shaping

Interchangeable Arbors Facilitate Output—Cycle of Operations Entirely Automatic—Micrometer Adjustment for Cutting Depth —Machine May Be Adapted to a Variety of Purposes

MULTIPLE shapers are built in two distinct types, up-stroke and down-stroke, each adapted to its own particular service. The advantages of this method of cutting gears arise from the fact that two work arbors are used, changes being made at the completion of each arbor full of gears.

When cutting gears by this method the blanks are first placed on an arbor as shown in Fig. 1. The ram is then elevated sufficiently to allow the tapered shank of the arbor to be inserted in the socket of the ram. The arbor is secured in position by means of a draw-bolt passing through the centre of the spindle. This draw-bolt is operated by means of a power-driven clutch controlled by the machine operator. The clutch is equipped with an automatic overload throw-out, which operates when the tension has reached a predetermined amount. When the arbor is secured the ram is lowered by power and automatically stopped when it has reached the working position. The machine is then started by the operator pressing an electric push button. The entire cycle of motions necessary for cutting the teeth is automatic. This gives the operator an opportunity to prepare another set of blanks on a second arbor, so that a minimum amount of time is required when recharging the machine. An electric brake is used for stopping the machine. The operator again temporarily elevates the ram to the charging position, reverses the draw-bolt lever which ejects the arbor, replaces the second arbor of blanks and proceeds as before. The entire time of cutting occupies from one to four minutes, depending on the face width of the blanks and depth of tooth being cut. The time required for stopping the machine, changing the arbors and starting again, is about one minute, thus making the total cycle of operations in a little over two minutes for an average.

The arrangement of the multiple shaping cutters and the method of operations is clearly shown in Fig. 3, where the sheet metal chip guard and top plate have been removed to disclose the interior mechanism. The tool head consists essentially of a flat steel disc, 30 in. in dia., provided with a hole at the centre and a number of radial grooves cut in the face in which the tool bits are arranged like the spokes of a wheel. The feeding movements are imparted to the tools by an annular sectional cam ring. As the gear blank is reciprocated past the cutting tools, the latter are gradually fed in to the full depth of the tooth. At the completion of each stroke of the ram, and before the next cut begins, the gear blank is indexed a space equal to the circular pitch, thereby presenting a different tooth space to each cutter from the one which made the preceding cut.

Uniformity of Tooth Shape

After the tools have been fed in to full depth, they are held stationary in that position while the cutting process continues until the gear has indexed one complete revolution thereby giving each tool an opportunity to take one last cut on each tooth. This final complete index insures a uniformity of spacing of the teeth in the gear equal to that of the indexing mechanism. This uniformity of the tooth form is secured even though the tools themselves may be far from uniform, for it is at once apparent that if any tool is longer or wider than any other tool, even though it be only a thousandth of an inch, that portion of it which is longer or wider will take one last cut on the corresponding portion of each tooth in the gear, thereby eliminating any variation which may have been caused by previous cuts. By this process of finishing all the teeth of a gear with a single finishing tool, this machine attains great accuracy and the speed is multiplied by the number of tools in operation on the gear blank at one time.

To facilitate production duplicate tool heads are provided for each machine, so that one is operating while the other is in the tool room having the tools resharpened and put in condition for relieving the working set. Special clamping devices provide for rapid and accurate changing of cutter heads.

The tool bits, a group of which are shown in Fig. 4, are rectangular in shape

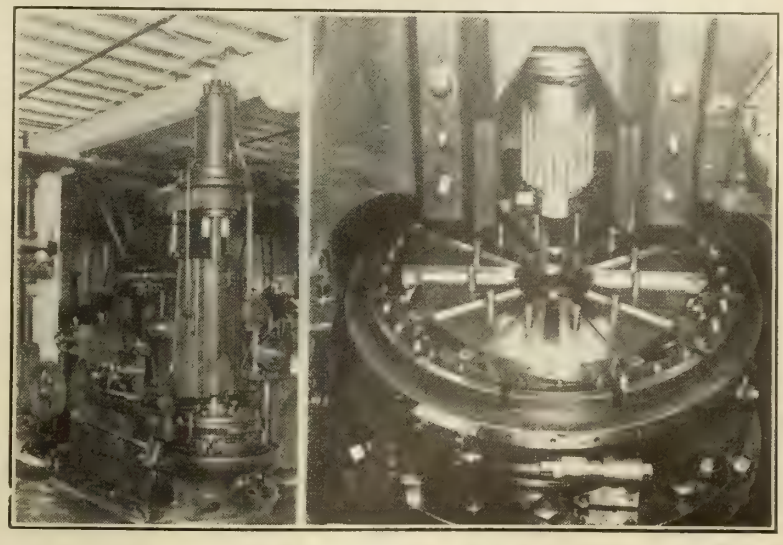


Fig. 2.—Left: general view of shaping machine. Fig. 3—Right: top plate removed, showing arrangement of cutters.

Illustrations and data through courtesy of Stevenson Gear Co., Indianapolis, Ind.

except the lower side which is in the form of a V. The gear tooth profile is formed at the inner end of this tool and is backed off to permit sharpening without changing the form. The outer end of this tool rests against a spiral cam surface and is ground in the form of an exact radius. A small pin near the back end fits in a groove which has an opposing spiral surface and retains the tool in close contact with the other cam surface to insure correct contact at all times as well as to withdraw the tools to the starting position as soon as the cut is finished.

Tools For Various Purposes

The tools shown at the right hand side of this illustration are for producing internal splines. Three of the tools shown represent types for cutting teeth and the two shown at the extreme right are types used for removing burrs raised by the other tools in certain classes of work. Two gang tools are shown, one for cutting saw teeth and another for cutting gear teeth. The use of gang tools is a great advantage in many cases particularly when cutting gears or other products having a large number of rather small teeth. Another type shown, which consists of an inserted bit set in a holder is somewhat more economical than the solid type of tool on account of the fact that the holders last indefinitely and the cost of replacing the small inserted bits as they become worn is comparatively small. The second and fourth tools from the left are roughing tools which are used in connection with the forming or finishing tools adjacent to them in the photograph. When used in the machine, the roughing and finishing tools are set alternately about the gear blank, the roughing tools slightly in advance of the finishing tools. As the gear is indexed and the tools are fed in gradually, the roughing tools cut grooves the width of the bottom of the tooth space and the finishing tools cut on the sides only, thereby eliminating the crowding and interference of the chips and consequently prolonging the life of the cutting edge of the finishing tools.

Cutting Head Cams

The individual cam lugs are mounted on a large ring which surrounds the tool bits and spacing plate and are held down by T bolts which fit in a circular T slot in the ring. The tool bits are adjusted individually along the T slot relative to the cam ring and each other. Rotary feeding movements are imparted to the cam ring through a gear train seen at the left side of the tool head in Fig. 2, and are produced by a feed mechanism located on the left side of the machine as seen in Fig. 2. The final depth to which the tools are fed is determined by an adjustable micrometer stop located on the front side of the tool head, which positively limits the rotary feeding movements of the cam ring. The feed mechanism being spring actuated, the position of the depth controlling stop can be varied within reasonable limits without re-setting of the feed mechanism. This is particularly desirable during the operation of the machine in cases where the tool bits may not have been set to exactly the right depth in the beginning or in cases where the keen wire edge wears off the tools and begins to cut gears that are uneven or oversize long before they are actually dull.

Accurate Adjustment

The micrometer stop which controls this adjustment, being located at the tool head in a very convenient position, can be re-set by the operator within less than one minute of time even while the machine is in operation. In order to provide relief to prevent the tools from dragging during the back stroke of the ram, a reverse feeding movement is imparted to the cam ring, and before the beginning of the cutting stroke, the forward feeding movement of the cam is made great enough to compensate for the slight retraction for the relief and also to provide the necessary additional feed for the depth of the next cut. The large cover plate on the top of the tool head is used to intermittently clamp and release the tool bits during the cutting operation. The tools are clamped during the cutting stroke and unclamped at the end of the cut so that they may be relieved and fed forward again and then reclamped ready for the next cut. This clamping movement is accomplished by means of an eccentric which is oscillated by a cam on the main crank shaft of the machine. This clamping movement by forcing the V shaped seat of the tool bit into the corresponding V shaped seat in the spacing plate in the tool head serves to centralize and accurately locate the cutting point of the tool and, in addition, to take up all clearance and looseness so as to eliminate vibration and chatter.

Feeding Mechanism

The feed mechanism shown in Fig. 5 and Fig. 2 consists of the cams and levers for producing the feeding and relief movements just described. The spiral cam seen near the centre of Fig. 5 is rotated slowly and intermittently by means of a ratchet through a worm and wheel connection. The rotary movements of this cam gradually force the fulcrum stud of the feed arm forward which, in turn, produces a longitudinal movement of a sort of rack slide which is connected by a gear train to the feed cam gear on the tool head. This feed rack is made in the form of a worm which engages a worm wheel so that adjustments may be made by rotating the worm, thus advancing or withdrawing the position of the tool bits without necessitating any change in the longitudinal position of the feed rack itself.

Return Stroke Relief

The relief movement of the tools is derived from a cam located on the crank shaft and a rocker arm seen at the left of Fig. 5 and is transmitted by a connecting rod to a stud at the upper end of the feed rocker arm. The relief cam rocker arm is provided with a T slotted extension which actuates the feed ratchet through a bevel gear segment and pinion. By adjusting the feed connecting rod stud along the T slot in the rocker arm, any desired fineness or coarseness of feeding movement may be obtained. A strong spring is attached to the relief rocker arm to hold the follower roller in contact with the relief cam on the crank shaft. A somewhat weaker spring is attached to the feed rack slide for holding the fulcrum stud roller of the feed rocker arm in contact with the spiral feed cam. By varying the shape of the feed cam, any sort of

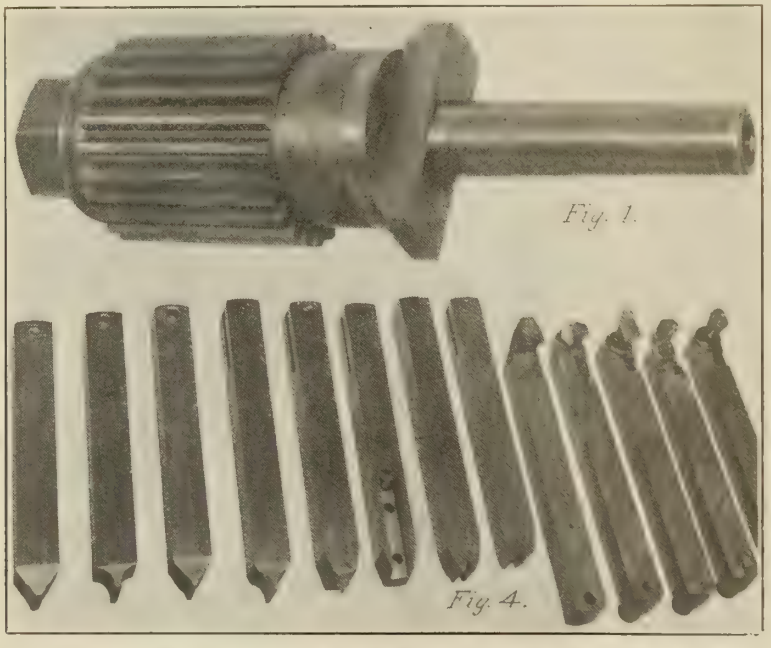


Fig. 1—Interchangeable arbor with six gears. Fig. 4—Group of cutters used for various purposes.

feeding movement can be secured. It can be seen from the illustration, that this cam has a long gradual slope for the feeding movement and a sharp descent for quickly returning the tools to their starting position at the completion of the cutting operation.

The cam also has a cylindrical dwell portion at the end of the spiral feed section and before the returning slope. The purpose of this dwell is to hold the tools in at the full depth position for a sufficient number of strokes to permit the gear blanks to be indexed one complete revolution in order to permit some one tool to take a last finishing cut on all of the teeth.

Indexing the Work

The indexing mechanism as shown in detail in Fig. 6 consists of two semi-cylindrical guides, one of which is attached to the ram spindle, the other being attached to a revolving drum on which is mounted a large spur gear driven through change gears by a pair of intermittent Geneva gears, encased in an oil-tight housing, and which, in turn, are driven from the crank shaft by means of a long connecting shaft seen in Fig. 5. The intermittent shaft driven gear and the compound gear shaft driven gear are used as change gears and by varying their ratio any desired number of divisions may be indexed. The compound gear shaft centre distance is adjustable with reference to the large index gear and also the intermittent shaft gear so that practically all back lash may be taken up. A differential washer is incorporated as a driving member between the intermittent shaft and its gear to provide an angular adjustment for cutting gears which have keyways, etc., which must have an exact location with respect to certain gear teeth.

Interchangeable Arbors

The work arbors used in this machine, as shown in Fig. 1, are interchangeable and are provided with a tapered shank and a thrust collar made in the form of a large face key. The tapered shank fits the tapered socket in the ram spindle and the thrust collar fits a corresponding keyway in the spindle and provides an accurate angular location for the arbor and also prevents the taper being thrust too tightly into the socket. The gear blanks are put on the arbor and fastened in place by a nut while the arbor is held in a vise-like fixture attached to a bench at the side of the machine.

The mechanism for driving the ram and producing the reciprocating motion for cutting purposes and the temporary elevating and lowering motion for changing work arbors consists of a crank that drives a reciprocating rack slide, which, in turn, transmits its reciprocating motion to the ram through two gears mounted on a rock shaft. This rack slide is made in the form of a worm and engages one of the gears on the rock shaft which is made in the form of a worm wheel. During the reciprocation, which produces the cutting motion, it operates in the same manner as a reciprocating rack.

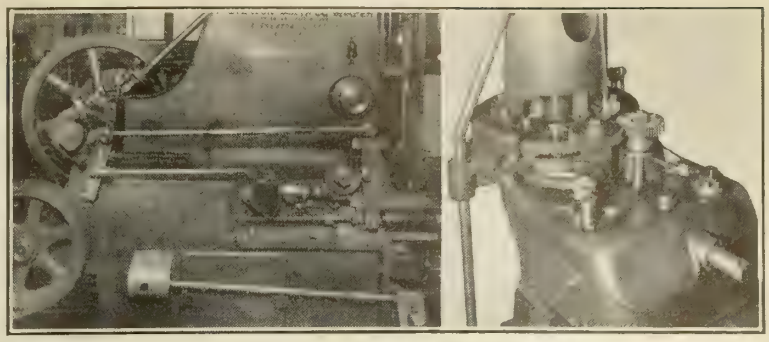


Fig. 5.—Left: view of feed mechanism. Fig. 6—Right: indexing mechanism located at top of machine.

Elevating the Ram

When it is desired to produce the temporary elevating of the ram for changing arbors, the rack slide is held stationary from reciprocating and is given a rotary movement the same as a worm, which rotates the worm wheel and rock shaft and in turn elevates or lowers the ram. This rotary movement is obtained through a gear train and is derived from a small motor which also furnishes power for actuating the drawbolt mentioned before. The amplitude of the elevating and lowering motion of the ram is controlled by adjustable stop collars placed on the shifting rod which engages and dis-engages the driving clutches. The crank head is slotted and the crank pin is made in the form of a T bolt and may be adjusted to provide any length of stroke from zero up to six and one-quarter inches.

Graduations are provided on the crank head for indicating the length of the cutting stroke. These graduations are made of the proper length to compensate for the extra length of stroke needed to provide the necessary over-travel before and after the cut begins for indexing, feeding, etc. Thus the operator merely measures the face width of the parts being cut and sets the stroke according to the corresponding graduations and knows that the proper over-travel is automatically provided.

Setting for Position

In order to set the ram and work in proper relative vertical position to the tools, a stationary pointer is attached to the machine frame and a corresponding mark is placed on the crank head in such an angular position with reference to the crank pin, so that when the mark on the crank head is set opposite the pointer, the ram may be adjusted downward until the lower side of the blanks is even with the cutting edge of the tools. The elevating control stops are then set to correspond to this position and require no further attention from the operator. This feature has been found to be a great convenience to the operator and to practically eliminate mistakes in this part of a set-up.

The following is a record of some of the work performed on these multiple shaping machines:—

Gear.—10 P, 24 T, ½in. face, 12 cutting tools, 50 strokes per min., 6 blanks on arbor, cutting time 2.4 min., cutting time per gear .4 min.

Sprocket.—3 in. dia., ⅝ in. p., 12 teeth, 12 cutters, 50 s.p.m., 16 blanks on arbor, total cutting time 3.7 min., time per piece, .23 min.

Shaft.—1½ in. dia., 6 splines, 50 s.p.m., time per shaft 1.35 min.

Reamer.—1 in. machine, 8 flutes, 50 s.p.m., time per reamer 1.04 min.

Cutter.—3 in. milling, 12 teeth, 50 s.p.m., 8 blanks on arbor, total time 2.9 min., time per cutter .36 min.

Saw.—Screw slotting 2¾ in. dia., 72 teeth, 36 cutting tools, 50 s.p.m., 120 on arbor, total time 1.3 min., time per saw .01 min.

EIGHT-HOUR DAY ADVANTAGES

REPORTING on "Work Periods in Continuous Industry," a committee of the Federated American Engineering Societies states that there are few continuous industries which do not have some twelve-hour plants; but of some forty or fifty continuous industries a number are operating almost entirely on three shifts, while the majority are partly on two shifts and partly on three shifts, with three-shift operation in the preponderance. The investigator of the steel industry was assured by blast furnace operators on more than one occasion that the cost of producing pig iron was less on the eight-hour than on the twelve-hour day. Outside the steel industry the total number of employees on eight-hour shift is now considerably larger than the total number of employees on twelve-hour shifts. Taking into consideration all continuous industries, between one-half and two-thirds of all workers on continuous operation are on shifts averaging twelve hours.

In a number of plants where the change has been made with success the management reports these results:

Better physical and mental condition of workmen.

Improvement in class of workmen.

Less shirking, tardiness, absenteeism

(Continued on Page 24)

Figuring Costs from Material to Product - No.1

Opening General Ledger Accounts—Material, Labor and Indirect Expense—Beginning at Foundry in Estimating for Machinery Plant—Accounting for Every Detail

By A. LUENBERG

KNOW WHAT IT COSTS

This is the first of a series of articles on cost-accounting as having practical application in machine tool production. Questions, discussions or suggestions upon the different phases of the subject are welcomed.

INTERNATIONAL reconstruction and the business depression in Canada for the last two years have forced many Canadian manufacturers to look for export trade, and enter upon international competition. A comparatively small number of manufacturers know the cost to manufacture and sell, and unless that fact is known, success on the world market may be considered very doubtful.

No business man, no matter how small the business may be, should be without some kind of cost system. At the present time where nearly every manufacturer has to figure on large competition it is absolutely necessary to know accurate factory cost. Accurate knowledge of factory cost is the foundation to success, where ignorance may be the direct cause of failure sooner or later.

The installation of a cost system makes it at once necessary to open general ledger accounts for what makes up factory cost—material, labor, and indirect expense. To get a start, an inventory must be taken of all materials on hand at a certain time. Materials may consist of raw materials, parts in process of making or parts finished and ready for shipment. A separate account should be opened for each class and named something like the following, for a company manufacturing machinery:

1. Raw Material & Supplies.
2. Foundry Raw Materials & Supplies.
3. Foundry—Work in Process.
4. Machine Shop—Work in Process.
5. Erecting—Work in Process.
6. Finished Parts.
7. Rough Casting Stores.
8. Payroll Account.
9. Indirect Expense.
10. Completed Machines

Every account must be debited and credited at proper times, say monthly periods, as raw materials are received or work is proceeding in plant. The following description will deal with how to find accurate factory costs of rough-castings. The system is in operation at one of the largest Canadian manufacturing concerns in the line of machinery, making their own castings.

How To Find Cost of Rough Castings

(See "Foundry Cost of Production" report.) In order to get the actual cost of rough castings, it is necessary to know the exact cost of foundry raw materials at the plant. In charging the cupola, all pig iron, scrap iron, steel, coke, limestone, etc, must be weighed and a record of same kept by person responsible for heat report. Nothing must be overlooked, no matter how trifling; everything must be charged at its proper value. The total weight of materials entering the cupola at their cost price at the plant represent the cost price of raw material per heat. Wages of cupola help, direct and indirect, as well as the department's fixed overhead charges, are then added to the cost of raw material. The result, divided by tonnage, gives what is called the price per pound at the spout.

The fixed overhead charge of a department is a proper share of general overhead expenses fixed for a certain department according to its size, its use of power, light and heat, its proper share of repair costs, maintenance and general administrative expenses, depreciation and in many cases, selling expenses.

The next step is to include core-room expenses into cost. All core oils, core sand, core compound, coke, etc, used in connection with core-making for a heat must be kept track of, and charged against the heat, adding coremakers' and core-room helpers' wages as well as the department's fixed overhead charges.

Knowing cost of heat at spout and core-room expenses the moulding shop must be taken into account. The total of cost of heat at spout plus core-room expenses as explained above minus foundry returns (drop-shot-grates and sprues) at scrap iron cost prices, are the figures to work from.

Moulders' and moulding shop helpers' wages, supplies used and the department's overhead are added. The result divided by tonnage will give the price per pound of castings in mould.

To arrive at the final cost of rough castings, the chipping and cleaning department must be included. Chippers' and chipping room laborers' wages and the fixed department's overhead are added to cost of heat in mould. The foundry bad castings are deducted at scrap iron value giving the accurate cost of heat. Tonnage divided into cost of heat is price per pound of good castings produced by foundry.

In order to get accurate figures for all productive and indirect labor, it is best to employ a man to check the actual number of men, productive and indirect, working on a heat, and figure out their wages at rates paid. The same employee will have time enough to take care of heat reports, make out requisitions for foundry materials used by all departments, checking patterns and keeping a record of castings for each heat. The record of castings per heat is very important, checker must go to every moulder and find out pattern numbers and number of pieces in mould. In a foundry where a heat is taken off daily, the chipping department may not

(Continued on Page 21)

FOUNDRY COST OF PRODUCTION REPORT.

Date.....

Tests and analysis

No.	Brake	Dep.	Sil	S. Iph	Phos.	M	N.
1	3050	26	1.90	.087	.58	.45	

Material used	No. 1 Dept. lbs.	Cupola
Pig iron	13,000	$304.10
Home Scrap	7,000	157.50
Foreign Scrap	6,000	135.00
Steel	1,000	10.00
Shot	1,000	22.50
Total melt	28,000	629.10
Loss by shrinkage, 1.44%	405	
	27,595	629.10
Coke used	3,150	28.89
Limestone	700	.60
Wages, productive		36.44
Wages, non-productive		11.80
Department's fixed overhead		69.61
Material produced and costs	27,595	778.47
Cost per lb at spout .0281.		

	No. 2 Dept. Moulding. lbs.	
Material used	27,595	$776.47
Returns from Foundry	7,820	175.95
Castings produced	19,775	600.52
Wages, productive		382.34
Wages, non-productive		124.00
Department's fixed overhead		208.92
Material produced and costs	19,775	1315.78
Cost per lb., .06653		

	No. 3 Dept. Core Room. lbs.	
Material used	19,775	1315.78
Core Oil, 7½ Gallons		7.50
Core Sand	3,960	[illegible]
Core compound, etc	176	3.78
Coke	1,100	[illegible]
Wages, productive		104.34
Wages, non productive		33.81
Department's fixed overhead		70.61
	19,775	1541.67
Foundry bad castings	411	9.35
Material produced and costs	19,364	1532.19
Cost per lb., .07865.		

	No. 4 Dept. Chipping lbs.	
Material used costs	19,364	1532.19
Wages, productive		[illegible]
Wages non productive		18.75
Department's fixed overhead		70.61
Good castings total cost	19,364	1587.83
Total cost per pound .08716		

In the above figures assumed for a [illegible] mix

Finishing Crankshafts in the Grinding Machine

High Degree of Accuracy and Finish Attained—Special Facilities to Prevent Stresses in Shaft—Special Throw Blocks and Steady Rests—Locating the Grinding Wheel

By R. E. W. HARRISON, A.M.I.A.E.

FINISHING, and in some cases the roughing and finishing of single and multi-throw crankshafts on the precision grinding machine is now generally accepted as being one of the most economical means whereby both accuracy and finish may be attained. In this, as in all other branches of the art of grinding, rapid progress has been made during the last few years, and it is the intention to set out here a few of the more important details which have matured.

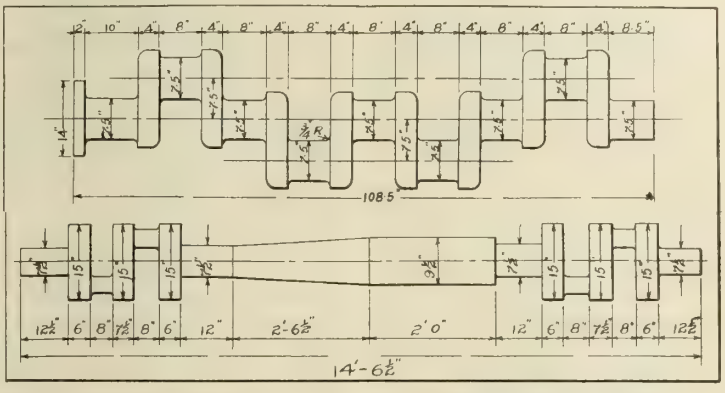
Securing Shaft Alignment

The finishing of crankshaft pins and bearings, both for single and multiple throw crankshafts, is a class of work peculiarly applicable to the grinding machine, owing to the high degree of accuracy and finish demanded. One of the difficulties encountered in any method of machining crankshafts is the securing of alignment of the crank pins in relation to each other, owing to the gradual release of the various stresses in the shaft forgings while the machining is proceeding step by step. It is for this reason that the grinding machine has been so successful on this class of work, the removal of the surplus material by grinding being a more gradual operation, and one that does not impart further stresses to the shaft. Crankshafts can also be economically ground direct from forgings or stampings, but if the full benefits of this method are to be obtained, the forgings must be specially designed to give the necessary clearance for the sides of the wheel.

Full Width Wheel

The method adopted in the grinding of crankshafts is the use of a grinding wheel equal to the full width of a crank pin or bearing, using the wheel in much the same manner as a broad forming tool in the lathe, no traverse of the crankshaft being necessary. The fillets on the shaft are formed direct by the wheel, a special device being fitted to the machine for forming the corners of the wheel to the correct radii. The necessary support to the shaft whilst grinding is given by a specially designed steady, which supports the shaft against the thrust of the wheel. For this work plain grinding machines are used with the addition of crankshaft equipment, and specially arranged to carry the large diameter grinding wheels necessary for grinding crank pins.

Author is assistant works manager of the Churchill Machine Tool Co., Broadheath, Manchester.

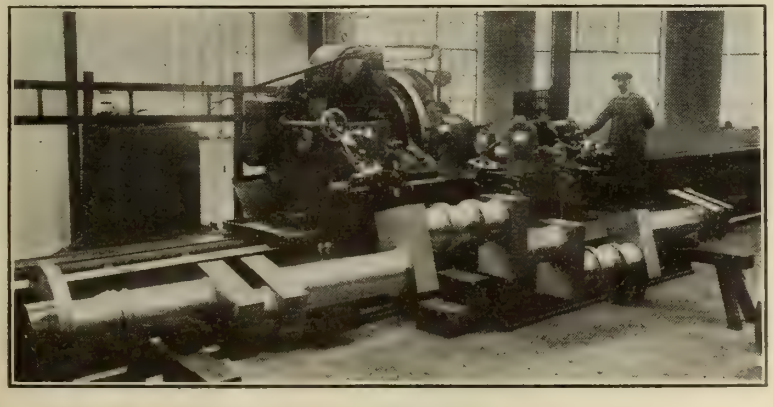


Upper—Crankshaft finished on 50 in. x 300 in. plain grinder, removing .125 in. or pins and .04 in. to .05 in. on bearings; limit, .00075 in. for round and .00025 in. for size and parallel; sides of web are ground to width gauge. Time —3¼ hrs. for pins, 3 hrs. for bearings. Lower—Crankshaft finished on 36 in. x 192 in. plain grinding self-contained drive. Finish ground where dimensioned removing .030 to .045 in. of stock, in 2¾ hours.

General Equipment

The equipment generally consists of: Adjustable throw blocks, setting gauge, special steadies, radius truing device and locating device. Lengthy experience has proved that the old type of throw block used for grinding the crank pins was inefficient inasmuch as the shaft being ground was kept under varying degrees of compression even during the final operation resulting in the production of work which could not be accepted under the standards of accuracy demanded in present day practice. This disability was due to the design of the throw block —an undesirable feature which has been entirely removed with the present improved design.

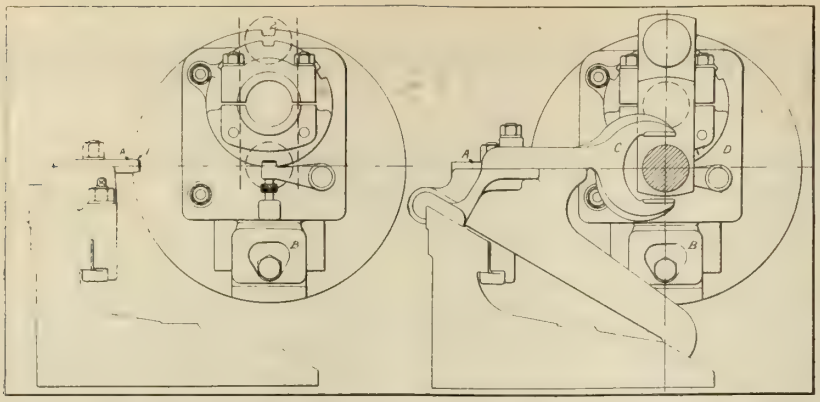
With the new type of throw blocks supplied with crankshaft grinding machines today, the crankshaft is supported in bearings, so that it is in no way subjected to end thrust, in fact, it is possible, if desired, to put the shaft being ground in tension. These new throw blocks are adjustable for stroke, so that one pair will cover all the sizes of the crankshafts that the machine will swing. Distance pieces are provided, machined to the throw dimension for governing the length of the crankshaft stroke. These distance pieces are plain metal blocks, easily attached or changed for different stroke.



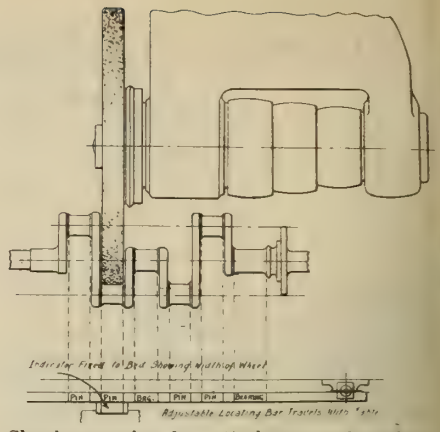
Finish grinding on large crankshaft.

Throw Block Bearings

The bearings in the throw blocks are accurately divided for three, four or six throw crankshafts with full provision for securing the pins in accurate alignment. Each throw block is mounted on ball bearings, and thereby torsional stresses in the crankshaft are reduced to a minimum while grinding is proceeding, a feature which has an important bearing on the accuracy and alignment of the finished crankshaft. The benefits secured by the design of throw blocks shown are, ease of manipulation and interchangeability of product due to



Showing first position of throw blocks when inserting crankshaft in machine. Spacing block B, which equals throw of crank determines length of stroke. Cap in setting gauge C in central with machine centres and will indicate any error in pin position.



Showing spacing bar attachment and setting.

the elimination of bending caused by end pressure and the removal of all torsional stresses due to friction.

Locating and Setting

The setting gauge is a device introduced and supplied to enable the operator to set the crankshaft in its correct grinding position without difficulty and in a minimum of time, and by its use, crank pins can be quickly and definitely located.

The locating device governs the position of the various pins and journal bearings of the crank. It is in the form of a graduated steel bar, adjustable lengthwise on the table, the graduations indicating the position of the pins and journals. Fixed to the bed of the machine is a gauge corresponding to the width of the grinding wheel, so that when the crankshaft is inserted in the machine the adjustable graduated bar is moved to correspond with the wheel width gauge when grinding the first bearing. The other bearings are then ground in accordance with the graduations on the bar.

The steadies used for supporting the crank pins when being ground are smaller in capacity than the steadies supplied for ordinary plain grinding, and also much narrower to allow of the rests passing between the webs of the crank. The tops of these steadies are each arranged to carry the radius truing device.

The radius truing device is used for rounding the corners of the grinding wheel to the radii of the fillets. It can be attached to the top of one of the steadies and used without removing the work from the machine.

Method of Procedure

The sequence of operations when grinding a crankshaft is as follows: (1) Rough grind to within .030 in. - .035 in. of finish size all journal diameters. (2) Rough grind pins to within .100 in. - .125 in. (3) Finish pins. (4) Finish journals. One of the most important factors contributing to the rapid production attainable with this design of throw block is the facility with which the surplus metal on the pin diameters may be ground away. This factor then makes it possible to allow a greater margin for the finishing operations than would otherwise permissible.

It will therefore be appreciated that there will be a considerable saving in time affected by the operator when, in the final operation on the pins, he is armed with the knowledge that he has a comparatively large surplus of metal available, which fact means that he is not compelled to check and re-check the alignment of the pins as frequently as would be the case if there were barely sufficient margin left on the pins to ensure cleaning up to size. Whatever commercial degree of accuracy may be demanded from the whole of the machining operation, the alignment of the finished journals must be above reproach, and it is by grinding these portions last on dead centres that this result is most easily obtained.

With careful operation the machine will produce crankshafts to any desired degree of accuracy and with a finish direct from the wheel which calls for neither a lapping nor a polishing operation of any description whatsoever. These results being obtainable with production maintained on a commercial basis.

The rough and finish grinding of crankshaft journals is a straight-forward plain grinding operation, but care should be taken to ensure that the tailstock centre does not exert an excessive end pressure, and that the work stays are used and so disposed that they take the thrust of the wheel without permitting any deflection in the work. In pin grinding the operation makes a somewhat heavier demand on the skill of the operator, and calls for special care in the setting up and manipulation of the work stays.

The sequence of operations also is dependent on the state of the crankshaft when it comes to the grinding machine, for instance where the pin is to be ground from the rough forging, a rough grinding operation is necessary, this is also the case where the shaft is rough turned first owing to the release of forging stresses during turning, and as a result a large amount of metal has had to be left on. The sequence of operations is as follows:—(a) Set cradles to correct throw using spacing blocks provided. (b) Place in position in cradles, bushes of the correct diameter to suit the shaft being operated on. (C) With locating bolts A in slots 1 place crankshaft in cradles and set with centre

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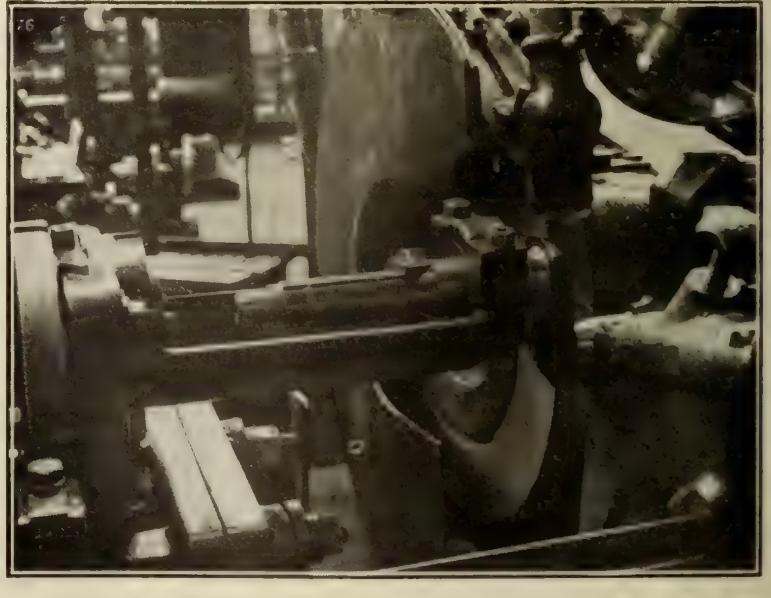


16" x 84" crankshaft grinding machine showing close-up of throw block during pin grinding.

?? Questions and Answers ??

HEATING WITH OIL

Question:—Is it possible to heat efficiently with oil a three-storey manufacturing building, 100 feet square, by using an ordinary furnace situated on the ground floor? We hear that it has been done.

Answer:—Heating buildings by means of an ordinary stove on the ground floor is by no means unusual, and the choice of fuel is governed by local conditions. If oil fuel is used, it must be fed through a special burner, and atomized either by pressure or gravity head. We would not think there should be any difficulty in burning oil this way. The relative heat value of oil to coal is about 1½, that is one pound of oil has 18,000 B. t. u. to an average of 12,000 B. t. u. of coal. Notwithstanding this advantage, the relative price may be such as to exclude oil. Wood has a heat value of about 8,000 B. t. u. per lb. We know of a case where such a building was heated by means of an ordinary hot air furnace. The firebox contained firebrick which was heated by a flame from an ordinary oil burner inserted underneath. The oil feed was by means of a very small electrically-operated pump. The furnace was pipeless and, apart from the stairway, no special floor openings had been made to permit of air passage. There is no specific data on the matter but the owner of the building declared that the apparatus served his purpose and was economical.

* * * *

PRICES ON MUNICIPAL CASTINGS

Question:—We have a foundry and machine shop and would like to know what is considered a fair price for municipal castings under present conditions. There seems to be a great difference of opinion on this matter and keen competition is probably responsible for much work being done at starvation prices. Gate valves are also sold by the piece, 2-inch valves being quoted at $4.10 while the 6-inch are quoted at $16.50. These prices, which are a fair average of what were contracted for last spring, would yield a good profit under present conditions although none too high. It is a simple matter for a good foundryman to figure exactly what it costs to produce his castings, and then the speculation is what competitors will want in way of profit. Machining may be included in the price or may be considered as extras. As a rule very little is required.

Answer:—Municipal castings are being specialized on the same as everything else, and the foundryman who is equipped for producing them can make money at prices which would mean a loss to those who are not. Prices are, of course, cut closely and ordinary gray iron castings such as gully grates and sewer manhole castings range between $2.90 and $3 00. Water mains, which cannot be made in anything but pipe foundries, were quoted in the spring at $62 per ton, and contracts were taken for the year at this price, while the cast fittings brought 5 cents per pound. Extension boxes are sold by the piece, from $2 to $3, according to size.

Canadian Machinery and Manufacturing News would have its readers feel that its resources for gathering special information, such as they may require, are freely at their service. Their questions will receive immediate consideration. On the other hand, should they feel that they are in a position to add to the information given in these columns upon any subject, their co-operation will be greatly appreciated. Desired information is first sent by mail to enquirers. Names will be supplied upon request.

* * * *

LEAKAGE OR EXPLOSION

Question:—In any insurance policy covering our boiler plant and steam piping we are covered, I understand, for explosion, rupture or collapse of any part of the system. There is a clause excluding leakage at joint. A gasket falls between two flanges in the ordinary course of events. In the event of damage, to what extent, if at all, may we claim under this policy?

Answer.—This is a point depending, to a certain extent, upon circumstances and the interpretation of the terms "leakage" and "explosion." A case of much interest to manufacturers and other owners of boilers and pressure apparatus who cover this apparatus with insurance, and to the issuers of such policies was tried in the High Court recently. This was an action on the part of a policy holder to recover damages on a policy covering the pressure piping on an ammonia refrigerating machine, but exclusive of the compressor itself. The policy was of the usual type, that is, it covered any damage arising directly from the rupture or collapse of any of the pressure piping, but expressly excluded any leakage at joints or couplings. The plaintiffs were the Toronto Packing Co., and the defendants the Royal Indemnity Assurance Co. The action arose out of an accident at the plant of the plaintiffs. The refrigerating machine is driven by a belt from a motor, and on the morning of the accident, the machine was started up in the usual way, but it is alleged, that the operator forgot to open the valve between the compressor and the condenser, with the result that after a short period, the rubber gasket in between two flanges was blown out by the pressure. The plaintiffs claimed that this was an explosion in the meaning of the policy, and claimed for the damage due. A room full of meat had been spoiled by the fumes of the escaping ammonia. The insurance company, on the other hand, claimed that this was a leakage at a joint, and as such expressly exempt under the clause of their policy dealing with this condition. Experts were called by both sides to define just what was the difference between an explosion and a leak, but the learned judge would not admit evidence of this kind, taking the ground that the word rupture or collapse in the policy rendered the insurer liable for damage. He held that a rubber gasket between two pipe flanges was essentially a part of the pipe, and could not be considered anything else. The damage then in his opinion was due to the rupture or collapse of the gasket, and as such constituted an explosion. Damages were accordingly awarded to the plaintiff as well as the costs in the action. The case may be appealed.

This department would welcome further discussion of this question.

* * * *

ACCOUNTING SYSTEM WANTED

Question:—We wish to revise our cost system. Have you any suggestions that may be helpful to us? In our foundry and machine shop we employ 60 to 75 hands.

Answer:—With the present number of Canadian Machinery, we are featuring the first of a series of articles on cost accounting by an experienced accountant in the machinery business. The series will deal with different departments in order of their proper relation to the business as a whole.

* * * *

Good judgment in the selection of equipment and a reasonable amount of proper attention to such tools after they have been placed into service should enable the small shop to take care of many jobs of accurate tool and jig work provided a capable man is in charge of the shop. Initiative is the most essential factor in making a paying proposition out of a small machine shop where the staff is called upon to perform a wide variety of work at irregular intervals.

Heat Treatment of Steel in Crucible Furnaces

Uniform Heat of First Importance—Pressed Steel Pots Give Good Service—Avoid Overheating of the Work—Handling Parts in Quantities—Preventing Formation of Scale

APPLICATION of the crucible furnace for the heat treatment of steel is not an innovation, as old time steel masters knew of it and practised it with varying results, depending on their knowledge and ability to determine the temperature of the bath. In those days pyrometers were either unknown or unreliable, and Seger cones were relied upon for accurate results. The craftsmen of our fathers' days were trained to judge temperatures by color, and crucible furnaces using a molten bath did not readily lend themselves to this old method of judging temperatures, and the Seger cone could not be used. The top of the bath was generally covered with dross, or a slight film of oxide, thus making temperature judging rather difficult and generally too high. This characteristic of crucible furnaces resulted in the production of overheated work and the process fell into disrepute, even though conceded to be an excellent method for heat treating.

A careful study of this type of furnace was made in later years, and with the development of the pyrometer to where it could be relied upon implicity, crucible furnaces have come into their own, and are specified by many manufacturers for use in the production of exceptionally fine heat treated work.

Furnace Construction

Crucible furnace construction for heat treating purposes require to be especially designed to obtain maximum efficiency. It is not simply the placing of a pot within a setting of brick and applying heat to it. Uniformity of heat is the prime object of the process, and this can be obtained only after careful design and experimentation. The action of the flame is also important, as it should not strike directly on the pot, for this will shorten the life of the pot considerably. The design that has given great satisfaction is the circular type which permits the placing of the burners so that direct impingement of the flame on the pot is prevented and a swirling motion is given to the flame, causing it to encircle the crucible several times before passing out of the flue. This holds true for either gas or oil fired furnaces. Less economy is shown with rectangular furnaces, owing to the short contact and high velocity of the gases in the combustion chamber. In crucible furnaces pressed steel pots give greater satisfaction than either cast iron or cast steel, due to the greater ductility and higher relative heat conductivity of their thinner walls. The life of any pot is materially increased by proper regulation of the atmosphere within the combustion chamber. A reducing or soft flame is best.

Methods of Heating

In an oven furnace the heat is transferred by convection and radiation, as the furnace is so designed that the flame will not come in direct contact with the work. In the crucible furnace the heat is transferred by conduction, which is many times greater than any of the modes available in the oven furnace.

This is demonstrated by the example of one being able to hold the hand several inches away from a red hot object for quite awhile, the heat being transmitted by radiation and convection, but knowing better than to touch the red hot object for fear of being severely burned, the heat being here transmitted by conduction. So great is the difference between the two types that an illustration or demonstration is needed to convince the uninitiated before they will believe that a crucible furnace using molten lead will heat the work up about 70 times faster than an oven furnace. It takes about 12 seconds to heat a piece of 3/16 inch steel in a lead furnace at 1450 deg. F., while at least 15 minutes is required in an oven furnace maintained at 1450 deg. F. Since the crucible furnace heats the work up so rapidly, it is imperative to preheat all work of uneven cross section.

Uniformity of Heat

Rapid heating is not the only advantage crucible furnaces have over other systems of heating steel. They heat uniformly, and this uniformity of temperature is throughout the entire crucible of molten salts or metal, and is a positive guarantee that the pyrometer indicates the exact temperature of the work. Non-uniformity in heating necessarily results in non-uniformity in cooling, which is the cause of most of the warping and cracking in the hardening process, and hardening cracks are more often the result of uneven heating than defects in the steel, both of which are not inherent in the crucible heating process.

One of the greatest weaknesses in heat treating practice is that of overheating of the work. Both workmen and charge hands are frequently responsible in this respect. In crucible furnaces this excuse is not to be tolerated, as the workman cannot see the work all the time, and it heats too rapidly for him to withdraw it at the "right time." The removal of this one bane of the heat-treating room is sufficient to recommend the crucible type furnace, for it is an axiom of the heat treater that best results are obtained by hardening a piece of steel at the lowest possible temperature, and always on a rising temperature, never a falling one. The most important function of the crucible furnace, other than its delivery of rapid, uniform heat, lies in its production of work without any decarbonized surface or scale; in fact, when cyanide is used, carbon is actually added to the surface layer of the steel.

Universal Application

Crucible furnaces may be adapted to any requirements of the heat treating field, dependent entirely upon the man or organization. In the beginning they were used for heating only very small parts, where uniformity of "temper" was required, but larger furnaces have since been produced for handling large parts wherein uniformity of hardness is essential at minimum expense.

Crucible furnaces lend themselves admirably to heat treating carbon steels, and similar low temperature alloys hardening below 1600 deg. F., using lead or some of the compounds in the market as the heating medium. For high speed steel barium chloride was formerly used exclusively, in spite of its shortcomings, but today this salt has been displaced to a great extent by other compounds. For hardening of high speed steel, however, the crucible furnace has fallen into disuse within recent years, being replaced by the oven type furnace and double deck furnace (see illustration), due principally to the fact that high speed steel parts are generally not very numerous.

The use of the crucible furnace for tempering at any temperature below 1,200 deg. F., is quite common. For lower temperatures the oil tempering furnace is used, as shown in illustration. This furnace when a high flash point oil is used will operate as high as 650 deg. F. nicely, after which a furnace of the rectangular crucible type, like illustration, must be used with an alloy of lead and tin as the heating medium. Using the crucible furnace for tempering overcomes the many weaknesses of the color tempering process, removing the personal element and cutting down labor costs to a negligible figure, as thousands of parts can be tempered at a time.

Carbon steel is the most generally used grade and where this steel is to be hardened lead works very satisfactorily. Here are a few suggestions in

As recommended by the American Gear Manufacturers' Association.

using lead: It is very necessary to place a hood over the furnace to carry off any lead fumes which may arise from the pot. Charcoal or old carburizer may be used to cover the surface of the lead to prevent oxidation and lessen the sticking of the lead to the work. Slag should not be thrown away, as it can be reduced back to the metal while red hot on top of the pot by means of charcoal.

It is common knowledge that when a piece of steel is heated in an oven furnace in which an oxidizing atmosphere is maintained, its surface is decarbonized for quite a depth. This cannot happen in a lead pot, and for this reason the lead pot furnace continues to be, as for years, the one furnace in which files can be successfully hardened.

Many baths and compounds are on the market, any of which should be satisfactory, providing their melting points are correctly chosen for the temperature at which they are to operate. For example: If a drawing temperature of 720 deg. F., is desired, a temperature too high for oil and a trifle too low for lead (M. P. 621 deg. F.), as it would freeze all over the parts and be slow work, some tin could be added to lower the melting point to 450 deg. F., or a mixture of potassium nitrate 2 parts, sodium nitrate 3 parts, melting at 450 deg., F., could be used.

A table of the salts commonly used to compound these baths follows:

Salt	Melting Point °F.
Barium Chloride	1580
Sodium Chloride	1418
Potassium Chloride	1346
Calcium Chloride	1328
Magnesium Chloride	1306
Lead Chloride	932
Cupric Chloride	928
Ferric Chloride	572
Zinc Chloride	504
Aluminum Chloride	356
Potassium Carbonate	1526
Sodium Carbonate	1317
Lithium Carbonate	1283
Potassium Nitrate	644
Codium Nitrate	572
Calcium Fluoride	1832
Magnesium Fluoride	1664

Of the above salts calcium chloride combined with sodium chloride and admixtures of sodium carbonate are most generally used.

One of the most common baths is lead of commercial purity, which melts at 621 deg. F., and may be used up to 1,600 deg. F., satisfactorily. In order to prevent the adherence of the lead to the work it may be dipped into a solution made up of 1 pound potassium cyanide dissolved in 1 gallon hot water, and thoroughly dried.

Summary

1. Crucible furnaces for heat treating have been in use after a fashion for many years, their revival and widespread use to-day being occasioned by the perfection of the pyrometer, whereby the temperature may be controlled.

2. The construction of a crucible furnace is the result of considerable experimental work, the circular type being found most satisfactory.

3. Comparative merits of the oven type furnace when compared with the crucible type show the crucible furnace to heat the work at least 70 times faster without scale, decarburization or non-uniformity, which tends to produce better work.

4. High speed steel and carbon steel hardening and tempering are all done in crucible furnaces very satisfactorily. High speed steel hardening in barium chloride is being abandoned in favor of the double-deck oven type furnace, due to the preheating feature. Carbon steel, readily hardened in lead or any of the numerous salts, compounds or cyanided, is being carried out more than ever in the crucible furnace, because of its many desirable features. Oil or low temperature tempering is commonly done in a crucible furnace.

5. The use of lead as the heating medium for carbon steels is common practice.

6. Many salts for heating mediums are on the market, all of which are compounded from a certain series of salts, a table of which is given.

The use of the crucible furnace is now established as one of the most accurate and satisfactory methods of heat treating small parts in quantity, where scale or decarburizing cannot be tolerated or where an increase in the carbon on the surface is desired by cyaniding. The process is productive of accurate work, uniformly heated, even when unskilled labor is used.

FIGURING COSTS FROM MATERIAL TO PRODUCT NO. 1

(Continued from page 16)

be able to get castings of one heat cleaned up every day. By checking castings leaving foundry against castings on heat lists, the employee making out the heat reports, will be able to find out just when the last casting of a previous heat has left the foundry and enable him to finish report for that heat. This record of castings per heat must also show the number of hours moulder put in on a certain number of castings. The foundry foreman should look over this record and find out if time put in on jobs is O. K., and if not he can at once go after offending party and in such a way help to keep down foundry cost of production.

For all raw materials and supplies used in connection with heats for a certain period:

DEBIT:—Foundry work in process.
CREDIT:—Raw materials and Supplies.

For all castings finished and delivered by foundry to casting stores:

DEBIT:— Rough casting stores.
CREDIT:—Foundry work in process.

FINISHING ENGINE CRANK SHAFT

(Continued from Page 18)

gauge C until the centre line of pins to be ground coincides with the centre line of the machine. (d) Withdraw locating bolts A and insert in slot 2. This revolves the crankshaft through 90 deg. and enables the circular check on the pin diameters to be completed. The pin is then in the correct grinding position. The remaining pins on either 2, 4 or 6 throw crankshafts can then be ground using the dividing plate embodied in each cradle.

General Repair Work

A special machine with a capacity 18 in. swing x 60 in. length between centres has been developed for this class of work, where there is a multiplicity of the types of jobs to be handled. The main feature of the equipment is the addition of a three-jaw chuck mounted on each throw block, these being provided to take care of the widely varying diameters of worn crankshafts which have to be contended with. If bushes were used for each diameter it would be obvious that there would be a tremendous number required.

The left hand chuck or rather the one which is mounted at the driving end, is provided with outside jaws to grip, should occasion arise, on to the flanged end which is a feature of the design of some crankshafts. The other chuck is fitted with inside jaws and both back plates are bored to a suitable diameter to allow the jaws to obtain a grip as close to the pins as practicable.

Heavy Engine Crankshaft Grinding

The illustrations testify to the faith of the builders of the heavier type of engine in the grinding method of finishing their crankshafts. Machines have been made and are now in regular commission on work of this description up to 72 in. swing and taking 23 ft. between centres. Whatever may be the consensus of opinion as to the merits or otherwise of grinding the pins, it is universally acknowledged that exceptionally good results are obtained with shafts which have been ground on the journals, the question of correct alignment being in this case the factor of prime importance and one which is easily assured when once the grinding method has been adopted.

Crankshaft Web Grinding

Refinements with the object of securing better engine running balance have resulted in some instances in the demand for a machine capable of grinding the contours of the crank webs to an accurate predetermined shape and a high degree of finish. This operation is taken care of by fitting a cam grinding attachment to the plain grinding machine with master cams arranged to suit the shape of web desired. The spindle of the attachment being rotated by the grinding machine work head, no further additions as regards overhead works are necessary.

The attachment itself is built on the lines of the standard automobile grinding attachment, and is entirely self-contained.

Standardization of Drills, Reamers and Cutters

Closer Co-operation of Manufacturers Necessary—Production Cost Reduced Through Improved Methods—Too Wide a Range in Small Tool Sizes—Proposed Modification of Standard Practice

By CARL J. OXFORD

MACHINE tools and small tools are so closely related to each other and interdependent that their respective developments logically should go hand in hand. In the past we have had instances of close co-operation between machine tool builders and small tool manufacturers. The results have invariably been noteworthy and beneficial both to the co-operating firms and to the tool-using industries in general.

Powerful and rapidly operating machine tools may be designed and built, but their success is largely nullified if they require cutting tools of prohibitive cost and of short life. Conversely, small tools may be developed which with the proper machine tools will produce wonderful results but which again with unsuitable machines are complete failures.

We have been, and are still, passing through a period in our industrial development where reduction of expenses has become the watchword. Particularly is this true of those expenses which may be classified as production costs. Facing, as we do, keenly competitive markets, it becomes necessary to cut the cost of production to the core, if the manufacturer is to show a balance on the right side of the ledger.

There seems to be but a scant likelihood that either raw material or labor costs will recede to a lower level in the near future. In fact, we have recently seen slight increases in both. The lowering of production costs must therefore be accomplished through improvements in methods, and through increased productivity and efficiency of tools and equipment as compared with first costs.

It is the primary purpose of this paper to point out how greatly the first cost of small tools can be lowered, without sacrificing their efficiency, by the adoption of standards that will permit manufacturers of tools to produce on a quantity basis.

Twist drills, reamers, and milling cutters all are classed as small tools. In this paper only these three types will be considered. Usually the manufacturer classifies them as being either standard or special. Standard tools are those sizes and designs which are regularly catalogued and carried in stock by the larger manufacturers, while special tools are those made up to the customers' specifications.

There exists at present a fair uniformity of general dimensions in the tools catalogued as standard by the various makers. This is a step in the right direction, but the belief is expressed here that this uniformity could be carried more into detail, and that the number of standard items listed could be cut almost in two without any serious handicap to the metal-working industries in general.

It is difficult to realize, by those not actively engaged in the small-tool business, what a wide variety of styles and sizes are catalogued as standard tools. An examination of several tool-manufacturers' catalogs shows the following average number of items:

Twist drills	3,400 items.
Reamers	2,200 items.
Milling cutters	4,500 items.

Roughly this makes a total of 10,000 items. Certainly this ought to be enough of a variety to take care of every conceivable requirement. That such is not the case, however, is illustrated by the fact that small tool manufacturers are annually making thousands of items of tools not listed in their catalogs, and must continue to do so as long as their customers insist on having them.

Standard vs. Special Tool

It is conceded that there are numerous instances where special tools are necessary; but the statement is made advisedly that in many shops from 40 to 60 per cent. of the work now performed with special tools could be equally well performed with standard tools, and at a much lower tool cost. To accomplish this it would be necessary, however, to educate the designers of both the manufactured article itself, and of the various holding and locating fixtures, to the importance of adapting their designs to the most economical uses of tools. Instances are numerous where no end of troubles are encountered in machining because the designers have paid more attention to the purely technical side of design than to the practicability of performing the various machine operations specified.

In the production of many manufactured articles the cost of perishable cutting tools, such as drills, reamers, and milling cutters, represents a large percentage of the total productive cost. As a consequence the question of efficient and long-lived tools has come in for considerable attention. The present tendency, however, seems to be toward the use of special tools where an increased production is desired, or where trouble is encountered. This is believed to be a fallacy in a great many cases. For if a little time and effort is expended in adapting the conditions, such as surface speeds, chip thickness, and holding devices, it is often found that equally good or better results can be produced with standard tools than with special tools, although the latter must be obtained at a much higher price.

In addition to the higher price of special tools, it must be borne in mind that these are only made up in quantities as specified by the user. Hence the source of supply is restricted, and deliveries are subject to delays. Standard tools, on the other hand, can be purchased on the open market and can usually be delivered from the manufacturers' stock.

Relative Costs

Standard tools which are carried in stock by both manufacturers and dealers can naturally be made up in fairly large quantities. Usually from about five hundred to ten or twenty thousand of each size and kind can be put through the factory at one time. This means that many of the benefits accruing from quantity production are realized. There is little time lost in setting up the machines, operators become more efficient on repetition operations, and in many instances it is possible to utilize multiple equipment and other time-saving devices. The non-productive overhead incidental to every order is also spread

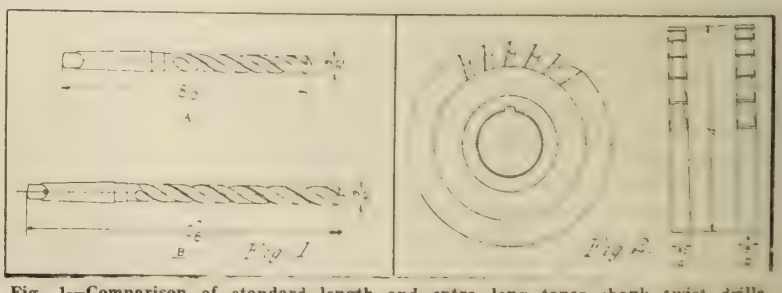


Fig. 1—Comparison of standard length and extra long taper shank twist drills.
Fig. 2.—Standard and special size milling cutters.

Extract of a paper prepared by the author for a recent meeting of the American Society of Mechanical Engineers.

over a great number of pieces, so that the amount chargeable against each piece is very small. All these conditions combined result in a low unit cost.

Compare this with the cost of producing special tools. These are as a rule ordered in small quantities ranging from one to ten or twenty pieces. Highly skilled all-around machine operators must be employed for this class of work. There is just as much time lost in setting up each of the various machines for one piece as for one thousand or ten thousand. There is no opportunity of using multiple equipment on such small numbers of pieces, nor do the machine operators acquire any increased efficiency from repetitions. Non-productive overhead expenses are nearly as high for one or two pieces as for several thousand. The difference is that in one case these expenses must be absorbed by one or two pieces, while in the other case they can be distributed over a very great number. It is obvious how this will affect the respective unit costs, and eventually the price at which the tools must be sold.

Concrete examples of comparative costs will perhaps illustrate the point more forcibly. Let us compare the two twist drills A and B, Fig. 1. Both are 19/32 in. in diameter and of identically the same design throughout except that drill A is of standard length of 8½ in., while B is 2⅜ in. longer, or 10⅞ in. Five hundred of the drills A were made at one time, this being a standard size. The drills B, being special, could be made only in quantity as specified by the customer, in this case six. The direct labor cost of A proved to be only 38 per cent. of the corresponding cost of B. Adding the non-productive overhead, chargeable against the respective orders of which these drills were a part, the total cost of the standard drill A was found to be but 21 per cent. of that of the special drill B.

Representing this in another way, we may say that the increase in length of B over A was 28 per cent., while the increase in cost was 480 per cent.

Similarly, we may compare the two milling cutters C and D, Fig. 2. The special cutter C is slightly smaller than the standard cutter D, yet, owing to the quantities manufactured in each case, the total cost of the cutter C was found to be 270 per cent. higher than the corresponding cost of D. These are but ordinary illustrations of conditions encountered by every tool manufacturer.

Necessarily the cost of producing must be reflected in the cost to the consumer. Pursuing this line of thought, it becomes evident that the high cost of special tools is eventually levied against the manufactured articles on which the tools are used, and in turn is passed on to the purchaser of these articles. Let us suppose that a certain operation requires a special milling cutter costing $30 and that the life of this cutter is 4,800 pieces. If we are able to adapt this same operation to the use of a standard milling cutter of approximately the same dimension we shall have effected a considerable saving. This latter cutter can probably be bought for about $18. The tool cost for one operation is then reduced from $6.25 to $3.75 per thousand pieces. With a great number of machine operations on which such savings may be effected, it is easily conceivable that the results may mean the difference between a possible business loss and a tidy profit at the end of the year.

Elimination of Special Tools

It has already been stated that the total elimination of special tools is impracticable, for there will always be conditions now and then where a standard tool cannot be used; but there can be no doubt that the number of special tools used in the average manufacturing plant, with a little foresight, can be greatly reduced. Engineers and designers responsible for the design of both the manufactured product and of the various jigs and fixtures, must be brought to realize the great economic advantage of standard tools over special tools. Especially is this true where production of large quantities of duplicate parts are involved.

A jig or fixture is a comparatively permanent thing, while cutting tools are in many cases very short-lived. Therefore a small additional expenditure, in order to adapt such jig or fixture to the use of standard tools, eventually becomes a highly profitable investment. Numerous cases can be mentioned where such simple expedients as the shortening of a jig bushing or the slight reduction in height of some projection on a milling fixture will mean from 20 to 50 per cent. reduction in tool costs for that particular operation, inasmuch as it will permit the use of standard tools.

From the author's own experience in the manufacturing of automotive parts there come to mind, too, several instances where the factory, in order to get out the required production, was compelled to ask the engineering department to alter its designs sufficiently so that practical and economical cutting tools could be used. It is a regrettable fact that many engineers, either through ignorance of, or through failure to attach sufficient importance to, small-tools requirements, are in this way wasting money that legitimately should be used either to reduce the cost of the goods or to pay a profit on the invested capital, as the case may be.

Technical schools and colleges would render a real service to the metal-working industries if they were to include in their machine shop curriculum at least a limited amount of instruction along these lines.

It may be properly argued that some of the tools now embodied in the tool manufacturer's standard list do not represent the highest degree of efficiency, and that there are certain other tools, now regarded as special, which will give better results. This is a sound and logical development of the small-tool industry, a development which should be encouraged through the elimination from the standard tool list of obsolete styles and designs, and the substitution of tools, developed through experience and research, that have proved more efficient under all conditions.

We have, for instance, the matter of numbers of teeth in milling cutters and numbers of flutes in reamers. The majority of manufacturers maintain a fair uniformity in this respect, based more or less on practical experience. However, materials and machine-tool equipment are being developed which in many cases demand numbers of teeth or flutes varying from the old established standard. As a consequence many users of tools are specifying numbers of teeth according to their own pet ideas. Obviously this at once classifies the tools as special, because it is impossible for the manufacturer to anticipate consumers' whims.

It seems reasonable to assume, though, that there is one number of teeth or flutes which in general will work most satisfactorily. It is in cases such as these that standardization becomes important from an economic point of view. If standards can be established, and these adhered to, the consumers will derive great benefits through the elimination of expensive special tools and the substitution of more moderately priced standard tools.

For the general good of the metal-working industries as a whole, a program of standardization should be carried out. Attempts should be discouraged to capitalize by attributing fancied advantages to minor construction details and charging special-tools prices for those which legitimately are standard. Standardization will undoubtedly go far toward the total elimination of such practices.

Reduction in the Number of Standard Tools

It is also believed that a material reduction in the number of tools now regarded as standard can be effected without hardship to anyone. A majority of the tools used in the metal-working industries to-day are made from high-speed steel. They are consequently expensive, due to the high cost of the raw material. When it is remembered that a small-tool manufacturer must carry in stock some 5,000 to 10,000 items of these tools, each in sufficient quantity to care for the possible requirements of the trade, it is easily seen that this imposes on him a large overhead, merely as interest on the investment involved. Therefore, the elimination of a number of items will mean a corresponding decrease in the price of those remaining. Some suggestions are given here, which if followed will accomplish much in this direction. It is at least hoped that these suggestions may serve as a basis for future action. The actual carrying

Symbol	Decimal Diameter	Symbol	Decimal Diameter	Symbol	Decimal Diameter	Symbol	Decimal Diameter	Symbol	Decimal Diameter	Symbol	Decimal Diameter
80	0.0135	1/32	0.0313	50	0.0700	31	0.1200	7/32	0.2187	25/64	0.3906
79	0.0145	66	0.0330	49	0.0730	1/8	0.1250	1	0.2280	13/32	0.4062
1/64	0.0156	65	0.0350	5/64	0.0781	29	0.1360	15/64	0.2344	27/64	0.4219
78	0.0160	63	0.0370	46	0.0810	9/64	0.1406	0	0.2420	7/16	0.4375
77	0.0180	61	0.0390	44	0.0860	25	0.1495	1/4	0.2500	29/64	0.4531
76	0.0200	59	0.0410	43	0.0890	5/32	0.1562	17/64	0.2656	15/32	0.4687
75	0.0210	57	0.0430	3/32	0.0937	19	0.1660	9/32	0.2812	31/64	0.4844
74	0.0225	3/64	0.0469	40	0.0980	11/64	0.1719	19/64	0.2968	½	0.5000
73	0.0240	55	0.0520	38	0.1015	15	0.1800	5/16	0.3125	...	....
72	0.0250	54	0.0550	36	0.1065	3/16	0.1875	21/64	0.3281	...	....
71	0.0260	53	0.0595	7/64	0.1093	9	0.1960	11/32	0.3437	...	....
70	0.0280	1/16	0.0625	33	0.1130	13/64	0.2031	23/64	0.3594	...	....
69	0.0292	51	0.0670	32	0.1160	4	0.2090	3/8	0.3750	...	....

Proposed Standard for Straight-Shank Drills

out of the changes proposed must of course be left to the tool manufacturers, but they can do so only after the consumers have been educated to the great economy made possible.

Let us first consider the ordinary straight-shank twist drill with which everyone is familiar. In the sizes up to and including ½ in. diameter we find 166 standard sizes listed, as follows:

Straight-shank wire drills	80
Straight-shank letter-size drills ..	26
Straight-shank drills — jobbers' lengths	31
Straight-shank drills — taper-shank lengths	29
Total	166

This does not include the approximately 140 sizes of millimeter drills under ½ in. diameter, nor the various odd styles of straight-shank drills such as tell-tale drills, dowel bits, etc. We are here dealing only with the kinds of drills in general use. The establishing of sizes on existing lists appears to have been entirely empiric, as there are many duplications or near duplications with the fractional size drills. One is unable to find any uniform variation in diameter between consecutive sizes.

The table herewith is an attempt to establish uniformity of variation in diameter, and to eliminate sizes which are thought unnecessary. This will mean a reduction from 166 to 73 sizes.

It will be noted that the old symbols have been retained, but that the amount of variation in consecutive sizes has been arranged roughly in a geometrical progression. Thus we have:

From No. 80 to No. 78, diameter increases approximately 0.001 in.

From No. 77 to No. 57, diameter increases approximately 0.002 in.

From 3/64 in. to ⅛ in., diameter increases approximately 0.004 in.

From No. 29 to ¼ in., diameter increases approximately 0.008 in.

From 17/64 in. to ½ in., diameter increases approximately 0.016 in.

Reamers and milling cutters can be made subject to similar methods of standardization and with equally profitable results. No specific proposals are made, because it is realized that such standards must be created through suggestions from a wide field, and through careful consideration and discussion of the suggestions offered.

Tolerances and Nomenclature

The British Engineering Standards Association in 1920 published their Bulletin No. 122, entitled British Standards for Milling Cutters and Reamers. From the introduction to this publication the following is quoted:

"The standards herein contained have been arrived at as a result of conferences, research, and direct co-operation between the small-tool makers, machine-tool makers, and users of this country, at whose instance the work was undertaken....."

An examination of the work done by the British engineers reflects their desire for uniformity in both design, tolerance, and nomenclature. Much of the material could probably be bodily adopted for us in this country, while some of it would necessarily have to be changed to suit our own conditions. We all recognize the desirability of having definite limits established. It seems that as far as reamers are concerned there would be an excellent field for co-ordination with the existing standards of tolerances on shafts and holes.

Uniformity of nomenclature is particularly desirable for the sake of avoiding confusion and loss of time. We have frequently had cases where a customer will order some sort of a tool we never heard of before. When we of necessity ask for further particulars, it is found that a standard tool is wanted, but that a local term is used for designating the same. On the whole it is believed that the engineering societies in taking up this question of standardization of small tools will perform a service to the manufacturers of tools; but more particularly to the users.

In the end it is of course the consumer who pays the bill, and if through standardization this bill can be reduced, we shall have made a step forward in the march toward the goal of economical manufacturing.

EIGHT-HOUR DAY ADVANTAGES

(Continued from Page 15)

and labor turnover and industrial accidents.

Improved spirit and co-operation of workmen.

More exact adherence to instructions as to working methods.

It was found that there were 300,000 wage earners in the United States working on twelve-hour shifts who with their families numbered more than one million persons. No technical difficulties have been encountered by the great majority of plants which have changed from a two to three-shift operation. The seeming disadvantage of having three men instead of two responsible for a given product, process or equipment is overcome by standardization and by using precision instruments. The effect of the eight-hour as compared with the twelve-hour shift operation on the quantity and quality of production, absenteeism and industrial accidents have been satisfactory where good management and co-operation of labor have been secured. A comparison of wage rates shows a general tendency to increase the rate per hour under the eight-hour shift so that the daily earnings will be the same as they were before the change.

The United States Steel Corporation employed approximately 70,000 twelve-hour employees. Altogether there are perhaps 150,000 wage earners in the entire steel industry on twelve-hour shifts. The twelvehour day is strongly established by custom in the iron and steel industry, but recent progress has been in the direction of a shorter day as well as in a reduction of the proportion of men on duty seven days a week.

LIFT-TRUCK PLATFORM

A platform for use with elevating trucks, and which combines both wood and steel in its construction, has been placed on the market recently. The top of the platform is made of wood anywhere from 1¼ to 2 in. in thickness. The wood top is fastened to the steel legs by means of flat-head bolts, set flush. The legs are made of heavy gauge flanged steel plate with vertical ribs to prevent buckling. The lower flange which rests on the floor is wide to provide a good bearing and prevent injury to the floor. The upper flange is extended up around the ends of the planks. The platform is designed for heavy service. The load carrying capacity is increased by the overhanging portion. These platforms are made by the Barrett-Cravens Co., Chicago, Ill.

Practical Ideas From Practical Men

REPETITION WORK IN SMALL QUANTITIES

By G. Blake

In the motor cycle trade the parts which are likely to wear out and replacements are generally made in large batches; for example, valves, valve guides, pistons, gudgeon pins, bushes, etc. The manufacturing of these and other items in large batches permits an efficient layout of jigs and tools so as to produce the work at a minimum cost, while this is the best way to deal with work in large quantities. On the other hand different means have to be adopted when the work is in comparatively small quantities of, say, a gross and under. We recently had an order to make a gross of bushes for motor cycle connecting rods and at a cut price which did not allow any margin for tools, etc. How we tackled the job may be of interest.

Fig. 1 shows the bush which was made from cored gun metal sticks 12 inches long. The equipment available in the shop was one 4¼ inch and two 6 inch lathes and a pillar drill. The first operation, parting off to length, was done on one of the 6 inch centre lathes, using a self-centring chuck to hold the work. The rate of production was 25 per hour, at 8c per hour, boy labour. The second operation—drilling, reaming and recessing, was also done on the 6 in. lathe. Holding the bush in the chuck, the drilling and reaming was performed from the tailstock, and the recessing on the cross slide with a small boring tool. The rate of production was 8 per hour at 8c per hour.

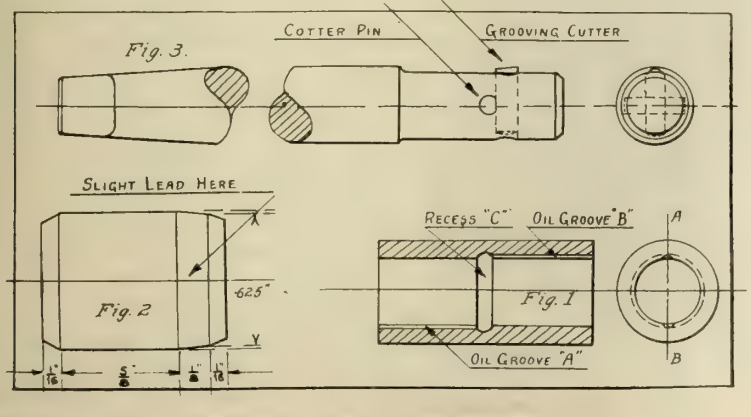
Difficulty was experienced in reaming the bore to size as it was discovered, when trying the gudgeon pin in the bush, that the bore was too small, the diameter of the pin being ⅝ in. + .005 in., and, as we had only a standard ⅝ in. reamer, our trouble was how to make the bore the correct size and at a small cost. As we had no likelihood of getting a repeat order, to grind down a 11/16 in. reamer was rather costly, as it would be of no use for other work. We overcame the difficulty in the following manner:

A small cast steel plug was made as shown in Fig. 2 and turned to the dimensions given and hardened dead hard, and then very highly polished. The tapered end of this plug was now inserted in the bush (after it had been reamed and recessed, etc.) and pushed through on the pillar drill, using it as an arbor press. This method proved very successful, and, in addition to making the bore of the bush the correct size, it produced a highly polished surface, the plug, whilst being forced through, compressed the metal, the result was a better bearing surface and longer wearing life. The writer at first intended using a steel ball to accomplish this end, but was unable to procure one the size desired. It is very essential that the diameter of the plug be highly polished, because if there be any scratches or tool marks, small particles of the bush will adhere to these scratches and score the work. Another point is that the plug must be made absolutely dead hard, or it will soon wear and be of no use. The rate of production on this operation was 40 per hour, at 6c per hour. This sizing operation did not, however, follow the second operation, but it is here mentioned as it was connected with the second operation in the manner described.

The third operation was oil grooving. Referring to the sketch of the bush, it will be noticed that the oil grooves are straight, but they do not run right through from end to end in a straight line; one groove A starts at one end and runs into the recess C, the other groove B starts at the other end on the opposite side and runs into the recess C.

A ⅝ in. dia. boring bar with a small cutter was used to cut these oil grooves. Fig. 3 illustrates the idea. Using the pillar drill as an arbor press, the Morse taper end of the boring bar was inserted in the drilling machine spindle, (by the way, the belt was removed to avoid any accident such as the machine starting up on its own) then the bush was located so that the bar would enter the bore, the plain end of the bar acting as a guide when the cutter commenced to cut as it was forced down, pressure being applied with the hand feed lever, the operator easily feeling the pressure relaxed when the cutter entered the circular recess, he would then raise the spindle, turn the bush over and groove the other end—taking care that it was on the opposite side to the first groove. The rate of production was 30 per hour, at 8c per hour, boy labour. The fourth operation was that of sizing the bore already mentioned.

The fifth operation, that of turning the bush on the outside diameter, was performed on the 4¼ inch centre lathe on a mandrel in the usual way. The rate of production on this operation was 6 per hour, at 8c per hour. It will be noticed that the actual cost in labour works out at about 4c each. This figure is high in comparison with the same article, produced in large quantities on automatic machinery, but, taking into consideration the type of machines available and the relatively small quantity, the cost is remarkably low.



Repetition work in small quantities.

BUY SMALL AMOUNTS OF PLATINUM

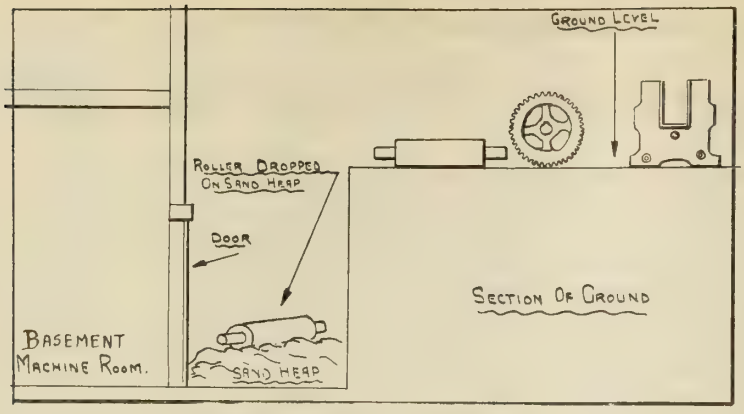
By D. A. H.

A machinist went to work in a garage—such as garages too often are. He asked the proprietor to get him an inch or two of ⅛ in. round platinum so that he could re-tip points. The proprietor was a generous soul and new at the game—he decided that an inch or two was a piker's buy so he ordered two feet. When he got the bill, he fainted for the first time in his life.

AN IMPROVISED C-CLAMP

By D. A. H.

In an emergency a monkey wrench makes a very fair C-clamp. Given some means of turning the screw under a load and one has all the features of commercial clamps, besides having a tool with a much stronger back, with parallel machined sides (when new) and which will go into space narrower than C-clamps. Some monkey wrenches have holes drilled through the knurled head and this is all that is necessary for tightening purposes, others—chiefly larger sizes—have a hex headed screw. For drill press work, the monkey wrench is frequently the simplest way to hold the job but if it is fixed so it can be more than thumb tightened, its value on such work is doubled.



Moving heavy parts to lower levels.

MOVING HEAVY MACHINERY

By G. Blake

It was once the writer's experience to have to move some heavy rubber machinery into the basement of a small factory and there were no appliances to lift the equipment; this is how we accomplished the job. Referring to the sketch it will be noted there was a space between the factory and the ground wall, this was utilized as shown, by dumping several cart loads of fine sand which we had handy. The main frames of the machines were dragged along the ground on rollers to the edge of the parapet and dropped on the sand; this broke the fall of the machine parts. It was then an easy matter to get them through the basement door and into position. The heavy chilled cast iron rollers, etc., were dealt with in a similar manner. By this means we got all the parts into the basement of the factory in a very short time. If the space between the walls had been wider we could have dispensed with the sand and slid the machine parts down on stout planks but unfortunately this was not possible owing to lack of room. However, the sand was quite effective.

BUZZ SAW SPEEDS EXTRAORDINARY

By D. A. H.

A manufacturer of wood and metal specialties was hard hit by German competition. He speeded up wherever he could but on buzz saws, everyone told him that they would not run at higher rates. Still his sawing costs were out of all proportion. Finally he threw precedent aside and began to run his saws faster; with higher speeds, the power feed was greater and production correspondingly increased. He first ascertained from saw manufacturers the safe limit and he learned that there was no limit if he could keep his teeth sharp (the work was all machine fed, and guided, and guarded). To-day he is running 12 in. saws on beech lumber at ten thousand revolutions and other diameters at a like surface speed. More than a year of usage has shown that a saw keeps its edge as well at these new speeds as time honored ones. Production is now satisfactory.

High speeds for saws was entering an untrodden field. There was nothing to go by—there were many things to learn. One thing that troubled was the bearings. This trouble, and lubrication with it, was overcome by building better housings and using a ball bearing. Here also, it was necessary to precede precedent for manufacturers of bearings have no data to guide one as to excessive speeds. Selecting a self aligning bearing of double the calculated capacity solved the problem so that little trouble is now encountered. Saw mandrels have to be very carefully made and the collars and pulleys made out of steel to insure homogeneous metal.

FINDING VOLUMES OF TANKS

By W. F. Schaphorst, M. E.

This chart will be found useful by anybody for determining the volume of a cylindrical tank without doing any figuring. All you have to do is: Lay a straightedge across the chart from known point to known point and the problem is solved. The best way to explain the chart is to give an example—How many gallons will a tank hold whose diameter is 10 ft. and whose height is 20 ft.?

Connect the 10 in column A with the 20 in column D and the answer found in column C is about 11,700 gallons, which is very close. The same act of laying a straightedge across the chart tells us immediately that the volume of the tank is practically 1,550 cub. ft., (see column B). The exact answer is 1,570 cu. ft., which shows that the chart is indeed very accurate although admittedly not absolutely accurate. Most graphical charts of this kind possess a certain degree of inaccuracy but they are useful because of their simplicity. This chart may also be used backwards. For example, if you want to build a tank or buy a tank to hold a certain number of gallons or a certain number of cubic feet, find that "certain number" on the chart and swing your straightedge around it until you find the most economical or most desired height and diameter. A little practice will make an expert of you.

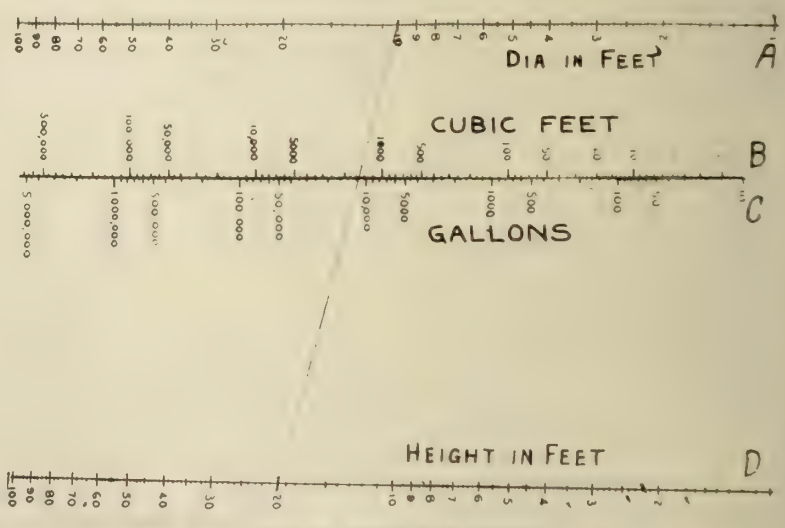


Chart for finding tank capacity.

BOOKLET

J. H. Williams & Co., Limited, of St. Catharines, Ont., with export office at 21 State Street, New York City, have ready for distribution a new and complete export catalogue, showing their lines of drop-forged specialties. These include hand hammers of all kinds—nail, machinists', tinners', riveting, plow, blacksmiths'—and the following wrenches: Stillson (wood and steel handle patterns), screw or monkey wrenches (3 patterns), automobile and bicycle wrenches and adjustable "S" wrenches.

The book is well illustrated and gives full particulars of all the above goods—dimensions, list prices, etc. J. H. Williams & Co., Ltd., is the Canadian branch of J. H. Williams & Co., Brooklyn, Buffalo and Chicago, U. S. A., London office, 56 Ludgate Hill, E. C. 4, known as manufacturers of drop-forged wrenches and machinists' tools, including the "Agrippa" and "Vulcan" brands.

Hangers for iron shafting should be located at the most, 15, 17, 19 or 21 feet apart for 2, 3, 4 and 5 in. diameters. For steel, the limit in each case is about 6 inches more.

New Things in Shop Equipment

VIBRATOR FOR FOUNDRY USE

A recent addition to foundry equipment is a pneumatic vibrator which has just been placed on the market. The device is especially designed for service in core rooms for rapping core boxes when removing the cores to avoid danger of breakage. Sufficient length of hose should be provided to allow the operator to reach any position desired. Air pressure of 20 lbs. per sq. in. is recommended. These tools are made by the Malleable Iron Fittings Co., Brantford, Conn.

BELT-LACE CLOSING TOOL

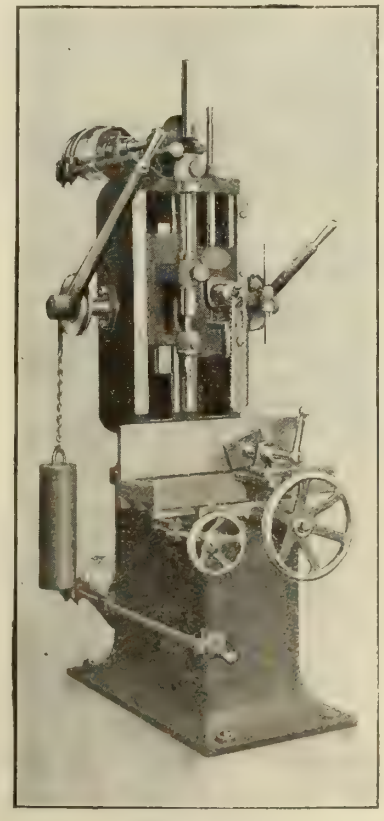
A device especially intended for use in a vise when joining belts with wire lacing has recently been placed on the market. The apparatus is normally held open by means of a spring to allow the belt to be inserted, but when the jaws of the vise are closed the two parts of the lacer are brought together in the proper position to shape the lacing. The standard staggered type of wire belt lacing is used; the hooks are mounted on a card which is placed in the closing device, the belt located by the operator with one hand while the vise is closed with the other. Pressure is used to sink the hooks into the belt and flatten the lacing. Rawhide pins are employed to connect the lacing on the two ends of the belt. They are made by the Detroit Lacer Co., Detroit, Mich.

HIGH SPEED SENSITIVE DRILL

For the particular purpose of drilling and tapping work that is too large for the ordinary sensitive drill, a new design of radial machine has been developed and placed on the market. The rapidity of positioning the drill, together with the ease of operation, minimize the time required between holes, while the high speeds and excess power reduce the actual drilling time. When the table is removed it allows for working on pieces 49½ in. between the spindle and base which has a working surface of 28 x 36 in. The table has an adjustment of 16 in., obtained by means of a ball-bearing telescopic screw. The arm is sensitive in its movement and has an operating range throughout the complete circle. Radial and thrust ball bearings are provided in the column. and the spindle. The spindle is fitted with a Morse taper and has a vertical movement of 8 in. and a horizontal traverse of 28½ in, the latter being obtained by means of a rack and helical gear. The position of handwheel enables the operator to swing the arm and move the head simultaneously with the right hand, while the left is free to raise and lower the spindle and clamp the arm. Friction back gears permit instantaneous shifting from high drilling speeds to slow speeds for tapping or drilling larger holes, the ratio being 4½ to 1. The drive is obtained by means of tight and loose pulleys on the machine, providing both a high and low speed forward and reverse. The belt maintains a uniform tension at every position of the head. The machines are built with either 3 or 3½ ft. arms; the smaller size machine weighs about 2,650 lbs. These drills are built by the Fosdick Machine Tool Co., Cincinnati, Ohio.

MORTISING MACHINE

A chain and hollow chisel mortising machine designed to cover a wide range of operations, has been developed to B. Smith and Son of Bingley, Eng. The chain will mortise at one cut up to 1¼ in. by 3 in., or down to 3/16 in x ⅛ in. x 3/16 in. x ⅞ in. The chisel arrangement takes in chisels from ¼ in. sq. up to 1 in. sq., and by slipping out the chisel this part of the machine may be used for boring round holes. The horizontal table traverse is by rack and pinion. The cross traverse movement is operated by hand wheel and screw. Operator has full control of all levers and handles without moving from his position in front of the machine. The drive is entirely self-contained; a countershaft is fitted in the base of the machine, and from this the drive is taken by belt to the chain mortising spindle.



Mortising Machine.

The driving belt is fitted with a simple device for making allowance for the tension of the belt being kept equal in all positions of the stroke, so that the machine can be operated from any position which may be found convenient in the shop. The chain mortiser has a device for taking up any slack which may develop in the driving belt. The hollow chisel side of the machine is fitted with an independent fast and loose pulley with separate belt fork, which enables this part of the machine to be put out of gear without having to push the belt off when this side of the machine is out of use. All bearings are of phosphor bronze and are provided with ring oiling arrangement. Each mortiser head travels 11½ in. and will make a mortise up to 7 in. deep at one stroke. Machine will accommodate timbers up to 12 in. x 9 in. This machine can be arranged for mortising hubs fitted with dividing heads, and canting arrangements for taper mortises. These machines are marketed in Canada by the A. R. Williams Machinery Co., Toronto.

HEAVY DUTY FRICTION CLUTCH

A friction disc clutch designed particularly for severe service has been developed and placed on the market recently. The former model of this clutch has been equipped on the discs with hard maple blocks that have contact with the friction discs when the clutch is engaged; Non-Burn friction lining is employed on the heavy duty type. These clutches are made in sizes with rated capacities from 5½ to 480 h.p. at a speed of 100 r.p.m. They are of the floating disc type with either one, two or three discs. These clutches are made by the T. B. Wood's Sons Co., Chambersburg, Pa.

NIBBLING MACHINE FOR SHEET METAL

A machine designed along the lines of a rapidly operated punch press and intended primarily for such operations as cutting irregular shapes out of sheet metal, celluloid, fibre and like materials, has been placed on the market recently. It has a cutting capacity of sheet up to 3/16 in. The cutting is done by means of a small cylindrical punch and die operated at high speed, the work being moved in any direction much the same as cutting a pattern out with a jig saw. It is claimed that 18 linear inches per min. can be attained. The amount of

stock cut out at each stroke is governed by a pilot located in the punch. Closed outlines may be worked out by first drilling a hole within the desired space. The movement of a small lever in the ram withdraws the pilot and permits the sheet to be pushed under the punch without disturbing the ram adjustment. By using a template any desired number of pieces may be produced without the operator watching a line. Circles up to 28 in. in dia. may be cut out by use of an attachment. Punches are 3/16 in. dia. and made of special alloy steel, with cutting edges on both ends. These machines are made by A. C. Campbell, Waterbury, Conn.

POCKET MICROMETER CASE

The leather covered metal case here shown has recently been placed on the market by the Brown and Sharpe Mfg., Co., of Providence, R. I. This case protects the micrometer from dirt and injury. The case is lined with plush and its shape adapts itself for pocket use, does not cause the pocket to bulge, and requires very little room. The case is made in two styles, No. 202 for the regular 1 in. micrometer and style No. 203 for the "Rex" 1 in. size. This case offers a good protection for the micrometer and a handy place to keep it.

Micrometer case.

ROLLER BEARING

A bearing in which the rolling action is obtained by means of cylindrical discs is a recent development in mechanical equipment. The periphery of each disc is parallel with its axis and the thickness is half the diameter regardless of the size. It is claimed that this construction, where the rollers have contact on two parallel conical surfaces, that excessive friction and end thrust are eliminated. The several series of rollers are mounted in separate ring cages, as the rollers near the apex of the cone travel faster than those in the other part of the bearing. The rollers are kept complete contact and at proper pressure by means of an adjusting spring. The pressure is automatically controlled, assuring uniform and constant contact with the cone surfaces. The bearings are made in all commercial sizes to accommodate a wide range of work where both radial and thrust loads must be carried. These bearings are made by the Whitney Bearing Corporation, Chicago, Ill.

HAND CENTERING MACHINE

To provide a light efficient machine for accurately centering work, the one here shown has been developed and placed on the market. It has been designed to cover the requirements of the shop having a variety of work which demands quick adjustment to all sizes within the capacity of the machine. While normally equipped with two opposed drill heads for centering both ends of the work in one operation, the machine can be supplied with only one head in cases where all the work to be centered is longer than the double end capacity. The right hand head is adjustable to suit different lengths of work, or it can be removed entirely for occasional long work.

Both heads are normally operated together by the hand lever A which is shown on the right hand head. The drills are advanced by the hand feed lever, with the right hand, until they contact with both ends of the work, which is placed loosely between the jaws of the vise E so that it can shift endwise for this purpose. When contact is secured both jaws of the vise are tightened at the same time by the hand lever F with the left hand, and the work is ready for centering. The drill spindles are mounted in sliding bronze sleeves, provided with ball thrust bearings. These spindles are driven from a constant speed motor, geared to provide a drill speed of 1,200 or 1,800 r.p.m. Changing gears or locking the spindles for the removal of drills, is easily taken care of by knobs B. B. on the top of the drill heads.

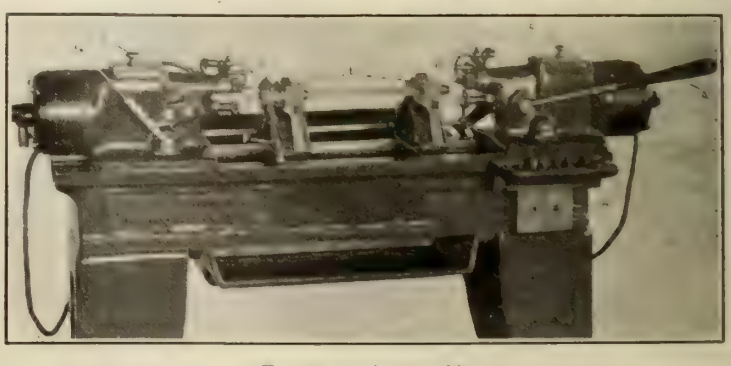
In order to hold the drilling depth to any dimension desired, adjustable stops C. C. are provided which are mounted on the head and bear against the ends of the work to limit the forward movement of the spindles. In certain cases it is necessary to have the center holes the same distance apart regardless of minor variations in the length of work. For this purpose, the adjustable stops are positioned to engage lugs D, D, on the drill heads, thus holding the spindles to a predetermined forward movement.

Two quick acting, self centering vises take all sizes of work up to and including 2 in. diameter. They are adjustable along the bed for different lengths of work, and are operated simultaneously by a single lever. For heavy work up to and including 4 in. diameter, adjustable "V" supports are used. Locking screws maintain the adjustments and one of these supports has a clamp lever to hold the work in place. The work after being centered is deposited in a removable metal tote box at the rear of the machine. Oil drains from this box into the tank and is conveyed to the drills by means of a plunger pump. This pump is connected to, and works with the hand feed lever, so that oil is always supplied to the drills while cutting, without the attention of the operator.

The machine requires a floor space 4 ft. 6 in. by 2 ft. 6 in., and has a net weight of 600 lbs. It is driven by a ¼ h.p. motor operating at a constant speed of 1,700 r.p.m. These centering machines are made by the Pratt and Whitney Co., New York.

PORTABLE ELECTRIC DRILL

A light-weight portable electric drill of simple design has just been placed on the market. The frame is made of aluminum and contains a 1/6 h.p. Westinghouse Motor operating on either alternating or direct current. For small drills the spindle has a speed of 2,000 r.p.m., and this is reduced to 850 r.p.m. when working with drills 5/16 in. dia. Motor windings are coated with a special compound and baked 90 hours, making a solid core This coating adds greatly to the insulating properties and makes the armature practically indestructible from mechanical abrasion. A cool grip is assured by special ventilation through the handle and all parts of the motor. The helical gears are made of bronze with a ratio of 7 5/12 to 1. The purpose of the odd ratio is to provide for better distribution of wear on the gear teeth. Ball bearing thrust is provided. When opening and closing the chuck it is prevented from turning by means of a small spring stop. The switch is located in the handle of the drill in such a position as to be operated by the thumb. The switch is of the quick-break type and is either completely closed or open. It was developed by the Cutler-Hammer Co. These drills are made by the Titan Mfg. Co., Chicago, Ill.



Hand centering machine.

CANADIAN MACHINERY
AND MANUFACTURING NEWS

Published in the Interests of the Machinery, Manufacturing, Iron, Steel, and Metal Working Industries.

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To Develop Empire Trade

THAT there is growing appreciation of the buying power of Canada and other British Dominions is evident from the recent speech at Glasgow of Right. Hon. A. Bonar Law, successor to Lloyd George. To him it appears that one solution of the trade problem caused by temporary loss of European markets, is development of resources within the Empire. For example, Russia formerly supplied a great amount of food. This is now coming from overseas dominions. A carefully thought-out plan in co-operation with these countries should lead to still better trade results within the Empire. An economic conference is proposed at which problems could be discussed.

Such movement as proposed would undoubtedly develop, as an essential, a greater knowledge as to the class of goods required by the different dominions. At the present time, some improvement has been noticed in the mechanism necessary for this purpose. A more consistent use of business papers, and more informative methods in that connection would undoubtedly be found to be effective.

Seven to One Against

IT IS UTTERLY impossible to take any measure of the reader-interest of a free-distribution paper. This was the assertion made by a leading national advertiser at the recent convention of the Audit Bureau of Circulation in Chicago. It explains, in brief, the decisive stand taken against recognition of free-distribution publications, the vote being more than seven to one against.

The Audit Bureau of Circulation, it may be explained, makes available to advertisers authentic analyses of circulation of the publications within its membership. This comprises the leaders among publishers, advertising agents and national advertisers in Canada and United States.

It stands to reason that a reader subscribes for a publication because it represents money's worth. He is keenly interested in its contents and appreciates the fact that the publishers are co-operating with him in his business, that the paper represents definite investment to that end. These are the factors behind reader interest and they make its appraisal a definite proposition.

While it is perhaps natural that publishers of paid-circulation papers should be unanimous against the admission of free papers to A.B.C. membership, it was notable that the most forceful speech at the convention should have been made by a large national advertiser. Reader interest is the basis and test of definite service in a publication. Where it introduces the factor of value received, it develops and maintains a sense of useful purpose and friendly intimacy between reader and publisher which cannot exist otherwise.

Further Deflation Predicted

THERE IS some opinion to the effect that the steel industry at present is in a weak position. In fact, reports from Pittsburgh indicate that the point has been reached when hand-to-mouth buying has developed out of the feeling that prices should gradually decline. Certainly, it is evident that the market is not marked by the heavy advance buying so reflective of upward movements. It is a bearish rather than bullish situation.

Advance in price of railroad steel from $40 to $43 had the desired effect. It brought out large tonnages while the lower figure ruled, and this has ensured winter rollings, but it is stated that the railways were not anxious to begin receiving and paying for rails so soon. Premiums for early shipments on steel have disappeared.

A Canadian observer describes the market as one in which the large interests are jockeying for downward revision of prices. There must be business, and the point has been reached where the possibility of reductions has to be considered; that deflation, rather than further inflation, is in order. Meantime, the industry is going strong at 70 per cent. capacity.

Economists may now say that, after all, the activity in the steel industry was simply an abnormal process by which the depressed area is filling in, and that the law of averages is about to assert itself. In that case, the Canadian recovery may be described as slow but steady and quite healthful.

Aggressive Policy Required

"BUSINESS runs in cycles; business men run in ruts." This observation was given expression by an economist of international repute who recently addressed a gathering of business men. Inclinations were too strongly in the direction of moving, aggressively or otherwise, with the tide, and of assuming too passive an attitude when business went into reverse gear. This made for high peaks and low valleys.

One point was stressed particularly—that the time to advertise, the time for forceful selling, was in periods of depression such as the present. When the cycle was moving above the normal line, when money was plentiful, when production was high, when there was evidence of extravagance on every hand, selling was not the problem that it was when the opposite condition existed. It was then that the most active co-operation of sales forces should be enlisted toward obtaining distribution, when the advertising appeal should be the most convincing. There was a depressed area that must be filled, representing activity rather than stagnation. Though this applied to basic commodities rather than specialties, nevertheless good business in one developed the same condition in the other.

Business men are of opinion that it will require two years to fill the present depressed area to normal level; that considerable re-adjustment in values and prices is still to be done.

Car Repair Program Will Benefit Steel Market

St. Malo Shops Said to Have Two Years' Work Ahead—C.P.R. Sends Cars to U.S. for Needed Material—Dealers Report Demand to be Satisfactory—Weakness in Sheets

ANOTHER ADVANCE IN MERCHANT STEEL PIPE

WHILE the car situation at American steel centres has improved to such an extent that piles of material that had accumulated are being moved, a box-car scarcity is said to be in sight owing to present requirements of the West. There is still a large amount of business on books and buyers are pressing for deliveries. Especially is this so of merchant steel pipes for which there is a very strong demand. Canadian mills have made an expected announcement to the effect that an advance of about two dollars a ton on steel pipe has been made following the recent lead by American mills. It is reported from Pittsburg that relatively little business has been done on the new price, 66 per cent. basing discount which went into effect Oct. 19.

There is a strong demand for sheets in the Pittsburgh market, but it is stated that purchases had been below the rate of production for a couple of months. An easing process has been noted in Canadian sheet markets owing to seasonal interference with roofing operations, and the fact that the market has been well supplied recently not only from the other side but from the Old Country. Bars, shapes and plates were not as active in October as in the preceding month, and specifications on structural are not the feature that they were some weeks ago. On the whole, however, business is good.

The railways, it is reported, are buying considerable material. St. Malo shops of the C. N. R have repair work on hand to keep 500 men busy for two years, and in the meantime other disabled stock accumulates. The C N. R. also has a large amount of such repairs and recently had to send cars across the line for materials needed. All of this means that the day is not far distant when the long-deferred buying activity of the railways must make itself felt in industry generally.

While pig iron markets are not active, they are interesting because of the large amount of English and Scotch iron that is making its appearance in the market. This iron is quite a competitive factor both in Canada and United States at the present time, but dealers declare that it will probably disappear as soon as local furnaces are on a nominal basis of production. Pittsburgh is quoting foundry iron at $29 and $30, valley, with only small lots being sold. It is stated that the whole pig iron market on the other side is lined up for a readjustment to $25 or less.

Montreal reports satisfactory demand for iron and steel, with the exception of sheets, in which the arrival of large supplies and a falling off in roofing demand, have caused a temporary weakness. Conditions generally are moving in the right direction.

Toronto

Nov. 8, 1922.

THAT shipments of steel and other materials are improving and that overdue deliveries have more definite prospect, is the report in Toronto markets this week. This forms a more encouraging background for business depending upon import supplies. Although there have been some seasonal readjustments in demand, as for example in roofing operations which fell off with the arrival of cold weather, dealers point out that demand continues good, and that orders from manufacturing concerns continue to show improvement. It is this steady growth, free from any spectacular movement that is regarded as more healthful and likely to lead to more permanent conditions than would an occasional "flash in the pan."

The most notable change of the week is the advance in steel pipe. Such an advance seemed inevitable following that of the American mills some weeks ago. Costs of production have advanced owing to difficulties in securing skelp and other materials which have been held up by car shortage. It has been known for some time that Canadian mills were confronting a serious curtailment of operations if the situation did not improve. The price increases have been long overdue.

Iron and Steel.—That the market is well supplied with sheet steel and that seasonal conditions are a factor in regulating prices, is evident from the easing process that has been going on during the past few weeks. The stability that marked the summer months has been shifting, and the best example of change is seen in Canada plates dull, 52, which are quoted at $4.90 by firms in close touch with roofing interests while "all brights" are at $5.40. Galvanized 28 are priced at $6.20 to $6.25, while black sheets, No. 28 are listed at $5.10. There is said to be large quantities of British materials coming into the market and that shipment now on the way to Montreal will swell stocks very materially. Reports from Pittsburgh indicate that premiums are practically a thing of the past and that a few weeks will see the leading interest price of $1.85 as the general basis. October has not been as good as September on heavy steel. Specifications do not indicate the same activity in industry generally but it is felt that the level of business for the year has made a very good showing and a great improvement over one year ago. Shipments in import metal have improved. Boiler tubes have also been advanced about 10 per cent. There appeared to be some hesitancy among certain dealers on this move, but this is ascribed to the fact that new stock was on the rails, and available supplies were low. Current iron and steel prices:

Iron bars	3 25	3 40
Steel bars	3 25	3 40
Reinforcing bars	3 15	3 25
Steel hoops		4 75
Tire Steel		3 50
Spring steel	7 00	14 00
Band steel, No. 10 gauge and 3-16 in base		3 90
Small shapes		3 50
Sheets, black, No 28		5 10
Sheets, blue ann., No 10		4 20
Canada plates, dull, 52 sheets		4 90
Canada plates, all bright		5 10
Galvanized Sheets, No. 28		6 25

Non Ferrous Metals.—Tin continues to be the active factor in this department, and while dealers are quoting $40 to $41, cables indicate the profit-taking has developed in the speculative orgy that has been going on in London and that lower levels are expected. Standard spot declined £1 in one day, while future also lost 17s. 6d. The world's visible supply at the end of October was 22 902 tons as compared with 22 829 tons at the end of September. Some increase had been expected because of increased shipments from the East.

Copper markets, though featureless during the past week, show an improved demand. New York reports tremendous sales both for domestic and export, and it is predicted that prices will become firmer immediately.

Dealers are quoting lead at $7.50 and there has been no change in sheet prices. American Smelting and Refining Company have been advancing prices; in fact a boost of $10 the ton in two days was announced a few days ago owing to a scarcity of prompt metals. This advance will duly become reflected in Canadian quotations. Current prices:—

Lake copper	17 25
Electrolytic copper	17 00
Castings, Copper	17 00
Tin	41 00
Lead	7 50
Spelter	9 50
Antimony	8 50
Aluminum	22 00

Old Material.—The dullness in this market is due in some measure to the fact that blast furnace demand is spasmodic and to a feeling that the price movement should reflect that of pig iron and show a downward tendency. Dealers, however, do not concur in this view since their stocks to some extent represent purchases at fairly high levels. Nor are

there over-abundant supplies in some grades, such as No. 1 machine cast iron. There is a fairly good demand in white metals or in those lines that scrap dealers are re-converting into pig iron or ingot form. Dealers are offering following prices:—

Copper, light	9 00
Copper, crucible	11 50
Copper, heavy	11 50
Copper wire	11 00
No. 1 composition	9 00
New brass cuttings	7 00
Red brass turnings	7 00
Yellow brass turnings	5 25
Light brass	4 50
Medium brass	6 00
Scrap zinc	3 50
Heavy lead	4 50
Tea lead	3 00
Aluminum	11 00
Boiler plate, per gross ton.	9 00
Heavy melting steel	10 00
Axles (wrought iron)	20 00
Rails (scrap)	11 00
Malleable	10 00
No. 1 machine cast iron	18 00
Pipe, wrought	7 00

Pig Iron.—This market has been comparatively light of late, and it would appear that foundries are only buying according to present requirements. Some competition is evident between English and domestic pig iron, but authorities claim that this can be only temporary, until Canadian furnaces can adjust themselves. Moreover much of the import pig iron is only for mixing purposes. Steel Company of Canada expect to blow in their second furnace about Dec. 1 on foundry pig.

Machine Tools.—While conditions generally appear to be improving, machine tool business is spotty. Enquiries, however, are encouraging and the feeling is that the phase of the situation is approaching when there will be a steadier flow of business in tools. In the meantime there is a good demand for mill and shop supplies.

Montreal

Nov. 8, 1922.

NO CHANGE in prices has been made this week and the demand for all products except sheet steel has kept up satisfactorily. A serious shortage of certain popular sizes of structural sections exists at the moment and heavy plates have become quite scarce in the various stocks in this district. While relief is expected shortly, conditions at the leading mills in the Pittsburg district are reported to be very bad and it might be quite a while before sufficient tonnage is received here to make the situation normal. Advices indicate that several hundred thousand tons of steel material have accumulated at the mills because of the shortage of rolling stock on the American railways as well as embargoes confining the use of open top cars to coal-carrying traffic.

Iron and Steel.—As an instance of how difficult it is for importers to obtain their requirements, it might be mentioned that last week the C. P. R., sent several empty cars from here to bring on material which was awaiting shipment to their Angus shops but which the mills could not load through their inability to obtain cars. The demand for sheet steel has fallen off considerably. Buyers are well supplied and a lull exists at present in new buying. There is no change in prices, however, and none is expected so far as supplies ex-warehouse are concerned, but some of the American independent mills have reduced the base price of blue annealed steel sheets from $2.75 to $2.60, f. o. b. Pittsburg for prompt shipment, with the "leading interest" maintaining a price of $2.50 base Pittsburg for deferred shipment.

Large importations of steel material including structural shapes, plates and bars were observed on the dock this week representing the cargoes of several steamers which arrived from British ports last week-end. Current prices:

Iron bars, base	3 15 to 3 25	
Steel bars, base	3 15 to 3 25	
Reinforcing bars, base	3 15 to 3 25	
Steel hoops	....	4 00
Tire steel	3 25 to	3 40
Spring steel	....	7 00
Band steel, No. 10 gauge and 3-16" base	3 65	3 75
Small shapes	....	3 40
Sheets, black, No. 28	....	4 75
Shets, blue, ann., No. 10	....	4 10
Canada plates, dull, 52 sheets	....	5 50
Canada Plates, all bright	....	7 00
Galvanized Sheets. No. 28	....	6 50

Pig Iron.—It is estimated that over 6,000 tons of pig iron were discharged from vessels from British ports this week. Reports are that even larger quantities will arrive by succeeding steamers before the close of navigation. A great deal of this iron is finding its way inland, a large portion being for Ontario points. It is not expected, however, that Scotch iron such as Summerlee and Carron will find a permanent place in the Ontario market, and unless something unforeseen happens Canadian iron will again be exclusively used there. There is a good deal of Middlesborough pig iron going into Ontario, but it is not as good as Scotch foundry iron and is merely for mixing purposes.

Discussing the pig iron situation a large dealer states:

"With regard to the pig iron situation, there has, of course, been a considerable quantity of English and Scotch imported during the past few months, and we have sold a fair quantity for Ontario delivery. This is, of, course, special business arising out of the situation in connection with the coal strike and we could not look for its continuation except perhaps in isolated cases. The situation locally is naturally improving and prices we judge, are very close to the cost of import to-day. We can lay down Scotch pig iron to-day at most Ontario towns at about $36.00 per ton delivered, duty paid. this, of course, being for direct import and not from stock. We consider that, by the Spring, conditions will have become quite normal and that it will be difficult or impossible to sell imported pig iron, except at points such as Montreal or nearby places where the import freight rate is very low. British furnaces have, of course, sold a large quantity for export to the U. S. during the past few months, and prices are naturally stiffer as a result. We therefore do not look for any easier prices on the other side at present." Montreal prices:

Algoma, No. 1, car lots on tracks, nominal quotation	38 65	
Summerlee, 30-ton lots, dock	35 00	....
Carron, 30 ton lots	35 00	....
Do., 5 ton lots, ex. warehouse	40 50	....

Old Materials:—The market, both as regards offerings and sales, remains quiet, but average buying prices are as follows:

Copper, light per 100 lbs.	9 00
Copper, crucible	11 50
Copper, heavy	11 25
Copper Wire	11 25
No. 1 composition	9 00
New brass cuttings	6 00
Red brass turnings	6 50
Yellow brass turnings	5 25
Light brass	4 50
Medium brass	6 00
Scrap zinc	3 50
Heavy lead	4 50
Tea lead	3 00
Aluminum	11 00
Boiler plate, per gross ton	9 00
Heavy melting steel	10 00
Axles (wrought iron)	20 00
Rails (scrap)	11 00
Malleable	10 00
No. 1 machine cast iron	25 00
Pipe, wrought	7 00
Car wheels	17 00
Steel Axles	15 00
Machine shop turnings	4 00
Stove plate	16 00
Cast boring	4 00

Non-Ferrous Metals.—Conditions are, to an extent, reflective of the New York and London markets. Tin is very firm in price, being quoted here at $40 and $40.50, but any influence causing a reaction in London may result in easier prices here. Business indicates that foundries are fairly well employed. Current prices:

Lake Copper	17 50
Electrolytic Copper	17 25
Castings, Copper	17 00
Tin	40 50
Lead	7 50
Spelter	9 50
Antimony	7 50
Aluminum	22 00

Pittsburgh

November 8, 1922

OPERATION of the steel industry continues at between 70 and 75 per cent. of capacity, the rate being probably close to 70 per cent., although some observers put it at fully 75 per cent.

Supplies of open-top cars continue at the better rate inaugurated about three weeks ago, and are fully equal to moving the current output of materials requiring such cars, while additional inroads have been made upon piles of materials previously accumulated, so that there is not much left of such material. A fresh box car scarcity, however, seems to be developing, as a result of box cars being ordered to move west to help in grain movement.

The finished steel markets, as a whole, are very dull in point of turnover in the open market. The heaviest movement is in sheets, but sheet purchases have been below the rate of production for a couple of months and lately have been considerably below. In merchant steel pipe, there is a very strong demand, but this does not involve very much new buying as there is a large amount of business on books, and buyers are pressing mills for heavier deliveries against these old orders. A little of the tonnage dates prior to the price advance in August, from 71 to 68 per cent. basing

discount. Relatively little business has been done on the further advanced price, 66 per cent, basing discount, in effect since October 19.

Dullness in Some Lines

Bars, shapes and plates are particularly dull. Delivery premiums on these products have now practically disappeared, having been diminishing for more than a month. Several independent mills are now able to make quite early deliveries, although they have some orders on books calling for deliveries strung out to the end of the year.

Tin plate is seasonably dull and is particularly dull on account of price uncertainty. Independent mills have been claiming that there should be an advance from the $4.75 price to $5.25, but buyers are unwilling to contract at an advance when the Steel Corporation has not committed itself. The corporation is likely this week to make a price announcement, and open its books for first half in the case of manufacturing consumers and first quarter in the case of jobbers. The corporation will probably at the same time announce its sheet prices for the first quarter, and in that case there is a question whether the corporation will make an advance. Its prices hitherto have been 2.50c. for blue annealed, 3.35c. for black, 4.35c. for galvanized and 4.70c. for automobile sheets. In the first three months of the year prices were 2.25c. on blue annealed, 3.00c. on black, 4.00c. on galvanized and 4.35c. on automobile sheets.

Several independents are now content to sell black and galvanized sheets at the corporation prices of 3.35c. and 4.35c. respectively, while on blue annealed and automobile sheets they all seem to be able to obtain higher prices, up to 2.75c. on blue annealed and 5.00c. on automobile sheets. Sales of black sheets at above 3.50c. are now somewhat unusual, while galvanized rarely if ever goes at above 4.50c.

Decline in Pig and Coke?

Connellsville furnace coke has ruled quite steadily at $7.50 to $8 for somewhat over a fortnight, following its sharp break from $12. When the market dropped with such celerity from $12 to $8 it looked as if it had enough momentum to carry it considerably farther, but it seems now that a number of furnacemen concluded they had better let well enough alone, and contract to the end of the year at $8 or thereabouts, since the market might perchance regain its $4 loss while there was no chance of its going down another $4. This is the explanation given for the market's steadiness in the past fortnight, in face of increasing production and no material increase in consumptive requirements. For a time after the settlement of the coal strike, when nearly all the merchant furnaces were idle, the attitude of each furnace was that it would get into blast as soon as it could pick up enough coke. With the furnaces that have since gone in, making deliveries on their old sales, with fresh sales in small lots from day to day, there seems to be good balance between production and consumption, and scarcely any of the merchant furnaces now idle are likely to get into blast until consumption increases. Indeed, it is understood that one foundry iron furnace had practically decided some weeks ago to blow in, but now does not intend to do so. A basic iron furnace is considering the matter of blowing in next month, and is meanwhile sounding out the selling prospects in basic iron. In this it must meet the competition of some steel interests, which can make more pig iron than their sales of steel promise to take up.

Bessemer iron continues to sell in small lots at the former price of $33, valley, and foundry remains at $30, valley. Only small lots are being sold, not large enough to cause energetic competition, and the prospect is that if one or two really good-sized inquiries should come into the market the price would decline again. On a small lot sale basic went down $1 to $29, valley, which puts it in more natural relation with foundry iron. The whole pig iron market, of course, is lined up for a readjustment to $25 or less, it being simply a question of how long a time is involved in the decline. Coke, of course, would have to go down also. Its present market of $7.50 to $8 compares with about $3 in January and February, since when there has been a wage advance of over 40 per cent.

Corporation Booked Far Ahead

In September and early in October sheet bars were very hard to buy, and nothing could be done under $40. Now there is no inquiry and there are half a dozen or more sellers. They could be bought at $38 and this price could probably be shaded. Predictions are that sheet bars will not be above $35 for the first quarter of the new year, against $29 in the first three months of this year. Since then there have been the freight rate reductions and the wage advances.

The finished steel market in general is now at the steel corporation prices, with the Steel Corporation booked far ahead in most lines and the independents booked not nearly so far, some of them being rather lightly booked, while the current buying on the whole, is very light. The whole question as to the market, therefore, is how long it will be until independents start cutting prices, the condition being much the same as that which obtained two years ago. Then the independents got down to an average operation of 30 per cent., in January, 1921, against a Steel Corporation operation of 90 per cent., before they started cutting prices. The price concessions began with Midvale, about February 1, and spread to other independents. It seems likely that this time independents will not be content to see their operations go far below those of the corporation.

Heavy Scrap Purchase

The Jones & Laughlin Steel Company has just made remarkably heavy purchases of heavy melting steel scrap, taking about 60,000 tons from five or six dealers, at $21, delivered. This was the quoted market, and on account of the market being soft it was not necessary, as usual, to pay a premium to secure a large tonnage. Delivery specified is to the end of the year, but on account of transportation conditions it will probably take all of January to complete the movement. As the company is now operating all its blast furnaces the inference is that it intends to maintain its steel production at a high rate through the winter.

ENLOW ON SHEET OUTLOOK

A. T. Enlow, president Dominion Sheet Metal Corporation, Hamilton, discussing impressions obtained at a recent meeting of the American Iron and Steel Institute states:—

"There was a great deal of public optimism and considerable private pessimism at the New York meeting, American Iron & Steel Institute. I am afraid there is going to be a soft spot although from present indications it will not be what you might denote 'mushy' especially in galvanized sheets because of the very continued strong tendency of zinc spelter.

"Most of the sheet makers in the States have been asking premiums as compared with the U. S. Steel Corporation price but several of them are now down to the Corporation basis and I question whether they will go any further unless they get desperate and ignore costs because very few of them are making what might be called a reasonable profit and the U. S. Steel Corporation, as you know, have for the seventh consecutive time failed to earn its full dividends, notwithstanding its enormous advantages.

"My idea therefore is, that for the next two or three months, the Canadian buyer will sit rather tight in the saddle and take few chances which may in the end be just as well, and if any of the several dozen things which might happen to upset the world at large do not occur between now and next March, we may expect then to see quite a development in demand but I sincerely hope that the price will remain within a reasonable limit.

"We are continuing our price unchanged but that is due to the fact that we have had a large excess of orders in the last week or so and our price to the Canadian wholesale buyer at the present time is just about on a par with the leading sellers in the U. S. after adding import charges."

Workers' Educational Association of Toronto and district announce their program for the season of 1922-23. This is an organization having for its object the co-operation of labor and learning. Subjects include Economics, English literature and rhetoric, international finance, trade union law, British history, psychology, public speaking, political philosophy.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Toronto price:—

Silicon, 2.25% to 2.75%	36 30
Algoma, No. 1, Montreal	38 65
Summerlee, Scotch, Montreal dock	35 00
Summerlee, Warehouse, 5-ton	40 50
Carron, Montreal docks	35 00
Grey forge Pittsburgh	31 27
Lake Superior, charcoal. Chicago	36 15
Standard low phos., Philadelphia	38 00
Bessemer, Pittsburgh	34 77
Basic, Valley furnace	30 00

METALS

	Montreal	Toronto
Lake copper	$17 50	$17 25
Electrolytic copper	17 25	17 00
Castings, copper	17 00	17 00
Tin	40 50	41 00
Spelter	9 50	9 50
Lead	7 50	7 50
Antimony	7 50	9 00
Aluminum	22 00	22 00

Prices per 100 lbs.

BILLETS

F. O. B. Pittsburgh

	Per gross ton
Bessemer billets, 4 in. x 4 in. and larger	40 00
Open hearth billets	40 00
O. H. sheet bars	40 00
Forging billets	45 00
Bessemer rods	46 50

IRON AND STEEL

Per 100 lbs. to large buyers

Iron bars, base, Toronto	$3 25	3 40
Steel bars, base, Toronto	3 25	3 40
Small shapes, base		3 50
Iron bars, base, Montreal	3 15	3 25
Steel bars, base, Montreal	3 15	3 [illegible]
Reinforcing bars, base	3 15	3 40
Steel hoops		4 50
Tire steel, base		3 50
Spring steel	7 00	14 00
Band steel, No. 10 gauge and 3-16 in. base		3 90
Chequered floor plate ¼" and heavier	6 25	7 00
Chequered plates ¼-in. and heavier, sunken diamond		5 40
Bessemer rails heavy at mill		2 35

PITTSBURGH MILL

Steel bars	2 00 to 2 10
Tank plates	2 00 to 2 25
Structural shapes	2 10
Steel hoops	2 90 to 3 00

F. O. B. Chicago Warehouse

Steel bars	2 80
Structural shapes	2 90
Plates	2 90
Small shapes under 3-in.	2 90

PLATES

Plates 3-16 in.	$3.85	$3 60
Plates, ¼ up	3 50	3 40

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$ 4 75	$5 10
Sheets, blue ann., No. 10	4 10	4 20
Canada plates, dull, 52 sheets	5 25	4 90
Can. plates, all bright	6 50	5 40
Galvanized sheets, No. 28	6 75	6 25
Queen's Head, 28 B.W.G.	7 25	
Fleur de Lis, 28 B.W.G.	7 00	
Gorbal's best, No. 28, U. S. G.	6 10	
Colborne's Grown, No. 28		
Premier 28	6 10	6 35
Premier 10¾ oz.	6 80	6 75
Zinc sheets	9 75	10 25 11 00

FREIGHT RATES

Pittsburgh to Following Points	Per 100 lbs. C.L.	L.C.L.
Montreal	52	65½
St. John, N. B.	76	96
Halifax	77½	97
Toronto	34	48½
Guelph	34	48½
London	34	48½
Windsor	31½	45½
Kingston	48½	61

Current surcharge 1 per cent.

OLD MATERIAL

Dealers' Average Buying Prices

	Montreal Per Ton	Toronto Gross
Boiler plate	$ 9 00	$ 9 00
Heavy Melting Steel	10 00	11 00
Axles (wrought iron)	20 00	16 00
Rails (scrap)	11 00	11 00
Malleable scrap	10 00	11 00
No. 1 Machine cast iron	22 00	18 00
Pipe, wrought	7 00	6 00
Car wheel	17 00	16 00
Steel axles	15 00	15 00
Mach. shop turnings	4 00	6 00
Stove plate	16 00	14 00
Cast boring	4 00	6 00
Copper, light	9 00	9 00
Copper, crucible	11 50	11 50
Copper, heavy	11 25	11 50
Copper, wire	11 25	11 00
No. 1 machine composition	9 00	9 00
New brass cuttings	6 00	7 00
Red brass turnings	6 50	7 00
Yellow brass turnings	5 25	4 85
Light brass	4 50	3 50
Medium brass	6 00	4 50
Scrap zinc	3 50	4 00
Heavy lead	4 50	4 50
Tea lead	3 00	3 00
Aluminum	11 00	11 00

COLD ROLLED STEEL

(At Warehouse)

Rounds and squares	$4 75 base
Hexagon and flats	$5 75 base
Cumberland ground shafting, base	$6 00 base

COPPER PRODUCTS

Prices per lb.

	Montreal	Toronto
Copper bars, 1¼ to 2 in.	30-31	.28
Plain sheets, 16 oz. in. 30 x 72 hot rolled	31-32	.29
Copper sheet, tinned, 16 oz.	36 00	.36
Copper sheet, planished, 16 oz. base	40 00	.46
Braziers', in sheets, 6 x 4 base	.30	.29
Copper tubing, seamless		.33

LEAD SHEETS

Roll Lot Prices

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$9 65	$10 50
Sheets, 3½ lbs. sq. ft.	9 55	10 50
Sheets, 4 to 6 lbs. sq. ft.	9 40	9 50

Cut sheets, ¾c. per lb. extra

Cut sheets to size, 1c. per lb. extra

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in.	22
Brass sheets, 24 gauge and heavier base	25
Brass tubing, seamless	30

WROUGHT PIPE

Price List No. 56. August 23, 1922.

Standard Buttweld Pipe S/C

Size	Steel Blk.	Steel Galv.	Gen. Wrot. Iron Blk.	Gen. Wrot. Iron Galv.
⅛ in.	6 00	8 00	....	....
¼ in.	3 96	6 00	7 20	9 30
⅜ in.	3 96	6 00	7 20	9 30
½ in.	5 02	6 55	7 31	8 93
¾ in.	6 10	7 82	8 86	10 70
1 in.	8 50	14 22	12 58	15 30
1¼ in.	11 50	15 18	17 02	20 70
1½ in.	13 75	8 15	20 35	24 75
2 in.	18 50	24 42	27 38	33 30
2½ in.	29 25	38 61	....	....
3 in.	38 25	50 49	....	....
3½ in.	49 68	64 40	....	....
4 in.	58 86	76 30	....	....

Standard Lapweld Pipe S/C

Per 100 feet.

Below dividing line—price per foot.

Size	Steel Blk.	Steel Galv.	Gen. Wrot. Iron Blk.	Gen. Wrot. Iron Galv.
2 in.	22 20	27 75	31 08	37 00
2½ in.	32 76	41 54	46 80	56 16
3 in.	42 84	54 32	61 20	73 44
3½ in.	50 60	66 24	72 68	89 24
4 in.	59 95	78 48	86 11	105 73
4½ in.	68 58	87 63	1 04	1 24
5 in.	79 92	102 10	1 21	1 45
6 in.	1 04	1 32	1 57	1 88
7 in.	1 38	1 79	2 02	2 45
8L in.	1 45	1 88	2 13	2 58
8 in.	1 67	2 16	2 45	2 97
9 in.	2 04	2 62	2 97	3 59
10L in.	1 89	2 43	2 75	3 33
10 in.	2 43	3 13	3 54	4 28

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4-in. and under, close and short, 55 per cent.

4½-in. and larger, close and short, 45 per cent.

4-in. and under running thread, 35%.

Standard couplings 4-in. and under 25%.

Do., 4½-in. and larger 5 per cent.

MALLEABLE FITTING LIST

1 in. elbow	.32	.53
2 in. elbow	1.05	1.70
1 in. tee	.43	.70
2 in. tee	1.45	2.40
1 in. coupling R. & L.	.33	.53
1 in. locknut R. & L.	.15	.23

Discount to dealers—70 per cent.

BOILER TUBES

Sizes	Seamless Lapw'ld Toronto	Seaml'ss Lapw'ld Toronto	Seamless Lapw'ld Montreal	Seaml'ss Lapw'ld Montreal
1 in.	20.00	....	20.00	....
1¼ in.	22.00	....	22.00	....
1½ in.	24.00	....	21.00	....
1¾ in.	24.00	....	24.50	24.00
2 in.	22.00	20.00	21.00	19.75
2¼ in.	24.00	....	24.00	22.25
2½ in.	27.00	25.50	27.00	23.25
3 in.	34.00	31.00	34.00	29.50
3¼ in.	36.00	....	36.00	....
3½ in.	38.00	35.50	38.00	34 25
4 in.	50.00	45.00	49.00	43.50

Prices per 100 ft., Montreal and Toronto

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, 7-16 and up	30
Carriage bolts, ⅜ in. and smaller 6 in. and shorter	40
Coach and lag screws	45
Stove bolts	72½
Wrought Washers	60
Do., corru. head	60
Machine bolts, 7-16 and over	35
Machine bolts, ⅜-in. and less	35
Blank bolts	35
Bolt ends	35
Machine screws, fl. and rd. hd., steel cut thread	37½ & 10
Machine screws, o. and fil. hd., steel cut thread	30
Machine screws, o, and fil. hd., brass cut thread	15
Standard couplings, 4-in. and under, brass cut thread	30% 30
Nuts, square, blank off net list	$1.00
Nuts, square, tapped off net list	50c.
Nuts, hex., blank off net list	50c.
Nuts, hex., tapped net list	
Copper rivets and burrs, list less	32c.
Burrs only, list plus	10%
Iron rivets and burrs	47%
Boiler rivets, base ¾ in and larger	$5.75
Structural rivets, as above	5 65
Wood screws, O. & R., bright	80
Wood screws, flat, bright	82½
Wood screws, flat brass	77½
Wood screws, O. & R., brass	75
Wood screws, flat, bronze	72½
Wood screws, O. & R., bronze	70

NAILS AND SPIKES

Wire nails, base	$3 65
Cut nails, base	4 35
Miscellaneous wire nails	72½%

MILLED PRODUCTS

(Prices on unbroken packages)

Set screws	65
Square and hexagon head cap screws	60
Round head cap screws	20
Fillister head cap screws	35
Flat head screws	25
Button head cap screws	20
Studs	45
Semi-finished nuts up to and including 9/16 in.	70
Semi-finished nuts ⅝ to 1¼ in.	65
Semi-finished nuts 1⅜ to 2 in	35
Coupling bolts	35
Taper pins, No. 2 to No 5	65
Taper pin No. 6 and over	10
Planer bolts without fillet	10
Planer bolts with fillet	Net
Patch bolts	Plus 10%
Hollow set screws	20
Thumb screws	50
Thumb nuts	70

CARBON DRILLS AND REAMERS

	Discount.
S. S. drills, wire size	60
Can. carbon cutters	plus 10
Standard drills, all sizes	60
3-fluted drills, plus	10
Jobbers and letter sizes	60
Bit stock	50
Ratchet drills	25
S. S. drills for wood	10
Wood boring brace drills	50
Electricians' bits	30
Sockets	50
Sleeves	30
Taper pin reamers	20
Drills and countersinks	20
Bridge reamers, carbon	30
Centre reamers	Net
Tape, machine screw	40 to 55
Taps, hand, sizes up to 1 in.	35 to 55
Chucking reamers	20 off
Hand reamers	20
High speed drills, list	40
Can. high speed cutters	plus 10
American	plus 40

FILES AND RASPS

Globe	60/5
Vulcan	50
P. H. and Imperial	60/5
Nicholson	40
Black Diamond	40
Heller	40
Jowitts	net
J. Barton Smith, Eagle	55
McClelland, Globe	50
Delta Files	20
Disston	40
Disston	50
Great Western-American	50
Kearney & Foote, Arcade	60/5

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

PROOF COIL CHAIN

B. B. B. CHAIN

⅜ in., $16.45; 7-16 in., $14.00; ½ in., $12.95; 5-8 in., $13.15; ¾ in., $12.75; ⅞ in., $12.25; 1 in., $11.85; 1⅛ and 1¼ in., $10.55. Fire weld chain same sizes respectively are $14.00; $11.50; $10.40; $10.55; $10.15; $9.75; $9.35; and $8.25.

ELECTRIC WELD COIL CHAIN B.B.B.

⅛ in. $20.00; 3-16 in. $16 50; ¼ in. $15.50; 5-16 in. $12.70.

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	30%
Standard	30 and 10%
Cut leather lacing, No. 1	1.75
Leather in side, (Lacing)	1.50

RUBBER BELTING

Standard 36 ....28% Best grades 28%

TAPES

Chesterman Metallic, 50 ft.	$5 00
Lufkin Metallic, 603, 50 ft.	3 17
Admiral Steel Tape, 50 ft.	3 00
Admiral Steel Tape, 100 ft.	4 50
Major Jun. Steel Tape, 50 ft.	3 75
Rival Steel Tape, 50 ft.	4 00
Rival Steel Tape, 100 ft.	8 75
Reliable Jun. Steel Tape, 50 ft.	5 25

PLUMBING SUPPLIES

Plumbers' oakum, per cwt.	6 00
Navy oakum, cwt.	13 00
Solder, strictly	0 25
Solder, guaranteed	0 26½
Soldering coppers, lb.	0 62½
White lead, pure, cwt	13 20
Red dry lead, 100-lb. kegs, per cwt.	9 75
Wood alcohol, per gal.	1 75
Whiting, plain, per 100 lbs.	3 00

ROPE AND PACKING

Packing, square braided	0 38
Packing, No. 1 Italian	0 35
Packing, No. 2 Italian	0 28
Pure Manila rope ¾ and larger, base	0 21
British Manila rope	0 19
New Zealand hemp	0 19
Jute packing, fine	15c
Jute packing, coarse	11c

OILS AND COMPOUNDS

Castor Machine Oil, per lb.	34½
Royalite, per gal. bulk	20
Palacine	23
Machine oil, per gal.	39
Black oil, per gal. (Summer)	19
Cylinder oil, Capital	69½
Petroleum fuel oil bbls., net	10.80
Turp., single bbls., gal.	2 00
Linseed oil, raw, single bbls.	1 08
Premier gasoline	29 00
Fuel oil, bbls., gal.	11 80

WASTE

XXX Extra	16	Atlas	18
Peerless	21	X Empire	13
XX Grand	15	Ideal	18
Superior	20	X Press	11½
X L C R	14		

Colored

Lion	12	Fancy	13½
Standard	10½	Popular	9
No. 1	13	Keen	7½

Wool Packing

Arrow	24	Anvil	16
Axle	20		

Washed Wipers

Select White	18	Dark colored.	13
Mixed Colored	14		

This list subject to trade discount

PLATING SUPPLIES

Polishing wheels, felt	$3 25
Polishing wheels, bull-neck	1 60
Emerey in kegs, Turkish	7½
Pumice, ground	3 to 4½
Emery glue	18
Tripoli composition	6 to 8
Crocus composition	12
Emery composition	11
Rouge, silver powder	60
Rouge, powder, nickel	35

Prices per lb.

ANODES

Nickel	40 to 45
Copper	22to 24
Zinc	14 to 14½

PLATING CHEMICALS

Acid boracic	.20
Acid, hydrochloric	.03¾
Acid, nitric	.10¼
Acid, sulphuric	.03¾
Ammonia, aqua	.20
Ammonium, Carbonate	.15
Ammonium, chloride	.13
Ammonium, hydrosulphuret	.75
Ammonium, sulphate	.10
Arsenic, white	.18
Copper carbonate, anhy.	.26
Copper, sulphate	8 to 10
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.14
Nickel carbonate	.32
Nickel sulphate	.14
Potassium sulphide (substitute)	.40
Silver chloride (per oz.)	.85
Silver nitrate (per oz.)	.70
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium evanide, 127-130%	.31
Sodium hyposulphite	.08
Sodium phosphate	.10
Tin chloride	.50
Zinc chloride, C. P.	.30
Zinc sulphate	.06

Prices per lb. unless otherwise stated

Profitable Operation of Small Shop Toolrooms

Treating Carbon and High Speed Steels in the Forge—Method of Quenching—Avoid Sharp Corners in Tool Construction—Reforging Undersize Cutting Tools—Making Special Equipment

By H. ALTON

MANY of our large machine shops are invariably equipped with up-to-date toolrooms and manned by a competent staff of toolmakers. The small shop is not so fortunate, generally speaking, but a great deal of real money can be saved if serious thought is given to this department. The writer fully appreciates that it is not possible to assign an appropriation to this phase of the business and purchase a few expensive machines to be devoted exclusively to the production of tools, in scores of shops. Jobbing and contract shops, constitute by far the greater number of our Canadian shops, and these are prohibited from enjoying the luxury of a fully equipped tool room for divers reasons. Nevertheless the successful small-shop-man must always carry in his head that he must be prepared to execute a certain amount of tool work.

Keep Lathe in Good Condition

The tools that necessitate lathe work, can be turned upon any modern lathe that is in good condition. A capable mechanic and a pair of "mikes" on a general purpose lathe in good shape, is able to turn out better work than a less skilled man on a tool room lathe of the first water. Likewise milling and shaping operations can be carried on with general purpose machine tools. A simple tool and cutter grinder is probably the only machine that would be required especially for tool work. The simpler types of these tools, with hand feeds, and minus some of the attachments are not expensive. They consume but little power, need only a minimum of floor space, and, if intelligently used, can be made to pay their way from the moment they are installed.

Use of High Speed Steel

It is often desirable to use high speed steel in special tools. Carbon steel can be hardened in the forge, but it requires a great deal more skill on the part of a tool-smith to handle high speed steel for forging purposes. It is far more desirable to use a miniature oil-fired or gas-fired furnace. Electrical furnaces are also available for this purpose and are very satisfactory. Temperatures from 2 000 deg. F. to 2 400 deg. F. are required to properly harden high speed steel. A pyrometer to definitely indicate these high temperatures is also useful, and if possible should always be part of the equipment. Nevertheless the writer has seen many excellent results from furnaces that were not equipped with these instruments. A good toolsmith knows that the temperatures required by high speed steel are usually about the high limit to which he can coax his furnace, and he also knows by the color of the tool when it is the proper heat. Then, too, a little overheating of the tool is not often accompanied by any serious results if the quenching is intelligently done.

Good judgment in the selection of equipment and a reasonable amount of proper attention to such tools after they have been placed into service should enable the small shop to take care of many jobs of accurate tool and jig work provided a capable man is in charge of the shop. Initiative is the most essential factor in making a paying proposition out of a small machine shop where the staff is called upon to perform a wide variety of work at irregular intervals.

Tools that are symmetrical about a centre line must be immersed with that centre line at right angles to the surface of the quenching oil to avoid distortion. There should be no sharp corners in a high speed steel tool, they should all have a radius, as sharp corners always have a tendency to check or crack in hardening. Form cutters of the single or double cutting edge can best be hardened by only immersing the cutting edges in the quenching oil until the tool has become cooled to a dull red. Tools cooled in this manner are very hard on the cutting edges and are softer in the body which makes them better able to withstand hard usage without breaking.

A good blacksmith will be able to save a great deal of money by softening a special tool that has been ground down to a point where it is useless, and planing same to size again, when it is again hardened and ground. Tools that are used up, as far as their original uses are concerned can be made over into tool bits and applied to tool holders in an infinite number of ways.

Every tool in the shop becomes more useful if the shop fosters a little tool making on the premises. Special tool holders of cast iron are designed and built, simple jigs and fixtures are also forms of tool work, and if designed and built in the shop in spare moments really cost but little. In a number of cases it is good economy to use carbon steel for tools that will only be used a few times at most, and will be required to machine nothing harder than cast iron.

Encourage Initiative

In contract shops a good toolmaker can save his wages many times in making special tools. If a large number of pieces are required on an order, some simple tool will save an extra chucking and may cut the shop cost ten per cent. Skill and ingenuity are never able to show to better advantage than in tool designing and tool making.

Coming again to the tool and cutter grinder, there are innumerable ways in which it can be used to good advantage. Simple fixtures for grinding drills, taps, reamers, milling cutters, etc., always ensure the proper rake and clearance angles and consequently produce tools that cut freely, remove more metal, require less power, etc., all of which are cumulative savings.

Any shop that employs in excess of half a dozen men should always have the nucleus of a tool department. The mechanics take a greater pride in their work and appreciate more fully what accuracy means.

Purchase Fine Tools

There are a number of types of tools that it is not advisable to attempt to make in a small tool room. These are generally—taps, dies, chasers for collapsible dies and taps, solid milling cutters, reamers, gear cutters, etc. Standard tools can usually be purchased at less cost. There is no reason why blades for expansion reamers, inserted teeth, milling cutters, etc., could not be made in a small tool room.

The idea of this article is to convey the fact that it is not necessary to have the highest class of equipment to make many tools, that are commonly required. A modest equipment will often function quite as well. Step by step more intricate tools can be made and equipment added. Simple gauges can be made on an ordinary tool room equipment, and the basis of standardization can be inaugurated in the most modest shops. The days of "cut-and-try" methods have gone and if a shop expects to be successful today tool work must be given attention.

Lackawanna Tubes Limited, Welland, which took over the plant of the Welland Machine and Foundries, and proposed installing a plant to make boiler tubes, has been making slow progress toward operation. The men behind this organization are said to represent large Pittsburgh interests.

News From the Industrial Field

Atlas Iron Works and General Metal Works, Toronto, have been granted an Ontario charter to carry on business as brass and iron founders; capital $40,000.

The N. Slater Co., Hamilton, report that the past month has been exceptionally good, with more business in sight than for some time past.

A. W. Irving, formerly with the Holden Co., and traveller of W. J. Irving, Toronto sales manager of Canada Machinery Corporation, has joined the sales organization of that company.

News comes from London, Eng., that jealousy of Eastern Canadian financiers is interfering with a $12,000,000 project for the development of British Columbia's iron ore resources.

Muskoka Wood Co., Huntsville, Ont., whose plant was destroyed by fire last June, are rebuilding. They will have one of the largest flooring plants in Canada.

Cobourg. — Dominion Wheel and Foundries, Toronto, who have a branch factory here, recently acquired the plant formerly occupied by the Crossen Car Co. They are making brakeshoes and general castings.

H. Bowen, Silver Drill Co., Salem, Ohio, was in Toronto this week calling on F. F. Barber Machinery Co. He is completing Canadian connections and finds the outlook encouraging.

Truman Norton, Wallace Barnes Co., Hamilton, states that business for October showed a wider distribution and a more general buying tendency than heretofore. The record has been very encouraging.

L. E. McKinnon, one of the founders of the McKinnon Industries, St. Catharines, is seriously ill. The plant with which he has been for many years actively identified is very busy at present in the departments having to do with motor car products.

In his report for the past year, the commissioner of patents, Ottawa, reports that 14,274 applications were filed, which was a decrease of 1,172 or eight per cent. from the previous year. Patents issued numbered 7,393, a decrease of 3,759 or over 33 per cent. from the previous year's figures. This decrease, it is explained, is due to the change in the manner of payment of fees. Under the amendments to the Patent Act six months was allowed for remittance of the final fee after notice of allowance, and most applicants took advantage of this change.

Robert S. Harmer, late president of the Sawyer-Massey Co., Brantford, who died in June, left an estate of $341,582.

Shawinigan Foundries, Limited, Montreal, capital stock $40,000, have been incorporated as iron and steel makers and converters and coke manufacturers.

National Radio Corporation, Montreal, $50,000 capital, incorporated to manufacture and market wireless receiving and broadcasting apparatus.

Lewis Mechanical Switches Limited, Ottawa, have been incorporated with $50,000 capital to manufacture and deal in mechanical switches of all kinds.

Pendell Boiler Company, Toronto, have been granted an Ontario charter to manufacture and deal in boilers, piping and general heating apparatus; capital, $500,000.

The Brown Process, Limited, Toronto, capital of $2,500,000, are incorporated to manufacture and deal in chemicals, explosives and other products and to acquire and develop coal, iron or other mineral properties.

More building was done in Windsor, Ont., during October this year than in the corresponding period in 1921, according to figures announced by the building inspector. During the month 113 permits were issued for buildings valued at $277,575, compared with 102 permits last year totalling $240,835. During October 41 residences were constructed at a cost of $194,000.

Building continues active in Galt. During October 19 permits with a value of $90,535 were issued bringing the total for the first ten months of the year to 215 permits with a value of $401,840.50, compared with 179 permits, valued at $483,042, for the same period of 1921. This year's building will amount to more than three-quarters of a million dollars, as a permit has yet to be taken out for the $360,000 addition to the Collegiate, work on which will be commenced before the New Year.

During October permits were issued in Kitchener for the erection of buildings valued at $68,280, bringing the total for the year to date up to $1,946,748. By the end of the year it is expected that the $2,000,000 mark will be passed, thus creating a record. During the month just passed permits were issued for 15 dwellings and 27 garages. In October, 1921, the permits issued called for the erection of buildings valued at $81,400, but the total for the year at that time had only reached a $882,080 figure.

Owing to expansions prosposed by General Motors, Oshawa is looking forward to a residential increase of about 3,000 people.

Efficiency Oil Burners, Limited, Hamilton, capital of $100,000 have been incorporated to manufacture and deal in oil burning, fuel saving and mechanical and electrical appartus.

In Stratford, during October, 34 building permits were issued to a valuation of $18,385, making the total valuation so far this year $678,731. For the corresponding period last year the valuation was $260,184.

Phillips Mfg. Co., Oshawa, are planning to expand in plant and staff at an early date. They are making windshields and curtains for autos, as well as their regular line of picture moulding and frames. They employ 60 men.

Trenton.—Gill & Fortune, Ltd., lumber and timber finishers, who own limits in North Hastings, will equip their plant for local production this fall. Material will be brought from the limits by rail.

Belleville.—Elliott Machinery Co., Limited, have disposed of the British and United States rights to the manufacture of their portable universal woodworkers. The company have been in existence for ten years and in that time have sold 2,000 of these machines.

An addition to their power plant equipment may be called for in connection with proposed expansion by General Motors in Oshawa. They now have equipment consisting of two Leonard boilers and two Detroit stokers; one hand-fed Inglis boiler and two hand-fed Goldie & McCulloch boilers.

General Motors, with Canadian plant in Oshawa and Walkerville, have issued a statement from their head office in Detroit, stating that combined sales by their car and truck divisions in the first quarter of 1922 totalled 71,039 vehicles; second quarter, 135,751; third quarter, 109,346. The nine months of 1922 thus produced sales of 316,136—more than in the entire year of 1921. With conservative estimates for the last quarter of the year, General Motors sales by divisions for the whole of 1922 will be as follows: Passenger cars—Buick, 134,000; Cadillac, 22,000; Chevrolet, 249,000; Oakland, 26,000; Oldsmobile, 23,000; total, 454,000. Commercial cars—Chevrolet, 2,900; G. M. C. trucks, 5,600; Oldsmobile, 1,500; total, 10,000. With miscellaneous cars of 4,355, the grand total amounts to 468,355.

Are You Ready for Your Share?
There's no better time than the present to weed out those worn-out or old-style machines and replace them with real producers. We have, for instant shipment, a huge stock of machines and supplies — each backed by the Williams Guarantee — at prices that will interest you. Present indications point to better times in the immediate future — are you prepared to get your full share?
Our Monthly Machinery List is full of bargains. Shall we put your name on our mailing list?
The A. R. Williams Machinery Co., Ltd.
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HALIFAX ST. JOHN MONTREAL WINNIPEG VANCOUVER
If its Machinery-Write "Williams"

CANADA GREATEST CAR EXPORTER

"It is predicted that within a decade Canada will be the greatest automobile exporting country in the world," says The Industrial Digest, New York. "Several of the world's largest producers of motor vehicles, according to recent reports, are now handling all their export business from the Dominion, while the largest individual manufacturer of motor cars has for some years filled all orders for the British Dominions and possessions from his plant on the Canadian side of the St. Clair River."

An invention that weighs a railway car while in motion, has been sold for $75,000 by Rev. S. W. Shuford, a Baptist minister of Woodlawn, N. C. The machine not only weighs but registers the initials and numbers of each car. Imagine a machine big enough to admit a railroad car, filled with freight upon its platform. Moving cars in succession come upon it, and when each car is in just the right position—and no other—its weight causes a printing lever to work. The weight is printed upon a card which drops as the car passes off the platform, and leaves another ready for the next car. Mr. Shuford will use the money for evangelistic purposes.

Leather belts, wherever possible, should be made endless on pulleys. A new endless belt will require to be tightened a couple of times, but this is a small job, and then the belt will run for a long time with no other attention than occasionally cleaning and dressing it.

Through confusion with information concerning another plant in Welland, an item recently appeared in these columns to the effect that the Canada Forge Co.'s plant at Welland had been closed for the past two years. This was an error. The Canada Forge Co.'s plant had never been closed down at any time with the exception of a week or ten days in the Spring of 1921.

If there are lacings or hooks that have injured the ends of a belt, new pieces may be cemented on them and there need never be more than one joint in the belt. Should the belt outlast its first installation, it may be cut to a narrower size, may be shortened or lengthened, and the made-over belt is as good as ever for another service. If it is a wide belt it can be cut into several sizes, thus adding to its period of usefulness.

Leslie S. Hall, vice-president Williams Tool Corporation, Erie, Pa., and Brantford, Ont., states: "Business both in Brantford and Erie is improving rapidly. Last month in Erie was the best month we have had in over a year, and this month will be just as good. Besides, we start off next month with a big lot of unfilled orders, which should make it the banner month of the year. In Canada we are now operating about 50 per cent. and the indications are that this will gradually grow until spring when we hope to be running full."

Bulletin CB1 of the Combustion Engineering Co., is descriptive of the burning of bituminous and semi-bituminous coals on Coxe Stokers. In addition to illustrations and description of the stoker, a number of test reports accompanied by curve charts are included.

Bulletin 249 of the Dayton-Dowd Co. is descriptive of their line of centrifugal pumps, and supersedes Bulletin 244 on the same subject. The bulletin is replete with information on the subject of centrifugal pumps, including their design and specifications. A large number of illustrations are shown, both of individual pumps and pump installations.

Inserted Tooth Metal Saws

Greater production and economy are reasons why Machine Shops are equipping their metal cutting machines with Simonds Inserted Tooth Saws. Fitted with High Speed Steel Teeth in an especially fine steel plate, these saws cut rapidly without dulling easily.

The Simonds "00" style Inserted Tooth metal saw cuts only 3/16 inch kerf.

Write for prices and catalog.

Simonds

Canada Saw Co. Ltd.

"The Saw Makers"

MONTREAL, QUE.
ST. JOHN, N. B
VANCOUVER, B. C.

St. Malo Shops Congested With Work; Force of 500 Busy on Car Repairs

Quebec—St. Malo Workshops of the C. N. R. are very active these days. They are in fact congested with work on the repair of locomotive and rolling stock in general, and from information gained here there is an accumulation of work to keep the five hundred employees actively engaged for the next two years. These shops have, of late, received a large amount of new machinery and are still receiving from Ontario and Montreal new equipment and material to fit up the plant with up-to-date machines necessary to meet all emergencies.

The St. Malo Workshops are by no means complete or in keeping with the original plans as agreed between the Government and the City of Quebec, when the latter handed over a large area of property, during the time of the late Laurier administration, worth in money value several millions of dollars. The shops comprise a machine shop, car repair shop, blacksmith shop, power house, round house, and office building, in which is also located the technical department. What is lacking is a brass, an iron foundry, and car building shop, and if these adjuncts were built and equipped, the St. Malo shops would, in all respects, with an enlargement of the present buildings, be capable of taking care of the building of locomotives and repair of rolling stock to meet the demands of the eastern section of the Canadian National Railway System.

It is well to point out, that, when the late Laurier administration agreed to build and centralize railway workshops at Quebec, in connection with the construction and completion of the Transcontinental railway, it had been decided that the shops were to be located at Cape Rouge in close vicinity to the Quebec bridge, with a car yard with capacity of 10,000 cars of every description. All plans had been made in this connection with steamship, deck, grain elevators along the St. Lawrence river frontage and a commodious union passenger station on the Chaplain Market Square overlooked by Dufferin Terrace. The general election of 1911, which resulted in the defeat of the Laurier administration upset all these plans, and these properties, purchased by the Federal Government, were left to fall into decay. Location at St Malo, seven miles from the Quebec bridge, necessitates the bringing of disabled locomotives and rolling stock from the south side of the river over the bridge to the shops for repair. Auxiliary shops to help out the accumulation of work and congestion are built at Cape Rouge, close by the bridge, where there are hundreds of cars now parked, awaiting their turn to be shunted to St. Malo.

The writer paid a visit to the shops to take cognizance of the activities and was surprised to see the congestion of locomotives, passenger and freight cars in the shops undergoing repairs, and the locomotives and cars parked on the sidings awaiting their turn. There were nine locomotives on the pits within the machine shop being repaired and, as there is no round house, there were some seventy others waiting in the open. It is said that there are approximately forty more disabled locomotives in the vicinity.

The car repair shop was congested with passenger cars undergoing repair while in the sidings were large number of box and platform cars waiting. In the meantime, disabled rolling stock will continue to arrive and add to the congestion. New machinery was arriving and the writer was informed that some of the machinery in question, including lathes, grinders, etc., were required to replace machinery which was worn out.

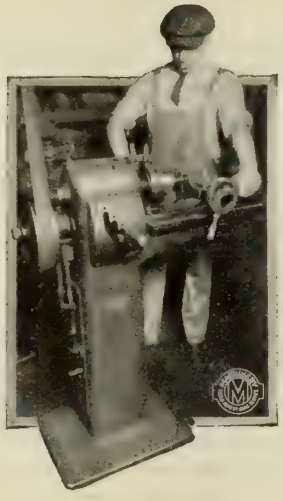
The area of the land purchased and on which the St. Malo shops are built is 160 acres with double that area, adjoining, which permits of an enlargement of the present shops and the building of a brass and iron foundry and a round house so essential for the thorough equipment of the shops. The present machine shop could be extended to allow for ten more locomotive pits, likewise for car repairing shops, etc.

FAMILY BUDGET SLIGHTLY LOWER

In retail prices the average cost of a weekly family budget of 29 staple foods in some 60 cities was $10.28 at the beginning of September as compared with $10.44 for August; $11.82 for September 1921; $15.95 for September, 1920; $11.6 for September, 1917; and $7.83 for September, 1914. The total for food, fuel and rent averaged $20.90 for September as compared with $20.88 for August; $22.37 for September, 1921; $26.38 for September, 1920; $18.57 for September 1917; and $14.33 for September, 1914. The only marked change in foods was a seasonal decline in potatoes, though meats, bread and flour were also lower. Eggs, butter, cheese, evaporated apples, prunes and sugar were slightly higher. Quotations on coal were considerably higher in some cities while in many others it was reported that no anthracite coal was for sale. Wood was also higher. Rent was practically unchanged.

Demand for men to work in lumber camps and railway construction continues, according to reports by the Government employment service. Places could be found for 2,000 to 3,000 men. Fifty or sixty farm hands could also be placed. A number of high-priced men have been located recently. One foundry superintendent was found a position at $5,000 a year; an analytical chemist at $3,600; cost accountant at $3,000; two draughtsmen at $2,500 and $2,000.

GEOMETRIC



and all's well

A Geometric Suggestion will be Worth While

Checking up information with us may give you some valuable information in return.

We have had many kinds of weeks and days—Thrift Week, Spend Week, Save Week, Smile Week, Everybody-to-Church Sunday, Prayer Sunday, Old Clothes Week—month, season—(and for some of us old clothes most of the time.)

Let us have a Screw Cutting Time of our own now. Let us check up the Screw Cutting. Fill in the coupon, and the canvass will be complete. We may be able to give you some information that will give you unmatched production.

It will cost you nothing to make the check-up, and if it appears that there might be a more profitable way for you to do your Screw Thread Cutting, we will not annoy you with advice. We will make the suggestion and leave it with you.

The Geometric Tool Company
New Haven, Conn.

The Geometric Tool Company
New Haven, Connecticut

Below we give you specifications of our Screw Cutting, and shall be interested to learn what you would suggest as a possible means to greater production.

Make of Machine .....
Diameter of Turret Holes .....
Distance from center of Turret Hole to top of Slide.....
Thread to be cut: Diameter.....Pitch.....
Length.....Form.....
Present method used .....
Number of pieces threaded per hour.....
Difficulties experienced (if any) .....
Have one of your Service Men call when he is in our vicinity. Have him see

Mr.....

Signed.....Address.....
(Street)

.....
(Post Office)

.....
(Province)

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FOR SALE OR ROYALTY—CANADIAN PATent No. 214964 on resilient wheel for automobiles and trucks, absorbs the shock in the leaf spring spokes of the wheel, either hard rubber or pneumatic tires may be used; simple, practical and substantial in construction. Reasonable terms. Wm. H. Schlake, Yuma, Colo.

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GALT, ONT.
Malleable.

S. Vessot & Company
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Hull Iron & Steel Foundries Ltd.
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Steel, Manganese, Chrome.

John T. Hepburn, Limited
TORONTO, ONT.
Grey Iron.

Can. Hanson & VanWinkle Co.
LIMITED
TORONTO, ONT.
Monel, Aluminum, Brass, Bronze, Grey Iron.

Tallman Brass & Metal, Ltd.
HAMILTON, CANADA
Brass, Bronze, Manganese Bronze, Aluminum.

Dom. Foundries & Steel, Ltd.
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Steel Castings all sizes.

Manitoba Steel Foundries, Ltd.
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BRANTFORD, ONT.
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GALT, ONT.
Grey Iron, Semi-Steel, Brass, Aluminum.

William Kennedy & Sons, Ltd.
OWEN SOUND, ONT.
Steel, Malleable and Heavy Grey Iron.
See Advertisement Page 7

Machinery & Foundries, Ltd.
BROCKVILLE, ONT.
Light and Medium Grey Iron.

A. F. McCulloch
OSHAWA, ONT.
Brass, Alum. Castings—Wood, Metal Patterns.

Corbet Foundry & Machine Co. Ltd.
OWEN SOUND, ONT.
Grey Iron, Brass.

Fittings Limited,
OSHAWA, ONT.
Malleable, Grey Iron, Brass, Aluminum.

W. W. Wells
370 Victoria Street, TORONTO, ONT.
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Light Grey Iron.

Canadian Steel Foundries, Ltd.
MONTREAL, QUE.
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Langley & Austin,
GALT, ONT.
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Maxwells, Limited
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The Eureka Planter Co., Ltd.,
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Specialty Light Grey Iron.

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International Malleable Iron Company, Limited
GUELPH, ONT.
Malleable.

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The foundries represented on this page are well equipped, progressive, and their product is of known high quality. If you are a foundry owner and you can say the same of your service and product, we shall be glad to list you in this department. Write us for particulars.

Canadian Machinery & Mfg. News
153 University Ave., Toronto.

Canadian Machinery BUYERS DIRECTORY

If what you want is not here, write us, and we will tell you where to get it. Let us suggest that you consult also the advertisers' index— last page of book, after having secured advertisers' names from this directory. The information you desire may be found in the advertising pages. This department is maintained for the benefit and convenience of our readers. The insertion of our advertisers' names undr proper headings is gladly undertaken, but does not become part of an advertising contract.

ABRASIVE DISCS
Lion Grinding Wheels, Limited, Montreal, Que.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John, London, S.E., Eng.

ABRASIVE MATERIALS
Lion Grinding Wheels, Limited, Montreal, Que.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John, London, S.E., Eng.

ACETYLENE, DISSOLVED
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Toronto.
Liquide Air Company, Toronto.

ANCHOR BELTS
Steel Co. of Can. Ltd., Hamilton, Ont

ANGLE BARS
Steel Co. of Can. Ltd., Hamilton, Ont.

ANVILS
Atkins & Co., Inc., E.C., Indianapolis, I.

ANCHOR BOLTS
Steel Co. of Can., Ltd., Hamilton, Ont.

ARBORS
Atkins & Co., Inc., E. C., Indianapolis,
Brown & Sharpe Mfg.Co., Providence,R.I.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.

BELLS, BRASS, BRONZE and STEEL
Canada Foundries & Forgings Co., Welland, Ont.
Canadian SKF Co., Toronto, Ont.

BARS, BORING
Armstrong Bros. Tool Co., Chicago, Ill.
Bertram & Son Co., td., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

BARS, BORING, PORTABLE
Underwood Corp., H. B., Philadelphia.

BARS, STEEL
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
British Empire Steel Corporation, Montreal, Que.

BEARINGS, BALL
Canadian SKF Co., Toronto. Ont.

BEARINGS, ROLLER
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

BELT CEMENT
D. K. McLaren, Limited, Montreal,
McLaren Belting Co., J. C., Montreal, Que.

BELT DRESSINGS AND FILLERS
Dom. Belting Co., Ltd., Hamilton, Ont.
D. K. McLaren, Limited, Montreal,

BELT FASTENERS
Bristol Company, Waterbury, Conn.
D. K. McLaren, Limited, Montreal,
McLaren Belting Co., J.C., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

BELT HOOKS
Bristol Co., Waterbury Conn.
D. K. McLaren, Limited, Montreal.

BELT LACING
Bristol Company, Waterbury, Conn.
D. K. McLaren, Limited, Montreal,
McLaren Belting Co., J. C., Montreal,

BELT LACING, STEEL
Bristol Company, Waterbury, Conn.

BELT LACING MACHINES
D. K. McLaren, Limited, Montreal,
McLaren Belting Co., J. C., Montreal, Que.
Petrie, Ltd., H. W., Toronto. Ont.

BELTING, CHAIN
Can. Link-Belt Co., Toronto, Ont.
Fittings, Limited, Oshawa, Ont.
Jones & Glassco, Montreal, Que.
Renold (Hans) of Canada, Ltd., Montreal, Que.

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Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Dom. Belting Co., Ltd., Hamilton, Ont.
D. K. McLaren, Limited, Montreal,
McLaren Belting Co., J. C., Montreal, Que.

BELTING, LEATHER
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Can. Fairbanks-Morse Ltd., Montreal, Q.
D. K. McLaren, Limited, Montreal,
McLaren Belting Co., J. C., Montreal, Que.

BELTS, ABRASIVE
Oakey & Sons, Ltd., John, London, S.E., Eng.

BENDING MACHINES, POWER
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bertrams Ltd., Edinburgh, Scotland.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

BILLETS, BLOOMS and SLABS
Steel Co., of Can. Ltd., Hamilton, Ont.

BLAST GATES
Rockwell & Co., W. S., New York, N.Y.

BLOCKS
Wright Mfg Co., Lisbon, Ohio.

BLOCKS, CHAIN (See Hoists, Hand)
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

BLOCKS, DIE
Canada Foundries & Forgings Co., Welland, Ont.

BLOCKS, PILLOW
Can. Link-Belt Co., Toronto, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

BLOWERS
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

BOLT AND NUT MACHINERY
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Montreal, Que.

BOLT AND NUT MACHINERY, Automatic
National Acme Co., Cleveland, Ohio.

BOLTS AND NUTS
British Empire Steel Corporation, Montreal, Que.
National Acme Co., Montreal, Que
Petrie, Ltd., H. W., Toronto, Ont

BOLT THREADING DIE HEADS
Landis Machine Co., Inc., Waynesboro, Pa.

BOLTS, TRACK
Steel Co. of Canada, Ltd., Hamilton, Ont.

BORING BARS, EXPANSION
Davis Boring Tool Co,. St. Louis, Mo.

BORING TOOLS, EXPANSION
Davis Boring Tool Co,. St. Louis, Mo

BORING and TURNING MILLS, Vertical
Bertram & Sons Co., Ltd., The John Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

BORING, DRILLING and MILLING MACHINES, Horizontal.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
Herbert, Limited, Alfred, Toronto, Ont.
Landis Tool Co., Waynesboro, Pa.

Vertical
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

BORING TOOLS
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.

BUCKET CARRIERS, Pivoted
Can. Link-Belt Co., Toronto, Ont.

BUFFERS
Pryibil Machine Co., New York, N.Y.

BUFFING OR POLISHING MACHINES
(See Polishing and Buffing Machines)
Blount Co., J. G., Everett, Mass.
Herbert, Limited, Alfred, Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pryibil Machine Co., New York, N.Y.
U. S. Electrical Tool Co., Cincinnati, O.

BUILDING MATERIALS
Bertram & Son Co., Ltd., The John Dundas, Ont.

BURNERS, OIL AND GAS
Rockwell Co., W.S., New York City.

BURRS
Steel Co. of Can. Ltd., Hamilton Ont.

CABINETS, OIL
S. F. Bowser & Co., Ltd., Toronto, Ont

CALIPERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Starrett Co., L. S., Athol, Mass.

For list of Dealers see the last page of This Buyers Directory

CAMS
Canada Foundries & Forgings Co., Welland, Ont.

CAN-MAKING MACHINERY
(See Sheet Metal Working Machinery)
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Bliss Co., E. W., Brooklyn, N. Y.
Smooth Mfg. Co., Jersey City, N. J.

CAR WHEEL BORING TOOLS, EXPANSION
Davis Boring Tool Co,. St. Louis, Mo.

CEMENTS, IRON

CENTERING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.

CHAINS (See Sprockets and Chains)
Reynold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

CARD CLOTHING
D. K. McLaren, Limited, Montreal.

CASTINGS, ALUMINUM, BRASS, BRONZE, COPPER, DIE-MOLDED, FERRO-ALLOY, IRON, SEMI-STEEL, STEEL.
See "Where to buy your castings" Section. Page number may be found by turning to Advertisers' Index.

CHAINS, DRIVING
Can. Link-Belt Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont
Jones & Glassco, Montreal, Que.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

CHASERS
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CHUCKING MACHINES
Acme Machine Tool Co., Cincinnati, O
Brown & Sharpe Mfg. Co., Providence, R. I.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

CHUCKS, DRILL AND TAP
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canadian SKF Co., Toronto, Ont.
Cushman Chuck Co., Hartford, Conn.
Geometric Tool Co., New Haven, Conn.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn
Union Mfg., New Britain, Conn.

CHUCKS, LATHE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Cushman Chuck Co., Hartford, Conn.
Geometric Tool Co., New Haven, Conn
Gisholt Machine Co., Madison, Wis.
Herbert, Limited, Alfred, Toronto, Ont.
Ker & Goodwin Machine Co., Brantford, Ont.
Pryibil Machine Co., New York, N.Y.
Skinner Chuck Co., New Britain, Conn
Union Mfg. Co., New Britain, Conn.

CHUCKS, MAGNETIC
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CHUCKS, PLANER
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cushman Chuck Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

CHUCKS, TAPPING
William L. Procunier, Chicago, Ill.

CHUCKS, VERTICAL BORING MILL
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

CLAMPS, MACHINISTS'
Brown & Sharpe Mfg. Co., Providence,
Starrett Co., L. S., Athol, Mass.

CLEANERS, METAL, WASTE, GENERAL
Oakley Chemical Co., New York, N. Y.

CLOCKS
Chicago Watchman's Clock Co., Chicago,
Hardinge Bros., Limited, Toronto, Ont.

CLOCKS, TIME
Gisholt Machine Co., Madison, Wis.

CLOCKS, WATCHMEN'S
Chicago Watchman's Clock Co., Chicago, Ill.
Hardinge Bros., Limited, Toronto, Ont.

CLUTCHES, FRICTION
Can.-Link-Belt Co., Toronto, Ont
Johnson Machine Co., Carlyle, Manchester, Conn.

COAL AND ASH HANDLING MACHINERY
Can.-Link Belt Co., Toronto, Ont.
Roelofson Elevator Works, Galt, Ont.

COAL-STORAGE SYSTEMS
Can. Link-Belt Co., Toronto, Ont.

COLLARS, SHAFT OR SET
Canada Foundries & Forgings Co., Welland, Ont.
Can. Link-Belt Co., Toronto, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

COLLETS
Butterfield & Co., Inc., Rock Island, Que.
Geometric Tool Co., New Haven, Conn.
Hardinge Bros., Inc., Chicago, Ill.
Hendley Machine Co., Torrington Conn.
Kearney & Trecker Co., Milwaukee, Wis
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

COMPOUNDS, CLEANING
Oakley Chemical Co., New York, N Y

BUYERS' DIRECTORY

COMPOUNDS—CUTTING, DRILLING, GRINDING, SCREW CUTTING
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Oakley Chemical Co., New York, N.Y.

COMPRESSORS, AIR AND GAS
Can. Fairbanks-Morse Co., Ltd., Montreal.

CONES, FRICTION
Norton Co., of Can. Ltd., Hamilton, Ont.

CONNECTING RODS AND STRAPS
Canada Foundries & Forgings Co., Welland, Ont.

CONTRACT WORK
Dominion Engineering Works, Limi Montreal, Que.
Victoria Foundry Co., Ltd., Ottawa, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

CONVEYORS AND ELEVATORS (SEE ELEVATORS)
Jones & Glassco, Montreal, Que.

COTTERS
Steel Co. of Canada, Ltd., Hamilton, Ont.

COUNTERBORES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

COUNTERS, REVOLUTION
Starrett Co., L. S., Athol, Mass.

COUNTERSHAFTS
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Johnson Machine Co., Carlyle, Man.
Kempsmith Mfg. Co., Milwaukee, Wis.

COUNTERSINKS
Butterfield & Co., Inc., Rock Island, Que.
Pratt &Whitney Co., of Canada, Ltd., Dundas, Ont.

COUPLERS, CAR AND LOCOMOTIVE
Can. Steel Foundries, Montreal, Que.

COUPLINGS
Steel Co. of Canada, Ltd., Hamilton, Ont.

COUPLINGS, SHAFT
Can. Link-Belt Co., Toronto, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

CRANES, ELECTRIC
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can.-Link-Belt Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Northern Crane Works, Walkerville, Ont.
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.

CRANES, LOCOMOTIVE
Can. Link-Belt Co., Toronto, Ont.

Bertram & Son Co., td., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Northern Crane Works, Walkerville, Ont.

CRANK PIN TURNING MACHINE
Underwood Corp., H.B., Philadelphia, Pa.

CUTTERS, GEAR
Brown & Sharpe Mfg. Co., Providence, R. I.

Butterfield & Co., Inc., Rock Island, Q. Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CUTTERS, HIGH SPEED
Atkins & Co., Inc., E. C., Indianapolis.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
New & Trecker Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CUTTERS, MILLING
Brown & Sharpe Mfg. Co., Providence, R. I.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.

CUTTERS, STAY BOLT
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.

CUTTING-OFF MACHINE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Starrett Co., L. S., Athol, Mass.

CUTTING OFF MACHINES, PIPE (SEE PIPE-CUTTING AND THREADING MACHINES)
Landis Machine Co., Inc., Waynesboro, Pa.

CUTTING-OFF TOOLS
Armstrong Bros. Tool Co., Chicago, Ill.

CUTTING OIL FILTERS (SEE OIL FILTERING SYSTEMS
Bowser, S. F. & Co., Ltd., Toronto.

CUTTING, OXY-HYDROGEN
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

DETACHABLE CHAIN
International Malleable Iron Co., Guelph, Ont.

DIAMONDS, BLACK AND ROUGH
Can. Desmond-Stephan Mfg Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

DIAMOND TOOLS
Can. Desmond-Stephan Co., Hamilton,
Wheel Trueing Tool Co., Windsor, Ont.

DIAMOND CROSSINGS
Can. Steel Foundries, Montreal, Que.

DIAMONDS, IMPORTERS
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Co., Windsor, Ont.

DIES, SCREW AND THREAD CUTTING
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.

DIES, SHEET-METAL AND SUB-PRESS (See Tool Work)
Brown, Boggs & Co., Ltd., Hamilton, Ont.

DIES, FORGING
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

DIES, SCREW AND THREAD CUTTING
Morse Twist Drill & Machine Co., New Bedford, Mass.

DIES, SELF-OPENING, ADJUSTABLE
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Landis Machine Co., Inc., Waynesboro,
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DIES, THREADING-OPENING
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DIVIDING HEADS
Burke Machine Tool Co., Conneaut, Ohio.
Hendey Machine Co., Torrington, Conn.
Kearney & Treacker Co., Milwaukee, Wis.

DOGS, LATHE AND MILLING MACHINE
Armstrong Bros. Tool Co., Chicago, Ill.

DRAFTING MATERIALS
American Lead Pencil Co., New York City, N.Y.

DRESSERS, GRINDING WHEEL
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ont.
Norton Co., of Can., Ltd., Hamilton.
Wheel Trueing Co., Windsor, Ont.

DRESSING TOOLS
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Co., Windsor, Ont.

DRILL HOLDERS
Armstrong Bros. Tool Co., Chicago, Ill.

DRILLING MACHINES, BENCH
Burke Machine Tool Co., Conneaut, Ohio.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Hardinge Bros., Inc., Chicago, Ill.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, ELECTRIC AND HAND
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, GANG
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

DRILLING MACHINES, HEAVY DUTY
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
Herbert, Limited, Alfred, Toronto, Ont.

BORING, DRILLING AND MILLING MACHINES, (HORIZONTAL.)
Gisholt Machine Co., Madison, Wis.
Herbert, Limited, Alfred, Toronto, Ont.

DRILLING MACHINES, Multiple Spindle
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
National Acme Co., Cleveland, Ohio.

DRILLING MACHINES, Pneumatic
Cleveland Pneumatic Tool Co., Toronto. Ont.

DRILLING MACHINES, PORTABLE
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, RADIAL
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal. Que.
Herbert, Limited, Alfred, Toronto, Ont.
Williams Machinery Co., A. R., Toronto,

DRILLING MACHINES, SENSITIVE
Burke Machine Tool Co., Conneaut, O.
Herbert, Limited, Alfred, Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Williams Machinery Co., A. R., Toronto.
Wisconsin Electric Co., Racine, Wis

DRILLING MACHINES, TURRET
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wisconsin
Williams Machinery Co., A. R., Toronto.

DRILLING MACHINES, VERTICAL
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Herbert, Limited, Alfred, Toronto, Ont.

DRILLS, CENTRE
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DRILLS, ELECTRIC
U. S. Electrical Tool Co., Cincinnati, Ohio
Black & Decker Mfg. Co., Ltd., Montreal, Que.

DRILLS, HIGH SPEED TWIST
Butterfield & Co., Inc., Rock Island, Que
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Cleveland Twist Drill Co., Cleveland, O.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DRILLS, RATCHET
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

DRILLS, TWIST AND FLAT
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.

DROP FORGINGS
Steel Co. of Canada, Ltd., Hamilton.

DUMB WAITERS
Roelofson Elevator Works, Galt, Ont.

DUST HANDLING EQUIPMENT
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

ELECTRIC DRILLS AND GRINDERS
Black & Decker Mfg. Co., Ltd., Montreal, Que.
U. S. Electrical Tool Co., Cincinnati, Ohio.

ELECTRIC STEAM GENERATORS
Dominion Engineering Works, Limited, Montreal, Que.

ELECTRICAL INSTRUMENTS
Bristol Co., Waterbury, Conn.

ELECTRICAL SUPPLIES
Atkins & Co., Inc., E. C., Indianapolis.
Diamond State Fibre Co., Toronto. Ont.

ELECTRIC TOOLS
U. S. Electrical Tool Co., Cincinnati, Ohio.

ELEVATORS AND CONVEYORS
Can. Link-Belt C., Toronto, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.

ELEVATORS, FREIGHT AND PASSENGER
Roelofson Elevator Works, Galt, Ont.

EQUIPMENT, ELEVATOR SAFETY
Jones & Glassco, Montreal, Que.

EMERY WHEELS (See Grinding Wheels)
Lion Grinding Wheels, Limited, Montreal, Que.
Atkins & Co., E. C., Indianapolis, I.
Norton Co., of Canada., Ltd., Hamilton.

ENGINES, CAPSTAN
Kennedy & Sons, Wm., Owen Sound, Ont.

ENGINEERS, MECHANICAL
Dominion Engineering Works, Limited, Montreal, Que.
Gisholt Machine Co., Madison, Wis.
Hamilton Gear & Machine Co., Toronto.

EXPANDERS, TUBE
Jardine & Co., A. B., Hespeler, Ont.

FANS, ELECTRIC
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

FANS, EXHAUST
Can. Blower & Forge Co., Ltd., Kitchner, Ont.

FANS, VENTILATING
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

FIBRE
Diamond State Fibre Co., of Can. Ltd., Toronto, Ont.

FILES AND RASPS
Nicholson File Co., Port Hope, Ont.
Simmons Canada Saw Co., Montreal, Que.

FILLER, IRON (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J.

FIRE ESCAPES
Roelofson Elevator Co., Galt, Ont.

FITTINGS, PIPE
International Malleable Iron Co., Guelph.
Fittings, Limited, Oshawa, Ont.

FLEXIBLE SHAFTS
Strand & Co., N. A., Chicago, Ill

FLUXES, WELDING
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd, Toronto
Liquide Air Company, Toronto, Ont.

FORGING MACHINERY
Acme Machinery Co., Cleveland, Ohio
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown Boggs & Co., Ltd., Montreal.
National Machinery Co., Tiffin, Ohio.
Steel Co. of Canada, Ltd., Hamilton.

FORGINGS, DROP
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Ltd., Toronto, Ont.

FORGINGS, HAMMER
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Hepburn Ltd., John T., Toronto, Ont.

FOUNDRY EQUIPMENT
Rice Lewis & Son, Ltd., Toronto, Ont.

FOUNDRY SUPPLIES
Rice Lewis & Son, Ltd., Toronto, Ont.

FROGS, SPRING OR RIGID
Can. Steel Foundries, Montreal, Que.

FURNACES, ELECTRIC
Rockwell Co., W. S. New York City.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

FURNACES, HEAT TREATING COAL
Rockwell Co., W. S., New York City.

FURNACES, HEAT TREATING OIL AND GAS
Bellevue Industrial Furnace Co., Detroit, Michigan.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Rockwell & Co., W. S., New York, N.Y.

FURNACES TEMPERING AND ANNEALING
Bellevue Industrial Furnace Co., Detriot, Mich.
Brown & Sharpe Mfg., Co., Providence R. I.
Rockwell Co., W. S., New York City.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

FURNACES AND OVENS, ELECTRIC
Rockwell & Co., W. S., New York, N.Y.
Starrett Co., L. S., Athol, Mass.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

BUYERS' DIRECTORY

GAGES, MEASURING (See Tool Work)
Brown & Sharpe Mfg. Co., Providence, R. I.
Greenfield Tap & Die Corp., Galt, Ont.
Lufkin Rule Co., Windsor, Ont.
Starrett Co., L. S., Athol, Mass.

GAGES, RECORDING
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GAGES, SPECIAL MEASURING
(See Tool Work)
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GAGES, THREAD
Brown & Sharpe Mfg. Co., Providence R. I.
Herbert, Limited, Alfred, Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

GALVANIZING
Fittings, Limited, Oshawa, Ont.

GAS, COAL COMPRESSED
L'Air Liquid Society, Toronto, Ont.

GAS, COMPRESSED
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

GASKETS
Diamond State Fibre Co. of Ca., Ltd., Toronto, Ont.
Smooth Mfg. Co., Jersey City, N. J.

GAUGES VACUUM AND PRESSURE
Taylor Instrument Co. Toronto, Ont.

GEAR BLANKS
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.
Dominion Engineering Works, Limited, Montreal, Que.

GEAR COUNTERS
Hart Mfg. Co., R. A., Battle Creek, Michigan.

GEAR CUTTING MACHINES
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Fellows Gear Shaper Co., Springfield, Vt.
Whiton Machine Co., D. E., New London, Conn.

GEAR TESTING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.

GEARS, CAST
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Hull Iron & Steel Foundries, Hull, Que.
Dominion Engineering Works, Limited, Montreal, Que.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

GEARS, CUT
Brown & Sharpe Mfg. Co., Providence, R. I.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Gardner & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

GEARS, DRESSED
Kennedy & Sons, Wm., Owen Sound, Ontario.

GEARS, FORGED
Canada Foundries & Forgings Co., Welland, Ont.

GEARS, HERRINGBONE
Hamilton Gear & Machine Co., Toronto, Ont.

GEARS, RAWHIDE (See Gears, Cut)
Hamilton Gear & Machine Co., Toronto.

GEAR, SILENT CHAIN
Gardner & Son, Robt., Montreal, Que.
Can. Link-Belt Co., Ltd., Toronto, Can.
Hans Renold of Canada, Ltd., Montreal, Quebec.

GEARS, WORM
Hamilton Gear & Machine Co., Toronto.

GENERATORS, ACETYLENE
L'Air Liquide Society, Toronto, Ont.

GOGGLES, SAFETY
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto
Liquide Air Company, Toronto.

GRAB BUCKETS
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Cleveland Twist Drill Co., Cleveland, O.

GREASE CUPS, PRESSED STEEL AND BRASS
Can. Winkley Co., Ltd., Windsor, Ont.

GREASES, LUBRICATING
Canadian SKF Co., Toronto, Ont.

GRINDERS, ELECTRIC
Black & Decker Mfg. Co., Ltd., Montreal, Que.
U. S. Electrical Tool Co., Cincinnati, Ohio.

GRINDERS TOOL POST
U. S. Electrical Tool Co., Cincinnati, Ohio.

GRINDING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Norton Co., of Canada, Ltd., Hamilton.

GRINDING MACHINES, ABRASIVE BELT
Norton Co. of Can. Ltd., Hamilton, Ont.

GRINDING MACHINES, AUTOMATIC
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, BENCH
Blount Co., J. G., Everett, Mass.
Geometric Tool Co., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co. of Canada, Ltd., Hamilton, Ont.
Pratt & Whitney Co. of Canada, Ltd.,

GRINDING MACHINES, CENTER
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES, CUTTER AND REAMER
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, CYLINDRICAL
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.
Norton Co., of Canada, Ltd., Hamilton

GRINDING MACHINES, DIE
Geometric Tool Co., New Haven, Conn.
National Acme Co., Cleveland, O.
National Machinery Co., Tiffin, Ohio.

GRINDING MACHINES, DRILL
Bellevue Industrial Furnace Co., Detroit, Mich.
Bertram & Son Co., Ltd., The John, Dundas, Ont.

GRINDING MACHINES, ELECTRIC
Strand & Co., N. A., Chicago, Ill.

GRINDING MACHINES, FLOOR AND TOOL
Blount Co., J. G., Everett, Mass.
Herbert, Limited, Alfred, Toronto, Ont.
National Acme Co., Cleveland, Ohio.
Norton Co. of Canada, Ltd., Hamilton, Ontario.
Greenfield Tap & Die Corp., Galt, Ont.
U. S. Electrical Tool Co., Cincinnati, Ohio.

GRINDING MACHINES, INTERNAL
Garlock Machinery Ltd., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES PORTABLE
Strand & Co., N. A., Chicago, Ill.

GRINDING MACHINES, SNAGGING
Blount Co., J. G., Everett, Mass.
Norton Co., of Can. Ltd., Hamilton, Ont
U. S. Electrical Tool Co., Cincinnati, Ohio.

GRINDING MACHINES, SURFACE
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, THREAD
Pratt & Whitney Co., of Canada, Ltd., Sound, Ont.

GRINDING MACHINERY, TOOL POST
Gisholt Machine Co., Madison, Wis.
Grenfield Tap & Die Corp., Galt, Ont.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES, UNIVERSAL
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Herbert, Limited, Alfred, Toronto, Ont.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co., of Canada, Ltd., Hamilton Ontario.

GRINDING WHEELS
Lion Grinding Wheels, Limited, Montreal, Que.
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Norton Co. of Can., Ltd., Hamilton, Ont.

GUN-BARREL MACHINERY
Steinle Turret Machine Co., Madison, Wisconsin.

HACK SAWS, POWER
Atkins & Co., Inc., E.C., Indianapolis, Indiana.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.

HAMMERS, CHIPPING
Cleveland Pneumatic Tool Co., Toronto, Ont.
High Speed Hammer Co., Rochester,

HAMMERS, DROP
Bertram & Son Co., Ltd., The John Dundas, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

HAMMERS, ELECTRIC
Brown, Boggs & Co., Ltd., Hamilton, Ont

HAMMERS, PNEUMATIC
Can. Steel Foundries, Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto Ont.

HANGERS, SHAFTING
Canadian SKF Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Hamilton Gear & Machine Co., Toronto.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

HOBBING MACHINES
Shore Instrument Co., Jamaica, N.Y.

HARDENING, CASE-HARDENING AND TEMPERING
Barnes Company, Wallace, Hamilton.
Gisholt Machine Co., Madison, Wis.
Cleveland Pneumatic Tool Co, Toronto Ont.

HAMMERS, POWER
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

HOBS
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

HOISTS, ELECTRIC
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.

HOISTS, HAND
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

HOISTS, PNEUMATIC
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont

HOLDERS-ON, PNEUMATIC
Cleveland Pneumatic Tool Co., Toronto Ont.

HYDRAULIC MACHINERY
Bertram & Son Co., Ltd., The John Dundas, Ont.
Dominion Engineering Works, Limited Montreal, Que.
Kennedy & Sons, Ltd., Wm., Owen

IGNITERS, GAS ENGINE
Canada Foundries & Forgings Co., Welland, Ont.
Burke Machine Tool Co., Conneaut, O

INDICATORS, SPEED AND TEST
Brown & Sharpe Mfg. Co., Providence, R.I.

INSULATION
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.

IRON BARS
Steel Co. of Canada, Ltd., Hamilton, Ont.

JACKS, HYDRAULIC
Norton, A. O., Boston, Mass.

JACKS, PLANER
Armstrong Bros. Tool Co., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

JAPANNING AND VARNISHING OVENS
Brantford Oven & Rack Co., Brantford, Ont.

JIGS AND FIXTURES (SEE TOOL WORK)
Fisher Motor Co., Ltd., Orillia, Ont.
Gisholt Machine Co., Madison, Wis.

KEYSEATING MACHINES
Morton Mfg. Co., Muskegon, Mich
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

KEYS, MACHINE
Can. Drawn Steel Co., Hamilton, Ont.
Morton Mfg. Co., Muskegon, Mich.

KNIVES, MACHINE
Atkins & Co., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

KNURL HOLDERS
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

LATHE ATTACHMENTS
Hendey Machine Co., Torrington, Conn.

LATHE TOOLS
Armstrong Bros. Tool Co. ,Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

LATHES, AUTOMATIC AND SEMI-AUTOMATIC
Gisholt Machine Co., Madison, Wis.
Herbert, Limited, Alfred, Toronto, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, BENCH
Hardinge Bros., Inc., Chicago, Ill.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

LATHES, BORING
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, CHUCKING (SEE LATHES, HORIZONTAL TURRET, AND LATHES, VERTICAL TURRET)
Acme Machine Tool Co., Cincinnati, O.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
Herbert, Limited, Alfred, Toronto, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, ENGINE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can Fairbanks-Morse Co., Ltd., Montreal.
Hendey Machine Co., Torrington, Conn.
Herbert, Limited, Alfred, Toronto, Ont.

LATHES, EXTENSION AND GAP
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison Wis
Herbert, Limited, Alfred, Toronto Ont.
National Acme Co., Cleveland, O.
Steinle Turret Machine Co., Madison, Wis.

LATHES, PRECISION
Hardinge Bros., Chicago.

LATHES, RELIEVING
Hendey Machine Co., Torrington, Conn.

BUYERS' DIRECTORY

LATHE, UNIVERSAL HAND
Brown & Sharpe Mfg. Co., Providence, Rhode Island.

LATHE, SPEED AND HAND
Blount Co., J. G., Everett, Mass.

LATHES, SPINNING
Pryibil Machine Co., Torrington, Conn.

LATHES, VERTICAL TURRET
Bertram & Son, Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

LATHES, WOOD TURNING
Blount, Co., J. G., Everett, Mass.
Can. Fairbanks-Morse Co., Ltd., Montreal.

LEAD PIPE
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

LEATHER FILLET
D. K. McLaren, Limited, Montreal.

LINOLEUM MILL MACHINERY
Bertrams, Ltd., Edinburgh, Scotland.

LIQUID AIR PLANTS
L'Air Liquide Society, Toronto, Ont.

LOCKERS, CLOTHES
Dennis Wire and Iron Works, London, Ont.

LUBRICANTS
Oakley Chemical Co., New York, N.Y.

LUBRICATING SYSTEMS
Bowser, S. F., & Co., Ltd., Toronto, Canada.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Ltd., Welland, Ont.
Ker & Goodwin Machine Co., Brantford, Ont
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R. Toronto Ont.

MANGANESE STEEL
Can. Steel Foundries, Montreal, Que.

MANDRELS, EXPANDING
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MANDRELS, SOLID
Greenfield Tap & Die Corp., Galt, Ont.
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Pratt & Whitney Co., of Canada. Ltd., Dundas, Ont.

MEASURING MACHINES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MECHANICS' FINE TOOLS
Lufkin Rule Co., Windsor, Ont.

METALS, ALLOY
Canada Metal Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.

METAL WORKERS
Parker Co., Charles, Meriden, Conn.

MICROMETER CALIPERS
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Rice Lewis & Son, Ltd., Toronto, Ont.

MILLING ATTACHMENTS
Burke Machine Tool Co., Conneaut, O.
Hendey Machine Co., Torrington, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.

MILLING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Burke Machine Tool Co., Conneaut, O

MILLING MACHINES, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence, R. I.
Hardings Bros., Inc., Chicago, Ill.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

MILLING MACHINES, BENCH
Burke Machine Tool Co., Conneaut. O.
Hardings Bros., Inc., Chicago, Ill.

MILLING MACHINES, HAND
Brown & Sharpe Mfg. Co., Providence
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MILLING MACHINES, HORIZONTAL PLANER TYPE.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Kearney & Trecker Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto.

MILLING MACHINES, PLAIN
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, O.
Hendey Machine Co., Torrington, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.

MILLING MACHINES, THREAD
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MILLING MACHINES, UNIVERSAL
Brown & Sharpe Mfg. Co., Providence,
Hendey Machine Co., Torrington, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.

MILLING MACHINES, VERTICAL
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, O.
Herbert, Limited, Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto.

MILLING TOOLS, ADJUSTABLE HOLLOW
Geometric Tool Co., New Haven, Conn.

MOTORS, ELECTRIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Roelofson Elevator Co., Galt, Ont.
Williams Machinery Co., A. R., Toronto,
Wisconsin Electric Co., Racine Wis.

NAILS AND STAPLES
Canada Metal Co., Ltd., Toronto, Ont.

NIPPLES
Canada Metal Co., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton,

NITROGEN
Carter Welding Co. Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

NUT TAPPERS
(See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
National Acme Co., Cleveland, Ohio.

NUTS, FINISHED and SEMI-FINISHED
Galt Macine Screw Co., Galt, Ont.
National Acme Co., Montreal, ue.

NUTS (Up to 4-in.)
Steel Co. of Canada, Ltd., Hamilton.

NUTS, S.A.E., PLAIN AND CASTELLATED
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

OIL FILTERING AND STORAGE SYSTEMS
Bowser, S. F., & Co., Ltd., Toronto,

OIL STORAGE ENGINEERS
Bowser, S. F., & Co., Ltd., Toronto,

OIL HOLE COVERS
Can. Whitney Co., Ltd., Windsor, Ont.

OILS, SOLUABLE
Brantford Oven & Rack Co., Brantford, Ontario.

ORNAMENTAL IRON AND WIRE WORKS
Roelofson Elevator Works, Galt, Ont.

OXYGEN
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

OXY-ACETYLENE APPARATUS
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Atlas Press Co., Kalamazoo, Mich.

PAINT SPRAYERS
Spray Engineering Co., Boston, Mass.

PAPER MILL CONVEYORS
Bertram Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd., Montreal, Que.

PAPER MILL MACHINERY
Dominion Engineering Works, Limited, Montreal, Que.

PATTERNS, WOOD AND METAL
Fittings, Limited, Oshawa, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.
Victoria Foundry Co., Ltd., Ottawa.

PHOSPHOR TIN
Canada Metal Co., Ltd., Toronto, Ont.

PHOTOGRAPHIC DUPLICATING MACHINES
Photostat Corp., Providence, R. I.

PIPE BENDING MACHINES
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Underwood Corp., H. R., Philadelphia, Pa.
Williams Machinery Co., A. R., Toronto.

PIPE CUTTING AND THREADING MACHINES
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Petrie, Ltd., H. W., Toronto, Ont.

PIPE
Canada Metal Co., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.

PIPE FITTINGS
Canada Metal Co., Toronto, Ont.
International Malleable Iron Co., Guelph Ont.

PIPE AND NIPPLE THREADING MACHINES
Landis Machine Co., Inc., Waynesboro, Pa.

PIPE FITTERS' TOOLS
Rice Lewis & Son, Ltd., Toronto, Ont.

PIPE THREADING DIE HEADS
Landis Machine Co., Inc., Waynesboro, Pa.

PISTON-RING MACHINES
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

PLANING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Williams Machinery Co., A. R., Toronto.

PLANING MACHINES, ROTARY
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Herbert, Limited, Alfred, Toronto, Ont.

PLATE ROLLS
Bertram & Son Co., Ltd., The John, Dundas, Ont.

PNEUMATIC TOOLS
Cleveland Pneumatic Tool Co., Toronto.

POLISHING AND BUFFING MACHINES
Lion Grinding Wheels, Limited, Montreal, Que.
Blount Co., J. G. Everett, Mass.
Brown & Sharpe Mfg. Co., Providence.
Pryibil Machine Co., New York, N.Y.

PRESSED STEEL PARTS
American Pulley Co., Philadelphia, Pa.
Fisher Motor Co., Ltd., Orillia, Ont.

PRESSES, ARBOR
Atlas Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

PRESSES, DROP AND FORGING
Brown, Boggs & Co., Ltd., Hamilton.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

PRESSES, FOOT AND HAND
Brown, Boggs & Co., Ltd., Hamilton

PRESSES, HYDRAULIC
Bertram & Son Co., Ltd., The John Dunidas, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Perrin Ltd., W. R., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

PRESSES, POWER
Bliss Co., E. W., Prooklyn, N. Y.
Brown, Boggs, & Co., Ltd., Hamilton,
Hepburn Ltd., John T., Toronto, Ont.
Stoll Co., Inc., D. H., Buffalo, N.Y.

PRESSES, SCREW
Brown, Boggs & Co., Ltd., Hamilton.

PROFILING MACHINES
Prit & Whitney Co., of Canada, Ltd., Dundas, Ont.

PROTRACTORS
Brown & Sharpe Mfg. Co., Providence.
Lufkin Rule Co., Windsor, Ont.

PROPELLERS
Kennedy & Sons, Wm., Owen Sound Ontario.

PULLEYS, CORK INSERT
American Pulley Co., Philadelphia, Pa.

PULLEYS, METAL AND FIBRE
American Pulley Co., Philadelphia, Pa.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.
D. K. McLaren Co., Limited Montreal, Que.

PULP AND PAPER MILL EQUIPMENT
Dominion Engineering Works, Ltd., Montreal, Que.

PUMPS, HYDRAULIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Dominion Engineering Works, Ltd. Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont

PUMPS, LUBRICANT AND OIL
Bowser, S. F., & Co., Ltd., Toronto.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Hepburn Ltd., John T., Toronto, Ont.

PUMPS, POWER
Bowser, S. F., & Co., Ltd., Toronto.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hepburn Ltd., John T., Toronto, Ont.

PUNCHES, CENTER
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

PUNCHES, HAND
Brown Boggs & Co., Ltd., Hamilton.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Jardine & Co., A. B., Hespeler, Ont.

PUNCHES, POWER
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

PUNCHING MACHINES, HORIZONTAL
Bertrams Ltd., Edinburgh, Scotland.

PYROMETERS, ELECTRIC
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Hiram Walker & Sons Metal Products Co., Walkerville, Ont.

RACKS, CUT
Hamilton Gear & Machine Co., Toronto.

RACKS, STORAGE
(See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ontario.

REAMER HOLDERS
Simonds Canada Saw Co., Montreal, Q.

REAMERS, ELECTRIC
U. S. Electrical Tool Co., Cincinnati, Ohio.

REAMERS, EXPANDING
Cleveland Twist Drill Co., Cleveland, O.
Davis Boring Tool Co., St. Louis, Mo.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

REAMERS, SOLID
Butterfield & Co., Inc., Rock Island, Q.
Morse Twist Drill & Machine Co., New Bedford, Mass.

REAMERS, TAPER
Brown & Sharpe Mfg. Co., Providence, R. I.
Butterfield & Co., Inc., Rock Island, Q.
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canad, Ltd., Dundas, Ont.

RECORDERS, TEMPERATURE
Taylor Instrument Co., Rochester, N. Y.

RECORDERS, TIME
Gisholt Machine Co., Rochester, N. Y.
Taylor Instrument Co., Toronto, Ont.

REGULATORS, TEMPERATURE
Taylor Instrument Co., Toronto, Ont.

RIVETS AND BURRS
Parmenter & Bulloch Co., Gananoque, Ont.
Steel Co., of Canada, Ltd., Hamilton,

RIVET-MAKING MACHINERY
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

BUYERS' DIRECTORY

RIVETING MACHINES
Can. Fairbanks-Morse Ltd., Montreal Q.
High Speed Hammer Co., Rochester, N.Y.
Parmenter & Bulloch Co., Gananoque Ont.

RUDDER FRAMES, STEEL
Can. Steel Foundries, Montreal, Que.

RUBBER MILL MACHINERY
Bertram Ltd., Edinburgh, Scotland.

RULES, STEEL AND WOOD
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Windsor, Ont.

RUST PREVENTATIVES
Oakley Chemical Co., New York, N. Y.

SAND EQUIPMENT
Can. Link-Belt Co., Toronto, Ont.

SAND RAMMERS, PNEUMATIC
Canadian Pneumatic Tool Co., Toronto.

SAW FRAMES AND BLADES, HACK
Atkins & Co., Inc., E. C., Indianapolis,
Diamond Saw & Stamping Works, Buffalo, N. Y.
Rice Lewis & Sons, Ltd., Tornto, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWING MACHINES, POWER HACK
Atkins & Co., Inc., E. C., Indianapolis,
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

SAW SHARPENING MACHINES
Atkins & Co., Inc., E. C., Indianapolis,
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

SAWS, CIRCULAR METAL
Atkins & Co., Inc., E. C., Indianapolis.
Pryibil Machine Co., New York, N. Y.
Gisholt Machine Co.. Madison, Wis.

SAWS, HAND
Atkins & Co., Inc., E. C., Indianapolis
Simonds Canada Saw Co., Montreal, Q.

SAWS, HOT AND COLD
Atkins & Co., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Q.

SAWS, HIGH SPEED STEEL
Atkins & Co., Inc., E.C., Indianapolis, I.
Butterfield & Co. Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWS, METAL BAND
Atkins & Co., E. C., Indianapolis, I.

SAWS, METAL CUTTING
Brown & Sharpe Mfg. Co., Providence,
Butterfield & Co., Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.
Starrett Co., L. S., Athol, Mass.

SAWS, SCREW SLOTTING
Atkins & Co., Inc., E., C., Indianapolis.
Butterfield & Co., Inc., Rock Island, Q.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canda, Ltd., Dundas, Ont.

SAWS, SCREW SLOTTING
Atkins & Co., Inc., E. C., Indianapolis.
Butterfield & Co., Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWS, WOOD
E. C. Atkins & Co., Indianapolis, Ind.

SCALES
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Lufkin Rule Co., Windsor, Ont.

SCREENS
Dominion Engineering Works, Ltd., Montreal, Que.

SCREW DRIVERS, OPTICAL, JEWELRY AND NOVELTY
Strand & Co., N. A., Chicago, Ill.

SCREW MACHINE WORK
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Montreal, Que.

SCREW MACHINERY, WOOD AND LAG
Cook Co., Asa S., Hartford, Conn.

SCREW MACHINES
Brown & Sharpe Mfg. Co., Providence, Rhode Island.

SCREW MACHINES, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.

SCREW MACHINE PRODUCTS
National Acme Co., Montreal, Que.

SCREW PLATES
Butterfield & Co., Inc., Rock Island. Que.
Jardine & Co., A. B., Hespeler, Ont.

SCREWS, CAP AND SET
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

SCREWS, SAFETY, SET
Galt Machine Screw Co., Galt, Ont.

SECOND-HAND MACHINERY
See last page of directory.

SEPARATORS, MOISTURE AND OIL
Bowser, S. F., & Co., Ltd., Toronto, Canada.

SEPARATORS, OIL AND WASTE
Bowser, S. F., & Co., Ltd., Toronto.

SHAFTS, FLEXIBLE
Strand & Co., N. A., Chicago, Ill.

SHAFTING
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
Williams Machinery Co., A. R., Toronto.

SHAPES, COLD-DRAWN SPECIAL STEEL
Union Drawn Steel Co., Hamilton, Ont.

SHAPING MACHINES
Hendey Machine Co., Torrington, Conn.
Morton Mfg. Co., Muskegon, Mich.
Williams Machinery Co., A. R. Toronto.

SHEARS HAND
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

SHEARS, POWER
Bliss Co., E. W., Brooklyn, N. Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Stoll Co., Inc., D. H., Buffalo. N. Y.
Williams Machinery Co., A. R., Toronto, Ont.

SHEARING MACHINES, ANGLE, IRON BAR AND GATE
Bertrams Ltd., Edinburgh, Scotland.

SHEET LEAD
Canada Metal Co., Ltd., Toronto, Ont.

SHEET METAL WORKING MACHINERY
Bliss Co., E. W., Brooklyn, N. Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Stoll Co., Inc., D. H, Buffalo, N.Y.

SHEETS, NICKEL, MONEL AND FIBRE
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.

SHEETS, O.P.C.R. & B. A. AND BLUE ANNEALED
Steel Co., of Canada, Ltd., Hamilton, Ont.

SIDE FRAMES, LOCOMOTIVE
Can. Steel Foundries, Montreal, Que.

SLOTTING ATTACHMENTS
Brown & Sharpe Mfg. Co., Providence, R.I.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

SLOTTING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.

SOLDERS
Canada Metal Co., Ltd., Toronto, Ont.

SPECIAL MACHINERY AND TOOLS
Brown Engineering Corp., Ltd., Toronto.
Gisholt Machine Co., Madison, Wis.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.
National Acme Co., Cleveland, O.

SPIKES, RAILWAY AND PRESSED
Steel Co of Canada, Ltd., Hamilton, Ont.

SPINNING LATHES
Prybil Machine Co., P., New York City.

SPRING, MILLED
Barnes & Co., Wallace, Hamilton, Ont.

SPRINGS, SMALL SPIRAL HELICAL, COMPRESSION, EXTENSION, TORSION AND SPECIAL
Barnes Company, Wallace, Hamilton.

SPRINGS
Barnes Company, Wallace, Hamilton.
Cleveland Wire Spring Co., Clevleand, O.
Steele Ltd., James, Guelph, Ont.

SPRINGS, FLAT STEEL, BRUSH HOLDER, CLOCK, SMALL FLAT SPRINGS
Barnes Company, Wallace, Hamilton.

SPROCKETS AND CHAINS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Renold-Hanson of Canada, Ltd., Montreal, Que.

SQUARES
Brown & Sharpe Mfg. Co., Providence, R.I.
Lufkin Rule Co., Windsor, Ont.
Steel Co. of Canada, Ltd., Hamilton. Ont.

STAMPING, METAL
American Pulley Co., Philadelphia, Pa.
Barnes Company, Wallace, Hamilton.
Diamond Saw & Stamping Works, Buffalo, N. Y.
Parmenter & Bulloch Co., Gananoque, Ont.

STAMPS, STEEL
Diamond Saw & Stamping Works, Buffalo, N. Y.

STEEL CONCRETE REINFORCEMENT
Steel Co. of Canada, Ltd., Hamilton.

STEEL PLATE
British Empire Steel Co., Montreal, Que.

STEEL AND IRON BARS
Steel Co. of Canada, Ltd., Hamilton.

STEELS TOOL
British Empire Steel Co. Montreal Q.

STEEL, COLD-ROLLED STRIP
British Empire Steel Co., Montreal, Q.
Barnes Company, Wallace, Hamilton.

STEEL, CRUCIBLE, SPRING
Barnes, Company, Wallace, Hamilton.
British Empire Steel Co., Montreal, Q.

SHEETS, OPEN HEARTH STEEL
Steel Co., of Canada, Ltd., Hamilton.

STEEL, SHAFTING AND FREE CUTTING SCREW
Union Drawn Steel Co., Hamilton, Ont.

STEEL, SHEET
British Empire Steel Co., Montreal, Q.
Rice Lewis & Son, Ltd., Toronto, Ont.

STEEL, STAINLESS
Steel Co., of Can. Ltd., Hamilton, Ont.

STEEL STAIRS
Roelofson Elevator Works. Galt, Ont.

STEELS, ALLOY AND CARBON
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Can. Steel Foundries, Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton Ont.

STEELS, HIGH-SPEED
Armstrong Bros. Tool Co., Chicago, Ill.
Atkins & Co., Ltd., Wm., Sheffield, England.
British Empire Steel Co., Montreal, Q.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton.

STEEL TUBING, CLOSE JOINT AND WELDED
Standard Tube & Fence Co., Ltd., Woodstock, Ont.

STERN FRAMES, CAST STEEL
Can. Steel Foundries, Montreal, Que.

STRAIGHTENING MACHINERY
Bertram Ltd., Edinburgh, Scotland.
Williams & Co., Ltd., J. H., Brooklyn, N.Y.

STUDS
Geometric Tool Co., New Haven, Conn.
Galt Machine Screw Co., Galt, Ont.

SWAGING MACHINES
Atkins & Co., Inc., E. C., Indianapolis, Indiana.

SWITCHES, RAILWAY
Can. Steel Foundries, Montreal, Que.

TACHOMETERS
Bristol Co., Waterbury, Conn.

TANKS AND PUMPS, OIL
Bowser, S. F., & Co., Ltd., Toronto.

TAP HOLDERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
William L. Procunier, Chicago, Ill.

TAPER PINS
Galt Machine Screw Co., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

TAPES, MEASURING
Starrett Co., L. S., Athol, Mass.
Lufkin, Rule Co., Windsor, Ont.

TAPPING MACHINES AND ATTACHMENTS
Burke Machine Tool Co., Conneaut, O.
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.
Wm. L. Procunier, Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

TAPS AND DIES
Butterfield & Co., Inc., Rock Island, Q.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Herbert, Limited, Alfred, Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

TAPS, COLLAPSING
Geometric Tool Co., New Haven, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.

TEETH, DREDGE BUCKET
Kennedy & Sons, W., Owen Sound, Ont.

THERMOMETERS
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Greenfield Tap and Die Corp., Galt, Ontario.

THREAD-CUTTING TOOLS
Butterfield & Co., Inc., Rock Island, Q.
Greenfield Tap and Die Corp., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

THREAD CUTTING MACHINES
Landis Machine Co., Inc., Waynesboro, Pa.

THREADING MACHINES
Acme Machinery Co., Cleveland, Ohio.
Geometric Tool Co., New Haven, Conn.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Williams Tool Corp., of Can. Ltd., Brantford, Ont.

THREAD LEAD TESTING MACHINES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

THREAD-ROLLING MACHINES
Bliss Co., E. W., Brooklyn, N. Y.

TIE PLATES
Steel Co. of Canada, Ltd., Hamilton.

TIME RECORDERS
International Business Machine Co., Ltd., Toronto, Ont.

TONGS
Hepburn Ltd., John T., Toronto. Ont.

TOOL CASES
Rice Lewis & Son, Ltd., Toronto, Ont.

TOOL HOLDERS
Armstrong Bros., Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Bertrams Ltd., Edinburgh, Scotland.

TOOL POSTS, LATHE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Williams & Co., Ltd., J. H., Brooklyn, N.Y.

TOOLS, SMALL
(See Machinists' Small Tools)
Armstrong Bros. Tool Co., Chicago, Ill.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Lufkin Rule Co., Windsor, Ont.
National Machine Tool Co., Racine, Wis.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S. Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A.R., Toronto,

TOOL WORK
Brown Engineering Corp., Ltd., Toronto, Ontario.

TORCHES, BLOW
Rice Lewis & Son, Ltd., Toronto, Ont.

TRACKWORK, RAILWAY
Can. Steel Foundries, Montreal, Que.

TRACKWORK, MANGANESE STEEL
Can. Steel Foundries, Montreal, Que.

TRANSMISSION MACHINERY
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound.
Renold, (Hans) of Canada, Ltd., Montreal, Que.

TROLLEYS AND TRAMWAYS
Can Link-Belt Co., Toronto, Ont.
Northern Crane Works, Walkerville, Ont.
Wright Mfg. Co., Lisbon, Ohio.

TROLLEY WHEELS
Langley & Austin, Galt, Ont.

TROWELS, PLASTERING
E. C. Atkins & Co. Indianapolis, Ind.

WRENCHES, MACHINISTS'
Armstrong Bros. Tool Co., Chicago, Ill.

TRUCKS
Can. Fairbanks-Morse Ltd., Montreal, Q
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.

BUYERS' DIRECTORY

TUBING, SEAMLESS STEEL, BRASS AND COPPER AND FIBRE
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.

TURRET HEADS
Bertram & Son Co., Ltd., The John Dundas, Ont.

TURRET MACHINES
(See Lathes, Horizontal Turret)
Acme Machine Tool Co., Cincinnati, O.
Cook Co., Asa S., Hartford, Conn.
Gisholt Machine Co. Madison Wis.
Herbert, Limited, Alfred, Toronto, Ont.
National Acme Co. Cleveland O.
Pratt & Whitney Co. of Canada Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin

TURRETS, TOOL POST
Gisholt Machine Co. Madison, Wis.

UNIONS, PIPE
Fittings, Limited, Oshawa, Ont.

VALVES
Canada Metal Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

VISES, DRILLING MACHINE
Burke Machine Tool Co., Conneaut, Ohio.
Charles Parker Co., Meriden, Conn.
Cleveland Pneumatic Tool Co., Toronto, Ontario.
Kempsmith Mfg Co., Milwaukee, Wis.

VISES, PIPE
Charles Parker Co., Meriden, Conn.

VISES, PLANER AND SHAPER
Bertram & Son Co., Ltd., The John Dundas, Ont.
Philip Gies Foundry, Kitchener, Ont.
Hendley Machine Co., Torrington, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.

VISES, WOOD WORKERS'
Charles Parker Co., Meriden, Conn.
Parmenter & Bulloch Co., Gananoque, Ontario.

VOLTMETERS
Bristol Co., Waterbury, Conn.

WAGON LEADERS
Can. Link-Belt Co., Toronto, Ont.

WASHERS, LOCK, SPLIT AND SPRING
Barnes Company, Wallace, Hamilton.

WATER POWER PLANTS
Dominion Engineering Works, Limited, Montreal, Que.

WELDING APPARATUS, OXY-ACETYLENE
L'Air Liquide Society, Toronto, Ont.
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto, Ont.

WELDING APPARATUS
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.

WELDING, ELECTRIC, ARC, SPOT AND BUTT
International Malleable Iron Co., Guelph, Ont.

WELDING MACHINES, OXY-ACETYLENE
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.

WELDING, ELECTRIC
McLaren Belting Co., J. C., Montreal, Que.
Steel Co. of Canada, Ltd., Hamilton.

WELDING ROD, TOBIN, MANGANESE, BRONZE AND ALUMINUM
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto, Ont.

WELDING SUPPLIES
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.

WHEELS, INDUSTRIAL
American Pulley Co., Philadelphia, Pa.
Hull Iron & Steel Foundries, Hull, Que.
Kennedy & Sons, Wm., Owen Sound, Ontario.

WINCHES, HEADGATE
Kennedy & Sons, Wm. Owen Sound, Ontario.

WINCHES, STOPLOG
Kennedy & Sons, Wm., Owen Sound. Ontario.

IPING PRODUCTS
Sanitary Wiping Products Co., Toronto, Ont.

WIRE
Barnes Company, Wallace, Hamilton.
Canada Metal Co., Ltd., Toronto, Ont.
Dennis Wire & Iron Works, London, Ontario.
Greening Wire Co., B., Hamilton, Ont.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

WIRE, BLACK TEMPERED, MUSIC PHOSPHOR BRONZE AND PREMIER
Barnes Company, Wallace, Hamilton

WIRE, COPPER AND BRASS, FINE AND HEAVY
Steel Co., of Canada, Ltd., Hamilton, Ontario.

WIRE STRAIGHTENING AND CUTTING MACHINERY
Brown, Boggs & Co., Ltd., Hamilton, Ontario.

WIRE, WELDING
L'Air Liquide Society, Toronto, Ont.
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.

WIRES, SPECIAL
Dennis Wire & Iron Works, London, Ontario.
Greening Wire Co., B., Hamilton, Ont

WOODWORKING MACHINERY
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Williams Machinery Co., A. R., Toronto, Ontario.

WRENCHES, DROP FORGED
Armstrong Bros. Tool Co., Chicago, Ill
Canada Foundries & Forgings Co., Welland, Ont.

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THE FINANCIAL POST 143 University Ave. Toronto

DIRECTORY OF DEALERS

THE Buyers' Directory of CANADIAN MACHINERY was originally intended to contain information regarding lines actually manufactured by our advertisers. We now carry the advertising of leading machinery dealers, some of whom represent scores of manufacturers in addition to being manufacturers themselves in some cases. We recommend, therefore, if our subscribers cannot find what they want in our Directory that they communicate with the dealers whose names appear herewith.

MACHINE TOOLS, ETC.

Bertram & Sons, Ltd., John, Dundas, Ont.
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Garlock Machinery Ltd., Toronto.
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BENCH DRILL STAND WITHOUT DRILL

$45.00

BLACK & DECKER SPECIAL HALF INCH DRILL

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ILLUSTRATION SHOWS BENCH DRILL STAND *with* BLACK & DECKER SPECIAL ½" DRILL

COMPLETE AS SHOWN

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The bracket supporting the drill may be raised or lowered to suit the height of the work and may be swung entirely around the post, which is a big advantage in locating the hole and for handling large jobs and odd shapes. The bracket is secured in position by means of a hand screw.

YOU can always tell a good mechanic by his tools. He never buys inferior tools because they are cheap, if he can avoid it. But if he is a good business man as well as a good mechanic he guards against unnecessary expenditures.

In most shops a portable electric drill is absolutely indispensable and a drill press often necessary. Good mechanics everywhere are using Black & Decker Portable Electric Drills; and to make it possible for them to have the advantages of a drill press at minimum expense we have produced the Black & Decker Bench Drill Stand.

The Black & Decker Portable Electric Drill can be mounted in this stand in a few seconds and dismounted just as readily. The Stand sells for only a fraction of what it would cost to install a drill press.

The Black & Decker Post Drill Stand is similar in all respects to the Bench Drill Stand except that it has a longer column and is arranged with brackets so that it can be mounted on wall or post and the drilling table is secured on the vertical column with a hand screw so that it can be raised or lowered or swung around.

MADE IN CANADA

A very substantial reduction in prices has been made possible by the establishment of our Canadian factory.

CREDIT

BLACK & DECKER National Credit Service enables any reliable person in Canada to purchase Black & Decker equipment from his jobber on terms that permit the equipment to pay for itself.

This is the new Black & Decker Special Half Inch Drill, which has created such a sensation in the trade by reason of the fact that it combines Black & Decker quality and an exceptionally low price.

The fact that Canadian Industrials insist upon the finest tools and equipment obtainable makes BLACK & DECKER a natural choice.

THE BLACK & DECKER MFG. CO.
LIMITED
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Miniature catalogue will be supplied on request

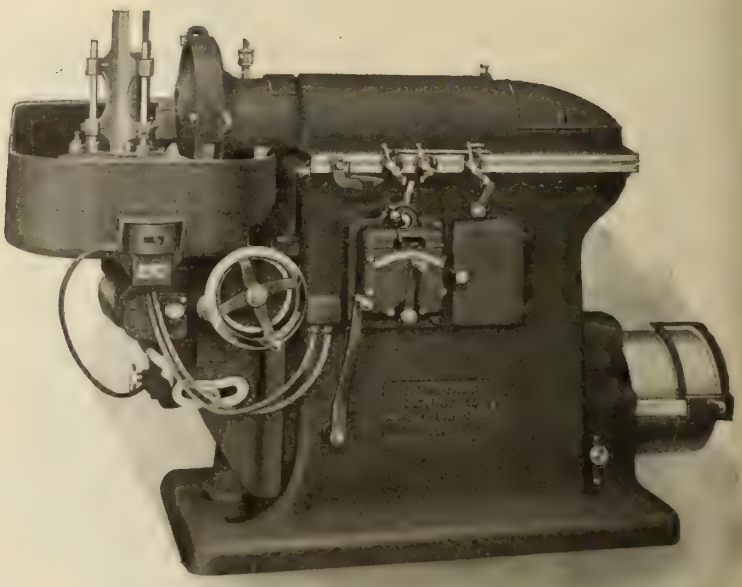
Automatically Chucks

Rings—Ball and Roller Bearings—Collars—Gears—Etc.

Just fill the magazine and take away the finished work with a

HEALD

No. 25



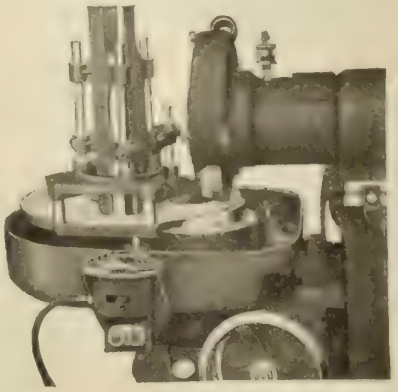
If you are interested in, or manufacture any such parts as rings, ball-races, collars, washers, gears, etc., you should make immediate investigation of the new Heald Rotary Surface Grinding Machine, for chucking by hand will soon be entirely obsolete.

Considering that it only requires filling the magazine and taking away the finished product, no concern can compete, using hand operation, for so many human equations enter when the work is handled by this method that the production in a day's time is decidedly low and uncertain compared to that obtained mechanically, which gives absolute results at a fixed production day after day.

This machine has been designed and built for large production, all of its units being extremely heavy and rigid with moving parts carefully guarded.

The slide is driven by an extremely simple hydraulic arrangement, operated by oil, which makes it possible to get any speed from nothing up to the maximum. The automatic feeding arrangement is made up of a feeding plate with five holes, which can be bushed to take rings up to 5 in. in diameter. As the plate indexes, a ring is moved from the magazine to the center of the chuck.

A two-step cone on the main drive shaft gives two speeds to the wheel, which enables the operator to maintain an efficient surface speed throughout the entire life of the wheel.



Automatic Feeding Attachment

The chuck spindle housing is absolutely tight, which makes it possible to fill it with oil, thus immersing the bearings and gears which drive the chuck spindle.

The diamond, which is located on the chuck pan, can be readily adjusted to true the wheel to give the desired thickness for the ring. Let us go into full details with you, either personally, through our representative or by mail.

THE HEALD MACHINE COMPANY

51 New Bond Street, Worcester, Mass.

CANADIAN MACHINERY
AND MANUFACTURING NEWS

Vol. XXVIII. No. 20 | Published Weekly by the MacLean Publishing Company, Limited, Toronto, Ont. | Nov. 16, 1922 | $4.00 a Year Subscription Price

READ AND PASS TO	Check	See Page	READ AND PASS TO	Check	See Page

It Pays to Keep Posted on
New Starrett Tools

Take a tip from the Old Timer—he knows by experience how much easier it is to turn out accurate work today than it was 20 years ago. Keeping up with tool improvements means keeping up with the latest and best shop practice.

It *pays* to keep posted—write for the Supplement to Catalog No. 22 "3" describing the latest Starrett Tools. It will be sent free on request.

THE L. S. STARRETT CO.
The World's Greatest Toolmakers
Manufacturers of Hacksaws Unexcelled
ATHOL, MASS.

*In lathe work, die work and general tool work these steel rules (shown approximately actual size) are very useful and convenient. With them you can easily take measurements in places inaccessible to an ordinary rule. Five rules are supplied with the holder from ¼" to 1" in length. They can be set in the rule in any position and locked by a slight turn of the handle. To insure easy reading, blades are held at 30° angle.

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STARRETT HACK SAWS
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12 118

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To meet all your boiler requirements, we build P & W Staybolt Taps in five standard styles, as well as Spindle Staybolt Taps with and without threaded end and also Combined Reamer and Tap to tap continuous hole in the reamer hole of the far boiler plate.

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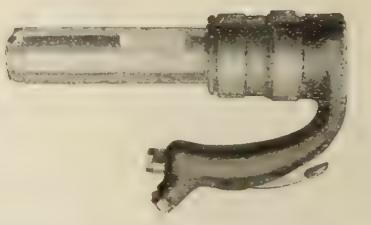
For Locomotive and Car Shops, Boiler and Tank Shops, Ship Yards, Etc.

THE "POCKET" IN-HEAD INCREASES PISTON SPEED



THE "POCKET" IN-HEAD INCREASES POWER of BLOW

The Inverted Handle Riveter is 4-in. shorter than regular styles.
CLEVELAND RIVETERS are Shorter, Lighter, Hit Harder, Run Faster and use less Air in Operation than any Riveter on the market.
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Write for Illustrated Bulletins No. 52 and 53.

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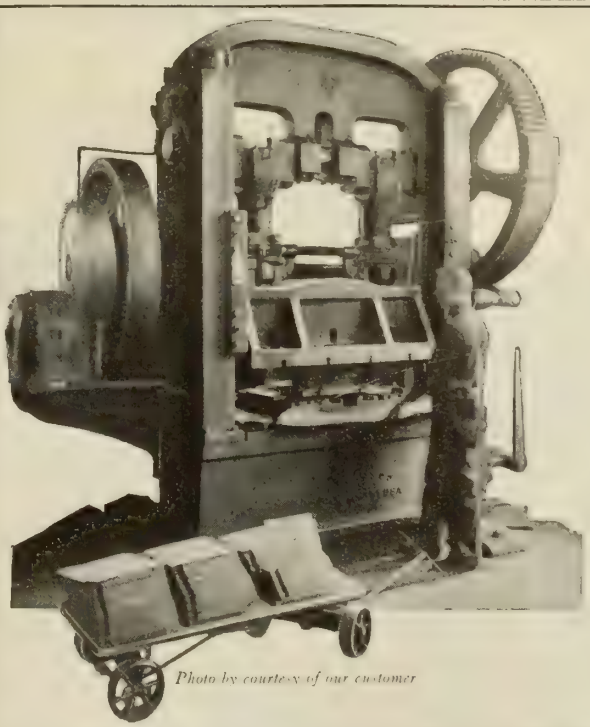

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Economy

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THIS BLISS No. 7 Double Crank Press handles the work formerly done on three or four Power Bending Brakes by six to eight men. Notching, perforating, and forming operations on various parts of metal filing cabinets and lockers, with frequent changes of work and dies.

It has cut out — abolished — the cost of fitting in the final assembly and effected other incidental economies.

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No. 322

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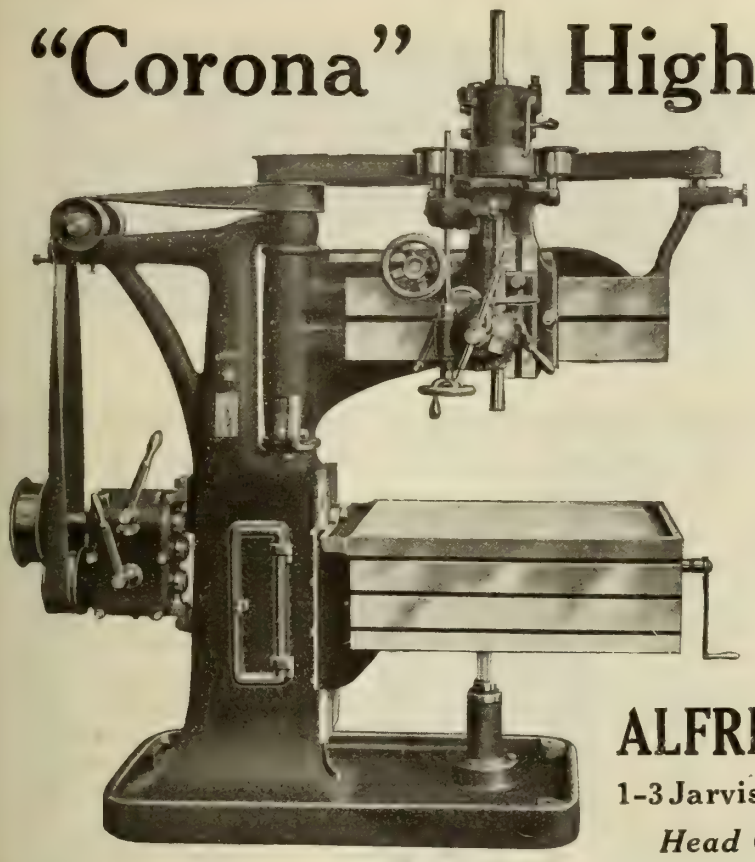
"Corona" High Speed Drills



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Every modern device that tends toward accuracy, speed and convenience has been incorporated in this carefully built, High Speed Drilling Machine.

The "Corona" Drilling Machines are built by Fred'k Pollard & Co., Ltd., Leicester, England, who specialise in drilling machines. As agents we carry a good stock of these machines, covering radial, vertical and sensitive drills and recommend them with confidence.

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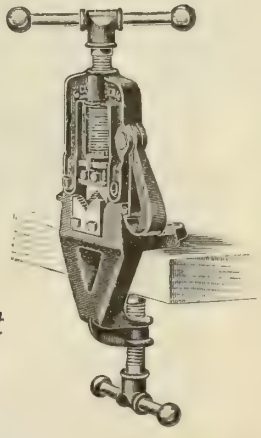

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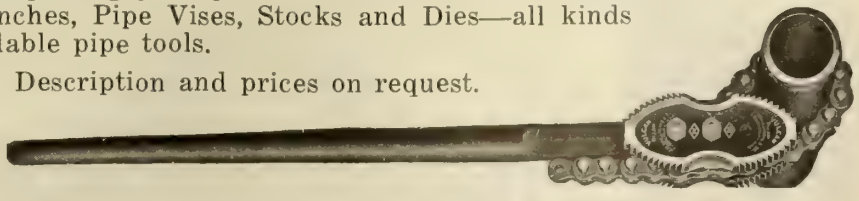

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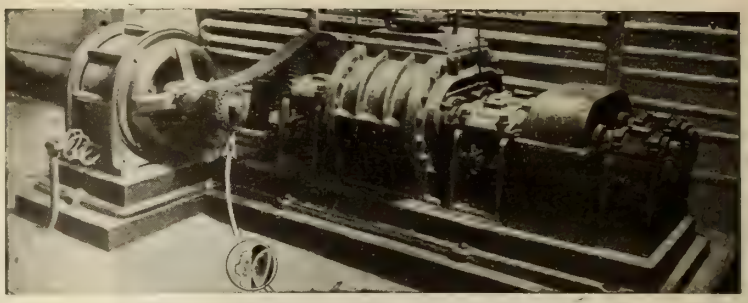

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are in every sense "Thoroughbred Springs." They owe their superiority to careful, painstaking creation by experts, whose knowledge of spring requirements comes from an intensive study of the subject for many years. In addition to this, even smallest details of their manufacture are given the same scrupulous care as obtains during the scientific heat-treatment which imparts to RAYMOND SPRINGS that attribute which places them in the "thoroughbred" class.

There is a RAYMOND SPRING for every purpose.

Raymond Mfg. Co., Ltd.

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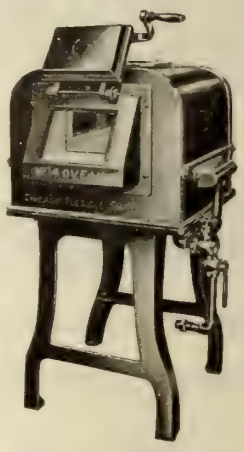

are designed and built to meet the most exacting and unusual requirements. They are the development of over quarter of a century of specialized effort. They are result getters—with a saving in time, fuel and material.

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For Hardening Small Tools—

this **Stewart No. 1 Oven Furnace** is very popular. The scientific proportioning of the vents permits **even heating.** It keeps the flame off the work, does away with the expense of replacing muffles and gives much quick and lively heat. Size of chamber, 5" x 9" x 13½".

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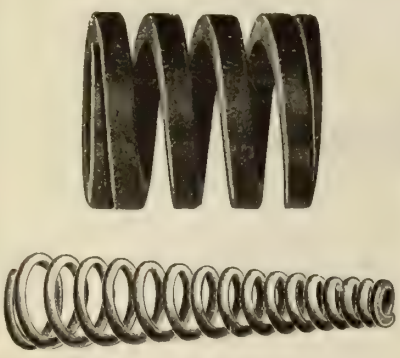

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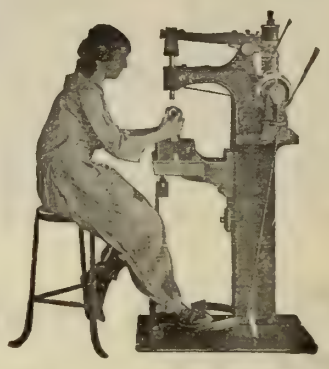

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Heads 'em tight or loose, flush, countersunk, or finishes heads any shape desired, and at the rate of:
A rivet a second, sizes up to 3/16".
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Besides riveting, the High Speed Riveting Hammer does all kinds of peining, swaging, upsetting, etc.
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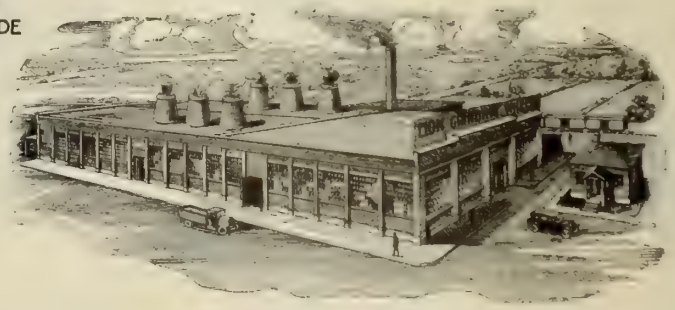
MANUFACTURERS OF HIGH GRADE GRINDING WHEELS



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For Grinding High Tensile Material

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The Wheels You Will Eventually Buy. Why Not Now?

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BROCKVILLE, ONT.
Agents for Prov. Quebec
J. R. Baxter & Co., Ltd.
Montreal

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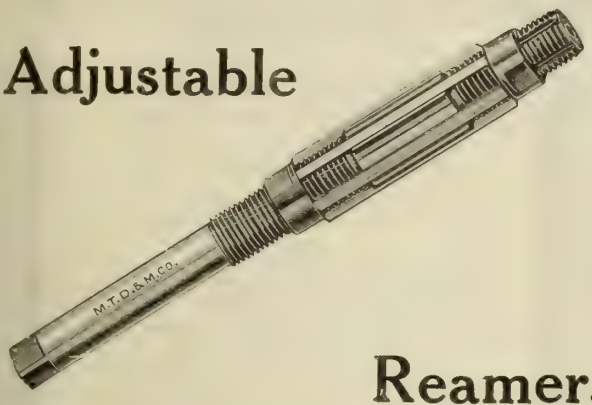
"Morse No. 728"

Adjustable



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"MORSE" Twist Drill & Mach. Co.
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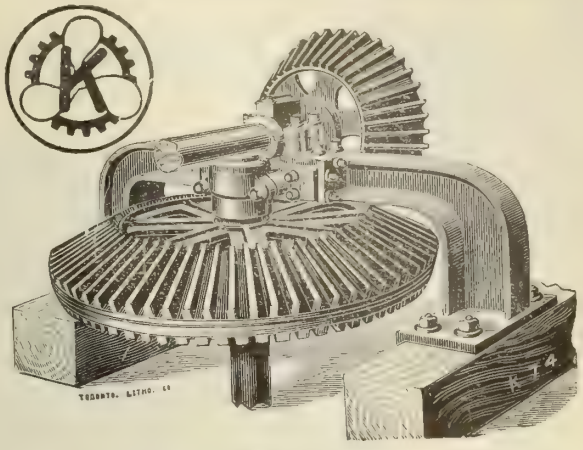
KENNEDY

Transmission Machinery



We have the largest range of patterns in Canada for gears, pulleys, bearings and bridgetrees. We build transmission machinery to any specifications.

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OWEN SOUND ONTARIO.

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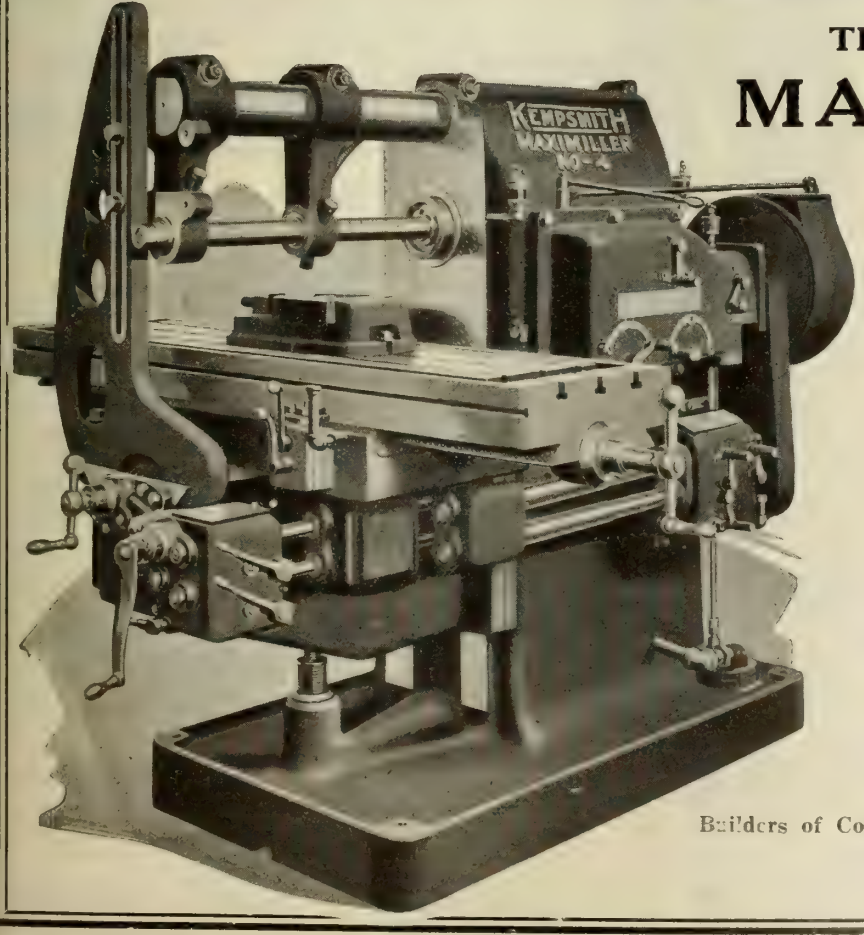
L. A. Mitchell, 1091A Bathurst St., Toronto, Phone Hillcrest 2014.
H. C. Kennedy, 232 St. James St., Montreal, Phone Main 394.



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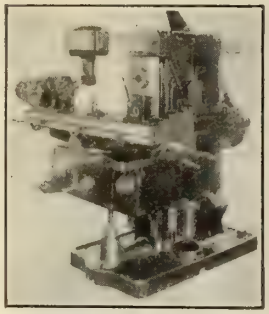

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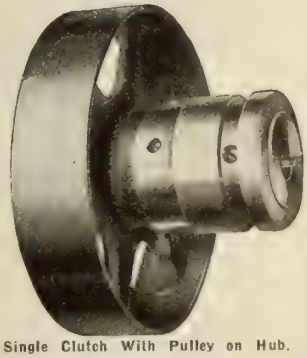
The operator has perfect control over the machine at all times through a lever conveniently located at the front of machine.



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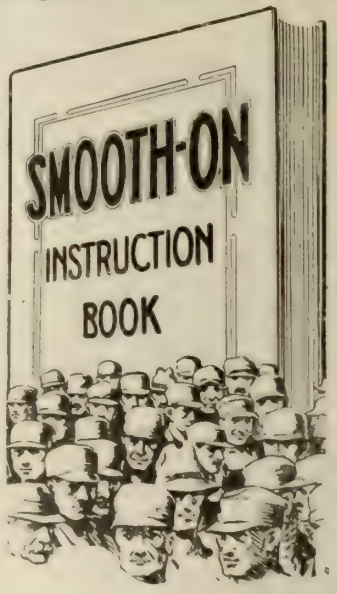

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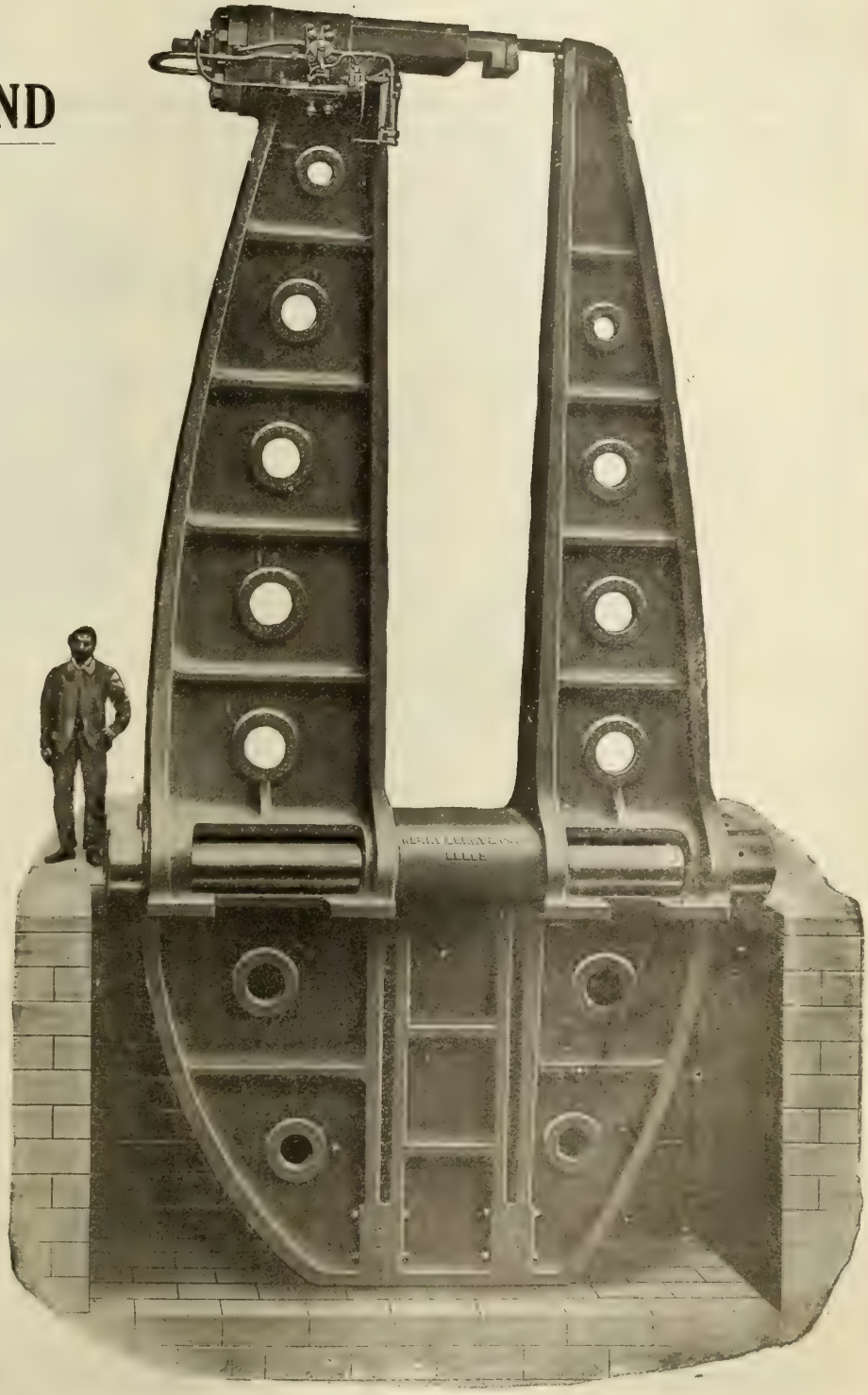

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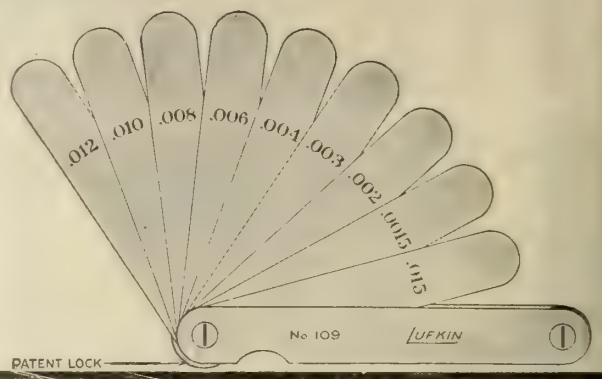

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10,000	1/2"	18
500	1/2"	16
4,500	7/16"	20
2,500	1/2"	20
500	5/8"	18
4,000	3/4"	18
10,000	7/8"	20
6,000	1-1/4"	20
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1000 lb. Board Lift
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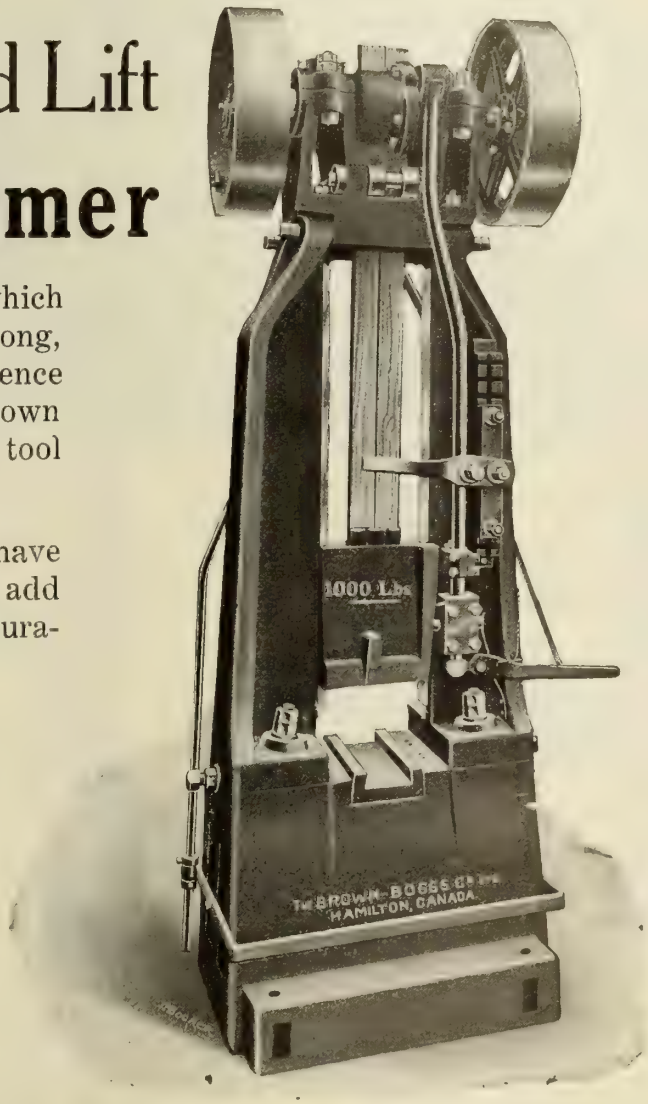

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Walton it Out in a Jiffy

And save the casting.

Special analysis steel fingers of the Walton Extractor drop into the flutes of the broken tap—and grip. Then a few turns of a wrench applied to the squared end of the Extractor backs out the buried tap.

Sixty-day trial offer proves the Walton Extractor pays for itself. Write.

The Walton Co.
Hartford, Conn.

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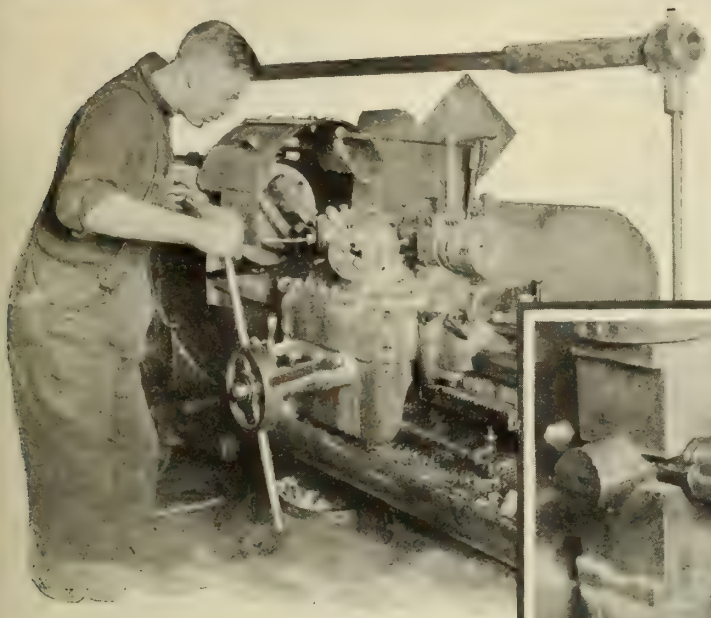
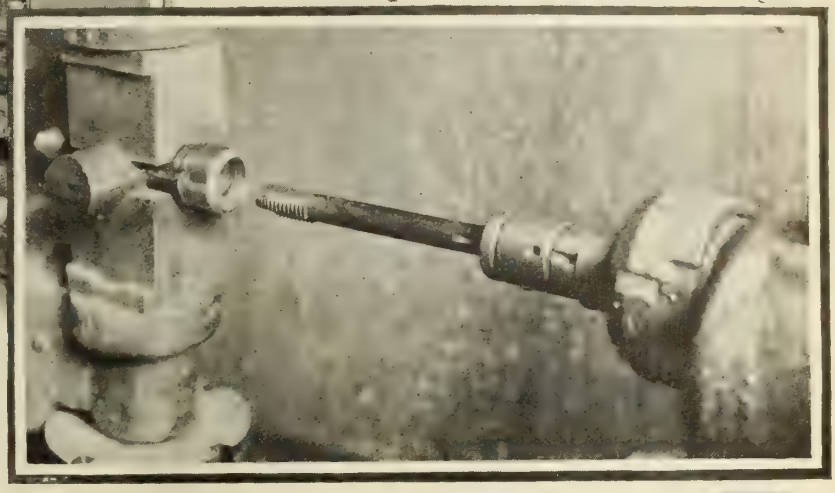
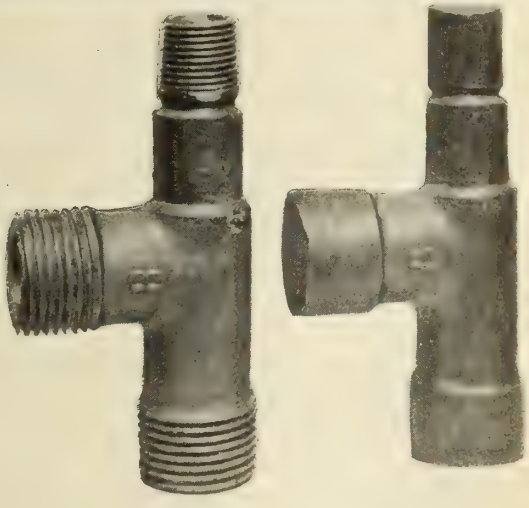
GTD *Little Stories of Real Production* GTD



Will a "Gun" Tap Stand Punishment?



Steel Forgings 5 Seconds per Hole 500 Holes per Grinding!



They say that "in the dark all coons look alike," and doubtless in a catalog or showcase it's hard to see the difference between the *original* spiral-pointed tap (the GTD "GUN" Tap) and an ordinary spiral-pointed tap which copies the *appearance* of a "GUN" Tap.

But out on the job—against the cold light of production demands—"GUN" Taps stand out by the way they stand "punishment." On the J & L pictured above, a "GUN" Tap is used to tap a 5/8 in. hole 1 1/8 in. deep (eleven threads) in a forged steel compressor drum. This tap, working under severe strain (5 seconds per hole), was selected after many ordinary taps had failed, and for four years has justified the confidence of a well-known New Jersey concern (name on request).

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Remember the "GUN" is the *original spiral-pointed tap.* Its superiority is characteristic of GTD small tool service all along the line.

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DROP-FORGED HAMMERS

Are dependable tools because:--

Their heads, drop-forged from a special grade of tough steel, carefully hardened and tempered, neither crack, chip nor splinter.

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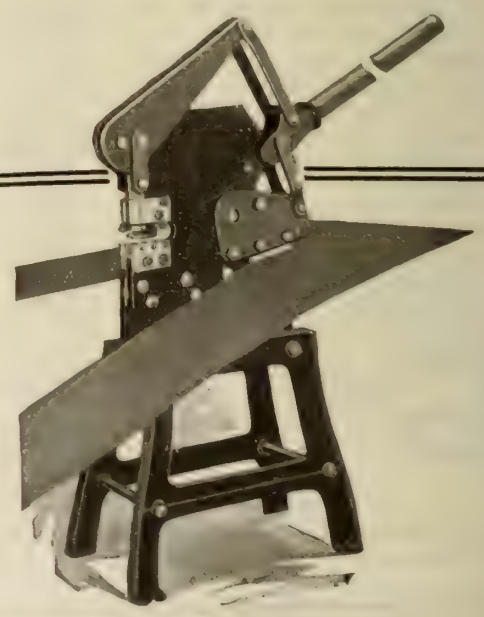

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Here's the tool for accurate, inside measuring—a Brown & Sharpe Inside Micrometer which measures directly in thousandths.

This reliable tool shows the exact size quickly—eliminates all uncertainty—speeds up accurate work.

These advantages, which you have found already in Outside Micrometers, are good reasons for using Inside Micrometers on accurate, inside work.

Ask your Dealer to show you this tool

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With this tool you can quickly tell exactly how much metal remains to be removed. This is a great help, especially when the work is nearly to size.

Inside Micrometers give you the facts essential for first-class work.

Let this Brown & Sharpe Tool help you on accurate, inside work. Buy your kit one of these Inside Micrometers—it will add to your reputation for good workmanship.

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No. 252
measures ½" to 1½"

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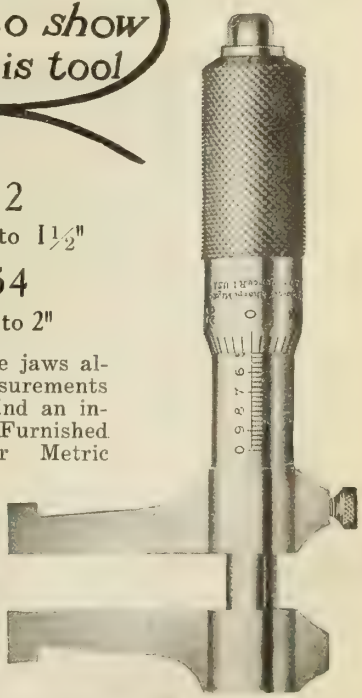
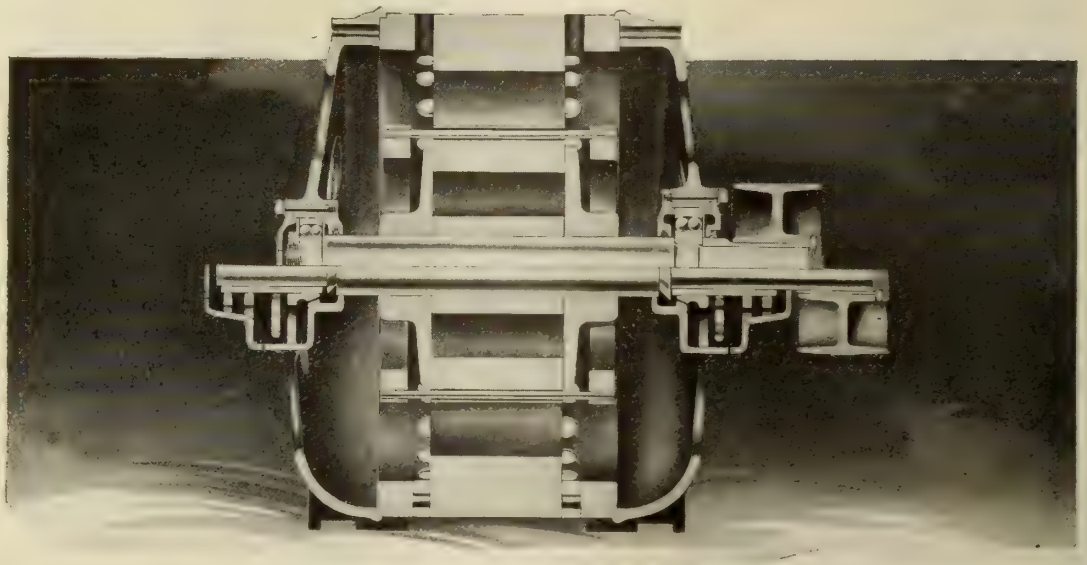
measures 1" to 2"

The shape of the jaws allows inside measurements to be made behind an inner shoulder. Furnished in English or Metric Measure.



BROWN & SHARPE MFG. CO. **PROVIDENCE, R.I., U.S.A.**

SKF



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Shorten your Motors - Extend their Market

The more compact a motor can be made, the greater the field of its application, for space restrictions—especially in the case of individual motor drive—frequently govern the make of motor selected.

When **SKF** marked self-aligning ball bearings are used, as compared with plain bearings, the over-all length of the motor can be decreased from 10 to 27 per cent. The natural outcome of this increased adaptability is a larger market for your motors without the necessity of quoting on special motors of uncertain performance in cases where space is restricted.

Motors equipped with self-aligning ball bearings are free from hot bearings and misalignment troubles and armatures cannot strike the field structures. No renewals or adjustments are required, and lubrication and maintenance costs are reduced 80 per cent. Bulletin No. 113 gives detailed information.

CANADIAN **SKF** COMPANY, LIMITED

TORONTO - MONTREAL

Normal View *Deflected View*

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CANADIAN MACHINERY
AND
MANUFACTURING NEWS

VOL. NO. XXVIII, No. 20 NOVEMBER 3 1922

Accurate Production on Horizontal Boring Machine

Special Fixture Facilitates Setting of Work—Indexing for Position—Face Milling Automobile Crank Cases—Many Operations on Milling Machine Frame Performed at One Setting

FEW MACHINES can be as readily adapted to a wide range of unusual operations as the horizontal boring machine. The vertical adjustment provided on the spindle head and the horizontal movement of the table in two directions, as well as the angular movement when fitted with a revolving work table, supplies ample solution for machining problems that would be very difficult, if not impossible to perform in any other way. To obtain the maximum efficiency of any machine it is frequently necessary, on the part of the plant superintendent or operator, to exercise considerable initiative in devising accessory equipment to facilitate the handling and locating of the work. Fixtures that minimize the possibility of error in machining are frequently of inestimable assistance when the volume of work will warrant their construction.

Cuts shown in Figs. 1 and 2 obtained through courtesy of the Universal Boring Machine Co., while illustrations shown in Figs. 3 and 4, were supplied by courtesy of Pawling and Harnischfeger Co.

An Unusual Job

An example of special interest in the boring of holes in intricate castings is shown in Fig. 1. The illustration shows a large casting 40 in. outside diameter and 8 in. thick. In addition to the centre hole, which is finished in a previous operation, the piece requires machine work on five 8 in. hobs, one 4½ in., and two 3⅝ in. diameter. The 4½ in. and 8 in. holes are all of equal radial distance from the axis of the central bore, while the two smaller holes are closer to the centre and require a second adjustment of the boring bar head or work table. The extreme accuracy of the work may be gathered from the fact that there is no limit allowed on any of the holes, every hole being bored to exact size and its position in relation to adjacent and central hole to specified dimensions. It may be seen that a special fixture has been designed for holding the work. While this fixture was primarily constructed for this particular job, it is more or less general in character, as it may be adapted readily

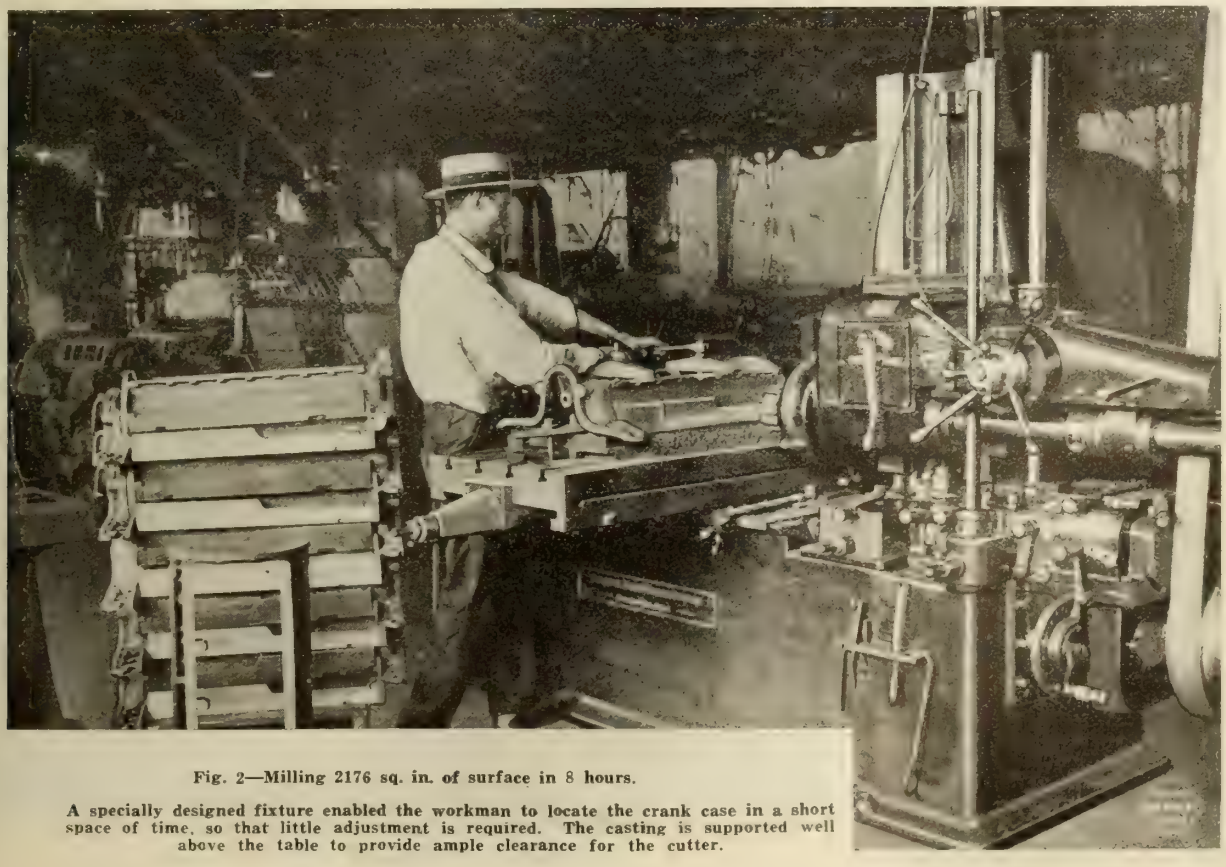


Fig. 2—Milling 2176 sq. in. of surface in 8 hours.

A specially designed fixture enabled the workman to locate the crank case in a short space of time, so that little adjustment is required. The casting is supported well above the table to provide ample clearance for the cutter.

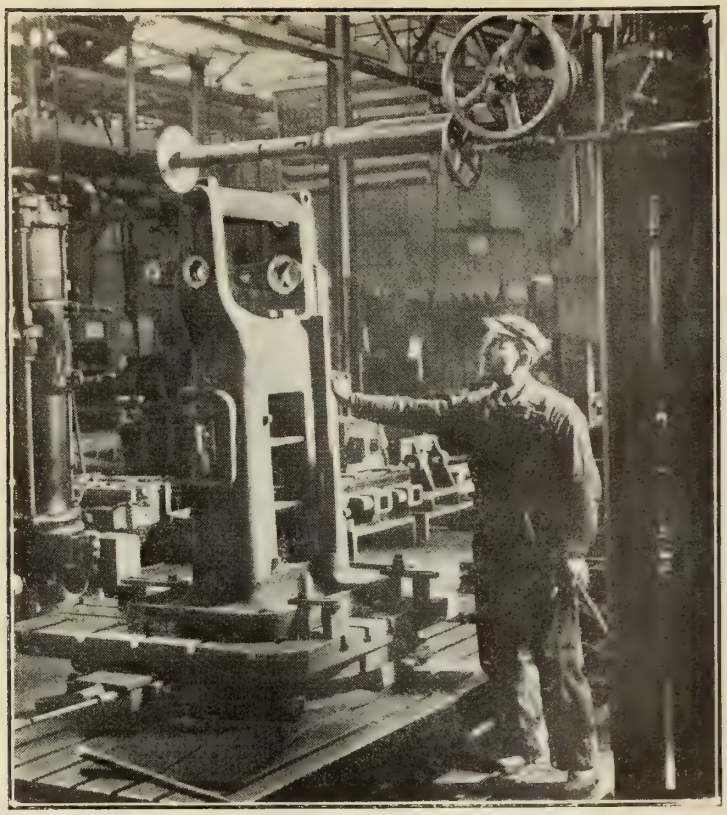


Fig. 3—Performing a number of operations at one setting.

to a variety of similar work within its range, where a number of holes are to be placed at a fixed distance from some other hole in the same casting. The jig consists of a base and two side walls in which a number of holes are accurately located for supporting the boring bar while tools are cutting. All jig holes are reinforced by bosses of ample size to rigidly support the bar under the stress of the cut.

After the central hole has been machined and the casting faced on either side in a large lathe or boring mill, it is placed on a large arbor which is then supported in the main housings of the fixture—the jig having previously been accurately located on the work table in relation to the position of the hole to be bored. After the first hole is bored the casting is indexed to the next position by means of a locating plug placed in the hole just machined and a corresponding hole in the fixture. These castings were machined at the plant of the Bawden Machine Co., Toronto, the production rate being one complete casting, floor to floor, in eight hours.

The machining of surfaces by means of milling, on a production basis, is nowhere more evident than in automobile engine plants. The problem is not only one of quantity but likewise of quality, and accuracy must not be sacrificed to volume output. Fig. 2 shows a horizontal boring mill face milling crank cases at the plant of a large motor plant. Each casting requires machining on two surfaces 21 in. long and ¾ in. wide. Approximately ⅛ in. of stock is removed from the entire 68 sq. in. in less than fifteen minutes. Including the handling and setting up these crank cases are finished at the rate of 16 per eight hours—one every half hour, floor to floor. Accuracy is maintained to the closest limits.

Maintaining Accuracy

In the construction of large machine tools one of the greatest problems is the maintaining of accuracy in alignment of the many holes and locating surfaces on large main castings, that are required to support a variety of shafts and brackets that are indispensable fo the efficient operation of the machine.

The chief difficulty that confronts the manufacturer in regard to the machining of large bed or frame castings is the different settings that are invariably necessary to complete the range of operations distributed on all sides of the piece. The efficiency of any machine may be said to vary inversely as the number of settings required to perform the range of machine operations required on the main supporting castings. In a great many cases the setting-up of the work requires considerably more time than the machining operation, and every subsequent setting after the first hole or surface has been finished necessitates additional care in maintaining accurate alignment of all machined surfaces.

Only One Setting Necessary

Fig. 3 illustrates a large horizontal boring machine sawing the slot in the top of a milling machine frame, this slot providing the clearance necessary for clamping the overhanging arm. All the operations of drilling, reaming and topping are performed at the one setting of the work, the turn table on which the frame is supporting, permitting the machine spindle to operate on all four sides of the casting as well as on top as shown. The various details accomplished at this setting are: bore and ream one hole ½ in. through 5⅜ in. of metal, faced and back-faced; drill one hole ¾ in. through 1¾ in.; drill and tap one hole ¾ in.

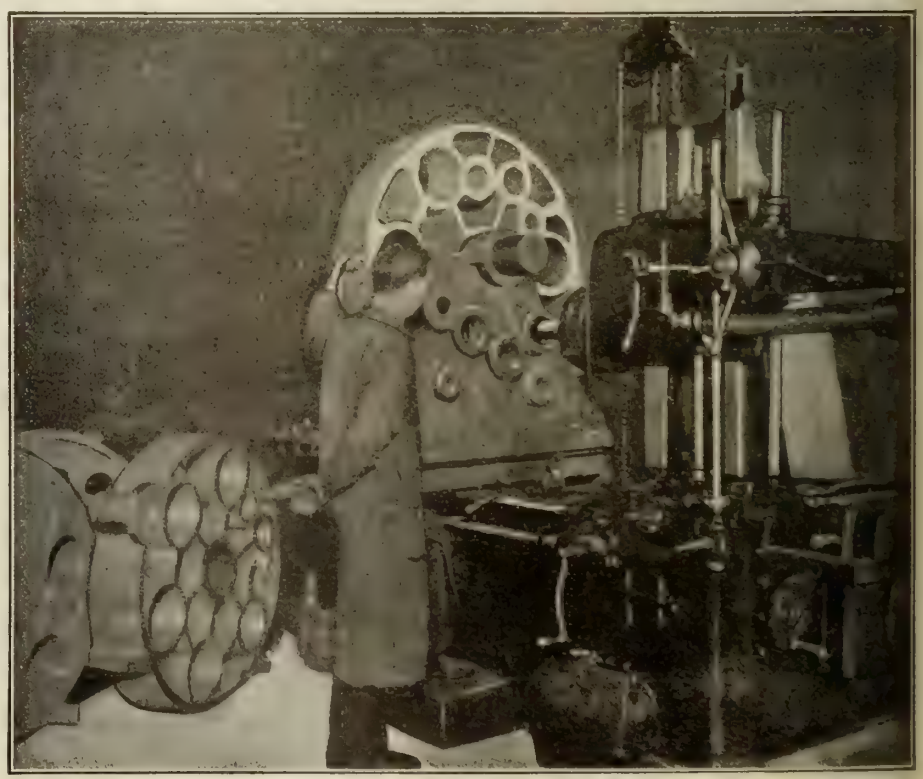


Fig. 1—Accuracy maintained on record production.

through 1¾ in.; drill one hole 7/16 in. through 1½ in.; drill and tap two holes ⅜ in. through 1 in.; drill one hole 11/32 in. through ¾ in.; drill and tap six holes ½ in. through 1½ in.; drill and tap two holes 7/16 in. through 1¼ in.; drill and tap one hole ½ in. through 2 in.; drill and tap three holes ⅝ in. through 2 in.; drill one hole 11/32 in. through ½ in.; mill ⅛ in. slot through 2 in. metal 4 in. long. All of these varied operations, including placing and setting of the work, are performed in 90 minutes.

One Hole a Minute

An example of the adaptability of the horizontal boring machine for the accomplishment of unusual jobs is shown in Fig. 4. The work is the speed ring for a large hydraulic turbine for the Allis Chalmers Mfg. Co. The operation consists of drilling at an angle 720 —1/16 in. hole through 2 in. of metal. The diameter of the ring was 12 ft. and the steel casting weighed approximately 14,680 lbs. Owing to the angle at which the holes were drilled it was necessary to provide special facilities for supporting the work, so that the job could be handled advantageously. The revolving table, which is adjustable to position, was tilted to a considerable angle and the boring machine tipped over 30 deg. off the vertical. The entire 720 holes were drilled in one day, averaging one hole in a little over one minute, including movement and setting for each position. This is about the only way a job of this description could be economically performed.

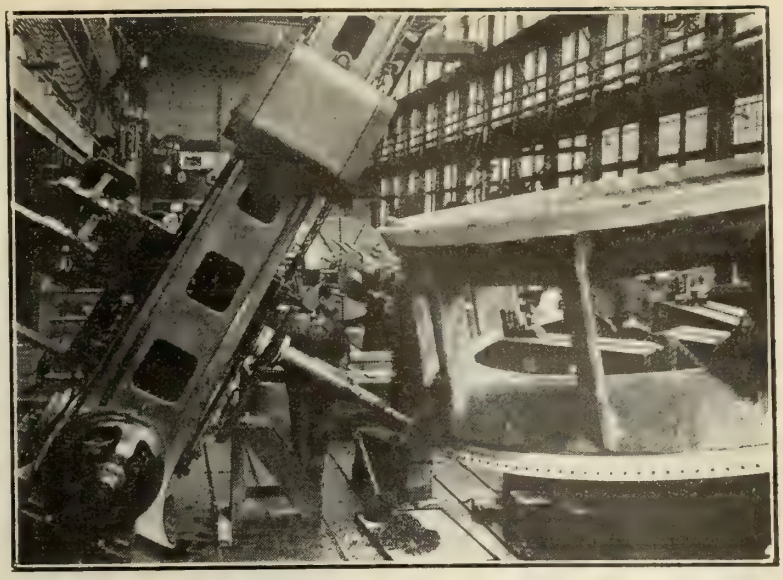


Fig. 4—Adapting the boring machine to unusual jobs.

Requirements of a Good Bearing Metal

THE relative value of a bearing metal is not to be judged by its composition and physical properties alone. Many other factors, which are frequently overlooked, should enter into its selection. For instance, the lower specific gravity of the tin-base metals, and the fact that they can be used to advantage in very thin linings, should make them the logical selection for many bearings in which a lead-base metal is now used.

Again, allowance is very rarely made for the losses which occur in the melting and remelting of many metals. A babbitt of properly balanced composition, which is carefully alloyed from strictly virgin materials, should give very little dross and be remelted without serious loss of either metal or properties. Unfortunately, however, the use of virgin materials in the manufacture of babbitt is the exception rather than the rule, and any apparent saving recoils heavily on the head of the purchaser. The loss in melting babbitts made from reclaimed metals is frequently as much as 6 per cent. This item alone, with a fair allowance for melting cost and overhad, increases the actual cost of the metal by fully 10 per cent., to allow nothing for the sacrifice of bearing properties inevitable to the substitution of reclaimed for virgin metals.

While it is difficult to secure bearings of perfect uniformity from babbitts alloyed in the customary manner, the difficulty is magnified a thousand fold when reclaimed metals are used, and if the purchaser is buying bearing service rather than so many pounds of metal he does not get what he pays for. In service, the most obvious, but by no means most important, requirement of a babbitt is that it should have sufficient strength and hardness to carry the load with a reasonable factor of safety. The physical properties of a babbitt are valuable only in determining that it will meet this requirement and it should be borne in mind that they normally give very little, if any, indication of the performance of the metal in other respects. The compressive strength and Brinnell hardness tests do, however, serve as an excellent guide to the uniformity of metals of the same analysis.

The tensile strength and elongation of a metal are valuable as indicating its ability to withstand repeated shocks and pounds without cracking or fracturing, and are more important than the compressive strength and hardness in metals which are to be subjected to a pounding action or are to be poured into very thin linings. It is when abnormal conditions are encountered that the true requirements of a babbitt become apparent.. In the majority of machines the bearing surfaces are normally separated by a film of oil, and were this condition to continue indefinitely, sufficient strength to carry the load would be the sole requirement of a bearing. There is, however, as will be discussed later, an ever present liability to separation of the oil film which cannot be foreseen or prevented. This breakage of the film may be due to many causes; temporary or permanent failure of the oiling device, the introduction of foreign matter, heavy overload, etc.

Immediately the oil film breaks, the journal and bearing come into contact and heat is generated due to the friction. How soon this heat may become sufficient to cause failure of the bearing depends entirely upon the true bearing properties of the babbitt. As in ninety-nine cases out of one hundred the separation of the oil film is temporary rather than permanent these properties are of extreme importance. It will be realized from the above that the metal is best which most fully combines the following properties:

(1) A tendency to hold the oil film when extraneous conditions are tending to separate it.

(2) A low coefficient of friction, to reduce the quantity of heat generated.

(3) Relatively high heat conductivity, to more rapidly convey the heat from the point at which it is generated.

(4) Ability to continue to carry the load at abnormal temperatures.

A consideration of the requirements outlined above is as essential to the intelligent selection of a babbitt as its more obvious physical properties, and they are even more deserving of the attention of the engineer.

When performing any babbitting in cold weather, or where the space to be filled is comparatively small, it is best to heat the shaft slightly to insure a good job and the box or container should be rough or supplied with hobs or undercut grooves so as to thoroughly lock the babbitt shell in position; a loose babbitt filling is a source of trouble and annoyance. And in all cases keep the contact surfaces perfectly dry.

"Throw Your Heart Across"—Inspiring Message

Sir Joseph Flavelle Discusses Individualism as a Factor in Affairs—Too Much Reliance Upon Social and Political Influence—Problems Solved From Within Rather Than Without

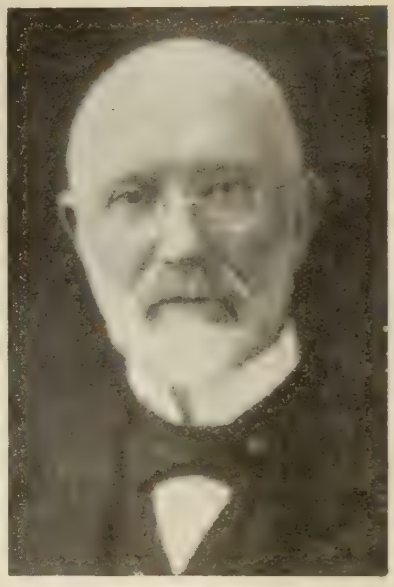
THAT the supreme test of a man consisted in his ability to "throw his heart across"—much as a horseman confronting a difficult venture—was the inspiring message, delivered by Sir Joseph Flavelle, in an address to business paper men on the occasion of the annual meeting of the Canadian National Newspapers and Periodicals Association.

Discussing the subject, "Individualism as a Factor in Affairs," Sir Joseph stressed the point that it was at the end of an undertaking that the real problem generally developed, and that it was then that supreme courage was required. The individualist was one who thought and worked for himself, and his recognition of the principle of relative responsibility made him an important factor in the world of affairs. In the speaker's view the reliance placed by men upon what governments might or might not accomplish, was piteous. Man did his best rowing hard against the stream, rather than in depending upon social or political influence in his behalf. The true destiny of men, as of nations, depended upon certain integrating forces which, as outlined by Lord Rosebery, in addressing the students of a Scottish university, consisted in measured self-control, respect for law and authority, obedience, limitation of desires and application. There was an abundance of vital energy; what was needed was vital control.

Misdirected Organization

Much was heard today of organization in business and industry. It could be developed in such a way as to either build up or destroy a man's individuality. It could be misdirected so as to defeat the purposes for which it was intended. The speaker referred to the very elaborate plans made by the military men of the United States during the war in building up an organization that had shell production as its ultimate objective. Acres of ground were covered with administrative buildings and miles of blue prints were produced showing the relation of departments very much the same as a family tree, all beautifully done. "Yet," said the speaker, "although that organization had a staff of 20,000 men, it never fired an American shell or discharged an American gun during the war." The individuality of the immense machine was not capable of the practical appreciation of the emergency."

In the same way, it was rare indeed that a workman admitted that a problem in his shop might be solved by harder work and more thoughtful application on his part, rather than by the purchase of more equipment or the enlargement of the plant. Rare indeed was it that so-called brotherhoods, unions and societies tended to give free play to the individuality of the man so that he might be encouraged to work toward his high purpose independently, and with the feeling that his destiny involved unflinching personal courage and effort rather than reliance upon outside influence for his advancement. On the other hand, organization might be developed along lines that were most dispiriting to the so-called craftsman. The speaker made reference to the Ford factory at Detroit. Wonderful, in every sense of the word, yet he could not but conclude that it was most dispiriting work to occupy a position beside a conveyor belt day in and day out tightening nuts or boring holes or performing other operation as the different parts moved onward toward completion. He wondered what the destiny must be of those craftsmen who could claim no other accomplishment than their ability to tighten nuts or bore holes. Here was no individuality. Yet the world today was living upon the capital of craftsmanship, representing long years of patient effort.



Sir Joseph Flavelle.

"Canada has had few serious losses to bear. We can accept our moderate discomforts with dignity and restraint. We can secure no relief from heavy taxation. There can be no freedom for years from the drain upon our cash resources through overbuilt railways, now the property of the State, but we have no cause to fear if we play the game with high courage. Whatever happens we must not lose our courage or abandon a sense of individual responsibility and individual effort. There is an honorable place for each man in Canada who does his job as well as he can each day, and that is the way the world's work, which matters, is done."

Study Defects From Inside

Another problem that frequently developed in connection with organization was the impression that defects had their origin from the outside and that solution should come from the same direction. It was the speaker's experience that self-examination would reveal that much of the trouble, if not all of it, came from within. He recalled an incident during the war. A manufacturer of munitions complained that, under the terms of the contract, he could not make headway profitably, that his plant was well organized and was in every respect efficient, and that it was useless to try to convince him that the trouble lay within, that there were things going on of which he knew nothing. An inspector was accordingly sent to the factory. He found, as had been suspected, that the organization did not have a grip of essential details within the plant. One workman, it was found, was driving screws into shell boxes by means of a hammer and thus causing a defect which explained why boxes were not standing up on their strenuous trip to the front. Problems within were sometimes obscured by the feeling that the remedy could be secured through outside agency.

Make Something Worth Sharing

Sir Joseph's theory with regard to trusts was that, while he did not think they were capable of much injury to the ultimate consumer by controlling prices, the public was frequently called upon to pay for their ill-advised organization and for the trouble that developed and emanated from within their own ranks. It was these internal problems which often explained the failure of two or more men to agree in partnership who might succeed individually. It was his opinion that unions, sympathetic strikes, the "ca' canny" which set a limit to a man's production, were menaces to society in that they sought to control the spirits and lives of responsible men and restricted their vision to such an extent that individuality was crushed in the

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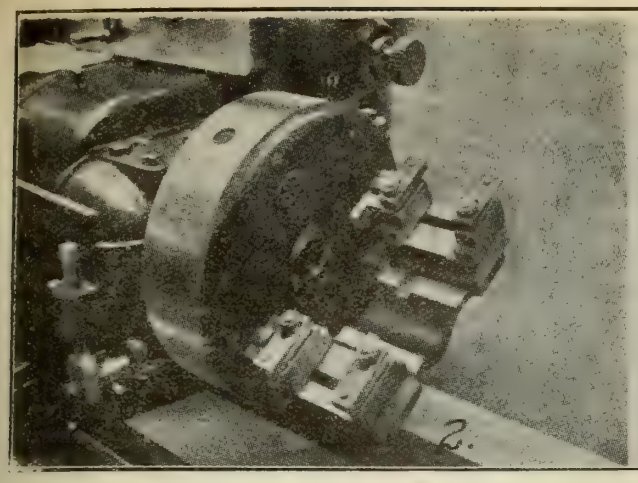

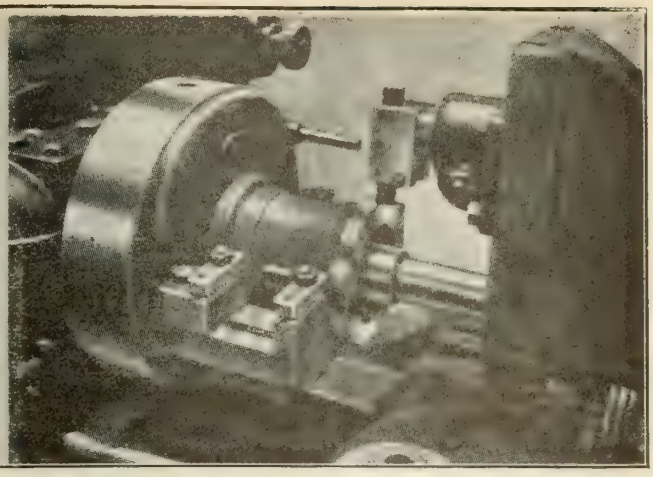

Fig. 2—View of work holding fixture before bearing is inserted. Fig. 3—Pair of half-bearings in jig for first operation.

Machine Work on Interchangeable Half-Bearings

Interesting Problem in Chucking—Special Clamping Lugs Cast on—Rear Face of Lug After Being Machined Acts as Locating Surface—Fixture Adjustable for Different Size Bearings

IN THE machining of bearing bushes cast in halves a variety of methods are employed, especially in the chucking, which presents an interesting problem. The object to be attained is, of course, the production of interchangeable bearings with the joint exactly on the centre line, combined with an easy and rapid method of chucking.

The most elementary method, quite commonly used, is to grip the half-bearings in a four-jaw chuck, after machining the joint. The half castings are kept together by a clip, the joint being set central with the aid of a scribing block. In some works it is the practice to dispense with the clip by sweating the two portions together for the machining process.

For some years the Alfred Herbert Co. have been using a method of chucking and machining half-bearings which has proved very successful both in their own practice and with other engineering firms using the same equipment. By this method it is necessary to make the rough castings in a special way with chucking lugs cast on; a detail is shown in Fig. 1. In this particular instance the centre lugs can be ignored, as they are part of the design of the bearing and are not essential to the method of handling. The lugs near the flange are those specially cast on and subsequently removed.

Previous to the lathe operation, the joint face on both halves is machined by grinding or milling. After this, a second operation on one half only consists of machining the opposite side of the lugs A to a pre-determined thickness, faces A serving as locating points for the half-bearing in the fixture.

Fig. 2 shows the fixture before insertion of the castings, together with the platforms or locating ledges on which the lugs rest and are clamped. Fig. 3 shows a pair of castings assembled in the fixture for the first lathe operation. It will be noticed that the machined lugs rest on the ledges which lie below the centre line of the lathe, an amount equal to the thickness of the machined lugs A, Fig. 1. The half-bearing with the unmachined lugs is laid on top, the clamps fixing the two halves securely together and to the fixture.

Referring again to Fig. 2, it will be noticed that the locating points on the fixture are adjustable in two directions to accommodate different sizes of bearings; for instance, the locating and clamping blocks are movable parallel to the axis of the lathe; the holders to which they are clamped are also movable inwards or outwards on the fixture proper.

At the first operation, shown in Fig. 3, the machining operation consists of boring, turning over the flange with a knee tool and facing, operations which are performed by standard tools. At the second operation, shown in Fig. 4, the Coventry chuck is used for gripping the semi-finished bearings on the flange turned at the first operation, the work being located true by a plug in the chuck

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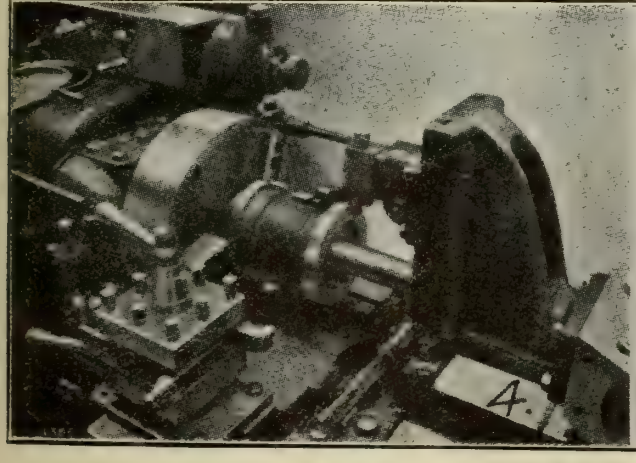


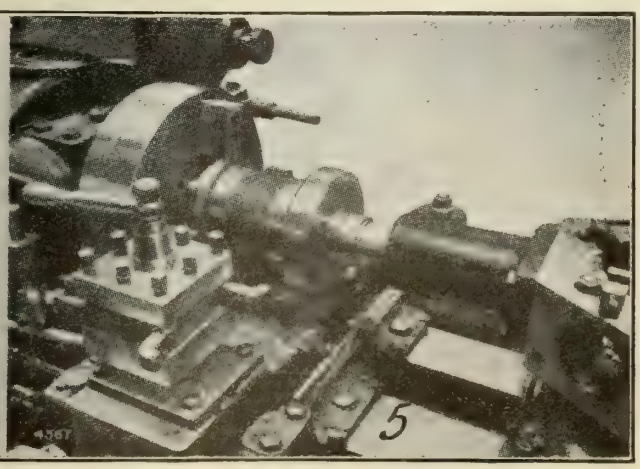


Fig. 4—Second operation on half-bearings. Fig. 5—Steady rest in position supporting end of bearing while lugs are turned off.

Operative Construction of Levers and Treadles

Outlining Various Designs to Meet Specific Requirements—Providing for Adjustment—Locating for Convenience of Operation Lever Operated Clamping Fixtures—Effect of Vibration

By FRANK H. MAYOH

FIG. 10 shows plan view of a lever operated tailstock for lathe used for quick operation of the tailstock spindle. This lever A is pivoted to the tailstock spindle at B and a slot in the lever engaging with a pin at C in a bar D completes this construction. By taking hold of the wooden handle E and pushing it in the direction of the arrow the lever is caused to assume the position shown by the dotted lines, while advancing the tailstock center F to the position shown by the dotted lines or in any intermediate position.

For Indexing Units

An important branch of lever construction has as one of their features incorporated therein what are known as indexing or locating units. These usually embody features common to standard lever design such as are shown in many of the examples illustrated herewith, while in addition a suitable pin arrangement is provided. The purpose of this pin is to locate the lever in a predetermined position. Two types of such levers are shown in Fig. 11, that in the upper view being of that type which are attached to the end of a shaft by means of a key to locate it radially, while a nut holds the lever in position. The lever itself is indicated as A, it being attached to the shaft at B, while in the boss C is a spring pin D, to the end of which is attached by means of a pin E a knob F, while a spring G completes the arrangement. In use an operator takes hold of knob F and pulls it back, thus compressing spring pin D until the reduced end is pulled out of a hole used for locating, after which the lever is swung radially about B as an axis until the spring D snaps into another locating hole, thus the lever and in consequence the mechanism operated thereby can be located at various positions, this being a construction similar to that employed on indexing centers. Another type of indexing lever for a similar purpose is often constructed with a ratchet arrangement.

In the lower view is shown a type of lever in which the same principle is embodied except that the spring pin operates at right angles to the indexing shaft. This is a convenient arrangement where the indexing is to be confined to a portion of a circle. Here the lever is indicated as H and integral therewith is machined a stem J, slidably mounted on this stem is a sleeve K. Attached to the outer end of this sleeve by means of a pin L is a springpin M. The sleeve K is knurled to give a good hand grip and in indexing the operator pulls back sleeve K thereby compressing spring P and pulling the spring pin M out of the hole N. The lever H is then moved to the next hole where the spring pin snaps into position, thereby locating the lever which in turn locates the shaft and attached mechanism (not shown) in the desired position.

Straightline Movement

A lever action used as a toggle for operating a straight line movement is shown by Fig. 12. Here the lever is curved under so that it may be connected with a foot treadle, and although it cannot be termed a hand lever it is used in common with a foot treadle and illustrates the principle of design which results in a very powerful action. The lever is indicated at A attached to the lower end of which is a connecting block B, which pivots on a stud at C in one direction and in the opposite direction on a stud D held in place with a nut. The lever A pivots about the stud E as a center, the upper end of the lever being made to form one-half of a toggle action. The other half of the toggle is provided for by a link F which pivots at G, while the link and the lever are connected with a stud at H, the entire arrangement being used for pushing the slide J in the direction indicated by the arrow with a powerful action, it being evident that the nearer the lever and toggle action come to being in a straight line the more powerful is the action. A spring is used on the operating foot treadle to return this mechanism to its starting position.

A group of rather simple lever constructions are shown in Fig. 13, each of which illustrates a principle which it is felt should be included in a discussion of this type although familiar to many. In the upper left hand corner is shown a plain off-set lever A, this having a handle at the upper end while it pivots at B, and at C it is connected to a rod which operates a clutch such as is shown in the upper right hand corner of this view. A foot treadle of the rocking type is shown to the right of this construction in Fig. 13. This operates in a manner different than any previously described as movement is imparted to a shaft indicated as D in a rotary manner, by stepping on either side E or side F of the treadle which imparts a rocking movement to the shaft, this in turn operates the mechanism attached there-

The first part of this article appeared in Nov. 2nd issue.

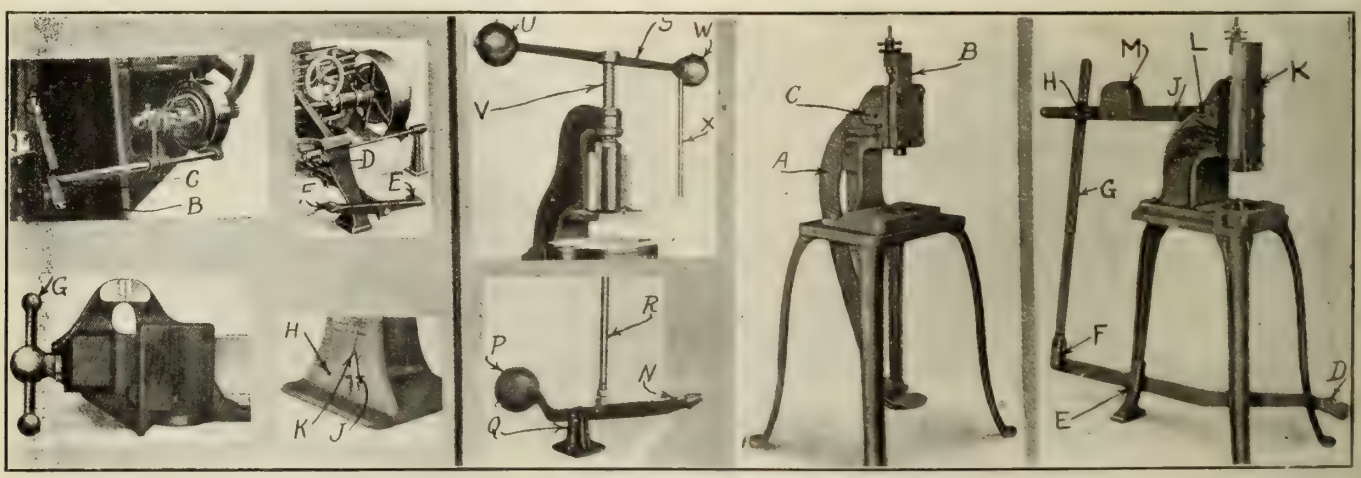


Fig. 13.—Two simple lever constructions and clutch operated press. Fig. 9.—Four lever examples of standard design.

to, which might be a clutch operating sleeve or other lever mechanism.

Bench Vise

Most everyone is familiar with common bench vise construction and it is therefore felt that no description is necessary with reference to the construction shown in the lower left hand corner of Fig. 13 except to say that bar G may be held by hand in the position shown for getting a two hand grip on it or it may be slid so that the ball at the end is in contact with the center portion of either end for a one hand grip, or to get a greater leverage with both hands. The balls on the end of this lever also act as counter-balancing weights to facilitate movement radially of this lever when tightening the screw. In the lower right hand corner is shown a foot treadle often used in punch press construction, the particular feature to be noted in connection with this lever H is that a swinging piece J is provided near the base to permit the press to continuously operate.

Clamping Fixture

When handling work on the bench or for many kinds of machine work where a rapid change from one length to another is desired a construction embodying the feature of operation shown in the illustration Fig. 14, can be often used to good advantage. In this illustration a section only of a tool is shown, this consists of a long strip A made of steel which is held to the bench by screws B. In the top of this strap are teeth of ratchet form which are caused to coact with the lever C shaped so as to form a handle with a pawl at its lower end. This is pivoted at D in a block E and the handle is so proportioned that the weight of it will be to the left of the center as shown, thus the pawl-handle will naturally engage the teeth of the bar A. Another unit of the fixture would be constructed at the opposite end of the bar A of a nature for handling the particular work used for; this end would be unadjustable except as necessary for handling one length of work. When changing from a long length to a short length an operator would simply take hold of the handle shown and slide the block along to the desired position for gripping that particular length of work, where the handle with pawl would engage a tooth in the bar and the work would be clamped against this slidable block.

Fixture for Squeezing

A toggle action lever construction used in a bench fixture for squeezing is shown by Fig. 15. Here the base of the fixture which is made of cast iron is indicated as A which is held by screws to the bench shown below, pivotally connected to the fixture at B is a lever C and this is in turn connected to two toggle levers D and E by a stud F, while the other ends of these toggle levers are attached by means of a stud G to the long lever H pivoted on a stud J. A steel block K held by screws to the base of the fixture is provided so that lever C may be caused to squeeze between the space indicated as L. A yoke M is attached by a stud at N to the long lever H while a rod P is attached to a foot treadle for operating this device. Other features are the spring Q held to the bench by hook R for pulling back the device after it has been caused to operate, and a collar S pinned in place to limit the up movement of lever H caused by the spring.

In using this device an operator pushes down the foot treadle attached to rod P which causes lever H to pivot about stud J as a center, operating links D and E with G as a center to push lever C towards block K, all of which is quite a powerful action for a foot operated device, as center G works through a long are to apply a slight movement at F. It should be noted that the action of lever C is not a straight line action but rather a swinging action which brings up parallel in the position shown which is the end of the action.

Locating Device

Figure 16 shows two constructions of mechanism, one of which is used for locating purposes while the other is used for a ratchet operating lever.

At the left of this illustration a lever is used for locating in combination with two keyways and this lever A is made of cold rolled steel. It pivots on a stud B which is held in a block C, this block being screwed in place in a boss D on the frame-work of the machine. In the particular construction shown the lever A has an extension end X which comes through a slot in the boss D. Mounted in the boss is a bushing E held in position by a collar F. To this bushing is keyed other mechanism and the object of this construction is that with end X of lever A in keyway G this lever holds bushing E so it will not turn radially, thus the mechanism attached there is secured against rotation. By pushing on lever A the end X is caused to disengage in the keyway of the bushing E thus allowing the bushing to revolve until the end X drops in another keyway. Two keyways only for locating are shown in this illustration although more could of course be used.

Ratchet Levers

To the right of Fig. 16 a lever H is made to straddle a ratchet J, this ratchet being keyed to a bushing K which has a square hole in it to fit over a square shaft. A spring pin L having its end shaped to engage with a ratchet J is backed up by a spring M, thus an operator can push the lever radially in the direction of the arrow, which in turn revolves the shaft on which the squared bushing is mounted through the medium of the ratchet, while in pulling back the lever the spring pin L will ride over the ratchet teeth; thus an oscillating movement of the lever imparts a rotary movement to the square

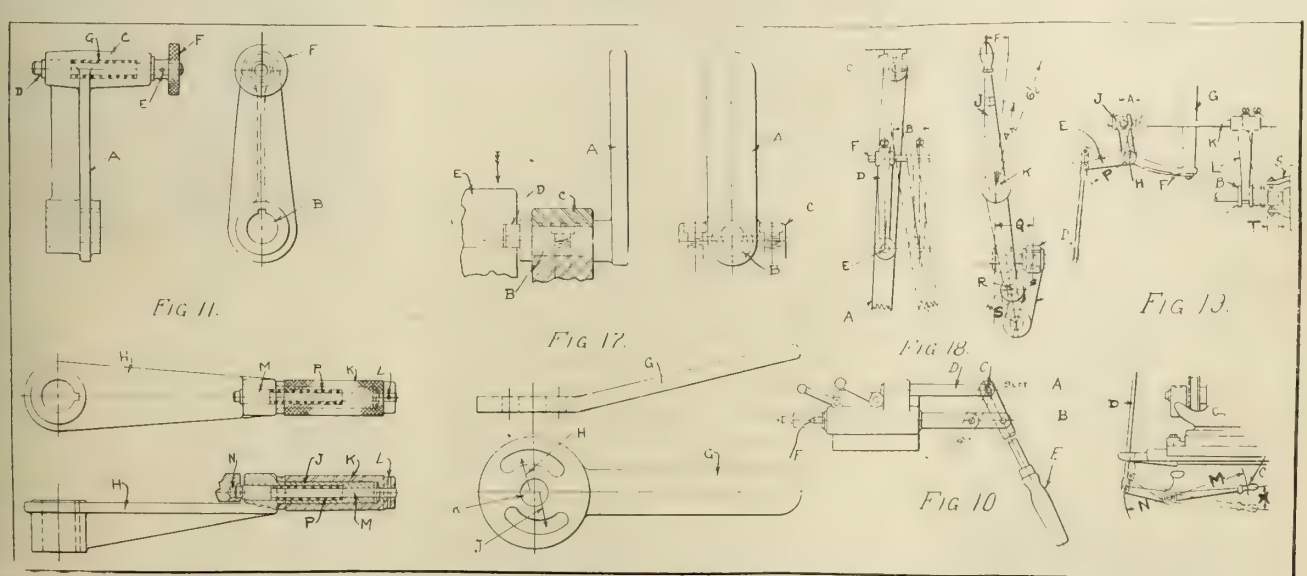


Fig. 10—Lever operated tailstock. Fig. 11—Top lever with indexing pin; lower; pin lever, sleeve operated. Fig. 17—Top: eccentric end lever; lower: lever with eccentric slots. Fig. 18—Left: belt shifter lever; right: shaft operated lever. Fig. 19—Grinding machine control lever.

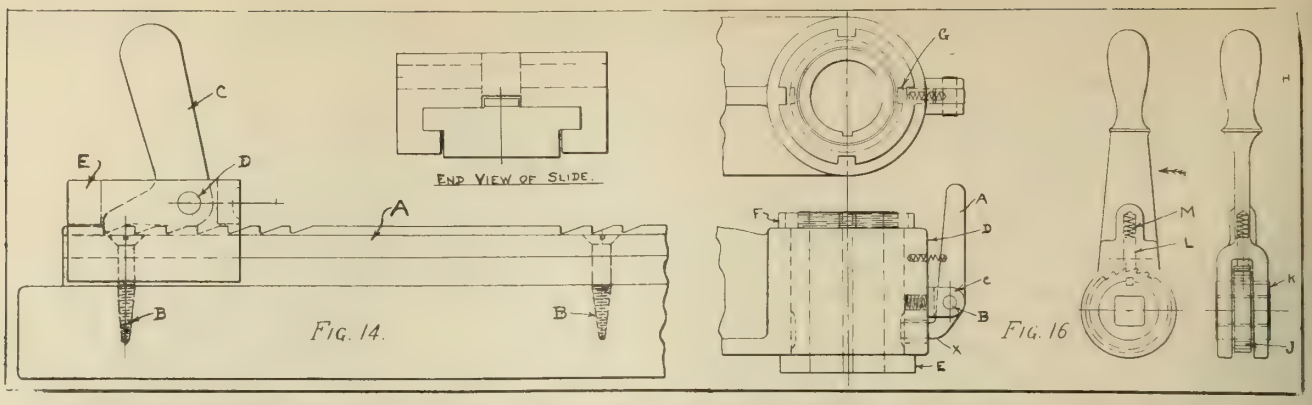


Fig. 14. Fig. 16

Fig. 14—Quick operating adjustment for adapting to various lengths. Fig. 16—Left: keyway locating lever; right: ratchet lever.

bushing K, the squared shaft and the mechanism which it operates.

A description of this nature would be incomplete without reference being made to eccentric operating levers, therefore Fig. 17 shows two types of the same which it is thought will be suggestive of constructions along this line. In the upper view of this illustration the lever A is made in part with a shank B, which is reduced making a shoulder at each side which fits in a capped bearing C. At the end of this lever is an excentric portion D which enters a slot in (say for instance) a tooth clutch E. To operate this clutch the lever A would be revolved in either direction, thus the excentric portion of the lever D would move clutch E slightly up and down. This construction could be used in a toothed clutch, gear shift or for other similar purposes, it also being applicable to use with a friction clutch.

Eccentrically Operated

The construction in the lower portion of this illustration shows a lever G which has two eccentric slots cut in it on a radius H and J, entering these slots ordinarily would be pins mounted in sliding members, thus when the lever G is resolved about hole K as a center the pins would be caused to move inwardly or outwardly from the center of the lever, thus operating slides attached thereto. This construction is used on many split nut mechanisms for engaging a screw, one particular purpose in mind being that of operating the nut on a screw threading lathe.

A belt shifting lever is illustrated in the left hand portion of Fig. 18, here a long lever A is made of wood, this is pivotally connected to a block C held to the ceiling above the counter shaft. This lever is attached at E to a bracket D mounted on a rod F, the opposite end of which is equipped with forks for shifting the belt. In operation a pull on lever A moves it to the position shown by the dotted lines or a distance equal to B operating about G as a center. It is obvious that in doing this the center distance H is lengthened slightly through this circular action which is compensated for by the flexibility or play of the long members used in the make up of this construction, or by a slight swing backwards or forwards, this action being hardly perceptible in most cases. At the right of Fig. 18 the lever J pivotting about K as a center operates a sliding member L through the medium of a rocking lever P. This moves sliding member L a distance equal to Q, an elongated slot in its lower end, which engages with pin R, causes lever P to operate with a circular action on radius S, it of course being necessary to have a floating action on account of the change in the relative centers of the two levers where they engage with pin R.

For Grinding Machines

A rather elaborate lever construction is shown in conclusion, this being a construction common to grinding machine operation. Fig. 19 illustrating the same. Mounted on the grinding machine is a lever C which operates through an arc X on a radius equal to M. This action X is reduced to a smaller action through the leverage of N to M; the end N is connected to a rod D which is shown broken apart. The upper end of this rod D connects to a lever E which moves through an arc equal to P. This lever E is attached to F which is in turn attached to that portion of the counter shaft G. The lever E operates about H as a center and moves sleeve J to a distance equal to A, which in turn operates rod K thereby moving arm L to the position shown by the dotted lines. This causes sleeve B to operate clutch S, a portion only of which is shown.

This sleeve B moves a distance equal to T and it will be seen that an operator moving C at a handy position on the machine controls its operation by the interposed arrangement of levers and connection, all of which is in line with the principle of getting the lever where it is most apt to save time and labor of the operator even though it may require a few additional parts in the construction of the various units. In some types of machinery and more particularly in that class which are known as light high speed mechanism, where there is considerable vibration due to the rapid movement of parts a number of connections in the operative levers might be objectionable owing partly to the vibration induced by a large number of joints.

MACHINING HALF BEARINGS

(Continued from page 21)

which fits the bore in the bearing. As the front portion of the bearing might tend to spring apart under cut, the halves are securely clamped together by C-shaped clasps which grip on the lugs At the commencement of the second lathe operation, the second flange is turned, faced, and chamfered with standard tools, as shown. As soon as the flange has been turned, the revolving steady shown in Fig. 5 is brought up on the turret and locked against the chamfer on the flange, which thus securely keeps the two parts together This enables the C clamps to be removed from the lugs, so that the portion in between the flanges can be turned with tools in the square turret; this turning operation also removes the lugs.

Fig. 1—Half-bearing with special lugs AA cast on.

It will be appreciated that by this method of handling chucking is quite simple, and interchangeable work can readily be produced. This method has been applied with slight modifications to the machining of bearings lined with white metal, an additional operation being required, as two borings are necessary. Throughout the operations the work is always securely held, enabling high speeds and coarse feeds to be used, with a consequent high rate of output.

?? Questions and Answers ??

QUESTION: — What information have you with reference to Canadian trade with India? Has there been any remarkable improvement recently and what lines seem to be in demand?—J. C., Windsor.

Answer:—Department of Trade and Commerce reports that Canadian goods to the value of $350,000 were imported by India during the three months, April to June, or over three times more than the same period last year, when 80 per cent. of the trade represented a certain make of motor car. This year, however, only 50 per cent. of the three months' total represented motor cars of all makes. Thus, Canadian goods in much greater variety are now reaching India. About 34 per cent. of the motor cars now going to India are from Canada. Customs tariff, recently increased from 20 to 30 per cent., favors the light, inexpensive car as made in Canada. While industries of all kinds have been encouraged in Indian provinces of recent years, it is reported that difficulty of securing efficient labor has been a serious handicap. It is said that a total of over 30 million dollars was invested in Bengal province alone. The ventures consisted of tanneries, boot and shoe factories, soap factories, rubber and glass factories, metal, machinery and chemical plants, but it is said that practically none of them have fulfilled the expectations of promoters. Naturally, failure to produce economically in certain lines, will broaden the market in these goods for the exporter in other countries.

* * * *

Question:—What are the prospects of further reductions in the price of pig iron? You are now quoting $36.30. Will it drop to $30 by the New Year?—T. L. M., Toronto.

Answer:—It seems safe to say that a decline of $6 within the next six weeks is somewhat out of the question. Canadian furnaces are operating on restricted capacity. They claim that difficulties in securing materials are such that pig iron business is somewhat unattractive. The U. S. market is hovering around the $30 level, and at that there is very little market though it is improving. There are those who predict that pig will drop below $25 across the line before Xmas. Foundries are buying from hand to mouth. A decline of $2 50 a ton in Canadian iron is announced. This is a sympathetic drop to meet Buffalo prices. British pig iron is a factor in the East, but, it is said, will pass out of the market with more normal Canadian output.

* * * *

Question: — We frequently have trouble in pouring babbitt. Is there any method whereby uniform run may be ensured?—J. R. T., Brantford.

Answer:—It is claimed that a small piece of rosin, about one-inch square, placed in the metal, will give the desired result. It is necessary, after stirring and mixing thoroughly, to remove the scum. When boxes are fogged, or damp, it is said that such a mixture is a safeguard against blowing. Babbitt will sometimes pour well in one place, but only poorly in another. The use of rosin, it is said, gives desirable uniformity.

Canadian Machinery and Manufacturing News would have its readers feel that its resources for gathering special information, such as they may require, are freely at their service. Their questions will receive immediate consideration. On the other hand, should they feel that they are in a position to add to the information given in these columns upon any subject, their co-operation will be greatly appreciated. Desired information is first sent by mail to enquirers. Names will be supplied upon request.

WOULD DEVELOP EXPORT LINES

Question:—Can you advise us of any line that might be produced in Canada upon which an assured export business could be built up? While we are not fully equipped at present, we feel that Canada's industrial future will be directed largely toward export lines. It is a question upon which we need fullest information. What is there in iron and steel that could be developed as an export specialty?—R. A. C., Ottawa.

Answer:—Unfortunately this is a rather general question and we would suggest that the inquirer get in touch with the Commercial Intelligence Service Department of Trade and Commerce. The competitive factor is a strong one, but cases are known where Canadian specialties have been marketed abroad with great success. It is in this department, apart from staple lines of merit, that export business seems to promise most. In this connection, it cannot be out of place to reproduce a letter written to a representative of Canadian Machinery by C. H. Withers, export manager for Robert Grant, Ltd., iron and steel suppliers of British, American and Continental materials, 62 Bath St., Glasgow, Scotland. The writer states:

"I have recently been discussing with my directors, the possibilities of using the Dominion as a source of supply, and on the assumption that you will be interested in helping to 'boost' up Canada's trade, I am taking the liberty of approaching you to ascertain whether you can advise me of any likely firms who would be interested in exporting their materials to various parts of the world.

"I might mention that we are not so much interested in dealing with the bigger and better known concerns, but rather the smaller type of mill who would be in a position to offer us competitive prices, and who would be interested in forming an alliance with us with a view to building up an outlet for their material. I might mention that through our attachment with the smaller mills here and on the continent we have built up for them a considerable amount of business.

"The class of material in which we are most interested in purchasing in Canada would be as follows: —Semi-finished products, billets, slabs, wire nails, wire rods, ordinary and barbed wire, tank, ship and boiler plates; black, galvanized and corrugated sheets, tubes of all descriptions.

"While I am quite aware that Canadian prices may not prove competitive at the moment, we feel convinced here that the time will come when Canada will be in an excellent position to quote in competition with the United States, and we are therefore anxious to obtain connections now so that we shall be prepared when business conditions become more established. We feel sure that the time will come when American material (in the general sense) will become highly competitive in the overseas trade.

"A further strong point in our organization lies in the fact that with regard to interchange of communications we have our own special code by which detailed specifications, enquiries and quotations may be sent by cable at a very nominal expenditure, and in most instances by the use of not more than two or three words.

"I have taken the liberty of writing you fully on this matter, knowing as I do your great interest in assisting firms in Canada to enlarge the growth of their business, as I feel that if we could get in touch with them very good business may result in the future. Of course, this may be a matter of even a year

(Continued on page 48)

Many Tinkers, Too Few Experts, Says Judge Gary

Those Who Talk Loudest About Economic Matters Sometimes Know the Least—Elements of Thrift and Prosperity Discussed —Value of Publicity Not Fully Appraised—Supply and Demand

DISCUSSING problems of supply and demand, the absolute futility of any man-directed effort that did not observe carefully the law of cause and effect, Judge Elbert H. Gary, chairman of the United States Steel Corporation and president of the Canadian Steel Corporation, whose plant is now being built at Ojibway, Ont., emphasized the point that private or personal gain or advancement or political advantage must be subordinated to the general public good.

"In the consideration of all economic questions," said Judge Gary, addressing the American Steel Institute, "everyone should endeavor to determine the final effect upon the people as a whole. Personal or private gain or advancement or political advantage must be subordinated to the general public good.

"Our business life is represented by various groups of men and women and involves a great diversity of economic activities. Taken alone, each branch of industry is naturally selfish and influenced more or less by unworthy motives. In discussing any particular one, all others must be considered as a part of the general public. If in management any wrong or injustice is perpetrated, it is the general public which must finally in some way suffer the consequences.

"As industry has developed, populations multiplied and wealth increased, the problems and difficulties in economic life have grown and we have been correspondingly forced to concentrate our minds upon proposed measures for relief or protection against imposition.

"We are still suffering from the very high cost of living caused by the inevitable cycle, developed during the war, which carries high prices from a starting point in a given place, proceeds around a spiral and returns step by step to a higher basis. Speaking generally and yet making the illustration specific, labor, which constitutes eighty-five per cent of the cost of production, is paid very large rates, but, with exceptions is not paid more than is proper, because compelled to pay high prices for the living costs. Normal conditions have not been fully restored and apparently are not likely to be in the immediate future, unless extraordinary efforts shall be made.

"We are apt to conclude that everything objectionable can be overcome by the adoption, amendment or repeal of laws. But on reflection one possessed with average intelligence and information, knows this is a fallacy. Many laws have been passed which are improper, and no doubt new ones ought to be enacted, all bearing upon economic questions. This will always be the case.

An Inexorable Law

"It is the purpose at this time to refer briefly to certain old and fundamental principles, which in modern times have been by large numbers overlooked or at least underestimated. Reference is made to the law of supply and demand.

"This law is inexorable. It is like the mills of the gods. It may be slow but its work is sure and fine. In its

JUDGE ELBERT GARY,
Chairman, U. S. Steel Corporation.

application, it is technically the doctrine expressed by the old and well-known phrase "quid pro quo." Individuals, groups, populations, become habituated to the idea that it is possible and also justifiable to get something for nothing; to get it by flattery, by mere promise, or by main strength and physical force.

"But it might as well be admitted first as last by every individual, collection of persons, or nation, that in order to obtain what is desired, there must be rendered an equivalent value, and that if secured on any other basis the business will not be satisfactory. What amounts to an equivalent or fair consideration in any transaction is, of course, mutually determined by the parties concerned, and if each agrees freely and voluntarily with full knowledge of the facts, uninfluenced by coercion, action is and should be final.

"What is to be done to prevent a practice which increases prices or costs from a starting point around or across back to the start and again commences another advancement? The first thing for every one of us to do is to think. One of our most prominent and ablest editors not infrequently urges us with emphasis to think, earnestly, seriously and all the time. We must adopt and practise the suggestion.

Must Not Be Interfered With

"When we ponder over the situation with the idea of suggesting a remedy, the first question presented relates to combinations or conspiracies to suppress natural laws. If one is actuated by motives of cupidity or dishonesty one is apt to suppress and then oppress. A combination calculated to control business or production either as to quantities or prices, by the employers or by the employees, interferes with the natural course of business and results in hardship upon all who are outside of the combination, who may be termed the consumers. A moment's reflection will bring conviction that it is because of these conditions, legislation has been invoked with the ostensible purpose of protecting the public, though it must be admitted that sometimes the real motives have been quite contrary to this idea.

"From what has already been said you are probably at least mentally inquiring, what is to be done? What is now proposed? How can business be done with fairness and with justice, except by the adoption and enforcement of laws which absolutely control business as to prices, rates, deliveries and all other particulars, and which secure proper treatment to every one, even though this would necessarily interfere with full, free and unlimited action on the part of all different groups in the advancement of their own interests respectively?

"Every one should attempt to answer these questions for himself or herself. A proper answer would be that the natural law of supply and demand should not be interfered with by the Government or by any administrators of the laws, except in case of turpitude, and

this applies to all business transactions. There are already too many man-made laws, and perhaps too many attempts to apply them, which are calculated to interrupt and hinder progress and industrial prosperity.

"The utilization of the great wealth, natural resources and productive capacity of this country should be permitted without interruption or hindrance up to the limit of propriety. But how shall this be accomplished since laws and their enforcement provide the only absolute rule for the conduct of persons? The answer is, by the enforcement of all those laws which establish order and safety of person and property as against riot, physical force and intimidation; enactments or amendments which permit immigration of foreigners on the basis of quality rather than numbers; and new laws or amendments which permit and require full publicity

"If one seeks to acquire property of any kind, or service, a fair price must be paid; or if service demands a certain price, the fair equivalent in work should be rendered. Any attempt to bring about rules of conduct contrary to these fundamental principles will not be successful. If put in practice by force or fraud they will eventually fail. There must be standards that are just and logical, as between the parties connected, and not inimical to the public weal.

"When an individual or association of individuals can and does collect an unconscionable amount for a commodity or for work, as the result of any circumstances or combination, the general public must and does finally pay the bill. This is inevitable and it is a pity that large portions of the public overlook or ignore this fact. It is not difficult nor embarrassing for a man in business to increase the production cost of what he sells by additions in salaries or wage rates if, at the same time, he correspondingly increases selling prices."

of economic transactions so far as they affect the public welfare.

Value of Publicity

"We have not fully appraised the value of publicity. Its practical results and its necessities in all departments of economic life without discrimination or exception have not been given due consideration. The full exposure to the people of business methods and management on the part of public and private institutions and organizations will create and firmly establish a powerful, effective and satisfactory public sentiment, which, on the average and for the long run, will be more potential than penal statutes.

"There is nothing to be said at this time against labor organizations or their leaders; certainly there is or should be no personal animosity. But to permit any group, and this representing only a minority in its branch of industry, to be exempted from publicity, is an injustice and a wrong to the general public.

"It goes without question that in business there are numerous matters relating to operation and management which are of interest only to the persons or concern connected, and these need not and should not be divulged to the general public, some of them particularly before consummation or pending negotiations; but as to the matters which at the time affect the public welfare there should be the right to have inspection by a competent, disinterested and non-partisan body. Let us demand in this country full, fair, impartial, competent publicity, applied without fear, favor or discrimination.

World Needs Economy

"The steel industry should and would welcome such a condition. It was proved to be desirable and proper during the panic of 1907 and a short period succeeding. There is no good reason why the public, through proper agencies, should not be present at private meetings of groups. It is, however, wrong to treat any branch of industry differently from all others. Of especial interest just now is the treatment, with like rules, privileges and penalties of both employers and employees. Unless and until that is brought about there can never be industrial peace nor can the public interest be protected. The untrammeled right to contract and the right to enforce contracts, both based on the law of supply and demand, together with opportunity on the part of the public to have the facts exposed, are essential to the protection of the public interest. Partial, prejudiced or incompetent investigations will not suffice.

"The fault or lack of continual prosperity in a measure may be laid at our own doors. If so, then let us to the best of our ability overcome our faults and consistently adopt and practise reasonable and constructive policies.

"Fault in many places no doubt exists. There are too many tinkers, too few experts. Many individuals, by reason of political position or other limited success, assume to know a good deal about matters, particularly economic, concerning which they have little information, derived either from study or experience, and these generally talk the loudest and longest on these subjects. Others from a desire to control or create antagonisms or to derive personal profit, attempt to interfere with the natural and reasonable course of business, sometimes resorting to force and brutality. We must keep our own houses clean, search our own hearts, remain true and loyal and above reproach, and then openly proclaim the truth at proper times and places.

"The world, now more than ever before, needs peace, international and domestic, political, social and industrial. It is a time for work, economy, saving, thrift; honest, reasonable and intelligent recognition, observance and enforcement of the rules of law, propriety and common sense. Gentlemen, what we preach let us practise, conscientiously, persistently and loyally. Let us always transact our business on the basis of rendering a full equivalent for what we demand or receive. Thus we shall best succeed and prosper.

Condition of Steel Business

"There are no obstacles to continued prosperity in the iron and steel business of the United States except such as may arise from interference with the natural course of supply and demand. There is a great abundance of high quality iron ore; steam, gas and coking coal; limestone and other raw products, all within easy reach; also furnaces, mills and shops of higher grades, railroads and ships for transportation, every variety of experts of pronounced ability, organizations and systems equal to any in the world; and the demand for every

"In spite of the difficulties which have confronted industry and appreciably frightened investors, the manufacturers of steel are now producing, on the average, about seventy-five per cent. of their estimated capacity. This is more than double the total capacity twenty years ago. We are making a better quality of steel, and increasing diversification of shapes for additional uses; and in many ways we are extending capacity and effecting economies, although selling prices have not kept pace with larger costs. We shall soon get back to a basis of business that will yield fair profits, if permitted to proceed without unreasonable interference.

"As to the general business conditions, in addition to what has already been said, great significance should be given to the publications concerning the enormous savings bank balances. These show conclusively a disposition to economize, whatever may be the reasons. Economy and saving are fundamental to thrift and prosperity."

kind and character of steel is far in excess of capacity to produce. Steel is needed immediately for buildings and structures, for railroads, for farms, for pipe lines, for canning, for equipment of every kind, for guns, tools and implements of thousands of varieties, for wire, ranging from the finest watch springs and piano strings to the largest cables, for cars, automobiles, aeroplanes and other vehicles for transportation of property and persons, and many other purposes.

"If the natural course of business had not been interrupted we would now be enjoying success and prosperity in our industry greater than ever before, so far as volume is concerned. Who is blamable? The answer is: Any one who by word or deed has interrupted or hindered the operation of the natural law of supply and demand; or has interfered with the full, free and unlimited right to work, to operate and produce.

Practice on Quenching Mediums for Hardening

Oil Gives the Best Proportions Between Hardness, Toughness and Warpage—Care Should be Taken to Keep Water Out of the Bath—Brine and Acid for Extreme Hardness

THE MOST common of the quenching mediums in every day use are water and oil. Some concerns use brine and acid solutions. Others use alkali solutions. The reasons for different mediums are the requirements of hardness, warpage and toughness.

The alkali solutions cool the steel through the critical range or from hardening temperature to the black stage at a slow rate. The hardness of steel depends upon this rate. In consequence, the use of alkaline solutions gives the least amount of hardness possible when quenching in a liquid to the cold stage. The loss of hardness is compensated for by the toughness and by great elimination of the warpage tendency. The grip received by the hot steel when plunged into the bath is so lessened that the case of the steel does not set with such hardness that the strains, etc., in the main bulk cannot bend it to a position of strain equilibrium. The alkali quench is adaptable to treating steel such as axles, etc., for certain desired physical properties. For carburized work the alkali solutions are well adapted for quenching for core refinement on delicate parts that would warp excessively if quenched in a faster medium. The alkali solutions are not generally used for the reason that with different grades of our standard steels, stock may be so selected as to give the desired physical results with the more universal oil or water quench. However, for obtaining certain physical properties which the steel does not have with oil or water quench, the alkali solutions are adaptable. The alkali solutions are made with lye, soda ash, soap, etc., and to various strengths, according to the final results desired.

Oil cools the steel at a faster rate than the alkali solutions. Oil is the most all round quenching medium used. For our standard steels, the oil quench gives the best proportions between hardness, toughness and warpage.

In the past such oils as fish, linseed, etc., were considered as the only oil in which steel could be quenched. This belief was handed down from the time when these products were low in cost. At present the cost is excessive and when one considers the odor of fish oil and the accumulation of gum about the top of the quenching tank from cottonseed, one wonders why such oils retained their popularity as long as they did. The only advantage which these oils possess is the high flash point.

These oils, however, were largely supplanted prior to the war by special compounded oils of the soluble type. The soluble properties consist of the ability of the oil to make an emulsion with water. There is a slight advantage to this in that if water gets into the oil it combines with it to form a medium which is slightly faster for quenching than the oil itself. Further, the medium is uniform in its properties throughout the whole. On the other hand, if the water did not go into emulsion, it would separate in the bottom of the quenching tank and the hot steel, passing through the oil to the water, would receive unequal hardening strains which would have a great tendency to crack the work. There should, however, be no reason for getting water in the oil in a well-designed plant. The soluble oils are further advertised to quench greater quantities of steel per gallon of oil and to have high refrigerating qualities. The ability of any oil to quench large quantities of steel per gallon of oil depends on how fluid it is or its viscosity or draining qualities. The lighter the body of the oil the better it drains from the work. The so-called refrigerating qualities are no more than the oil's ability to remove the heat from the steel at a fast rate and then radiate the heat it carries to the atmosphere, the amount of heat carried per unit of oil is the specific heat of the oil. These properties are further improved by a light-bodied oil that will circulate itself by thermo-syphon effect.

Further claims are made that the physical properties of the quenched steel do not vary to an appreciable degree when the oil is used up to temperature of 200 deg. to 250 deg. F. These claims are in the main true, but are in the main true of other oils. There is very little sense in the usual shop of allowing the oil to go to such temperature. The discomfort to the men through burns, etc., is great.

Other than the above properties which these oils are claimed to possess there is perhaps no advantage over any other oil as far as the hardening of the work is concerned. A good quenching oil should possess a flash and fire point sufficiently high to be safe under the conditions used. 350 deg. flash point should be about the minimum.

Viscosity should be sufficiently low to allow the oil to drain from the work readily and circulate itself freely by thermo-syphon action. Average of oils run about 115 deg. to 150 deg. at 100 deg. F. and 150 deg. Saybolt is recommended as a maximum.

Specific heat regulates the hardness and toughness of the quenched steel. The higher the specific heat the harder the steel. Viscosity must also be considered to some extent. Specific heats of quenching oils vary from .20 to .75, water considered as unity. A specific heat from .20 to .40 is usually found with the fish, animal and vegetable oils, from .50 to .70 with the soluble type and mineral oils. Further, the oil should contain no water, should not gum on use and should not be of disagreeable odor or become rancid and should have no skin-drying effect on men's bodies.

A great many concerns are using paraffin mineral oils for quenching, and a few are using crude fuel oils.

The following is a résumé of a recent test on various oils:

The method of test was to heat up to a temperature of 1,400 deg. F. a cylinder of steel weighing 3510 grams. This block was heated in a lead pot maintained at 1500 deg. F. Ten liters of each oil under test were used. A thermocouple was placed in the center of steel cylinder for accurate readings of the cylinder temperature at all times. The temperature of the oil was taken with a thermometer, before and after quenching the cylinder. The number of seconds required to cool the steel from 1400 deg. F. to 800 deg. F. and from 1400 deg. F. to 500 deg. F. was also taken. This data gave a comparative specific heat value by the formula:

$$C = \frac{c\,w\,(t - T')}{W\,(T' - T)}$$

where c w and t are specific heat, weight and original temperature of piece of metal quenched; and C W and T are specific heat, weight and original temperature of bath of oil in which it is cooled, and T' is the final temperature of both. For the test c equals .1165, w equals 3510 grams, and t equals 1400 deg. F.

Mixtures of oil and water are used in a few instances in different proportions, to give a greater hardness than the straight oil and a less hardness than water. This can only be done with the soluble type oils or such oils as will emulsify and make the usual milky solution with water. The following experience shows one instance where such a solution was used:

A concern making permanent magneto magnets were experiencing trouble in cracking and warping when the magnets were water quenched. On the other hand an oil quench, though causing no such trouble, did not give the desired hardness for the magnetic requirement. A quenching bath of three parts water to one part oil was mixed and satisfactory results were attained, which help-

As recommended by the American Gear Manufacturers' Association.

ed them out of the immediate trouble until such a time as the steel and the fabrication of it was rectified.

Water is the most used of the quenching mediums and its cost is very little. Its use is primarily only restricted from its action of warping delicate work. The colder the water the harder the work. Water at boiling point, 212 deg. F., is supposed to have the quenching properties of oil. Addition of alkali which raise the boiling point will undoubtedly give some such results. The cost of alkali and the cost of maintaining the water at a fairly constant heat in combination with uncertainties are oftentimes more expensive than the use of oil as a quenching medium. Water, however, is as a rule plentiful and no pump or cooling devices are necessary as with oil.

Brine and acid baths are used where extremely hard work is desired. The quench is very rapid. Great warpage results and likewise cracking of the work. Many hardeners have devised fast quenching baths, the secret of which they carefully guard. These sometimes have merit for particular classes of work but for our standard steels there is very little use for them.

There are a few other methods of quenching, which, however, have no great value for carburized work.

By quenching in molten metals, such as lead, the hardness is decreased as the steel cools from the red to the black stage at a slower rate and the work is tempered to the temperature of the lead. By quenching in mercury extreme hardness is assured. This is only practical on very small parts desired extremely hard.

Keeping the quenching bath cool is important when using solution or oil. There are three ways in which this is accomplished: first, using a large quantity of the liquid; second, circulating the oil past colder objects; third, passing colder liquids in pipes through the oil.

In using large quantities of oil, the oil will retain approximately its surrounding temperature if there is one gallon of oil for every pound of steel quenched per hour, circulation of oil past steel to be one gallon per hour. One concern has a circulating supply of oil of 3,300 gallons which will normally be 70 deg. F. on a Monday morning; 12,000 pounds of steel are quenched. The oil temperature at the end of the week is 120 deg. F. The pound hour rate of steel is 219 pounds per hour. The rate of oil flow is sixty-four gallons per hour. Increasing the oil supply would keep the temperature of the oil down at the end of the week, though the temperature of 120 deg. does not cause trouble with hardening.

In circulating the oil past colder objects the oil is pumped from the quenching tank through pipe to the cooler. The cooler may be a brine tank cooled by an ammonia refrigerating system. It may be a reversed water heater where the oil passes through many lengths of piping and cold water flows about these. It may be metal sheets set at angles on which the oil is sprayed and allowed to flow from one to the other (a downward, zig-zag motion) and collected and pumped back to the quenching tank. It may be an open tank in which half the periphery of many revolving discs are placed and air blown past the exposed disc which has the oil film. Any of these methods is good practice. Spraying in the open air after the style of the cooling ponds of steam plants is not used because there is no evaporation and therefore no cooling from the latent heat of evaporation, and, due to wastage, this method is not recommended.

	Flash Point (New) Deg. F.	Flash Point (After Test)—Deg. F.
Fish Oil	400	400
Raw Linseed Oil	400	520
Mineral Oil	395	398
Mineral Oil No. 1	360	355
Mineral Hardening Oil	328	330
Soluble Type Oil	370	370
Engine Oil	390	390

	Viscosity Now at 100 deg. F.	Viscosity After Test at 100 deg. F.	On Rise in Temperature of Oil During Quench
	sec.	sec.	deg. F.
Fish Oil	112	112	130.5
Raw Linseed Oil	134	129	125.2
Mineral Oil	140	109	126.2
Mineral Oil No. 1	101	105	125.9
Mineral Hardening Oil	70	73	126.1
Soluble Type Oil	119	125	127.7
Engine Oil	230	230	128.5

	Average Time to Quench from 1400 to 500 deg. F.	Average Time to Quench from 1400 to 800 deg. F.	Specific Heat
	deg. F.	deg. F.	
Fish Oil	142.2	70	.4057
Raw Linseed Oil	164.7	81	.4118
Mineral Oil	172.0	96	.4410
Mineral Oil No. 1	181.9	86	.4273
Mineral Hardening Oil	167.2	78	.4551
Soluble Type Oil	173.9	86	.4354
Engine Oil	190.9	96	.4120

	Condition of Oil when Held at 240 deg. F. for 60 Hours.
Fish Oil	Thickened and lump, very bad.
Raw Linseed Oil	Dark and thick as a light grease.
Mineral Oil	Dark and thickened considerably.
Mineral Oil No. 1	Dark a little and some deposits, thickening.
Mineral Hardening Oil	Dark a little and some deposits, thickening.
Soluble Type Oil	Dark with heavy sediment deposit, thickening.
Engine Oil	Very dark, thick and lumpy.

In passing colder liquids in pipes through the oil, the oil itself is not circulated. Water pipes are laid in bottom or at sides of tank and the cold water passed through. Cold brine from an ammonia refrigerating system is used for large installations, desiring low temperatures.

MAKING BELTS ENDLESS

Where endless belts are to be used the work should be done by the manufacturer in his own factory if possible. This operation is one for experts. Some manufacturers send expert belt makers out to make belts endless where belts cannot conveniently be sent to the factory.

A good general purpose joint is the cemented splice. But it entails a lengthy operation. The length of the splice for leather belts is an open question. The following conservative rule will be safe under all conditions where the belt splice should be 10 inches; from 10 to 18 inches it should be equal to the width of the belt, and above 18 inches a uniform splice of 18 inches will answer requirements. The belt glue should be applied hot and the belt allowed to stand in the clamps for at least 2 to 4 hours. Glue may be made waterproof by adding a small amount of bichromate of potash a short time before applying.

Canvas, rubber, balata and some solid woven belts are joined by a step splice in which the plies are cut away and overlapped. They are first cemented in place and then stitched to give added strength. The joint should be still further reinforced by a covering of heavy duck cemented in place. Rivets are sometimes used for additional reinforcement. The cement joint while efficient takes considerable time and special tools. Although in some transmission, an endless belt is a practical necessity, ordinarily steel lacing is found preferable, considering the relative expenditures of time, labor and money involved. This is not merely the statement of the manufacturers—it is the findings of many good belt manufacturers and engineers the world over.

Never try to put a belt on or take it off moving pulleys with bare hands. This is a good rule to follow if absolute safety from injury is to be had. In cases where pulleys are revolving even at slow speed, use a stick or belt shifter. Keep hands and arms away from the belt entirely. Where cone pulleys are used a belt shifter placed where a workman can reach it without moving will materially increase the production of that particular machine unit. Efficient belt shifters also tend to decrease insurance requirements and greatly lengthens the life of a belt.

In placing a belt on the pulleys do not have it too tight as it may be injured in forcing it on. When the belt is first put on insert, say a 6-inch strip of the same material as the belt, if that is the estimated amount of stretch, using lacing for making the joint. When the first sag is observed, take out the 6-inch strip and insert a 5-inch strip. As the belt stretches, reduce the size of the inserts until the belt rests under normal tension. Another method is to trim an inch at a time from one end of the belt as it stretches until the final length is reached.—From Short Cuts to Power Transmission.

News From the Welding Field

Result of Several Tests Made on Welded Cylinders

Method of Making Seamless Pipe—Process of Welding Girth Seams—Practice Followed in Testing the Welds—Results of Observations—Determining the Factor of Safety

By PROF. E. A. FESSENDEN and S. J. BRADFORD

THE following observations were made during the test at the pressure indicated:

1,000 lb. per sq. in. Scale began to crack at bend of flange in head at end of section 1.

1,200 lb. per sq. in. Distortion of head at end of section 1 continued; head at end of section 6 began to show distortion.

1,400 lb. per sq. in. Considerable distortion apparent in both heads. The head at the end of section 1 showed an increase in diameter in the part flanged over into cylindrical shape as indicated in Fig. 10.

1,700 lb. per sq. in. Complete failure occurred suddenly by tearing the acetylene-welded longitudinal seam. Failure apparently began by the material which had been added from the welding wire tearing away from the plate for a distance of about 3 in. Then the tear extended in both directions through the body of the weld itself until total length of the tear was about 16 in. The broken surface exhibited a very coarse granular structure. Fig. 11 shows the final fracture. The part which is thought to have failed first is below and to the right of figure 2 in the photograph. Where the tear left the weld and extended into the shell material at the left-hand end is also shown.

TABLE 3 TENSION TEST OF CYLINDER NO. 2 SPECIMENS.

Sample	Dimensions in.	Area, sq in.	Load, lb. Yield point	Load, lb. Ultimate	Tensile strength, lb. per sq. in. Yield point	Tensile strength, lb. per sq. in. Ultimate
H	0.46 × 2.38	1.094	.....	28,200	.....	25,820
I	0.424 × 2.05	0.87	.....	25,850	.....	29,750
	Average of acetylene-welded seams					27,785
J	0.345 × 1.55	0.535	27,000	35,620	50,500	66,700
K	0.341 × 1.51	0.515	24,000	33,310	46,700	64,700
	Average of shell material					65,700

Fig. 11—Final failure of acetylene-welded longitudinal seam of cyl. No. 4.

Extract of a paper presented at a recent meeting of the American Society of Mechanical Engineers. The first part appeared in the October 19th issue, the second in November 2.

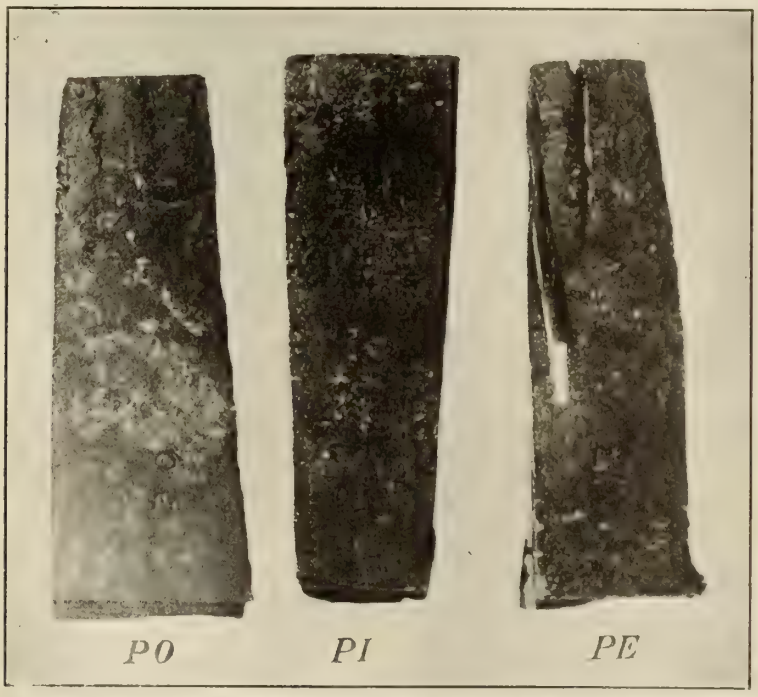


Fig. 12—Cracks in specimens of cylinder No. 1 revealed by etching and the crack in piece P E which probably caused failure.

The factor of safety, computed on the same basis for cylinder No. 1, may be taken as one of the following figures: (a) On the basis of the first noticeable distortion of the cylinder head, the factor is 5.41. (b) On the basis of final complete failure, the factor of safety is 9.18.

For the pressure at which the acetylene-welded longitudinal seam failed and assuming the effective thickness of the weld to be the same as that of the shell material, the stress in the seam was 40,500 lb. per sq. in. Measurements on samples of the weld cut out for tests showed the average actual thickness of the weld to be 0.358 in., so that the actual strength of the weld was 28,300 lb. per sq. in., or 10,140 lb. per linear inch of welded seam. Three samples were cut from the longitudinal seam at a point well removed from the section which failed and subjected to tension

TABLE 4 TENSION TEST OF CYLINDER NO. 4 SPECIMENS

Sample	Dimensions at weld, in.	Area at weld, sq. in.	Ultimate load, lb.	Tensile strength, lb. per sq. in.
L	0.336×1.919	0.645	22,710	35,200
M	0.373×1.670	0.623	17,590	28,200
N	0.365×1.924	0.693	18,170	26,200
	Average			29,870

TABLE 6 STRESSES PER LINEAR INCH OF SEAMS

Cylinder No.	At first observed leakage through seam during test, lb.	At maximum pressure reached in test, lb.	At failure of joint by tension test, lb.
1 (forge-welded)	2810	4295	.....
3 (forge-welded)	3920	4040	.....
1 (acetylene-welded)	....	8590[1]	10097
2 (acetylene-welded)	6020	7830[1]	12010
4 (acetylene-welded)	10140	10140	10770
5 (acetylene-welded)	....	5715[1]	.....

[1] Stresses marked thus are simply the highest stresses reached in tests where the final failure was due to other causes than failure of the seam in question.

tests by Professor Patterson. The results are given in Table 4.

The average ultimate strength is above the requirement of the Boiler Code of The American Society of Mechanical Engineers for good forge welds. The fractures exhibited the same characteristics as were described for the test pieces of cylinder No. 1, except that one specimen, sample L, failed by pulling the welded-in material away from the shell material instead of tearing through the centre of the weld. The other two specimens showed a discolored region in the fracture that indicated the same poor knitting together at the bottom of the scarf already commented upon in the description of the fractures of weld specimens in connection with cylinder No. 1. The average ultimate strength of the acetylene-welded seam per linear inch of seam computed from Professor Patterson's tests, is 10,770 lb.

Test On Cylinder No. 5

The shell of this cylinder was made of seamless pipe 12¾ in. outside diameter, with pressed dished heads acetylene welded to the shell with the convex face outward, the construction being the same as that of cylinder No. 2, except that the finished cylinder was only about 3 ft. long instead of 6 ft. A short time before finishing the tests on the first four cylinders already described, it was decided to test an additional cylinder taken out of stock. Therefore, cylinder No. 5 was chosen from a pile in the welding shop. One of the welded girth seams did not appear to be as good as those in some of the other cylinders, a second course of welding apparently having been run around the seam.

As this cylinder was tested simply as a check to compare the workmanship on stock cylinders with those submitted for test, it was not considered necessary to take detailed observations during the test. The cylinder behaved in practically the same manner as cylinder No. 2 except that no leakage through the circumferential seams was observed. Final failure occurred at a pressure of 1,900 lb. per sq. in. by serious leakage through an acetylene weld securing a pipe coupling in one of the heads. The scale cracks along the bend of the flange of the head and the tendency of the head to assume a hemispherical shape were also noticeable. On the basis of final failure and assuming that the working pressure for which the cylinder was designed was

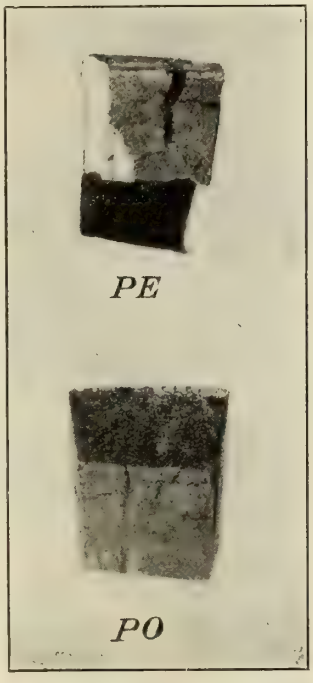


Fig. 13—End views of specimens PO and PE, showing cracks extended deeply into metal. Magnification 1.5.

185 lb. per sq. in. as in the other cylinders tested, the factor of safety is 10.28.

Using the same initial diameter as in cylinder No. 2 and assuming that the effective thickness of the acetylene-welded circumferential seam is the same as that of the shell material, this seam safely withstood a stress of 16,820 lb. per sq. in. of cross-section without any sign of leakage or distress. If the actual thickness of the weld is taken to be 0.442 in. as was found on carefully measured specimens of similar welds in cylinder No. 2, the stress safely withstood was 12,930 lb. per sq. in. The stress per linear inch of seam safely withstood was 5,715 lb., without any sign of leakage or distress of any kind.

Final Summary

Table 5 summarizes the results of the tests. It is somewhat difficult to make a comparison between the acetylene-welded and the forge-welded seams on the basis of tensile strength, because the stress on the acetylene-welded seam is a direct tension while that on the forge-welded seam is shearing. Possibly the fairest comparison is the load which the seam will carry, expressed in pounds per linear inch of seam. Table 6 gives the strength of the several joints, using the results of the tests on the five cylinders as well as those obtained by Professor Patterson. Even this is not an entirely fair comparison, because some of the acetylene-welded seams are thicker than others. The average stresses per linear inch of seam are as follows:

	At first leakage through lb.	At final failure of seam lb.
Forge-welded seams	3365	4168
Acetylene-welded seams	8080	10754

In considering the results here presented it must be borne in mind constantly that the object of the investigation was to compare different methods of constructing containers for anhydrous ammonia for use in refrigerating-plant practice. Even a comparatively small ammonia leak is sufficient to make the room in which it occurs untenable. If the leak occurs in a confined space where ventilation is poor, as, for example, on shipboard, the results may be quite serious. In boiler practice absolute tightness is not nearly so important as adequate strength against serious rupture, but it should be emphasized that in the case of containers for anhydrous ammonia, leakage constitutes failure.

From all of the data secured by the tests themselves and also by subsequent investigation and analysis it appears that the vessels having forge-welded heads are the least reliable. The entire

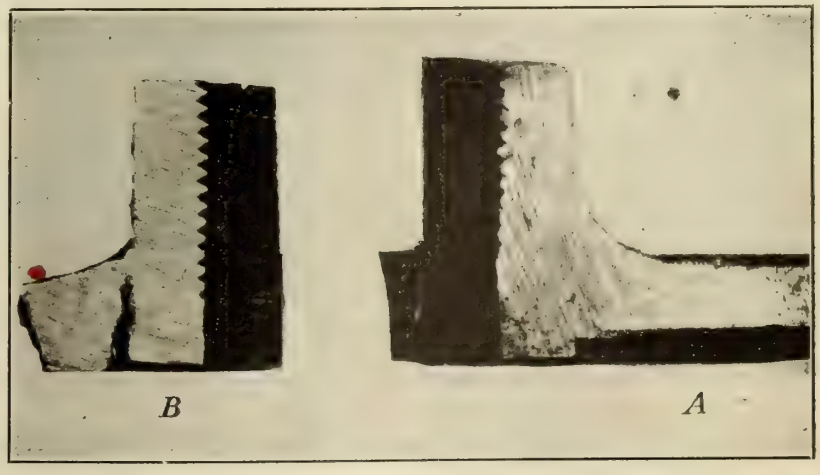


Fig. 14—Two pipe-coupling specimens. B is nipple of cylinder No. 2 which leaked through weld. A is sound nipple welding that did not leak.

circumference of the weld is likely to have incipient cracks where the union between the flange of the head and the end of the shell is imperfect. If the common shape of dished head is used it obviously must be inserted in the shell with the concave side outward in order to make a forge weld. Under the action of heavy internal pressure the curvature of the heads is reversed and this sets up a tearing or peeling action which increases the incipient flaws in the weld and leakage follows. This result is still further aggravated by the opening out of the crimped ends due to the spreading action of the head during reversal and the consequent expansion of the material just at the weld. Furthermore, it is quite likely that the dished heads are more or less distorted during the forge-welding process. Surfaces that are subjected to pressure on the convex side are in a state of unstable equilibrium and even slight initial distortion will result in excessive distortion at much lower pressures than would be carried safely. This was shown in the case of cylinder No. 3, in which one head was somewhat flattened when received at the testing floor. This head began to reverse curvature at 200 lb. per sq. in. The initial distortion undoubtedly contributed to its low resistance.

In the forge-welded specimens examined microscopically, evidence of burnt steel was found in all cases. In general, burnt steel may be expected in forge welds because the burning temperature and the welding temperature for steel are quite close together. Some time must elapse, and hence some cooling takes place, between the instant the pieces are removed from the forge and the time at which the welding actually takes place. It is essential that the pieces be at the welding temperature at the time the blows are struck. The comparatively thin pieces in question lose heat rapidly and this leads to their requiring a higher forge temperature than pieces of more compact form, thus increasing the danger of burnt steel. Burnt steel and overheated steel are very weak and brittle as compared to steel not treated so. When burnt steel is forged, cracks like those in specimen PE (Fig. 12) are formed. This action renders leakage under pressure and consequent failure easy.

Oxide inclusions along the surfaces joined by forge welding are practically inevitable. Where an oxide inclusion exists the union between the two pieces welded together is obviously imperfect, thus weakening the weld. If the forge-welding process is to be used it is recommended that decisive steps be taken toward much more careful temperature control. The work also indicates clearly that the best type of vessel tested was that made up of a seamless-pipe shell with acetylene-welded dished heads, convex outward. This construction places the welds where they have to sustain a minimum stress and eliminates the danger of a failure such as occurred in the cases of cylinder No. 4.

TABLE 5 SUMMARY OF TEST RESULTS

Cylinder No.	1	2	3	4	5
Shell	Flange steel, longitudinal seam acetylene welded	Seamless pipe	Seamless	Flange steel, longitudinal seam acetylene welded	Seamless pipe
Heads	Forge welded to shell	Acetylene welded to shell	Forge welded to shell	Acetylene welded to shell	Acetylene welded to shell
Pressure at first leakage, lb. per sq. in.	950	2000	1300	1700	1900
Maximum pressure attained, lb. per sq. in.	1450	2600	1380	1700	1900
Cause of final faliure	Leakage through forge weld	Leakage through acetylene-fitting weld	Leakage through forge weld	Rupture of acetylene-welded longitudinal seam	Leakage through acetylene-fitting weld
Factor of safety on first leakage	5.13	10.81	7.03	9.18	10.28
Factor of safety on final failure	7.85	14.06	7.46	9.18	10.28
Stress in longitudinal seam, lb. per sq. in.	34,400	....	....	40,500	....
Stress in circumferential seam, actual, at first leakage	....	13,620	....	28,300*	12,930
Same at final failure	....	17,690	....	28,300	12,930

*Caused final complete failure.

In the five cylinders tested there were two acetylene-welded longitudinal seams and six acetylene-welded circumferential seams, a total of eight important acetylene-welded seams. The authors were able to rupture but one of these, a longitudinal seam. Very slight leakage was obtained at one other, a circumferential seam. Of the four forge-welded seams every one failed by excessive leakage at pressures considerably lower than those safely sustained by the acetylene welds. There were a total of 28 pipe fittings acetylene-welded to the five cylinders. Leakage was observed through two of those, in each case finally resulting in failure.

The tests also indicate that the acetylene welds are likely to have occasional porous spots and that pinholes may often develop when high pressures are reached. They also indicate that the welds where fittings for pipe connections are joined to the vessel are almost as likely to cause failure as are the longitudinal and circumferential seams. The acetylene welds also have non-metallic inclusions, but they are more globular in form than those found in the forge welds and are also scattered in all directions through the material instead of being concentrated along the contact surface. They are therefore less likely to cause leakage.

The principal defects in the acetylene welds examined seem to be the coarse granular structure and porous spots obtained and the occasional poor adhesion of the welding material to the original plate. Poor adhesion may be due to the plate cooling below a good welding temperature, or becoming oxidized along the surface before the welding material is added. These defects suggest the following possible remedies:

(a) The plate should be heated for as short a distance ahead of the fused-in material as possible. This should render cooling less likely and reduce the chance of oxidation.

(b) The work should be done as rapidly as possible in order to reduce the grain size to a minimum. As low a temperature as possible, consistent with good welding, is desirable for the same reason.

(c) The weld should be cooled as soon as possible after being made, in an effort to reduce the growth of ferrite crystals.

(d) Possible oxide inclusions might be reduced by using a flame so adjusted as to be neutral or slightly reducing rather than oxidizing in nature. This would require some experimentation.

(e) Defects in welding attachment couplings to shells or heads, similar to those which caused the failure of cylinders Nos. 2 and 5 (see Fig. 14) could probably be avoided by scarfing the edge of the hole into which the coupling is set. While defects of this character can be avoided by careful workmanship, it would seem that scarfing would render the difficulty much less likely to occur. A scarfing tool similar to a pipe reamer could be devised easily.

(f) In the case of seams examined, poor adhesion was noticed in a number of cases, particularly at the bottom of the weld. This might be improved by scarfing both edges to be joined and carrying the bevel nearly if not quite to the bottom of the plate.

CATALOGUES

The Geometric Tool Co. has just issued two new catalogues, one covering their style D.S. die head as applied on single spindle automatics, and the other on the Jarvis line of high speed tapping devices and appliances, such as quick change chucks, collets and self-opening stud setters.

Practical Ideas From Practical Men

ACCURATE DRILLING SOLUTION

By R. Henderson

In the day's work in many plants drilling jobs are constantly arising for solution. Often times the men who must handle these problems have in their day's work a great variety of solutions to pass upon and as a result these problems do not get the expert solution they would get were they to be handled by men who study nothing other than driller problems. In the manufacture of accounting machines one of the very important operations is the making of the die plates which must punch the cards. The reason for the accuracy is that in the multiple printing each punch must accurately enter each die, and further, the cards must be accurately punched in order to register properly in the electric tabulating machine.

The plate in line cut which is one of a series is made of a high grade tool steel varying in thickness from ⅛ inch to ⅜ inch. Two problems presented themselves, one was the question of time for the drilling of the plate which took from 3 to 4 hours, and the second was accuracy. The tolerance between the two extreme holes was plus and minus .002 inches, while any two adjacent holes could not vary more than .0005 inch. The plate had 45 holes the long way and 12 rows across. As the holes were too close to drill every one, the best plan finally worked out to have 9 spindles drilling every fifth hole, making five operations to complete each row.

This plate was located on the upper table of the indexing jig which had an oil basin for cutting compound, by means of accurately located dowel pins, so that should the plate for any reason be removed, it could easily be replaced in its original position. This table was placed on a compound table which accurately moved at right angles. The threads on each screw were so cut that either one turn, or a multiple, gave the exact distance to be moved over. Inasmuch as the accuracy of the finished work had to be held to very close limits an interesting problem arose in the cutting and testing of the lead screw. Of course great care was also necessary in scraping in the sliding members.

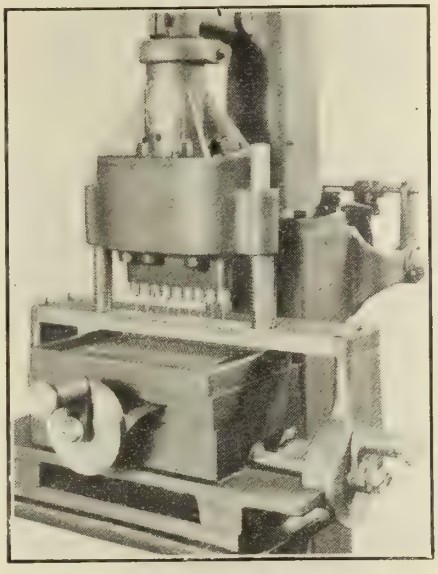


Fig. 2—Interesting design of multiple drilling machine.

Across the top of the jig is carried a heavy steel plate in which is located the liner and the slip bushings which guide the drills as near the work as possible in order to maintain the requisite accuracy. From this plate two heavy hardened and ground guide rods rise to keep the head and jig in alignment at all times. The head itself is counterbalanced in the column of the driller, but the springs are added to assist.

The head is of the usual sturdy construction with sufficient metal to keep all parts in alignment. This head is mounted on the high speed ball-bearings with automatic cam feed and return, so that practically the only duty of the operator is to index the jig and replace drilled parts. With this equipment the 540 holes in the plates were finished in twenty-two minutes, floor to floor, as against the previous time of three to four hours. The entire equipment was handled by the engineering department of the Hoefer Co., Freeport, Ill.

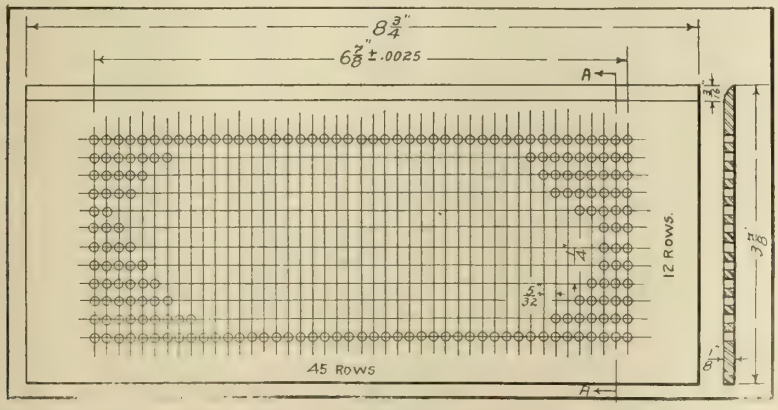


Fig. 1—540 holes drilled with an allowable variation between any two holes plus or minus .0005.

SHOW VISITORS AROUND YOUR PLANT

By D. A. Hampson

In this enlightened age, visitors are welcomed in most shops. Not loafers or back-door visitors, but bonafide visitors who come into the office, say they happen to be in town, and would like to see "how castings are made," for instance. A goodly proportion of present-day visitors are automobilists; they tour as one way of taking a vacation and in so doing they see much of the world while acquiring red cheeks. Sometimes the male members route their tour to pass through a town where is located a plant they would like to visit—more often, in passing through, the sign attracts and the tourist stops to visit while the female members go sightseeing or shopping.

Some shops do not extend the glad hand to visitors, fearing that they may carry away business secrets. This is an old fashioned policy—a boomerang policy, in fact. If there is actually anything that needs to be guarded, and it comes along the path of the inspecting party, it can be guarded or clouded by stopping the work temporarily or by throwing a pair of overalls across the machine just as a mechanic does when the whistle blows.

But the visitor who comes to the office, states his wishes, and identifies himself and his business connections is more apt to bring business than to "steal" ideas. He is equally ready to exchange courtesies when positions are reversed.

Not long ago a tourist was attracted by the sign, "National Electric Iron Co." atop a 50 x 100 ft. building in a city he was passing through. He stopped and went in, was courteously received and shown everything from coil winding to nickel plating. He also saw quantities of outside work being plated—the company have greater capacity than the iron business required. Now it happened that only three weeks later this visitor's own business ran into a job that required several thousand parts to be nickeled. Quite naturally he thought of the flat-iron business and put the proposition up to them: It resulted in a fine job for the platers and better delivery and lower prices for the buyer than he had been getting before on his plating work.

Two other instances of this kind came

to notice the past summer. In both the visitors were interested in an allied trade or branch and had no business to offer to the plant being visited. In both it happened that the turn of events brought these men into the position of prospective buyers of the very goods sold by the plants visited. Courtesy won and very satisfactory business connections were established. One instance was in the wire spring forming line and the other was in brass castings. So we can see that it pays to receive visitors. And it pays to have a sign on your building.

HOW MUCH FUEL DOES A CLEAN BOILER SAVE?

By W. F. S.

Here is an interesting and valuable chart for finding the fuel saved by keeping boilers clean. Simply zigzag across the chart three times with a straightedge or fine black thread, as indicated by the dotted lines drawn across, and the per cent. of fuel saved is found in the last column at the right—Column G.

For example, if the temperature of the chimney gases before cleaning was 580 deg. F., and after cleaning 480 deg., and if the heat value of the coal is 12,000 b.t.u. per pound, what is the percentage of fuel saved?

Connect the 580 (column A) with the 12,000 (column C) and make a note of the figure intersected in column B. In this case we find the figure in column B to be 70 per cent. Now begin at the 12,000 (column C) and run a line through the temperature difference (before cleaning and after) in column D, which is easily figured to be 100 deg. Continue the line until it intersects column E. Column E, you will note, is intersected at 3.8 per cent. Now from this point (column E) run through the figure in column F, which is the sum of the figures obtained in column B and E. In this example the sum is (70 plus 3.8 per cent.) 73.8 per cent. The continuation of this last line through column G gives the answer as 5.15 per cent.

The instructions on the chart itself tell just what to do as you go along. Each column is fully explained, excepting column B and E, which are to be added together for use in column F. In zigzagging across, the second line from column C to column E begins where the first line ended—at the 12,000 b.t.u., the 13,000, or whatever it happens to be. In this example it is 12,000 b.t.u. In the same way the third line, from column E to column G, begins where the second one ends. The writer has experimented with this chart to find which is quicker—the chart itself or the formula on which the chart is based. In every instance I found the chart to be much quicker. The only mathematical operation involved—adding two simple numbers—requires very little time or thought and can frequently be done mentally.

Not long ago I developed and published a formula for computing the fuel saved by cleaning boilers. This formula met with considerable approval. One correspondent, however, asked if I could alter the formula and get rid of the "boiler efficiency factor" which was contained in the formula. Many operators of boilers haven't an inkling regarding their boiler's efficiency, and as soon as one begins to talk efficiency to them they shrug their shoulders and give up the task as hopeless. With this correspondent's suggestion in mind I sought out some good representative steaming tests where I knew the firemen and engineers did the best they could and derived this formula:

$$\frac{100\ (T-t)}{0.22H-0.37T-t} =$$

Per cent. of fuel saved, assuming 18 pounds of air per pound of fuel.

Where

T=the temperature of the chimney gas before cleaning;

t =temperature of chimney gas after cleaning, deg. Fahr.;

H=heat value of fuel in b.t.u. per pound.

This is the formula upon which the chart is based. It contains three most important factors, all of which are usually known or determined without great effort. T and t can be found by means of a pyrometer or a thermometer properly placed in the gases. If a thermometer is used don't place it close to any comparatively cool body or the bulb will radiate heat so rapidly as to affect the reading considerably. The heat value of the coal, H, can be ascertained with fair accuracy from Bureau of Mines publications, which list the heat values of coals mined all over the United States. Naturally the chart is subject to criticism. It is not claimed to be perfect. No boiler efficiency formula can be expected to be perfect, containing only three factors, as this one does. It is simple, however, and that is a thing that is always wanted. It shows clearly that a cleaning operation should reduce the temperature as much as possible. The lower the final temperature the better. It also shows that it is desirable to use high-quality coal—coal of high heat value. The lower initial temperature and the higher heat value of the coal, the more difficult it is to save coal, because under such conditions the efficiency of the boiler is already high.

The range of this chart is great enough to include most boilers. The efficiencies range from 50 to 100 per cent. The maximum temperature decrease is 200 deg. F., which is sometimes exceeded but seldom is an average decrease. Column G shows that the chart will compute savings all the way from 2 to 15 per cent. Should your problem be so unusual as to fall outside of this chart, which is improbable, recourse may be had to the formula which is given above.

DRIVING OUT TIGHT BUSHING

By C. Howard

A job came in the shop one day in which there was a bushing fittted in a blind hole very tightly. There was not enough space at the bottom of the hole to get a hook of sufficient strength to pull the bushing out. After several attempts had failed, a rod was turned to fit quite accurately into the hole. The hole was then filled with oil and the rod inserted and driven in against the heavy oil with a hammer. The pressure exerted was transferred to the inner end of the bush which was forced out with very little difficulty.

When using a vertical belt, have no more center distance than absolutely necessary—the weight of the belt reduces the efficiency of the drive.

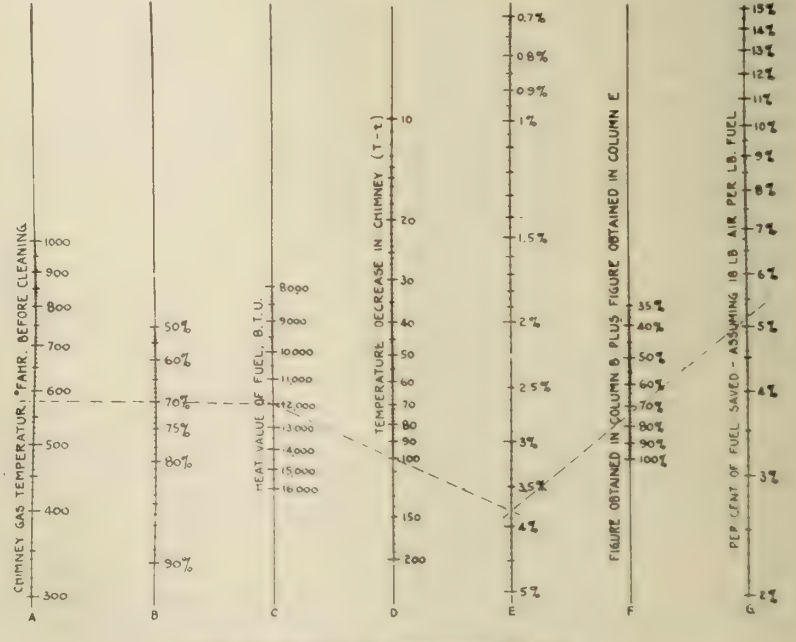


Chart for finding the consumption of fuel.

New Things in Shop Equipment

48-INCH PLATE SHEAR

An exceptionally large plate shear, designed for heavy duty, has been developed recently and placed on the market. It has a capacity for shearing 1 in. steel plate 48 in. in width. The shear is arranged for either motor or steam engine drive. The camshaft is 11 in. in dia. and is fitted with an automatic releasing clutch, either for stopping at every stroke or arranged for continuous operation. The machine has a weight of 55,000 lbs. It is manufactured by the Reading Foundry Co., Reading, Pa.

COMBINATION CLUTCH AND BRAKE

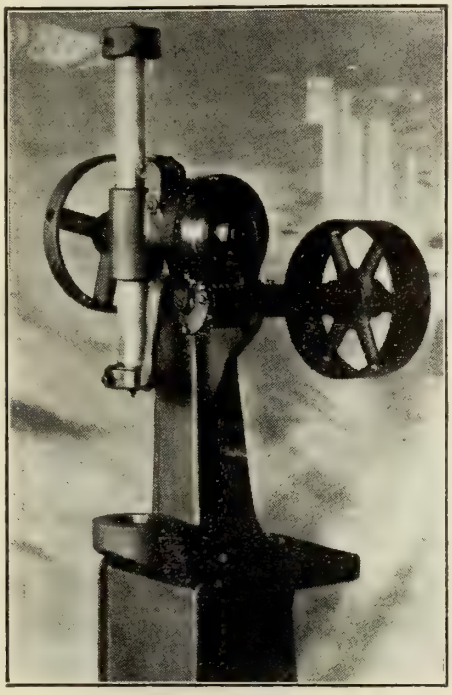
To facilitate the operation of tumbling barrels and guard against accident, a combination clutch and brake has been placed on the market. The device is of simple construction and controlled by a single hand-operated lever. The clutch is engaged by shifting the lever towards the mill, and when moved in the opposite direction the brake is brought into operation. The loading and unloading position is quickly obtained and the brake prevents possible creeping when recharging. Even when the barrel is unevenly loaded it cannot move when the brake is set. These devices are made by the Whiting Corp. of Harvey, Ill.

ELECTRIC GLUE POT

An automatically-controlled glue pot has recently been offered to the trade. The heating medium for the pot may be obtained from an electric lighting circuit by simply connecting and turning on the switch. The heat is maintained at a temperature ranging between 140 deg. and 150 deg. F. The proper degree of heat is assured without cooking or injury to the holding properties. The pot may be employed as a water bath or dry heat as desired, and may be adapted to the melting of such materials as wax, pitch, or other substances requiring a definite working temperature. The heating element is in the bottom of the pot but provision is made for protecting the bench from the heat. The temperature is controlled by means of a thermostat. The water pot is above the thermostat, and the glue container inside the pot. The glue container is of cast aluminum and fitted with lugs that prevent the floating of the inner vessel when only partly filled. A part of the bail extends across the top of the pot, which serves as a brush wiper. A temperature gauge is fitted to the pot. This device is the product of J. D. Wallace & Co., Chicago, Ill.

POWER BENCH BROACH PRESS

A machine, particularly designed for the broaching of small holes, has been placed on the market recently. The machine has a maximum stroke of 14 in.; develops approximately two tons pressure; will take work up to 6 in. in diameter; the table is bored 2½ in. diameter central with the rim; size of driving pull 10 in. diameter; 3 in. face. The power is transmitted through a steel worm and a bronze worm gear. The machine is fitted with an automatic stop and the movement of the ram is controlled by a positive jaw clutch, which is of steel and is hardened. The return movement of the ram is by means of a counter-weight. The machine also can be operated as a hand machine, the hand wheel having hollow spokes to receive a leverage bar. Height of the top of the work table to the floor is 36 in. The pedestal shown has an oil receptacle and this can be connected with an oil pump when required. Machine weighs approximately three hundred and fifteen pounds. It is made by the American Broach and Machine Co., Ann Arbor, Mich.



SENSITIVE DRILLING MACHINE

A new line of highspeed sensitive drilling machines, adapted to either bench or floor work, has been placed on the market recently. They are made with one, two, three or four spindles. The spindles are entirely enclosed by telescope sleeves to prevent oil from being thrown upon the work or on the operator. Norma ball bearings are fitted to the spindles which may be operated at a speed of 4,000 r. p. m., without shock or vibration. Independent ball bearings are provided for the driving pulley. All bearings are conveniently adjustable so as to maintain tightness and alignment in service. On the column type the table has a vertical movement of 30 in. and is counterbalanced inside the column. The table is accurately set to central position by means of a planed line on the column. The spindle head has a vertical adjustment of 6 in. When using chucks the machine has a capacity for drilling 5/16 in. holes. Larger holes may be drilled by using taper shanks directly inserted in the spindle. Rack movement of the spindle is 2-5/16 in., the reaction being taken by a concealed coil spring.

Driving belts are endless and tension regulated by moving the auxiliary countershaft. These machines are manufactured by the Sigourney Tool Co., Hartford, Conn.

CYLINDER BORING MACHINE

A portable machine primarily intended for reboring automotive cylinders, and known as the "Superior" re-boring machine, has been offered to the trade recently. It is of rigid construction and will economically handle any work within its range. The bed plate to which the cylinder is secured while being bored, is provided with two housings that carry the two stiff steel posts on which the cross rail is supported. The boring bar is held between two centres which retains it in accurate alignment when tools are working on hard or soft spots, ports and clearances. Supporting centres are of tool steel, tempered and round. The rigid construction of the cutter head assures accurate service when working on cylinders that are worn out of truth. The cutter head contains six inserted blades adjustable simultaneously by means of a hand wheel. All blades are made of high-speed drill rods and well tempered. The helix of the cutters resists the tendency to cut into the wall of the cylinder. Cutter heads provide a range of size from 2-13/16 in. to 4⅛ in. dia. A special arbor is supplied for setting the cylinder centrally with the cutter spindle. Four different feeds are available by means of a star wheel which may be set to engage with different rollers. Both star wheel and rollers are hardened. The driving motor is attached to the cross rail and gears are of helical design and hardened. These machines are made by the Production Machinery Co., Jackson, Mich.

KRITISCOPE FOR TESTING STEEL

An instrument for determining the critical point in steel has been developed and placed on the market recently. These points that occur when the part is being heated can be detected magnetically, as it is a characteristic in steel to lose its magnetism as soon as the lower point is reached and the rearrangement of the structure takes place. The critical point is indicated when a loss of magnetism is registered with the instrument in contact with the heated steel. When it is desired to make a test the tool is touched to the steel and then withdrawn slightly. If the bar or indicator remains in contact with the work, the latter is still magnetic and requires further heating. The part of the instrument that comes in contact with the heated steel is not a magnet, and can therefore be heated without danger. This indicating bar receives its magnetization by induction from a permanent magnet located within the body of the instrument. The magnet itself is protected from the heat by the walls of the body. The Kritiscope does not register the temperature of the furnace or the piece. The device does not require calibration and is not affected by vibration or rough handling. The instrument is self contained and the reading can be made quickly and directly to ascertain the condition of the steel and the proper time for quenching it. These instruments are made by Herman H. Sticht & Co., New York.

SPEED INDICATOR

A speed indicator that accurately determines and registers the revolutions of shaftings, motors, etc., in either direction, and measures both high and low speeds equally well, has just been placed on the market. The indicator registers up to 5,000 revolutions by every 5 revolutions, although speeds much faster than 5,000 r.p.m. can be very readily determined. The two arrows on the face of the dial indicate the figures to use for the different directions of rotation, eliminating any confusion. The figures showing through the small round windows on the dial read every 5 revolutions direct. The small inside dial reads every 100 revolutions. This dial is quickly turned to 0 for repeated use by the knurled knob on the back of the indicator. The fibre handle is especially shaped to fit the hand and the fibre is an insulation against electricity. The working parts are enclosed in a heavily dull-nickeled case. Three points are furnished as shown; a steel point for ordinary speeds and rubber points for high speeds. All projections, rough edges, and corners which might interfere with its ready use have been eliminated. It is a neat, light, and convenient indicator, easily handled.

This instrument is manufactured by the Brown and Sharpe Mfg. Co., Providence, R.I.

TAKE-UP WEDGE FOR HAMMER HANDLE

A tapered, threaded plug intended for retightening the handle in the head of impact tools, such as hammers, axes, hatchets, etc., has recently been placed on the market. The thread is of uniform pitch throughout its length and a slot is located on the large end for use of a screw driver. The design of the plug not only provides for tightening the handle when first inserted but provides an adequate means to maintain the firm setting almost indefinitely. When first placed in a hole is drilled and the screw driven in. Subsequent tightening is accomplished by a slight turn of the screw. This plug has been developed by Fayette R. Plumb, Philadelphia, Pa.

HACK SAW FRAME

A hack saw frame with the handle so positioned as to afford a comfortable grip has just been placed on the market by the Consolidated Tool Works of New York. The construction is said to provide for a powerful stroke without undue fatigue to the operator. The frame is made entirely of nickel-plated steel, with the exception of the wooden handle. The wing nut for tightening the blade is located at the handle end of the frame where it is out of the way. The blade may be placed to operate in any one of four directions.

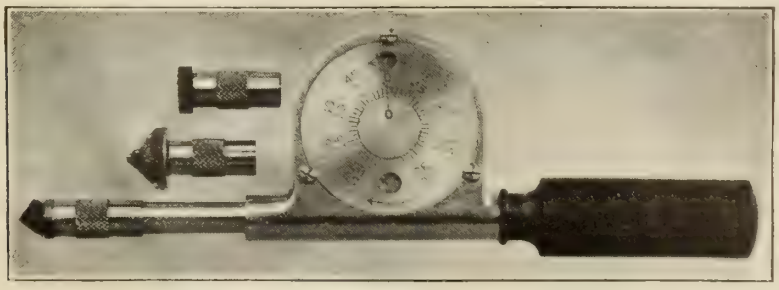
FLEXIBLE SHAFT COUPLING

A new type of flexible shaft coupling in the form of a machine cut spring has been placed on the market recently. The device is primarily intended for shafts up to one in. in dia. The body of the coupling is formed from a cylindrical tube of a quality of steel suitable for power transmission on account of its toughness and high elastic qualities. Hollow-head safety set-screws are employed for securing the coupling to the shafts. These couplings are especially adapted to direct connection on light-duty motors for driving small machines where shafts may be slightly out of alignment and it is necessary to reduce bearing friction and absorb shock. The coupling allows for both angular and parallel misalignment. However, shafts should be as nearly in line as possible. Larger couplings of similar design are also made. These are made of rectangular chrome-vanadium steel bars tempered to provide high elasticity. These coils are mounted, one within the other, on machine steel plugs. On the ends of the coil are shrunk steel headers, binding the parts into a continuous flexible unit. Flanges are attached by means of safety cap screws. These cut-spring flexible couplings are made by the Steel-Flex. Coupling Corp., Detroit, Mich.

LAYING-OUT AND DRILLING MACHINE

A machine intended for toolroom use in conjunction with Johansson compound slide and blocks, has recently been developed and placed on the market. It makes a complete laying-out and drilling machine for the spacing of holes in such work as dies, jigs, templates and master plates. One of the features of construction is the rigid arm extending below the point of the drill so that a bushing of the correct size for the drill can be located just above the surface of the work, thus preventing the drill from springing. The machine table is adjustable for height so that work of any size may be placed beneath the bushing. The head of the machine can be moved through 360 deg. The spindle housing and guide arm are cast integral, assuming accurate alignment. Guide bushings are lapped and ground concentric with the hole. Chrome-nickel ball bearings are provided on spindle and pulleys. A compensating spring idler is fitted to machine to maintain a uniform belt tension. Speeds range from 400 to 4,300 r.p.m. By using a single lip cutter, the machine can be adapted to routing or milling. The head may be disconnected and attached to the column of a milling machine in a few minutes. In drilling small holes in jig or tool work, any number of holes may be accurately drilled by use of the Johansson blocks. The machines are made by E. L. Krag and Co., Chicago, Ill.

Elevator lubrication is considered by many authorities to be a lubricating problem in itself. Few other types of machinery involving the same mechanical principles operate under such severe conditions, where starting and stopping is continuous and generally under heavy load. Especially does this hold true in the electric geared traction machine where the worm has to exert a starting torque approximately three times the normal, doing this when the oil has probably been entirely squeezed out from between the worm and gear.—Lubrication.



Direct Reading Speed Indicator.

CANADIAN MACHINERY
AND MANUFACTURING NEWS

Published in the Interests of the Machinery, Manufacturing, Iron, Steel, and Metal Working Industries.

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Important Export Prospect

THERE IS marked improvement in trade between Canada and Australia and New Zealand. A preferential tariff arrangement is now proposed which will further develop trade relations. The motor car industry seems to have derived the greatest benefit from the activity in this direction. There is no doubt that the move to establish greater trade intimacy with these colonies will be closely watched by American firms and tend to strengthen whatever inclination they may have to locate their exporting plants in Canada. A large demand for cars for Australia already exists, and business of this kind encourages the feeling that other lines, particularly products of iron and steel, can be equally successful. There is some movement in agricultural implements, although reports indicate that Australians have developed an industry of this kind and it has now to be demonstrated whether it can compete with import lines. Hardware, small tools and machine tools have an opportunity in this field and there is no doubt that manufacturers are keen on the prospect.

Given favorable bases for trade, an important factor in its growth will be regular shipping facilities. In this connection an exclusively Canadian service will undoubtedly prove of great value.

For Better Cost Accounting

IN A RECENT talk to business men, a banking authority dealing with information secured in an investigation of industrial accounting methods, declared that it was as surprising as it was deplorable that so many concerns with promising futures, had not equipped themselves properly in the methods of correct cost accounting. In many cases, it was found that the system in use was that which had been employed in the early stages of the business and had become inadequate.

It may be argued that a system that had answered the purpose during periods of growth could hardly be criticised at the present time when operations were running below normal. So long as manufacturers are satisfied that their equipment in this respect is the best available for the purpose, there is nothing more to be said, but where they sense the fact that the matter should have their attention and that greater efficiency is easily possible, they cannot afford to allow the matter to slide. There is sometimes a reason behind assertions that So-and-Co does not know what it is costing to run his business. He may have a very definite knowledge, if he has been in business for any length of time, but the point is to make the most profitable use of that knowledge.

A series of articles on cost accounting was begun in this paper with the issue of Nov. 9. They are prepared by a practical accountant engaged in the office of a machine tool manufacturer and should prove of great practical value. Discussion or suggestions upon the subject are welcomed.

May Encourage Relative Attitude

WHILE THERE appeared to be no outstanding national issues involved in the recent American elections, the result is not without interest to the Canadian manufacturer. The Republicans suffered a decided slump, and it was not altogether unexpected. Recent utterances by American business men indicated that the ship of state was not being handled to the entire satisfaction of industrial interests by the Harding administration.

The great showing made by the Democrats may be attributed largely to the cumulative pressure of so-called local questions. The current appeared to run strongest when high tariff policies threatened industrial prospects. New York State was an illustration of this. Here Governor Miller, who was big enough to be mentioned as a presidential prospect, was defeated by Al. Smith, a former governor.

It is claimed that the larger industrial interests have not been pleased, either on the tariff policy of the government, or on its attitude in international affairs in general. There seems to be some feeling that while it may be good business to avoid entangling alliances abroad, it is equally good business to discourage the development of what is described as an extreme insularity. While it was claimed on one hand that desirable goods always found a market, it seems to have become equally evident to economists on the other side that, in present conditions of world affairs, selling without buying, in outside trade, was out of the question. World intercourse, on a profitable basis, can hardly dispense with inter-responsibility. This question, in its national aspect, did not have the same local bearing or appeal as other matters such as labor, prohibition, soldiers' bonus, and transportation, but there is reason to believe that it has been the subject of serious thought by men of world outlook.

One thing may come of the election; it may demonstrate to the Harding administration the advisability of the same sympathetic relative attitude that worked so satisfactorily during the disarmament conference.

"THERE never was a time when business newspapers could do a better stroke for the world than they can to-day by bringing it home to their readers and the great public that all the peoples profit by the peace and prosperity of each other. They are the most practical of internationalists and through the sensitive machinery of the market can estimate from day to day the reactions of policy and the supreme value of a settled order in the relations of states. They, better than anyone else, can realize the fallacy of the view on which nations have too often acted that what is one nation's gain must be another's loss. The world as we see it to-day is largely what politicians and statesmen have made it. Is it not time for the business man to take a hand?"—C. P. Scott, Editor, "Manchester Guardian."

Canadian Furnaces Drop Pig to Meet Competition

Domestic Metal Reduced $2.50—Better Than Buffalo Price—English Iron Covers Eastern Demand for Time—Record Ingot Production—Using Canadian Cars to Solve Shortage

THAT production of steel ingots for the present year will surpass that of last year by 75 per cent. and that of the two largest tonnage years before the war, 1912 and 1913, by 10 per cent. seems evident, according to reports from Pittsburgh. Should production continue during November and December at the October rate, the year's ingot production will be close to 34,000,000 tons, or 76 per cent. of estimated capacity.

High cost of material is now the important item in production, not only in the United States but also in Canada. Coal and coke are still high. For example, Pittsburgh quotes Connellsville coke at $7 to $7.50 as against an average of $3 in January and February. In this region there has also been a wage advance of 40 per cent.

There is much talk of car shortage and cases are known in which, to secure a supply of much-needed material, Canadian mills have made Canadian cars available to American roads. In one case, in the past few days, a whole train of cars was offered with the understanding that they might be used for ore from Ashtabula to Pittsburgh. However, in this instance, the cars might have solved the difficulty, but there was a shortage of the material required. While the car supply in Canada is none too sufficient, it apepars that the railroads are in a position to co-operate with influential customers.

While pig iron production was at a very low rate in April there has been an improvement to a basis of 70 per cent. of capacity. Customers, however, are buying only for pressing requirements as there has rarely, if ever, been a time when it was plainer that recessions in pig iron prices are expected. In order to meet the reduced prices of Buffalo furnaces domestic furnaces announce a drop of $2.50 per ton. This brings the Canadian market price down to $33.80. This compares very favorably with the Buffalo figure of $29 for 2x foundry iron. The Canadian buyer must add to this a sales tax of 3¾ per cent.; duty $3 80 per gross ton and freight of $3.30, a total of $7.10. This, added to the new Canadian figure, makes domestic pig a far more attractive proposition. The market, however, is not strong. In the East, there has been considerable buying of English pig iron for temporary requirements.

In non-ferrous metals, tin at present holds the spotlight by reason of the rather bullish tendency of the British market. Speculation has sent prices to high levels and, in spite of frequent fluctuations, these are being fairly well maintained. The Canadian price ranges from $40 to $41.

Wholesalers of ingot metals are preparing to protest to Ottawa because of what they consider an unfair distribution of sale tax. They point out that under the present arrangement there is an import tax of 3¾ per cent. and a resale tax, from wholesaler to manufacturer, of 2¼ per cent. But the large manufacturer finds that he can save the latter sales tax by buying direct from the manufacturer. This cuts the dealer out of the best part of his business and leaves only that part which has to do with the small foundries who cannot afford to carry stock. Another fine point and one that appears difficult to understand is, that scrap material sold from a manufacturer to a wholesaler for re-conversion into briquette or ingot form, carries a sales tax, while material purchased from a public utilities company is tax free. The ruling in the matter is that the latter has reached the ultimate consumer while the former has not. Ottawa, it is said, will shortly learn something about the problems of the metal business.

There is a strong demand for boiler tubes. The market for sheets is much easier, owing to large supplies coming from British mills.

Toronto

November 15

WHILE iron and steel markets are operating along lower levels at present, than in September and October, demand seems to be fairly steady. It will justify the conclusion that business improvement has been encouraging since the first of the year. There were unsettling influences but these seem to have had no fundamental effect. This is a good sign and indicates that the demand was based on actual industrial requirements rather than on speculative prospects. There has been definite reason behind all buying movements, even though this has resulted frequently in that conservative process known as buying from hand to mouth. Building operations, however, have accounted for a fair growth, and explain the somewhat active market in structural material up to the beginning of the present month, when there was a seasonal decline. The motor car industry has also been a strong department, and while the placing for next season's requirements has been a little backward, steel interests state that a slightly higher tonnage than was called for last year is indicated. Competition in the cheaper cars is developing a keen edge and it is predicted that car prices will reflect every advantage on raw material that the market can offer.

Iron and Steel.—A very quiet market in steel sheets is reported. There is almost an over supply on certain items, due to some extent, to imports from British mills. Dull Canada plates are an example. It is stated that supplies that should have been here three months ago are now available, and this has made for a very easy market. The same applies to other lines of sheet steel. The market is exceptionally well covered and prices are off from the levels of a month ago.

Boiler tubes have an active demand at the present time, and prices are firm, as a rule, but there are cases when competition is said to have caused a break away from stable quotations. For example, one dealer quoting $29 on a three-inch lapweld was confronted by the fact that a competitor had quoted $3 better, and had announced that it was their policy to quote easier prices at this time of year. The natural conclusion is that there are much heavier stocks in some quarters than in others. When conditions such as described exist, it is also responsible for the tendency on the part of buyers to bargain or dicker for what they suppose to be an advantageous price. As a rule, however, the average price from month to month represents a fair degree of stability as compared with base quotations. Current iron and steel quotations:

Iron bars	3 25	3 40
Steel bars	3 25	3 40
Reinforcing bars	3 15	3 25
Steel hoops		4 75
Tire Steel		3 50
Spring steel	7 00	14 00
Band steel, No. 10 gauge and 3-16 in base		3 90
Small shapes		3 50
Sheets, black, No. 28		5 10
Sheets, blue ann., No. 10		4 20
Canada plates, dull, 52 sheets		4 90
Canada plates, all bright		5 40
Galvanized Sheets, No. 28		6 25

Pig Iron.—Another reduction in the domestic price of $2.50 brings the price from $36.30 to $33.80. Easier quotations by Buffalo furnaces are the cause, largely, and at present figures domestic furnaces are well below the so-called nominal of $29 at Buffalo. When sales tax of 3¾ per cent., freight $3.30 and duty of $2.80 per gross ton, a total of $7.10, are considered, the concession represented in the new figure is obvious. Eastern foundries are reported to have stocked up with British pig, although it is evident that there will be a certain

amount of domestic iron in constant demand in order to ensure proper mixtures.

Non-Ferrous Metals.—Tin is still a centre of considerable speculative interest. There has been some fluctuation, but advances have been fairly well maintained and may go higher. Copper is quiet, lead prices remain firm and zinc markets continue to show strength.

A movement is developing among dealers in ingot metals to strengthen their protest to the government in connection with what they claim to be an unjust distribution of the sales tax. These dealers perform a useful purpose by carrying stock for the small foundry which cannot afford to tie up money in large stocks and hence buys as he requires. They also supply large manufacturers, and during the war were the sources of supply to many firms who could not adjust their credits to the carrying of heavy tonnages in these materials. Under the present arrangement of the sales tax, there is an import tax of 3¾ per cent. and a resale tax, from dealer to manufacturer, of 2¼ per cent. But the large manufacturer finds that he can import direct and pay only one tax, and that he can save the dealer's profit, which, however, is a very small percentage. Thus, the wholesaler loses most desirable business and is confined to small foundries. Many of these find that they cannot very well compete with the larger man who can afford to carry stocks of ingot metal.

Another fine point, and one that is hard to understand about the tax law is, that scrap sold from a large manufacturer to a wholesaler carries with it a sales tax, while scrap purchased from a public utilities company carries no tax. The ruling is that such material must carry a tax until it reaches the ultimate consumer. When he rejects it as scrap, it escapes taxation. These are hair-breadth distinctions and have added to the hazards of the metal business to such an extent that there are those who consider the advisability of stepping out. It is felt that transactions involving the junk dealers or small wagon dealers would show some very liberal interpretations of the tax laws. Large metal men are carrying their grievances to Ottawa, where there does not seem to be a very practical knowledge of the metal business among so-called tax experts.

Current prices on non-ferrous metals:

Lake copper	17 25
Electrolytic copper	17 00
Castings, Copper	17 00
Tin	41 00
Lead	7 50
Spelter	9 50
Antimony	8 50
Aluminum	22 00

Old Materials.—There is a lack of activity in this department which, in a sense, is explained by the pig iron situation. There has been little market in the latter pending an expected price adjustment, hence furnaces maintain that there must be a drop in scrap. The dealers in this material have been holding firm, but there may be a slight concession at an early date. The entire list seems to be at a standstill, with very light offerings or demand. Dealers' average buying prices:

Copper, light	9 00
Copper, crucible	11 50
Copper, heavy	11 50
Copper wire	11 00
No. 1 composition	9 00
New brass cuttings	7 00
Red brass turnings	7 00
Yellow brass turnings	5 25
Light brass	4 50
Medium brass	6 00
Scrap zinc	3 50
Heavy lead	4 50
Tea lead	3 00
Aluminum	11 00
Boiler plate, per gross ton	9 00
Heavy melting steel	10 00
Axles (wrought iron)	20 00
Rails (scrap)	11 00
Malleable	10 00
No. 1 machine cast iron	18 00
Pipe, wrought	7 00

Copper and brass products indicate a fairly strong market. While this is a department of industry which as a rule, has to do with such lines as chemical equipment, fire extinguishers, etc., the Christmas season opens up a demand in other directions and this explains a certain activity at the present time. Sheets and tube prices are firm, but there is some difficulty in securing supplies.

Machine tool manufacturers and dealers report good enquiries but no marked development in actual business. There has been sufficient in all lines, however, to warrant improvement in the staffs at many of the shops and the general feeling is that business tends toward a better record than earlier in the year.

Montreal

November 15

NO CHANGE in prices is reported this week and orders continue to come out for general steel commodities in a satisfactory manner and quite as good as during the last two months.

Iron and Steel.—Notwithstanding reports to the effect that railroads are getting the better of the car shortage, the difficulties of obtaining supplies from American suppliers are becoming severe. Embargoes are in effect in all directions and it is with the utmost difficulty that permits can be obtained for the forwarding of shipments. No relief is promised until a plentiful supply of suitable equipment is released from coal traffic. The result is that many commodities which are dependent upon American suppliers are becoming scarce in warehouses and manufacturers are having a hard time of it in obtaining delivery of sufficient supplies to satisfy their needs. Current prices:

Iron bars, base	3 15 to 3 25
Steel bars, base	3 15 to 3 25
Reinforcing bars, base	3 15 to 3 25
Steel hoops	4 00
Tire steel	3 25 to 3 40
Spring steel	7 00
Band steel, No. 10 gauge and 3-16" base	3 65 3 75
Small shapes	3 40
Sheets, black, No. 28	4 75
Shets, blue, ann., No. 10	4 10
Canada plates, dull, 52 sheets	5 50
Canada Plates, all bright	7 00
Galvanized Sheets, No. 28	6 50

Pig Iron.—A reduction of $2.50 per gross ton has been brought about by the necessity of Canadian furnaces meeting the downward trend of prices in the United States, more particularly those in the Buffalo district. In this district the foundry trade, shows no improvement, manufacturers of specialities being the only purchasers of any considerable tonnage.

"This reduction," a dealer states, "will not be felt in the East, however, as there is still a difference in favor of Scotch iron and consumers here have covered for their requirements over the next few months. The large recent importations of Scotch and English iron, together with tonnage still to arrive by the last direct vessels, presently, will provide a supply sufficient to cover the needs of local foundries well into the winter. It is now much easier to obtain supplies of foundry coke and the price has dropped off considerably. A difference of $3 to $4 per ton has been noted this week." Current prices:

Algoma, No. 1, car lots on tracks, nominal quotation		36 15
Summeriee, 30-ton lots, dock	35 00	
Carron, 30 ton lots	35 00	
Do., 5 ton lots, ex. warehouse	40 50	

Non-Ferrous Metals.—Commenting on prevailing conditions, the British Metal Corporation (Canada) Limited, have this to report:—

Copper.—Copper seems to have settled around 13⅞c. Domestic enquiry in the States continues fair, but there has been a large falling off in demand for export. This can be accounted for by the recent heavy depreciation of French and German exchange.

Tin.—Prices on the London market have fluctuated considerably; the opening of the week saw a new high for the year of £187-7-6, but this level was not maintained and the close was at £184-2-6 for spot and £184-15-0 for forward. Fluctuations are bound to occur on a rising market with a speculative element and though the close is lower than the opening there is a net gain over last week and the upward movement is therefore still maintained. As to the future, if optimism can be counted a gauge, prices should go still higher. Whether the grounds for this optimism are well founded or not, is another matter and on the face of the situation, it is difficult to see on what basis the "bulls" are working.

Lead.—There is no new feature of note and indications seem to point to a firm market for some while yet.

Zinc.—The London market has been very firm and good quantities have been bought on this side, thus strengthening the American market. Zinc stocks in England are negligible, so much so that it is becoming a costly business for "Shorts" to cover spot metal. Current local prices:—

Lake Copper	17 50
Electrolytic Copper	17 25
Castings, Copper	17 00
Tin	40 50
Lead	7 50
Spelter	6 50
Antimony	7 50
Aluminum	22 00

Pittsburgh

November 15

PRODUCTION of steel ingots by the 30 companies which make monthly returns to the American Iron and Steel Institute was 2,871,415 gross tons in October, against 2,373,779 tons in September, showing an increase of 21 per cent., the months having the same number of working days.

Allowing for the producers not making monthly returns, October production by the whole industry was at the rate of 40,000,000 tons of ingots a year, or about 76 per cent. of estimated capacity, which is a trifle above the estimates made during the month. However, October, on account of weather conditions, is usually a month of production above the average, while the midwinter and midsummer months run below, hence the probability is that hardly as much as 76 per cent. of the productive units were actually engaged.

There has been, not merely a recovery from the curtailment in production produced by the coal strike, but a further gain, since the October production was at the highest rate since October, 1920. June, the best previous month this year, was beaten by 9 per cent. Should production continue during November and December at the October rate, which is somewhat improbable, the year's ingot production would be close to 34,000,000 tons. This would be 75 per cent. above the output in 1921 and more than 10 per cent. above the output in either 1912 or 1913, by far the two biggest tonnage years before the war.

Costs Still High

Steel mills find no difficulty in operating now, as regards supplies of coal and coke, and railroad movement of same, except for the very high cost. Connellsville coke, although it has declined in the past week, is $7 to $7.50 against an average of $3 in January and February. There has been a wage advance of slightly more than 40 per cent. in the Connellsville region. Pittsburgh district coal is $3.25 to $3 50 for steam, $3.75 to $4.00 for by-product and $4.50 for gas, against free offerings before the strike at $2.25, and some sales at less than $2. There has been no wage advance in that direction, the remarkable thing being that the old wage scale was continued.

Labor shortage at steel mills is still talked of, but does not seem to be as serious as a month or two ago, and the advent of winter weather, curtailing outside operations, will no doubt give the mills and furnaces a still better supply.

There remains much talk of car shortage. Mills have to make great efforts to secure enough cars for shipping finished product, but they are succeeding, as shipments are fully equal to production while the moderate accumulations of steel that developed when the car situation was at its worst are gradually being reduced.

Supplies of finished steel products reaching jobbers and manufacturing consumers are apparently adequate except in the case of butt weld merchant pipe, both black and galvanized. In these lines there is much pressure upon mills for heavier deliveries, and mills would probably produce more if they could secure more cars.

Pig Iron Production

Production of pig iron was down to 25,000,000 tons a year at the end of August, the lowest rate since April 1, while the rate now is about 32,500,000 tons, or between 70 and 75 per cent. of capacity. Current production appears to be adequate for present requirements, as some of the steel interests are offering pig iron in the open market, either openly through their own sales offices, or quietly through merchant firms, while the regular merchant blast furnaces can only occasionally effect sales of any size, consumers being apparently fairly well taken care of by stocks and by deliveries against old contracts. Consumers would, of course, buy only for pressing requirements as there has rarely if ever been a time when it was plainer that pig iron prices were in a recessive mood. Prices have declined only slightly from the peak, which was produced by a famine in fuel due to the coal strike. Taking an average of all prominent grades in the chief districts, pig iron prices are about $11 a ton or more than 50 per cent. above their average in the first three months of the year, before the coal strike. Meanwhile there have been reductions in freight rates, for which the furnaces were clamoring, and wage advances. The latter more than offset the former but the difference is only a few dollars a ton.

The valley market is quotable at $32 for Bessemer, $29 for basic and $29 for foundry, with $1.77 freight to Pittsburgh, Bessemer and foundry being down $1 a ton from last week. The market is stagnant, and prices would probably decline more rapidly if there were enough inquiry to produce active competition.

Coke Declines

Connellsville coke has suffered another break but is of course very high still. Furnace is off about 50 cents and foundry coke $2, in the week, furnace now being $7.00 to $7.50 and foundry $8 00 to $9.00, according to brand. Production has been increasing continuously, but the rate of increase has been somewhat less in the past two or three weeks than formerly. Most of the furnaces now in operation that depend on purchased cokes are covered more or less fully to the end of the year on contracts at about $8.00. On this account, and because the furnaces have considerable tonnages of pig iron to deliver to the end of the year on old sales they are not especially anxious to see either coke or pig iron prices decline. Some eastern furnaces, now idle, have intimated to coke operators that a $6 coke price would interest them. Operators consider $6 out of the question at present, as they can do better selling by-product coal.

Steel Market Quiet

The whole finished steel market is very quiet. There is little demand for prompt shipments since buyers have been receiving heavy deliveries lately on their old purchases, while there is not much buying for the new year. In bars, shapes and plates, now $2, as against $1.35 at the low point early in March, buyers naturally expect a considerable decline. In pipe, sheets and wire products advances were much more moderate and declines are hardly to be expected.

Steel Corporation Tonnage

The United States Steel Corporation's unfilled obligations stood at 6,902,287 tons at the end of October, equivalent to nearly six months of production at 75 per cent. of capacity. The business is not, of course, equally distributed in the different lines. Independents on an average have much leaner order books and some will probably be energetically seeking business within the next few weeks, making price an inducement if necessary. Having been hampered in their operations so long by the coal strike and transportation conditions, these mills are indisposed to allow lean order books to stand in the way of their operation.

The Steel Corporation's unfilled obligations increased by 173,944 tons in August, 741,502 tons in September and 210,680 tons in October. The September and October increases were due chiefly, probably wholly, to the large business done in rails and track supplies. Nominally this business was closed in September, as the rail price advance that caused the business to be placed became effective October 1, but practically some of the tonnage was not formally entered until October.

ELECTRIC FURNACES

Criticism of the electric furnace sometimes arises from wrong working, and this point is emphasized by several writers recently. For instance, says the Practical Engineer, it is pointed out that lack of adequate knowledge of the operations involved, have in many instances led to abuse of the electric furnace, and that certain mechanical and electrical weaknesses have jeopardised the successful operation of many furnaces. This leads to the proposition that properly made electric steel is superior to other grades of steel, as close control of the elements produce a product of chemical purity with great density and good physical properties. Competent control is not the only factor in the case. Consideration should be given to the cost of electricity, amount of power available, position for freights, costs of labour, &c. Records should be kept of units consumed per ton of steel produced, raw materials, refractories consumed, wear and tear on moulds and other operating details.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Toronto price:—

Silicon, 2.25% to 2.75%	$33.80
Algoma, No. 1, Montreal	36 15
Summerlee, Scotch, Montreal dock	35 00
Summerlee, Warehouse, 5-ton	40 50
Carron, Montreal docks	35 00
Grey forge Pittsburgh	30 77
Lake Superior, charcoal. Chicago	36 15
Standard low phos., Philadelphia	38 00
Bessemer, Pittsburgh	34 27
Basic, Valley furnace	29 00

METALS

	Montreal	Toronto
Lake copper	$17 50	$17 25
Electrolytic copper	17 25	17 00
Castings, copper	17 00	17 00
Tin	40 50	41 00
Spelter	9 50	9 50
Lead	7 50	7 50
Antimony	7 50	9 00
Aluminum	22 00	22 00

Prices per 100 lbs.

BILLETS

F. O. B. Pittsburgh

	Per gross ton
Bessemer billets, 4 in. x 4 in. and larger	38 00
Open hearth billets	38 00
O. H. Sheet bars	38 00
Forging billets	45 00
Bessemer rods	46 50

IRON AND STEEL

Per 100 lbs. to large buyers

Iron bars, base, Toronto	$3 25	3 40
Steel bars, base, Toronto	3 25	3 40
Small shapes, base		3 50
Iron bars, base, Montreal	3 15	3 25
Steel bars, base, Montreal	3 15	3
Reinforcing bars, base	3 15	3 40
Steel hoops		4 50
Tire steel, base		3 50
Spring steel	7 00	14 00
Band steel, No. 10 gauge and 3-16 in. base		3 90
Chequered floor plate ¼" and heavier	6 25	7 00
Chequered plates ¼-in. and heavier, sunken diamond		5 40
Bessemer rails heavy at mill		2 35

PITTSBURGH MILL

Steel bars	2 00
Tank plates	2 00
Structural shapes	2 00
Steel hoops	2 90 to 3 00

F. O. B. Chicago Warehouse

Steel bars	2 80
Structural shapes	2 90
Plates	2 90
Small shapes under 3-in.	2 90

PLATES

	Montreal	Toronto
Plates 3-16 in.	$3.85	$3 60
Plates, ¼ up	3 50	3 40

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$ 4 75	$5 10
Sheets, blue ann., No. 10	4 10	4 20
Canada plates, dull, 52 sheets	5 25	4 90
Can. plates, all bright	6 50	5 40
Galvanized sheets, No. 28	6 75	6 25
Queen's Head, 28 B.W.G.	7 25	
Fleur de Lis, 28 B.W.G.	7 00	
Gorbal's best, No. 28, U. S. G.	6 10	
Colborne's Grown, No. 28		
Premier 28	6 10	6 35
Premier 10¾ oz.	6 80	6 75
Zinc sheets	9 75	10 25 11 00

FREIGHT RATES

	Per 100 lbs. C.L.	L.C.L.
Pittsburgh to Following Points		
Montreal	52	65½
St. John, N. B.	76	96
Halifax	77½	97
Toronto	34	48½
Guelph	34	48½
London	34	48½
Windsor	31½	45½
Kingston	48½	61

OLD MATERIAL

Dealers' Average Buying Prices

	Montreal Per Ton	Toronto Gross
Boiler plate	$ 9 00	$ 9 00
Heavy Melting Steel	10 00	11 00
Axles (wrought iron)	20 00	16 00
Rails (scrap)	11 00	11 00
Malleable scrap	10 00	11 00
No. 1 Machine cast iron	22 00	18 00
Pipe, wrought	7 00	6 00
Car wheel	17 00	16 00
Steel axles	15 00	15 00
Mach. shop turnings	4 00	6 00
Stove plate	16 00	14 00
Cast boring	4 00	6 00
Copper, light	9 00	9 00
Copper, crucible	11 50	11 50
Copper, heavy	11 25	11 25
Copper, wire	11 25	11 00
No. 1 machine composition	9 00	9 00
New brass cuttings	6 00	7 00
Red brass turnings	6 50	7 00
Yellow brass turnings	5 25	4 85
Light brass	4 50	3 50
Medium brass	6 00	4 50
Scrap zinc	3 50	4 00
Heavy lead	4 50	4 50
Tea lead	3 00	3 00
Aluminum	11 00	11 00

COLD ROLLED STEEL

(At Warehouse)

Rounds and squares	$4 75 base
Hexagon and flats	$5 75 base
Cumberland ground shafting, base	$6 00 base

COPPER PRODUCTS

Prices per lb.

	Montreal	Toronto
Copper bars, 1¼ to 2 in.	30-31	.28
Plain sheets, 16 oz. in. 30 x 72 hot rolled	31-32	.29
Copper sheet, tinned, 16 oz.	36 00	.36
Copper sheet, planished, 16 oz. base	40 00	.46
Braziers', in sheets, 6 x 4 base	.30	.29
Copper tubing, seamless		.33

LEAD SHEETS

Roll Lot Prices

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$9 65	$10 50
Sheets, 3½ lbs. sq. ft.	9 55	10 50
Sheets, 4 to 6 lbs. sq. ft.	9 40	9 50
Cut sheets, ¾c. per lb. extra		
Cut sheets to size, 1c. per lb. extra		

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in.	22
Brass sheets, 24 gauge and heavier base	25
Brass tubing, seamless	30

WROUGHT PIPE

Price List No. 56. August 23, 1922.

Standard Buttweld Pipe S/C

Size	Steel Blk.	Steel Galv.	Gen. Wrot. Iron Blk.	Gen. Wrot. Iron Galv.
⅛ in.	6 00	8 00	....	....
¼ in.	3 96	6 00	7 20	9 30
⅜ in.	3 96	6 00	7 20	9 30
½ in.	5 02	6 55	7 31	8 93
¾ in.	6 10	7 82	8 86	10 70
1 in.	8 50	14 22	12 58	15 30
1¼ in.	11 50	15 18	17 02	20 70
1½ in.	13 75	8 15	20 35	24 75
2 in.	18 50	24 42	27 38	33 30
2½ in.	29 25	38 61	....	....
3 in.	38 25	50 49	....	....
3½ in.	49 68	64 40	....	....
4 in.	58 86	76 30	....	....

Standard Lapweld Pipe S/C

Per 100 feet.

Below dividing line—price per foot.

Size	Steel Blk.	Steel Galv.	Gen. Wrot. Iron Blk.	Gen. Wrot. Iron Galv.
2 in.	22 20	27 75	31 08	37 00
2½ in.	32 76	41 54	46 80	56 16
3 in.	42 84	54 32	61 20	73 44
3½ in.	50 60	66 24	72 68	89 24
4 in.	59 95	78 48	86 11	105 73
4½ in.	68 58	87 63	1 04	1 24
5 in.	79 92	102 10	1 21	1 45
6 in.	1 04	1 32	1 57	1 88
7 in.	1 38	1 79	2 02	2 45
8L in.	1 45	1 88	2 13	2 58
8 in.	1 67	2 16	2 45	2 97
9 in.	2 04	2 62	2 97	3 59
10L in.	1 89	2 43	2 75	3 33
10 in.	2 43	3 13	3 54	4 28

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4-in. and under, close and short, 55 per cent.

4½-in. and larger, close and short, 45 per cent.

4-in. and under running thread, 35%.

Standard couplings 4-in. and under 25%.

Do., 4½-in. and larger 5 per cent.

MALLEABLE FITTING LIST

1 in. elbow	.32	.53
2 in. elbow	1.05	1.70
1 in. tee	.43	.70
2 in. tee	1.45	2.40
1 in. coupling R. & L.	.33	.53
1 in. locknut R. & L.	.15	.23

Discount to dealers—70 per cent.

BOILER TUBES

Sizes	Seamless Lapw'ld Toronto	Seaml'ss Lapw'ld Montreal	
1 in.	20.00	20.00	....
1¼ in.	22.00	22.00	....
1½ in.	24.00	21.00	....
1¾ in.	24.00	24.50	24.00
2 in.	22.00	19.00	21.00	19.75
2¼ in.	24.00	21.50	24.00	22.25
2½ in.	27.00	23.50	27.00	23.25
3 in.	34.00	28.50	34.00	29.50
3¼ in.	36.00	....	36.00	....
3½ in.	38.00	33.00	38.00	34.25
4 in.	50.00	42.00	49.00	43.50

Prices per 100 ft., Montreal and Toronto

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, 7-16 and up	30
Carriage bolts, ⅜ in. and smaller 6 in. and shorter	40
Coach and lag screws	45
Stove bolts	72½
Wrought Washers	60
Do., corru. head	60
Machine bolts, 7-16 and over	35
Machine bolts, ⅜-in. and less	35
Blank bolts	35
Bolt ends	35
Machine screws, fl. and rd. hd., steel cut thread	37½ & 10
Machine screws, o. and fil. hd., steel cut thread	30
Machine screws, o, and fil. hd., brass cut thread	15
Standard couplings, 4-in. and under, brass cut thread	30%
Nuts, square, blank off net list	$1.00
Nuts, square, tapped off net list	50c.
Nuts, hex., blank off net list	50c.
Nuts, hex., tapped net list	
Copper rivets and burrs, list less	32c.
Burrs only, list plus	10%
Iron rivets and burrs	47%
Boiler rivets, base ¾ in and larger	$5.75
Structural rivets, as above	5 65
Wood screws, O. & R., bright	80
Wood screws, flat, bright	82½
Wood screws, flat brass	77½
Wood screws, O. & R., brass	75
Wood screws, flat, bronze	72½
Wood screws, O. & R., bronze	70

NAILS AND SPIKES

Wire nails, base	$3 65
Cut nails, base	4 35
Miscellaneous wire nails	72½%

MILLED PRODUCTS

(Prices on unbroken packages)

Set screws	65
Square and hexagon head cap screws	60
Round head cap screws	20
Fillister head cap screws	35
Flat head screws	25
Button head cap screws	20
Studs	45
Semi-finished nuts up to and including 9/16 in.	70
Semi-finished nuts ⅝ to 1¼ in.	65
Semi-finished nuts 1⅜ to 2 in	35
Coupling bolts	35
Taper pins, up to and including No. 5	65
Taper pin No. 6 and over	55
Planer bolts without fillet	10
Planer bolts with fillet	Net
Patch bolts	Plus 10%
Hollow set screws	20
Thumb screws	50
Thumb nuts	70

CARBON DRILLS AND REAMERS

	Discount.
S. S. drills, wire size	60
Can. carbon cutters	plus 10
Standard drills, all sizes	60
3-fluted drills, plus	10
Jobbers and letter sizes	60
Bit stock	50
Ratchet drills	25
S. S. drills for wood	10
Wood boring brace drills	50
Electricians' bits	30
Sockets	50
Sleeves	30
Taper pin reamers	20
Drills and countersinks	20
Bridge reamers, carbon	30
Centre reamers	Net
Taps, machine screw	55 to 60
Taps, hand, ¼ in. to ⅜ in	40 to 45
7/16 in. to. ⅝ in.	40 to 50
11/16 in. to 1 in.	35 to 45
Chucking reamers	20 off
Hand reamers	20
High speed drills, list	40
Can. high speed cutters	plus 10
American	plus 40

FILES AND RASPS

Globe	60/5
Vulcan	50
P. H. and Imperial	60
Nicholson	35/5
Black Diamond	35/5
Heller	40
Jowitts	net
J. Barton Smith, Eagle	55
McClelland, Globe	50
Delta Files	20
Disston	40
Disston	50
Great Western-American	50
Kearney & Foote, Arcade	60/5

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

PROOF COIL CHAIN
B. B. B. CHAIN

⅜ in., $16.45; 7-16 in., $14.00; ½ in., $12.95; 5-8 in., $13.15; ¾ in., $12.75; ⅞ in., $12.25; 1 in., $11.85; 1⅛ and 1¼ in., $10.55. Fire weld chain same sizes respectively are $14.00; $11.50; $10.40; $10.55; $10.15; $9.75; $9.35; and $8.25.

ELECTRIC WELD COIL CHAIN B.B.B.

⅛ in. $20.00; 3-16 in. $16 50; ¼ in. $15.50; 5-16 in. $12.70.

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	30%
Standard	30 and 10%
Cut leather lacing, No. 1	1.75
Leather in side, (Lacing)	1.50

RUBBER BELTING

Standard 36 .... 28% Best grades 28%

TAPES

Chesterman Metallic, 50 ft.	$5 00
Lufkin Metallic, 603, 50 ft.	3 17
Admiral Steel Tape, 50 ft.	3 00
Admiral Steel Tape, 100 ft.	4 50
Major Jun. Steel Tape, 50 ft.	3 75
Rival Steel Tape, 50 ft.	4 00
Rival Steel Tape, 100 ft.	8 75
Reliable Jun. Steel Tape, 50 ft.	5 25

PLUMBING SUPPLIES

Plumbers' oakum, per cwt.	6 00
Navy oakum, cwt.	13 00
Solder, strictly	0 25
Solder, guaranteed	0 26½
Soldering coppers, lb.	0 62½
White lead, pure, cwt	13 20
Red dry lead, 100-lb. kegs, per cwt.	9 75
Wood alcohol, per gal.	1 75
Whiting, plain, per 100 lbs.	3 00

ROPE AND PACKING

Packing, square braided	0 38
Packing, No. 1 Italian	0 31
Packing, No. 2 Italian	0 24
Pure Manila rope ¾ and larger, base	0 20
British Manila rope	18
New Z aland hemp	0 18
Jute packing, fine	15c
Jute packing, coarse	11c

OILS AND COMPOUNDS

Castor Machine Oil, per lb.	34½
Royalite, per gal. bulk	21
Palacine	23
Machine oil, per gal.	39
Black oil, per gal. (Summer)	19
Cylinder oil, Capital	69½
Turp., single bbls., gal.	2 00
Linseed oil, raw, single bbls.	1 08
Premier gasoline	29 00
Fuel oil, bbls., gal.	11 80

WASTE

XXX Extra	16 Atlas	18
Peerless	21 X Empire	13
XX Grand	15 Ideal	18
Superior	20 X Press	11½
X L C R	14	

Colored

Lion	12 Fancy	13½
Standard	10½ Popular	9
No. 1	13 Keen	7½

Wool Packing

Arrow	24 Anvil	16
Axle	20	

Washed Wipers

Select White	18 Dark colored.	13
Mixed Colored	14	

This list subject to trade discount

PLATING SUPPLIES

Polishing wheels, felt	$3 25
Polishing wheels, bull-neck	1 60
Emerey in kegs, Turkish	7½
Pumice, ground	3 to 4½
Emery glue	18
Tripoli composition	6 to 8
Crocus composition	12
Emery composition	11
Rouge, silver powder	60
Rouge, powder, nickel	35

Prices per lb.

ANODES

Nickel	40 to .45
Copper	22to 24
Zinc	14 to 14½

PLATING CHEMICALS

Acid boracic	.20
Acid, hydrochloric	.03¾
Acid, nitric	.10¼
Acid, sulphuric	.03¾
Ammonia, aqua	.20
Ammonium, Carbonate	.15
Ammonium, chloride	.13
Ammonium, hydrosulphuret	.75
Ammonium, sulphate	.10
Arsenic, white	.18
Copper carbonate, anhy.	.26
Copper, sulphate	8 to 10
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.14
Nickel carbonate	.32
Nickel sulphate	.14
Potassium sulphide (substitute)	.40
Silver chloride (per oz.)	.85
Silver nitrate (per oz.)	.70
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium evanide, 127-130%	.31
Sodium hyposulphite	.08
Sodium phosphate	.10
Tin chloride	.50
Zinc chloride, C. P.	.30
Zinc sulphate	.06

Prices per lb. unless otherwise stated

A Poor Machine's a Bad Investment
It's false economy to let an old-fashioned or worn-out machine occupy valuable floor space and, quite possibly, affect the production of better machines. No need to buy a new machine either. Williams' re-manufactured machines are guaranteed as good as new for all practical purposes—and we've some specially good "buys" right now. Come and look them over.
Ask us to put your name on our mailing list for our monthly machinery list.
The A. R. Williams Machinery Co., Ltd.
64 Front Street W., TORONTO
HALIFAX ST. JOHN MONTREAL WINNIPEG VANCOUVER
If its Machinery—Write "Williams"

"THROW YOUR HEART ACROSS"

(Continued from page 20)

assurance that their destinies were assured from without. "The problem," said the speaker, "is not how shall we obtain our share, but how shall we make something worth sharing—not by capture, not by oppression, but by creation."

Sir James Barrie was frequently quoted as the apostle of hard work and of high endeavor. "The greatest glory that ever came to me," he had said, "was to be swallowed up in London, not knowing a soul and having to work until the stars went out." Very little reward had crowned his efforts, he had long been intimately acquainted with poverty, yet success finally came as the result of patient, courageous, cheerful effort. The speaker was assured that in spite of the problems that confronted Canada, problems that meant severe taxation, it was this high courage and cheerfulness which would win through in the development of her nationhood.

QUESTIONS AND ANSWERS

(Continued from page 25)

or so, but I am sure you will agree with me that this is the time in which to look around and for connections with a view to future possibilities. With your vast knowledge of firms in the Dominion, and of business conditions generally, I feel convinced that you will be in a position to materially assist in this connection.

"I might further mention that this matter is not really in my province; as I previously mentioned I am in charge of the export department, but I cannot forget my old allegiance to Canada, and I promised to give my directors all possible help that I can with a view of their doing business in your country."

Canadian Machinery welcomes letters from its readers seeking information that may be useful to them in developing export connection.

WHO PROFITS MOST?

A business can be built in a year, a month, even in a day; or the building of a business can command the greatest efforts of a lifetime. Craft, cunning, shrewdness, if diligently practised, may bring a result resembling success; but the constant application of sincerity, experience, and craftsmanship build for a success that all others can but imitate and envy.

A great thinker once said: "A business is but the lengthened shadow of a man." Whatever is your aim, your ideal —rest assured that it is known to all with whom you deal. Let no man be mistaken. Just as his true character will be known to his friends, so will the dominating idea behind his business be apparent in every transaction. The business that, spurning opportunities for mean profits, devotes its entire energies to the development and maintenance of a reputation and quality, often envies the seeming progress of a sharp-trading competitor. But such a business has none to envy. As by natural right, the superior quality of its product, honestly maintained, brings to it the friendship of each user. This friendship, multiplied again and again, builds a good will that is the greatest reward in business.

A business carrying the good will of its customers has little to fear. Temporary set-backs and interference it may have, but as long as its ideal is maintained, it will rise above small mistakes and errors. Let the directors of such a business keep their greatest asset and duty ever in mind, and profits will be satisfactory. Look at the businesses that have had more than ordinary success. Who are they? They are the firms that do more than their duty, that give more than agreed, that work for quality and service rather than for profit. For it is the rule that he profits most who covets profit least.—The Diston Crucible.

Fisherman's Ballast Leads to Great Ore Discovery

Newfoundland Has One of Most Valuable Iron Deposits in World —Richer Than American Fields—One Million Tons Per Year From Wabana—Easy Mining With Improved Equipment

Special to Canadian Machinery

ST. JOHN'S, Newfoundland.—Newfoundland has probably the most extensive iron ore deposits in the world. Their discovery in 1895 was the result of a fisherman's use of a piece of ore for ballast. The varieties include magnetite, hematite, limonite, specular and jaspery ores, but the only actual mining that has yet taken place in the colony is in connection with the hematite deposits on Bell Island, about twenty minutes run by steamer from the main land.

Though cruised by competent prospectors, even up to the present moment, the full extent of the mineralised areas of this little island is not completely known, but an estimate has been made by the "Besco" people, at present working the mines of Wabana, the capital of the island, that they can at least produce the enormous quantity of one million tons per year for several generations.

One of the best-known authorities on iron ores, in estimating the values (comparative) of the same deposits on the whole American continent, has placed on record that Bell Island areas will produce two thousand million tons, whereas the richest deposits of the United States, already known, have a capacity amounting to but one thousand, three hundred million tons.

58½ Per Cent. Iron

Formerly there were two companies working the Bell Island mines at Wabana—an Indian name meaning "where the light first shines." The pioneer company was the Nova Scotia Steel and Coal, which commenced operations in the year 1895, on properties which they had purchased from the original settlers on the land. In 1895 the Scotia sold to the Dominion Iron and Steel Company a portion of its holdings. The ownership of both concerns, which has recently been merged with the British Empire Steel Corporation, comprise five huge beds of ore, which up to the year 1921 has yielded over eight million tons.

The great success attending the development of these mines is largely due to the ready water transportation facilities that there are in Conception Bay, no less than to the cheapness in mining, as the ore at one time could be almost shovelled off the surface pilings into the holds of the ships lying at the piers ready to take it.

Besides the land areas, with a production capacity of still many millions of tons, operations have been carried on far beneath the bottom of the waters of the bay, in one place at as far as eight thousand feet, and at a depth of one thousand feet below the bed of the ocean. Thirty-five miles of these submarine areas were owned by the Scotia Company at the time of the merger and from these there is taken a quality of ore which is far superior to that found in the land deposits. The ore taken from these submarine beds has shown an average of over 58½ per cent. of metallic iron.

Much Ore for Germany

The work at these mines, at first, consisted of removing the surface earth, extracting the ore, the formation of which was in irregular cubes, and carrying it from the diggings to the side of the ship in waiting at the other side of the island, where it was loaded by means of shutes from hill to hold, the viaduct being on a sharply-inclined plane.

To-day all this crude method has been changed, for with deeper excavations an elaborate system of tramways for carrying and loading has been installed, and piers and wharves have been built which can accommodate ships of any tonnage. Most of the ore mined on Bell Island is used in the blast furnaces of the company at Sydney, Cape Breton, for the manufacture of steel rails and other construction material requiring steel as the basis of strength.

A great deal of the raw ore is now being exported to Great Britain and Germany, particularly the latter country, for since the close of the war, Germany has been taking huge cargoes weekly, and Custom House clearings show that the greater portion of the minings are now being shipped to former enemies by the British Empire Corporation.

It was not until the year 1895 that the first discovery of iron ore was made on Bell Island. The length of the deposits is three miles, and the breadth between a quarter and half a mile, on the land areas. On the removal of the covering turf and rock a horizontal band of ore is reached, which is worked like an open quarry. The first stratum is estimated to contain twenty million tons and is about six feet in depth. Then comes another rock covering of five feet, and this being penetrated, a second iron band of the same depth as the first is reached, containing about the same quantity of ore, so that the two first and original deposits as discovered are reckoned to have contained forty million tons, thus being practically inexhaustible.

There is no need of shafts in the working. Pickaxes, crowbars, wedges and a few charges of dynamite were sufficient to work the holdings at the beginning, for one unique feature about it is that th ore has a jointed cleavage, so that when taken out it breaks up into rhomboidal masses of various sizes, none, however, being of greater size than twelve inches by four. When extracted from the bed in this way it is shovelled into wagons with as much ease as coal is shovelled into a cart.

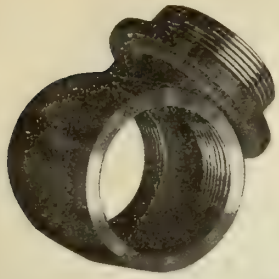
Since the early days of the working, all modern improvements have been installed and the manual labor is only that employed in digging the ore. Tramways now run from end to end of the workings and connect with the various piers. An endless cable worked by steam power moves the cars when loaded to a huge iron cage overhanging the water, through which the ore is dropped into the holds of the ships in waiting, so that loading is accomplished with great rapidity and expedition. When not completing cargoes the ore is dumped into piles, or pockets, which are always held in reserve for emergency contracts or accepted orders coming in with the legend "rush" crossed on them. It would be very difficult to find a mine of such value anywhere that can be worked at such small cost.

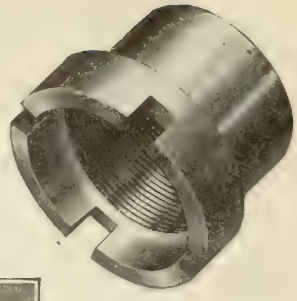
Brown Hematite Ore

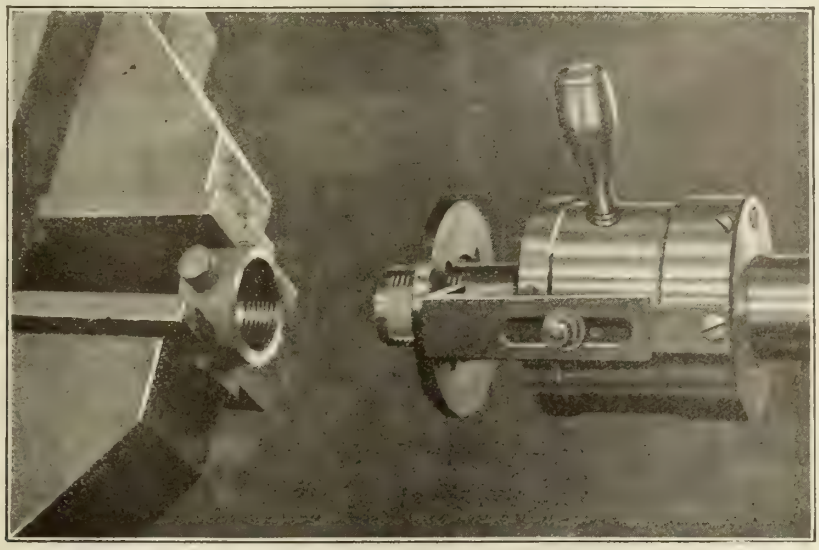
The ore of Bell Island is brown hematite containing fifty-five per cent. of iron. Mixed with other ores, it makes the finest steel. The original company belonged to New Glasgow, Nova Scotia, and were the lessees of the property, which consisted of four grants, each being one mile square. The "Besco" are now the sole operators. Bell Island, as we have stated, is a piece of land six miles long by two miles broad, and the deposits described have been extended by the opening up of others, many of th se running under the bottom of the waters of Conception Bay for considerable distances. In all the years prior to 1895 no person even suspected the mineral treasures it held concealed under the surface of the earth, and it was only the accidental discovery of a fisherman of a piece of ore on his property, which he brought to St. John's as ballast for his boat that led to the opening up and working of this great deposit.

In our next article, which we hope to illustrate with original photographs of the mines, piers, pockets, tramways and buildings, the further story of Bell Island will be continued, with more wealth of detail as to its importance and bearing on the steel trade and manufactures of the world.

50 Per Cent. More Work With a Geometric Collapsing Tap Than With a Solid Tap







Anyone familiar with thread tapping knows what backing out a solid tap each time means. All the expense and annoyance of tapping screw threads with a solid tap have been overcome by the Geometric.

Special Taps for Special Jobs.

Standard Taps for Standard Jobs.

No doubt you and Geometric Screw Cutting Tools are not strangers. You may not realize, however, the number of styles that there are and the different classes of work that they are particularly adapted to.

Whatever the need in Screw Cutting, there is a Geometric to take care of it.

Adjustment to correct diameter each time a thread is tapped. Then chasers collapse automatically, leaving the thread clean cut and perfect.

The Chasers are readily reground, and when finally used up, are renewed at comparatively small cost, leaving the Tap as efficient as when new.

GEOMETRIC AUTOMATIC THREADING TOOLS

For cutting all classes of Screw Threads, internal or external, of any diameter and form.

The Geometric Tool Company

New Haven, Connecticut, U.S.A.

Canadian Agents :

Williams & Wilson, Ltd., Montreal. The A. R. Williams Machinery Co., Ltd., Toronto, St. John, N.B.; Halifax, N.S.; Vancouver, B.C.

If what you need is not advertised, consult our Buyers' Directory and write advertisers, listed under proper heading

News From the Industrial Field

Loss of $10,000 was caused by fire at the producer house of the Sun Brick Co., Toronto. Fifty hands are out of work temporarily.

New electric power to be brought into production of 2,500 horse power, is proposed for next summer at Windego Falls near Cobalt. The development is owned by Canadian Associated Goldfields.

C. B. Turner, of C. B. Turner & Co., Toronto, recently returned from a convention trip to St. Louis, Mo. Returning via New York he made arrangements to handle several American lines in Canada.

Weston, Ont., has annexed the property occupied by three industrial concerns—Moffats, Limited, Canada Cycle and Motor Co., and the Co-operative Wool Growers. A fixed asessment for 15 years was granted to Moffats, Limited.

Beldam Asbestos Co., formerly at 19 Jarvis St., have removed to larger quarters, 3 Mutual St., Toronto. Mr. Abraham, general sales manager for Canada, states that they have made selling arrangements with a chain of jobbers throughout the Dominion.

Shareholders of Dominion Iron and Steel Co. are asked to authorize an increase of the common stock of the company to $25,000,000. The company is now said to be operating on a profitable basis and furnishing practically full time employment to 23,000 men.

Steel mills and foundries, it was announced some weeks ago in these columns, had been asked to consider preliminary enquiries upon 3,500 box and refrigerating cars for the Canadian National. It is now reported that tenders have been sent out for between eight and fifteen million feet of lumber for car-building purposes.

In giving decision defining conditions under which a railway is entitled to charge demurrage, Justice Audette, at Ottawa, finds that railway is entitled to charge demurrage after a car has been available for unloading by the consignee from a proper and reasonable team track for a period of 48 hours. "It is not necessary thereafter for the railway company to keep the car on a team track to enable it to claim demurrage, and the consignee has no right to ask the railway company to keep his car indefinitely upon a team track, thus paralyzing the business of the railway company," states the judgment.

Imports from Canada to United States increased in value $4,000,000 and exports to Canada declined $1,000,000 in September of this year, states a report from Washington.

W. P. Perrin of W. P. Perrin, Limited Toronto, makers of hydraulic machinery, reports an improved demand for this class of equipment. Not for some time has there been two months' work ahead as at present. The outlook is promising and there are indications that railway requirements are becoming more active.

An Italian-Canadian commercial agreement is now being negotiated between Premier Mussolini of Italy and Hon. W. S. Fielding, Minister of Finance. Under the 1910 agreement Italy gave Canada special rates on woods, furniture, wood pulps, paper, boots and shoes, tools, sewing machines, horses and cattle, fish and cheese.

The following British Columbia companies were recently incorporated: International Electric Co., Ltd., $100,000, Stewart; Burrard Equipment Co., $20,000, Vancouver; Herondale Products Co., Ltd., $50,000, Vancouver; A. J. Johnson Lumber Co., Ltd., $50 000, Vancouver; Brooks-Iowa Lumber Company, $400,000, Vancouver; Vancouver Woodyard Ltd., $20,000, Vancouver; Delaney and Sinclair, Ltd., $20,000, Vancouver.

Although British Columbia produced the bulk of copper mined in Canada, that province has only three small plants manufacturing brass and copper articles, with an annual production of $57,314, as compared with 59 manufacturing plants in Canada, with an annual production value of $13,760 311. The bulk of the manufacturing plants are in Ontario and Quebec. Ontario has 39 plants, producing $6,774,066 worth of goods; Manitoba, 3, producing $955,998; Quebec, 12, $5,525,153; and New Brunswick, 2, producing $477,780.

It is reported that Alberta's total coal output for the first six months of 1922, amounted to 2,404,266 tons, compared with 2,833,075 tons during the same period a year ago. The total output last year was 5,937,000 tons, while 1920 was the banner year for Alberta with 6,908,000 tons mined. The market in Manitoba is steadily developing. Last year it took a half million tons of Alberta coal, practically all domestic. Saskatchewan gets most of its import coal from Alberta, but still imports some anthracite from elsewhere.

Owen Sound Board of Trade is exerting its influence to have some of the Canadian Merchant Marine winter in that harbor this winter. Good harbor and fire protection is available, and there are facilities for repairs.

Lumbering operations are active in all parts of British Columbia at the present time, according to reports received here. The Bucklin Lumber Company is entering on a logging operation, tapping a stand of 80,000,000 feet in the Upper Pitt Valley. The Company hope to have an output of 75,000 feet a day.

Up-to-date there has been somewhat in excess of two millions spent on federal aid highways in New Brunswick, of which amount the federal grants have totalled in the vicinity of $850,000. The gross amount which has been expended this year is approximately $300,000, which is about half of what has been expended in previous years.

A steady reduction in the volume of unemployment is evident through the Maritime Provinces. The chief factors affecting conditions have been the settling down to full time employment at the coal mines, the gathering of the fruit and grain crops, and the general improvement in the manufacturing group of industries, especially steel.

Since 1911 the Quebec Provincial Government has spent over $41,000,000 on roads, according to a statement made by Hon. J. L. Perron. Out of the 40,000 miles of roads, there were 10,000 miles of main roads, divided into leading highways and county roads. The government has so far built 1,500 miles of leading highways, improved 5,000 miles of county roads, and over 8,000 miles of the third class, or local roads.

Seven carloads of glass ware used in the ten hot houses, each 36 ft. x 341 ft., built for Miller & Sons, florists at Concord, a few miles north of Toronto. Twenty more of these houses will be built next year. The glass and steel work was in charge of the King Construction Co., Toronto. Three and three-quarter miles of four-foot rose benches of Ontario cedar were installed by J. S. Knapman, Toronto. The heating plant, by the John Inglis Co., and the power equipment, are said to have cost $200,000. Construction work was begun April 15, and on June 17 the first of 64,000 roses were planted. Cuttings are now being made at the rate of 2,000 daily. It is the intention of Miller & Sons to move their Lauder Ave. plant to Concord eventually.

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METAL CUTTING SAWS

Solve your Metal Cutting problems easily, quickly and economically, by adopting the products made by

ATKINS

We make Kwik-Kut Power Hack Saw Machines which use practically the full cutting edge of the Hack Saw Blade at each stroke; Metal Cutting Band Saw Machines for general shop work, cutting all classes of metal up to 12 x 14 inches.

Your requirements for Metal Cutting Circular Saws can be supplied promptly and we solicit a trial of our "AAA" Non-Breakable and Power Hack Saw Blades and Frames.

"A Better Saw for Every Use"

E. C. Atkins & Co.

Established 1857

"The Sterling Quality Saw People"

Factory: HAMILTON, Ont. *Branch:* VANCOUVER, B.C.

ONTARIO CONCERN EXTENDS TO QUEBEC

QUEBEC, Que.—Standard Steel Co., Welland, will establish a branch plant in Quebec. It is recognized by building contractors that the company have shown some foresight in entering the Quebec field to manufacture steel for bridge and general construction purposes. Apart from the Dominion Bridge Company at Lachine, there is only one such plant in Quebec, the Eastern Steel Company, which was established about twelve years ago. A small plant was then equal to the demand. Within the past ten years there has been quite a large demand for steel for bridges and public buildings in this district. In addition there is a growing demand for steel in connection with the construction of hotels and schools as well as for the more important private dwellings. The danger from fire and the increased cost from insurance have improved the demand for steel.

The addition to the Chateau Frontenac including the twenty-storey tower, in course of erection, calls for 28,000 tons of steel, which is being furnished by the Dominion Bridge Co.

There are abundant ore deposits along the ranges of the north shore, extending from Les Embankment. The iron is impregnated with titanic acid, which has prevented development. This ore is now going to Niagara in large quantities, and with the electric process, the titanic acid can be extracted and used as a by-product.

The Standard Steel Co., which will operate here under the French name of Le Construction Cie., Limitee, expect to erect their plant next spring on a location two miles from the city but with good railway connections. They will employ forty to fifty men and will handle structural steel and ornamental iron castings.

Imported pig iron, laid down in Quebec, costs $32.75 per ton, while Hamilton pig costs $36 per ton. There are only two large foundries in Quebec manufacturing machinery and castings—Terreau and Racine and the Drolet Foundry and Machine Co. These two shops use on an average of 1,200 tons of pig iron annually, one half of which is imported from abroad and the other half from Hamilton. There are no brass foundries in Quebec. Castings are brought from Ontario to quite an extent and also from the United States. Terreau and Racine do the largest business in Quebec. They store plates and machinery and also deal largely in all classes of stoves and furnaces. Their turnover in 1921, which the partner says was a fair year, amounted to $1.600,000. Their constant stock is valued at $600,000 in all classes of goods used in construction.

Consumers' Gas Co., Toronto, are considering the erection of an additional unit to provide for increased consumption. Considerable steel construction is called for.

Electroplax Co.'s factory at Mount Dennis, Ont., was destroyed by fire Nov. 13, the loss being placed at $100,000; insurance, $60,000. The plant was used for the manufacture of electrical insulation equipment.

Permits for new buildings to cost $662,000 were recently issued in Toronto. These include the new Jarvis collegiate to cost $500,000, and an addition to Malvern Ave. school to cost $25,000. The list include 39 dwellings, 34 garages, and 3 stores.

It now rests with the Imperial and Federal governments whether guarantees are to be provided looking to the establishment of an iron and steel industry in British Columbia. An investigation of the ore resources of the province may be instituted.

Massey-Harris plant, Brantford, reflects improved industrial conditions by the addition of from 250 to 300 men to the present staff of 500. The statement is made that this industry expects to have a busy winter. Other firms there report encouraging prospects.

That Canada possessed great trade advantages in Colombia and Venezuela, as well as other Latin-American countries, is the opinion of Edward C. Austin, pioneer trade agent. These countries had shown strong development since the opening of the Panama canal. This market is closer to Toronto than is Calgary.

As indicating the activity in woodworking machinery the Garlock Machinery Co., Toronto report that sales during the past two months have exceeded those of the preceding months of the year. Metal working equipment, however, remains quiet, although enquiries give reason for optimism.

ELEVATOR LUBRICATION

The problem of lubrication of elevator machinery is becoming of considerable importance to the engineering profession to-day. The ever-increasing demand for elevator service, as higher buildings are becoming more and more necessary to house the executive offices of our industries and store their products, has eliminated the heretofore popular idea that elevator machinery, especially of the electric type, could be lubricated in much the same manner as other types of gearing and general motor driving mechanisms. There are certain pertinent operating features which prevail that demand considerable cooperation between the elevator engineer and lubricating oil manufacturers, and careful attention must be paid to these details.

WILLIAM JESSOP & SONS TO BUILD IN CANADA

REPORTS are current in the Toronto steel market that William Jessop & Sons, steel manufacturers, Sheffield, Eng., are preparing to locate a branch factory in Canada. Enquiry at their Toronto office regarding the matter, brought an emphatic statement that there was absolutely nothing to give out at the present time and that rumors indicated a somewhat more extensive outside, and hence unreliable, knowledge of the Company's affairs than could be claimed by their own officials.

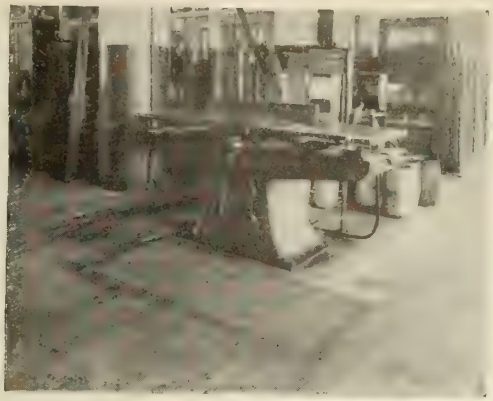
It has been common knowledge that, for some time, this firm has considered the advisability of a Canadian plant but nothing definite has emerged. Present reports have it that methods of financing the Canadian proposition were actually being considered and that the plan would involve the taking over of a going Canadian plant with which would be incorporated the Jessop lines of steel. This was done successfully in connection with the introduction to Canada of the English Electric Co. It is a plan that has merit since it makes available an equipment and organization familiar with Canadian methods and conditions.

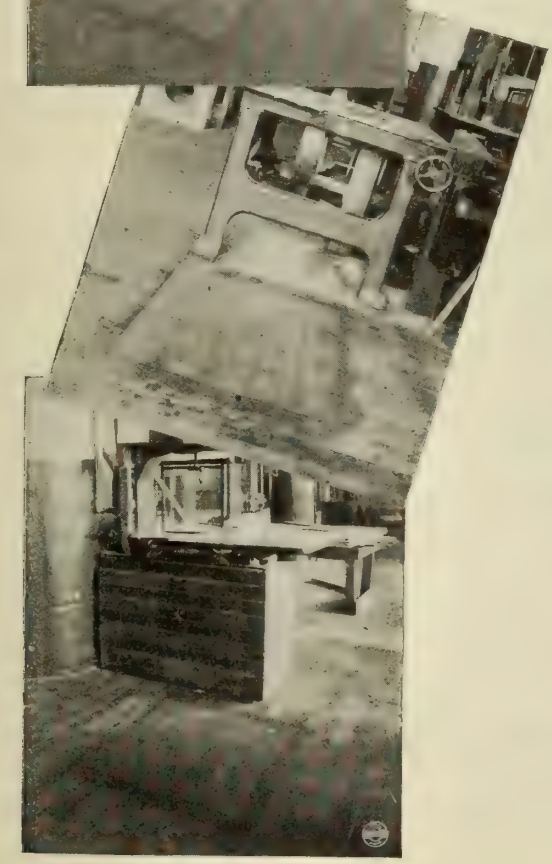
William Jessop & Sons opened their Toronto office some thirty years ago. At their "Brightside Works," Sheffield, their steels have been made since 1775. They are said to have a line that is most adaptable for engineering purposes, whether the product be a twist drill or a 60-ton casting or massive forging. Four typical industries in which their products have figured largely are fine toolmaking, shipbuilding, machine tool work and automobile engineering. It may be that the possibilities of the motor car industry, from a domestic as well as an export point of view, have some appeal to the Company. Among their specialties are crankshafts of nickel-chome steel for any type of engine.

NEGOTIATING FOR BALDWIN

Bethlehem Steel Corporation, as hinted in these columns some weeks ago, are negotiating for the purchase of the plant in Toronto of the Canadian Baldwin Steel Corporation. It is learned at the office of the latter that while the deal is going forward, there is nothing to be made public in that connection and that reports in a morning newspaper, commenting upon details as to price, were absolutely erroneous.

The Baldwin plant is idle at present although there are large stocks of black and galvanized sheets on hand which are reported to be moving freely. While some of the equipment of the plant, particularly that of the rolling mill, is of American make, the galvanizing equipment is British. The outstanding cause of the plant's idleness at the present time is the inability to secure adequate supplies of quantity and quality to keep the plant running steadily on requirements of the Canadian trade.





NO MORE SLIPPING

Wood Floors in wood-working shops become smooth and dangerous when partly covered by sawdust and shavings.

Machine shop floors become slippery from oil, grease and other lubricants. A permanent non-slip surface may be made with

ALUNDUM Safety Tile

Always slip-proof, never wears smooth. Flush with the floor, nothing to trip on. Neither grease, oil, shavings nor sawdust affect its slip-proof surface. Easy to install.

Alundum tile contains the same material as used in the manufacture of Norton Alundum grinding wheels.

NORTON COMPANY OF CANADA, LIMITED
HAMILTON - ONTARIO

Electric Furnace Plants:

CHIPPAWA, ONTARIO, CANADA

If interested, tear out this page and place with letters to be answered

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We have a complete Belknap Equipment for sale. This equipment is still in use in our Subscription Department and is in excellent working order. We have placed an attractive price on this outfit, and would advise manufacturers or merchants having a mailing list to let us tell you how it will save you money. We will give a guarantee as to the proper working condition of this equipment.
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BERTRAMS LIMITED
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FOR BLACK DIAMOND OVENS SALE

Japanning Oven Electrically Heated

Size Over All	**Height, 60"**	500 lbs. dead weight, will reach temperature 370 deg. F. in 1 hour.
	Width, 36"		
	Depth, 57"		

Core Ovens—Swing door type, 5 shelves or sectional wall construction.
24" Kernchen Siphonage Ventilators—Special price, made of Toncan galvanized iron.
Double ball bearing casters with 4" single wheels. The best truck caster made and with an easy swivel.

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Expert Metal and Wood Pattern Work. Our advice and estimates will save you money.
Semi-finishing operations on Lathe or Grill on Castings supplied if required.
ASK US.
THE KATIE FOUNDRY, GALT, ONT.

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STEEL PLATES 9, 10, 11 Gauge

Carloads or less. Suitable for making Iron Washers.

The Graham Nail Works
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Manufactured and sold by

Sanitary Wiping Products Co.
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COSTS LESS AND GOES FARTHER

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Write us for full particulars.
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Air Pressure Tanks, Air Receivers, Steel Plate Tanks, Pneumatic Tanks, Tote Boxes, Shop Barrels, Steel Factory Equipment, Smoke Stacks, Gasoline Tanks.
Write For New Catalogue
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MANAGER OF FOUNDRY MACHINE SHOPS desires a larger opportunity. Age 45. Can personally run office, foundry and machines. Practical training as draughtsman, pattern maker and machinist. Can handle iron, brass and aluminum. References the best. Box 816. Canadian Machinery.

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Reasonable rent to responsible party. For further particulars write Box No. 818.

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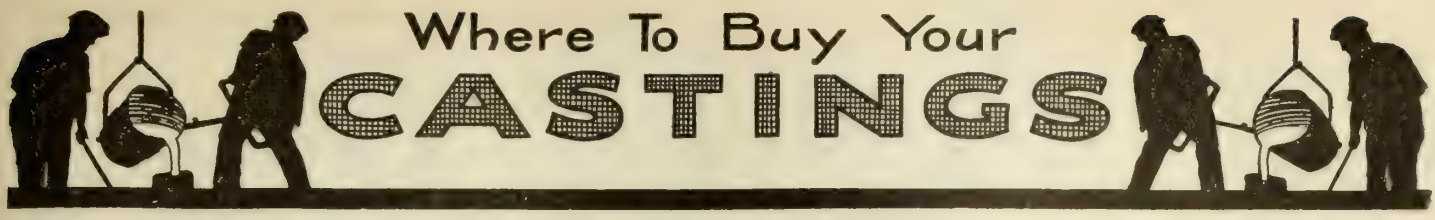
In order that the announcements of your wants, machinery for sale, etc., etc., shall not be delayed, please try to have them in our office with the Tuesday morning mail.

Canadian Machinery

If you want something unusual

and it isn't advertised here, the logical thing would be to advertise for it. You'll find that a small ad. in the Classified Advertising Section will save you a great deal of time in locating men or machinery. Look over these pages and if you don't see what you want, send us your copy to-day for next week's issue.

CANADIAN MACHINERY
Classified Advertising Section
143-153 University Avenue
TORONTO



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Brass, Bronze, Copper and Aluminum.

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Brass, Bronze, Manganese Bronze, Aluminum.

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Steel, Malleable and Heavy Grey Iron.
See Advertisement Page 7

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370 Victoria Street, TORONTO, ONT.
Nickel and Monel Metal.

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Grey Iron and Semi-Steel to 75 tons.

Smith's Falls Malleable Castings, Limited
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International Malleable Iron Company, Limited
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Canadian Machinery & Mfg. News
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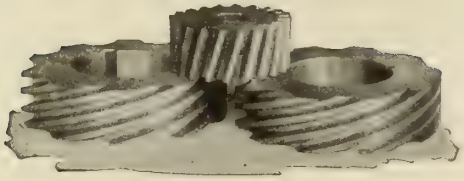

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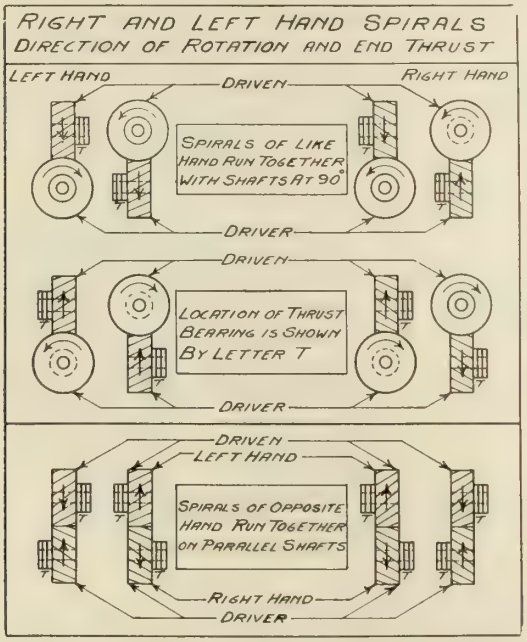

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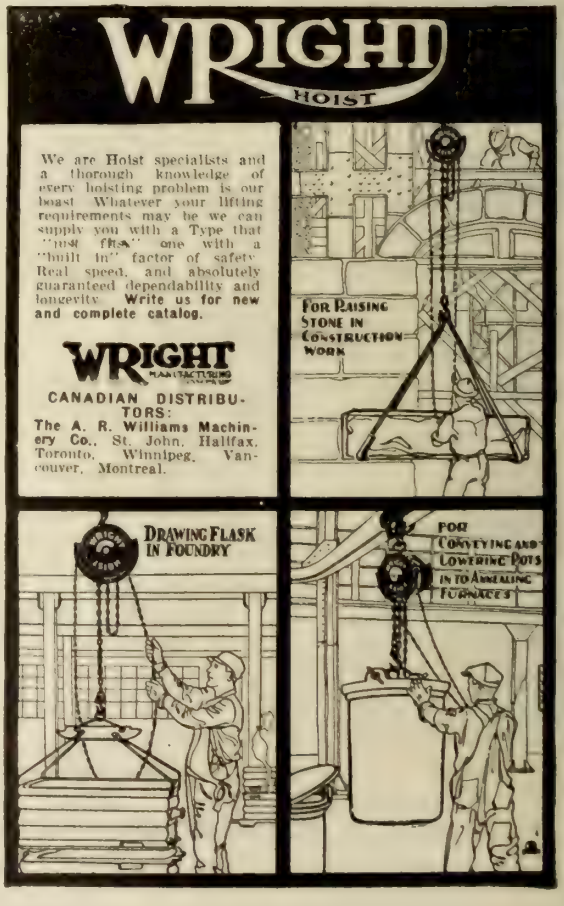
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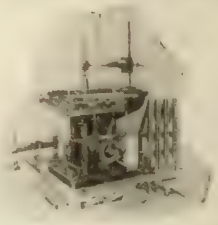

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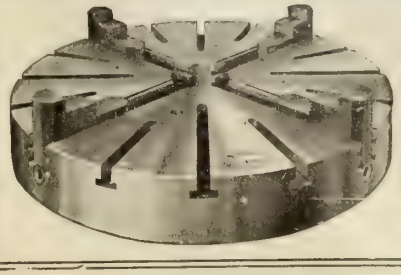

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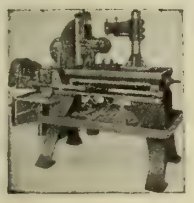

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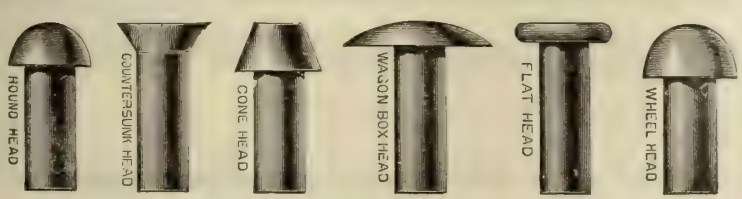

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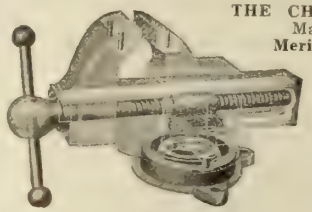

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COUPLINGS
Steel Co. of Canada, Ltd., Hamilton, Ont.

COUPLINGS, SHAFT
Can. Link-Belt Co., Toronto, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

CRANES, ELECTRIC
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can.-Link-Belt Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Northern Crane Works, Walkerville, Ont.
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.

CRANES, LOCOMOTIVE
Can. Link-Belt Co., Toronto, Ont.

Bertram & Son Co., td., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Northern Crane Works, Walkerville, Ont.

CRANK PIN TURNING MACHINE
Underwood Corp., H.B., Philadelphia, Pa.

CUTTERS, GEAR
Brown & Sharpe Mfg. Co., Providence, R. I.

Butterfield & Co., Inc., Rock Island, Q. Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CUTTERS, HIGH SPEED
Atkins & Co., Inc., E. C., Indianapolis.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
arney & Trecker Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CUTTERS, MILLING
Brown & Sharpe Mfg. Co., Providence, R. I
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.

CUTTERS, STAY BOLT
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.

CUTTING-OFF MACHINE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, Rhode Island
Starrett Co., L. S., Athol, Mass.

CUTTING OFF MACHINES, PIPE (SEE PIPE-CUTTING AND THREADING MACHINES)
Landis Machine Co., Inc., Waynesboro, Pa.

CUTTING-OFF TOOLS
Armstrong Bros. Tool Co., Chicago, Ill.

CUTTING OIL FILTERS (SEE OIL FILTERING SYSTEMS
Bowser, S. F. & Co., Ltd., Toronto.

CUTTING, OXY-HYDROGEN
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

DETACHABLE CHAIN
International Malleable Iron Co., Guelph, Ont.

DIAMONDS, BLACK AND ROUGH
Can. Desmond-Stephan Mfg Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

DIAMOND TOOLS
Can. Desmond-Stephan Co., Hamilton,
Wheel Trueing Tool Co., Windsor, Ont.

DIAMOND CROSSINGS
Can. Steel Foundries, Montreal, Que.

DIAMONDS, IMPORTERS
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Co., Windsor, Ont.

DIES, SCREW AND THREAD CUTTING
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.

DIES, SHEET-METAL AND SUB-PRESS (See Tool Work)
Brown, Boggs & Co., Ltd., Hamilton, Ont.

DIES, FORGING
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

DIES, SCREW AND THREAD CUTTING
Morse Twist Drill & Machine Co., New Bedford, Mass.

DIES, SELF-OPENING, ADJUSTABLE
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Landis Machine Co., Inc., Waynesboro,
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DIES, THREADING-OPENING
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DIVIDING HEADS
Burke Machine Tool Co., Conneaut, Ohio.
Hendey Machine Co., Torrington, Conn.
Kearney & Treacker Co., Milwaukee, Wis.

DOGS, LATHE AND MILLING MACHINE
Armstrong Bros. Tool Co., Chicago, Ill.

DRAFTING MATERIALS
American Lead Pencil Co., New York City, N.Y.

DRESSERS, GRINDING WHEEL
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ont.
Norton Co., of Can., Ltd., Hamilton.
Wheel Trueing Co., Windsor, Ont.

DRESSING TOOLS
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Co., Windsor, Ont.

DRILL HOLDERS
Armstrong Bros. Tool Co., Chicago, Ill.

DRILLING MACHINES, BENCH
Burke Machine Tool Co., Conneaut,, Ohio.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Hardinge Bros., Inc., Chicago, Ill.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, ELECTRIC AND HAND
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, GANG
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

DRILLING MACHINES, HEAVY DUTY
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
Herbert, Limited, Alfred, Toronto, Ont.

BORING, DRILLING AND MILLING MACHINES, (HORIZONTAL.)
Gisholt Machine Co., Madison, Wis.
Herbert, Limited, Alfred, Toronto, Ont.

DRILLING MACHINES, Multiple Spindle
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
National Acme Co., Cleveland, Ohio.

DRILLING MACHINES, Pneumatic
Cleveland Pneumatic Tool Co., Toronto. Ont.

DRILLING MACHINES, PORTABLE
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, RADIAL
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Herbert, Limited, Alfred, Toronto, Ont.
Wiliams Machinery Co., A. R., Toronto,

DRILLING MACHINES, SENSITIVE
Burke Machine Tool Co., Conneaut, O.
Herbert, Limited, Alfred, Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Williams Machinery Co., A. R., Toronto.
Wisconsin Electric Co., Racine, Wis

DRILLING MACHINES, TURRET
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wisconsin.
Williams Machinery Co., A. R., Toronto.

DRILLING MACHINES, VERTICAL
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Herbert, Limited, Alfred, Toronto, Ont.

DRILLS, CENTRE
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DRILLS, ELECTRIC
U. S. Electrical Tool Co., Cincinnati, Ohio
Black & Decker Mfg. Co., Ltd., Montreal, Que.

DRILLS, HIGH SPEED TWIST
Butterfield & Co., Inc., Rock Island, Que
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Cleveland Twist Drill Co., Cleveland, O.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DRILLS, RATCHET
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

DRILLS, TWIST AND FLAT
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.

DROP FORGINGS
Steel Co. of Canada, Ltd., Hamilton

DUMB WAITERS
Roelofson Elevator Works, Galt, Ont.

DUST HANDLING EQUIPMENT
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

ELECTRIC DRILLS AND GRINDERS
Black & Decker Mfg. Co., Ltd., Montreal, Que.
U. S. Electrical Tool Co., Cincinnati, Ohio.

ELECTRIC STEAM GENERATORS
Dominion Engineering Works, Limited, Montreal, Que.

ELECTRICAL INSTRUMENTS
Bristol Co., Waterbury, Conn.

ELECTRICAL SUPPLIES
Atkins & Co., Inc., E. C., Indianapolis.
Diamond State Fibre Co., Toronto, Ont.

ELECTRIC TOOLS
U. S. Electrical Tool Co., Cincinnati, Ohio.

ELEVATORS AND CONVEYORS
Can. Link-Belt C., Toronto, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q

ELEVATORS, FREIGHT AND PASSENGER
Roelofson Elevator Works, Galt, Ont.

EQUIPMENT, ELEVATOR SAFETY
Jones & Glassco, Montreal, Que.

EMERY WHEELS (See Grinding Wheels)
Lion Grinding Wheels, Limited, Montreal, Que.
Atkins & Co., E. C., Indianapolis, I.
Norton Co., of Canada., Ltd., Hamilton.

ENGINES, CAPSTAN
Kennedy & Sons, Wm., Owen Sound, Ont.

ENGINEERS, MECHANICAL
Dominion Engineering Works, Limited, Montreal, Que.
Gisholt Machine Co., Madison, Wis.
Hamilton Gear & Machine Co., Toronto.

EXPANDERS, TUBE
Jardine & Co., A. B., Hespeler, Ont.

FANS, ELECTRIC
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

FANS, EXHAUST
Can. Blower & Forge Co., Ltd., Kitchner, Ont.

FANS, VENTILATING
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

FIBRE
Diamond State Fibre Co., of Can. Ltd., Toronto, Ont.

FILES AND RASPS
Nicholson File Co., Port Hope, Ont.
Simmons Canada Saw Co., Montreal, Que.

FILLER, IRON (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J.

FIRE ESCAPES
Roelofson Elevator Co., Galt, Ont.

FITTINGS, PIPE
International Malleable Iron Co., Guelph.
Fittings, Limited, Oshawa, Ont.

FLEXIBLE SHAFTS
Flexible Shaft Co., Ltd., Toronto, Ont.
Strand & Co., N. A., Chicago, Ill

FLUXES, WELDING
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd, Toronto
Liquide Air Company, Toronto, Ont.

FORGES
Flexible Shaft Co., Ltd., Toronto, Ont.

FORGING MACHINERY
Acme Machinery Co., Cleveland, Ohio
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown Boggs & Co., Ltd., Montreal.
National Machinery Co., Tiffin, Ohio.
Steel Co. of Canada, Ltd., Hamilton.

FORGINGS, DROP
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Ltd., Toronto, Ont.

FORGINGS, HAMMER
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Hepburn Ltd., John T., Toronto, Ont.

FOUNDRY EQUIPMENT
Rice Lewis & Son, Ltd., Toronto, Ont.

FOUNDRY SUPPLIES
Rice Lewis & Son, Ltd., Toronto, Ont.

FROGS, SPRING OR RIGID
Can. Steel Foundries, Montreal, Que.

FURNACES, ELECTRIC
Rockwell Co., W. S. New York City.
Hiram Walker & Sons Metal Products. Ltd., Walkerville, Ont.

FURNACES, HEAT TREATING COAL
Rockwell Co., W. S., New York City.

FURNACES, HEAT TREATING OIL AND GAS
Bellevue Industrial Furnace Co., Detroit, Michigan.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Flexible Shaft Co., Ltd., Toronto, Ont.
Rockwell & Co., W. S., New York, N.Y.

FURNACES TEMPERING AND ANNEALING
Bellevue Industrial Furnace Co., Detriot, Mich.
Brown & Sharpe Mfg. Co., Providence R. I.
Flexible Shaft Co., Ltd., Toronto, Ont.
Rockwell Co., W. S., New York City.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

FURNACES AND OVENS, ELECTRIC
Rockwell & Co., W. S., New York, N.Y.
Starrett Co., L. S., Athol, Mass.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

BUYERS' DIRECTORY

GAGES, MEASURING (See Tool Work)
Brown & Sharpe Mfg. Co., Providence, R. I.
Greenfield Tap & Die Corp., Galt, Ont.
Lufkin Rule Co., Windsor, Ont.
Starrett Co., L. S., Athol, Mass.

GAGES, RECORDING
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GAGES, SPECIAL MEASURING
(See Tool Work)
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GAGES, THREAD
Brown & Sharpe Mfg. Co., Providence R. I.
Herbert, Limited, Alfred, Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

GALVANIZING
Fittings, Limited, Oshawa, Ont.

GAS, COAL COMPRESSED
L'Air Liquid Society, Toronto, Ont.

GAS, COMPRESSED
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

GASKETS
Diamond State Fibre Co. of Ca., Ltd., Toronto, Ont.
Smooth Mfg. Co., Jersey City, N. J.

GAUGES VACUUM AND PRESSURE
Taylor Instrument Co. Toronto, Ont.

GEAR BLANKS
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.
Dominion Engineering Works, Limited, Montreal, Que.

GEAR COUNTERS
Hart Mfg. Co., R. A., Battle Creek, Michigan.

REAP CUTTING MACHINES
Bertram & Sons Co., Ltd., The John, Dundas, Ont.

Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Fellows Gear Shaper Co., Springfield, Vt.
Whiton Machine Co., D. E., New London, Conn.

GEAR TESTING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.

GEARS, CAST
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Hull Iron & Steel Foundries, Hull, Que.
Dominion Engineering Works, Limited, Montreal, Que.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

GEARS, CUT
Brown & Sharpe Mfg. Co., Providence, R. I.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Gardner & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto, Ont.
Hepburn Ltd., John T. Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

GEARS, DRESSED
Kennedy & Sons, Wm., Owen Sound, Ontario.

GEARS, FORGED
Canada Foundries & Forgings Co., Welland, Ont.

GEARS, HERRINGBONE
Hamilton Gear & Machine Co., Toronto, Ont.

GEARS, RAWHIDE (See Gears, Cut)
Hamilton Gear & Machine Co., Toronto.

GEAR, SILENT CHAIN
Gardner & Son, Robt., Montreal, Que.
Can. Link-Belt Co., Ltd., Toronto, Can.
Hans Renold of Canada, Ltd., Montreal, Quebec.

GEARS, WORM
Hamilton Gear & Machine Co., Toronto.

GENERATORS ACETYLENE
L'Air Liquide Society, Toronto, Ont.

GOGGLES, SAFETY
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

GRAB BUCKETS
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Cleveland Twist Drill Co., Cleveland, O.

GREASE CUPS, PRESSED STEEL AND BRASS
Can. Winkley Co., Ltd., Windsor, Ont.

GREASES, LUBRICATING
Canadian SKF Co., Toronto, Ont.

GRINDERS, ELECTRIC
Black & Decker Mfg. Co., Ltd., Montreal, Que.
U. S. Electrical Tool Co., Cincinnati, Ohio.

GRINDERS TOOL POST
U. S. Electrical Tool Co., Cincinnati, Ohio.

GRINDING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Norton Co., of Canada, Ltd., Hamilton.

GRINDING MACHINES, ABRASIVE BELT
Norton Co. of Can. Ltd., Hamilton, Ont.

GRINDING MACHINES, AUTOMATIC
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, BENCH
Blount Co., J. G., Everett, Mass.
Geometric Tool Co., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co. of Canada, Ltd., Hamilton, Ont.
Pratt & Whitney Co. of Canada, Ltd.,

GRINDING MACHINES, CENTER
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES, CUTTER AND REAMER
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, CYLINDRICAL
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.
Norton Co., of Canada, Ltd., Hamilton.

GRINDING MACHINES, DIE
Geometric Tool Co., New Haven, Conn.
National Acme Co., Cleveland, O.
National Machinery Co., Tiffin, Ohio.

GRINDING MACHINES, DRILL
Bellevue Industrial Furnace Co., Detroit, Mich.
Bertram & Son Co., Ltd., The John, Dundas, Ont.

GRINDING MACHINES, ELECTRIC
Strand & Co., N. A., Chicago, Ill.

GRINDING MACHINES, FLOOR AND TOOL
Blount Co., J. G., Everett, Mass.
Herbert, Limited, Alfred, Toronto, Ont.
National Acme Co., Cleveland, Ohio.
Norton Co. of Canada, Ltd., Hamilton, Ontario.
Greenfield Tap & Die Corp., Galt, Ont.
U. S. Electrical Tool Co., Cincinnati, Ohio.

GRINDING MACHINES, INTERNAL
Garlock Machinery Ltd., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Cleveland Pneumatic Tool Co., Toronto Ont.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES PORTABLE
Strand & Co., N. A., Chicago, Ill.

GRINDING MACHINES, SNAGGING
Blount Co., J. G., Everett, Mass.
Norton Co., of Can. Ltd., Hamilton, Ont
U. S. Electrical Tool Co., Cincinnati, Ohio.

GRINDING MACHINES, SURFACE
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, THREAD
Pratt & Whitney Co., of Canada, Ltd., Sound, Ont.

GRINDING MACHINERY, TOOL POST
Gisholt Machine Co., Madison, Wis.
Grenfield Tap & Die Corp., Galt, Ont.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES, UNIVERSAL
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Herbert, Limited, Alfred, Toronto, Ont.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co., of Canada, Ltd., Hamilton Ontario.

GRINDING WHEELS
Lion Grinding Wheels, Limited, Montreal, Que.
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Norton Co. of Can., Ltd., Hamilton, Ont.

GUN-BARREL MACHINERY
Steinle Turret Machine Co., Madison, Wisconsin.

HACK SAWS, POWER
Atkins & Co., Inc., E.C., Indianapolis, Indiana.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.

HAMMERS, CHIPPING
Cleveland Pneumatic Tool Co., Toronto, Ont.
High Speed Hammer Co., Rochester,

HAMMERS, DROP
Bertram & Son Co., Ltd., The John Dundas, Ont.
Pliss Co., E. W., Brooklyn, N.Y.
Brown Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

HAMMERS, ELECTRIC
Brown, Boggs & Co., Ltd., Hamilton, Ont.

HAMMERS, PNEUMATIC
Can. Steel Foundries, Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto Ont.

HANGERS, SHAFTING
Canadian SKF Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Hamilton Gear & Machine Co., Toronto
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

HOBBING MACHINES
Shore Instrument Co., Jamaica, N.Y.

HARDENING, CASE-HARDENING AND TEMPERING
Barnes Company, Wallace, Hamilton
Gisholt Machine Co., Madison, Wis.
Cleveland Pneumatic Tool Co., Toronto Ont.

HAMMERS, POWER
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont
Jardine & Co., A. P., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

HOBS
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.

HOISTS, ELECTRIC
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.

HOISTS, HAND
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio

HOISTS, PNEUMATIC
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

HOLDERS-ON, PNEUMATIC
Cleveland Pneumatic Tool Co., Toronto Ont.

HYDRAULIC MACHINERY
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Kennedy & Sons, Ltd., Wm., Owen

IGNITERS, GAS ENGINE
Canada Foundries & Forgings Co., Welland, Ont.
Burke Machine Tool Co., Conneaut, O.

INDICATORS, SPEED AND TEST
Brown & Sharpe Mfg. Co., Providence, R.I.

INSULATION
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.

IRON BARS
Steel Co. of Canada, Ltd., Hamilton, Ont.

JACKS, HYDRAULIC
Norton, A. O., Boston, Mass.

JACKS, PLANER
Armstrong Bros. Tool Co., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

JAPANNING AND VARNISHING OVENS
Brantford Oven & Rack Co., Brantford, Ont.

JIGS AND FIXTURES (SEE TOOL WORK)
Fisher Motor Co., Ltd., Orillia, Ont.
Gisholt Machine Co., Madison, Wis.

KEYSEATING MACHINES
Morton Mfg. Co., Muskegon, Mich.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

KEYS, MACHINE
Can. Drawn Steel Co., Hamilton, Ont.
Morton Mfg. Co., Muskegon, Mich.

KNIVES, MACHINE
Atkins & Co., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

KNURL HOLDERS
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

LATHE ATTACHMENTS
Hendey Machine Co., Torrington, Conn.

LATHE TOOLS
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

LATHES, AUTOMATIC AND SEMI-AUTOMATIC
Gisholt Machine Co., Madison, Wis.
Herbert, Limited, Alfred, Toronto, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, BENCH
Hardinge Bros., Inc., Chicago, Ill.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

LATHES, BORING
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, CHUCKING (SEE LATHES, HORIZONTAL TURRET, AND LATHES, VERTICAL TURRET)
Acme Machine Tool Co., Cincinnati, O.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
Herbert, Limited, Alfred, Toronto, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, ENGINE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hendey Machine Co., Torrington, Conn.
Herbert, Limited, Alfred, Toronto, Ont.

LATHES, EXTENSION AND GAP
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison Wis
Herbert, Limited, Alfred, Toronto, Ont.
National Acme Co., Cleveland, O.
Steinle Turret Machine Co., Madison, Wis.

LATHES, PRECISION
Hardinge Bros., Chicago.

LATHES, RELIEVING
Hendey Machine Co., Torrington, Conn.

BUYERS' DIRECTORY

LATHE, UNIVERSAL HAND
Brown & Sharpe Mfg. Co., Providence, Rhode Island.

LATHE, SPEED AND HAND
Blount Co., J. G., Everett, Mass.

LATHES, SPINNING
Pryibil Machine Co., Torrington, Conn.

LATHES, VERTICAL TURRET
Bertram & Son, Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

LATHES, WOOD TURNING
Blount, Co., J. G., Everett, Mass.
Can. Fairbanks-Morse Co., Ltd., Montreal.

LEAD PIPE
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

LEATHER FILLET
D. K. McLaren, Limited, Montreal,

LINOLEUM MILL MACHINERY
Bertrams, Ltd., Edinburgh, Scotland.

LIQUID AIR PLANTS
L'Air Liquide Society, Toronto, Ont.

LOCKERS, CLOTHES
Dennis Wire and Iron Works, London, Ont.

LUBRICANTS
Oakley Chemical Co., New York, N.Y.

LUBRICATING SYSTEMS
Bowser, S. F., & Co., Ltd., Toronto, Canada.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Ltd., Welland, Ont.
Ker & Goodwin Machine Co., Brantford, Ont
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R. Toronto Ont.

MANGANESE STEEL
Can. Steel Foundries, Montreal, Que.

MANDRELS, EXPANDING
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

MANDRELS, SOLID
Greenfield Tap & Die Corp., Galt, Ont.
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MEASURING MACHINES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MECHANICS' FINE TOOLS
Lufkin Rule Co., Windsor, Ont.

METALS, ALLOY
Canada Metal Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.

METAL WORKERS
Parker Co., Charles, Meriden, Conn.

MICROMETER CALIPERS
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Rice Lewis & Son, Ltd., Toronto, Ont.

MILLING ATTACHMENTS
Burke Machine Tool Co., Conneaut, O.
Hendey Machine Co., Torrington, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.

MILLING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Burke Machine Tool Co., Conneaut, O.

MILLING MACHINES, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence, R. I.
Hardinge Bros., Inc., Chicago, Ill.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

MILLING MACHINES, BENCH
Burke Machine Tool Co., Conneaut, O.
Hardinge Bros., Inc., Chicago, Ill.

MILLING MACHINES, HAND
Brown & Sharpe Mfg. Co., Providence
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MILLING MACHINES, HORIZONTAL PLANER TYPE.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Kearney & Trecker Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto.

MILLING MACHINES, PLAIN
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, O.
Hendey Machine Co., Torrington, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.

MILLING MACHINES, THREAD
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MILLING MACHINES, UNIVERSAL
Brown & Sharpe Mfg. Co., Providence,
Hendey Machine Co., Torrington, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.

MILLING MACHINES, VERTICAL
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, O.
Herbert, Limited, Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto.

MILLING TOOLS, ADJUSTABLE HOLLOW
Geometric Tool Co., New Haven, Conn.

MOTORS, ELECTRIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Roelofson Elevator Co., Galt, Ont.
Williams Machinery Co., A. R., Toronto,
Wisconsin Electric Co., Racine Wis.

NAILS AND STAPLES
Canada Metal Co., Ltd., Toronto, Ont.

NIPPLES
Canada Metal Co., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton,

NITROGEN
Carter Welding Co. Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

NUT TAPPERS
(See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
National Acme Co., Cleveland, Ohio.

NUTS, FINISHED and SEMI-FINISHED
Galt Macine Screw Co., Galt, Ont.
National Acme Co., Montreal, ue.

NUTS (Up to 4-in.)
Steel Co. of Canada, Ltd., Hamilton.

NUTS, S.A.E., PLAIN AND CASTELLATED
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

OIL FILTERING AND STORAGE SYSTEMS
Bowser, S. F., & Co., Ltd., Toronto,

OIL STORAGE ENGINEERS
Bowser, S. F., & Co., Ltd., Toronto,

OIL HOLE COVERS
Can. Whitney Co., Ltd., Windsor, Ont.

OILS, SOLUABLE
Brantford Oven & Rack Co., Brantford, Ontario.

ORNAMENTAL IRON AND WIRE WORKS
Roelofson Elevator Works, Galt, Ont.

OXYGEN
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

OXY-ACETYLENE APPARATUS
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Atlas Press Co., Kalamazoo, Mich.

PAINT SPRAYERS
Spray Engineering Co., Boston, Mass.

PAPER MILL CONVEYORS
Bertram Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd., Montreal, Que.

PAPER MILL MACHINERY
Dominion Engineering Works, Limited, Montreal, Que.

PATTERNS, WOOD AND METAL
Fittings, Limited, Oshawa, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.
Victoria Foundry Co., Ltd., Ottawa.

PHOSPHOR TIN
Canada Metal Co., Ltd., Toronto, Ont.

PHOTOGRAPHIC DUPLICATING MACHINES
Photostat Corp., Providence, R. I.

PIPE BENDING MACHINES
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Underwood Corp., H. R., Philadelphia, Pa.
Williams Machinery Co., A. R., Toronto.

PIPE CUTTING AND THREADING MACHINES
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Petrie, Ltd., H. W., Toronto, Ont.

PIPE
Canada Metal Co., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.

PIPE FITTINGS
Canada Metal Co., Toronto, Ont.
International Malleable Iron Co., Guelph Ont.

PIPE AND NIPPLE THREADING MACHINES
Landis Machine Co., Inc., Waynesboro, Pa.

PIPE FITTERS' TOOLS
Rice Lewis & Son, Ltd., Toronto, Ont.

PIPE THREADING DIE HEADS
Landis Machine Co., Inc., Waynesboro, Pa.

PISTON-RING MACHINES
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

PLANING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Williams Machinery Co., A. R., Toronto.

PLANING MACHINES, ROTARY
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Herbert, Limited, Alfred, Toronto, Ont.

PLATE ROLLS
Bertram & Son Co., Ltd., The John, Dundas, Ont.

PNEUMATIC TOOLS
Cleveland Pneumatic Tool Co., Toronto.

POLISHING AND BUFFING MACHINES
Lion Grinding Wheels, Limited, Montreal, Que
Blount Co., J. G. Everett, Mass.
Brown & Sharpe Mfg. Co., Providence.
Pryibil Machine Co., New York, N.Y.

PRESSED STEEL PARTS
American Pulley Co., Philadelphia, Pa.
Fisher Motor Co., Ltd., Orillia, Ont.

PRESSES, ARBOR
Atlas Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

PRESSES, DROP AND FORGING
Brown, Boggs & Co., Ltd., Hamilton.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

PRESSES, FOOT AND HAND
Brown, Boggs & Co., Ltd., Hamilton

PRESSES, HYDRAULIC
Bertram & Son Co., Ltd., The John Dundas, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Perrin Ltd., W. R., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

PRESSES, POWER
Bliss Co., E. W., Prooklyn, N. Y.
Brown, Boggs, & Co., Ltd., Hamilton
Hepburn Ltd., John T., Toronto, Ont.
Stoll Co., Inc., D. H., Buffalo, N.Y.

PRESSES, SCREW
Brown, Boggs & Co., Ltd., Hamilton.

PROFILING MACHINES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

PROTRACTORS
Brown & Sharpe Mfg. Co., Providence
Lufkin Rule Co., Windsor, Ont.

PROPELLERS
Kennedy & Sons, Wm., Owen Sound Ontario.

PULLEYS, CORK INSERT
American Pulley Co., Philadelphia, Pa

PULLEYS, METAL AND FIBRE
American Pulley Co., Philadelphia, Pa.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.
D. K. McLaren Co., Limited Montreal, Que.

PULP AND PAPER MILL EQUIPMENT
Dominion Engineering Works, Ltd., Montreal, Que.

PUMPS, HYDRAULIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Dominion Engineering Works, Ltd. Montreal Que
Hepburn Ltd., John T., Toronto Ont

PUMPS, LUBRICANT AND OIL
Bowser, S. F., & Co., Ltd., Toronto.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Hepburn Ltd., John T., Toronto, Ont.

PUMPS, POWER
Bowser, S. F., & Co., Ltd., Toronto.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hepburn Ltd., John T., Toronto, Ont.

PUNCHES, CENTER
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

PUNCHES, HAND
Brown Boggs & Co., Ltd., Hamilton.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Jardine & Co., A. B., Hespeler, Ont.

PUNCHES, POWER
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

PUNCHING MACHINES, HORIZONTAL
Bertrams Ltd., Edinburgh, Scotland.

PYROMETERS, ELECTRIC
Bristol Co., Waterbury, Conn.
Flexible Shaft Co., Ltd., Toronto, Ont.
Taylor Instrument Co., Toronto, Ont.
Hiram Walker & Sons Metal Products Co., Walkerville, Ont.

RACKS, CUT
Hamilton Gear & Machine Co., Toronto.

RACKS, STORAGE
(See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ontario.

REAMER HOLDERS
Simonds Canada Saw Co., Montreal, Q.

REAMERS, ELECTRIC
U. S. Electrical Tool Co., Cincinnati, Ohio.

REAMERS, EXPANDING
Cleveland Twist Drill Co., Cleveland, O.
Davis-Boring Tool Co., St. Louis, Mo.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

REAMERS, SOLID
Butterfield & Co., Inc., Rock Island, Q.
Morse Twist Drill & Machine Co., New Bedford, Mass.

REAMERS, TAPER
Brown & Sharpe Mfg. Co., Providence, R. I.
Butterfield & Co., Inc., Rock Island, Q.
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canad, Ltd., Dundas, Ont.

RECORDERS, TEMPERATURE
Taylor Instrument Co., Rochester, N. Y.

RECORDERS, TIME
Gisholt Machine Co., Rochester, N. Y.
Taylor Instrument Co., Toronto, Ont.

REGULATORS, TEMPERATURE
Taylor Instrument Co., Toronto, Ont.

RIVETS AND BURRS
Parmenter & Bulloch Co., Gananoque, Ont.
Steel Co., of Canada, Ltd., Hamilton,

RIVET-MAKING MACHINERY
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

BUYERS' DIRECTORY

RIVETING MACHINES
Can. Fairbanks-Morse Ltd., Montreal Q.
High Speed Hammer Co., Rochester, N.Y.
Parmenter & Bulloch Co., Gananoque Ont.

RUDDER FRAMES, STEEL
Can. Steel Foundries, Montreal, Que.

RUBBER MILL MACHINERY
Bertram Ltd., Edinburgh, Scotland.

RULES, STEEL AND WOOD
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Windsor, Ont.

RUST PREVENTATIVES
Oakley Chemical Co., New York, N. Y.

SAND EQUIPMENT
Can. Link-Belt Co., Toronto, Ont.

SAND RAMMERS, PNEUMATIC
Consolidated Pneumatic Tool Co., Toronto.

SAW FRAMES AND BLADES, HACK
Atkins & Co., Inc., E. C., Indianapolis.
Diamond Saw & Stamping Works, Buffalo, N. Y.
Rice Lewis & Sons, Ltd., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWING MACHINES, POWER HACK
Atkins & Co., Inc., E. C., Indianapolis.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

SAW SHARPENING MACHINES
Atkins & Co., Inc., E. C., Indianapolis.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

SAWS, CIRCULAR METAL
Atkins & Co., Inc., E. C., Indianapolis.
Pryibil Machine Co., New York, N. Y.
Gisholt Machine Co., Madison, Wis.

SAWS, HAND
Atkins & Co., Inc., E. C., Indianapolis
Simonds Canada Saw Co., Montreal, Q.

SAWS, HOT AND COLD
Atkins & Co., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Q.

SAWS, HIGH SPEED STEEL
Atkins & Co., Inc., E.C., Indianapolis, I.
Butterfield & Co. Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWS, METAL BAND
Atkins & Co., E. C., Indianapolis, I.

SAWS, METAL CUTTING
Brown & Sharpe Mfg. Co., Providence.
Butterfield & Co., Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.
Starrett Co., L. S., Athol, Mass.

SAWS, SCREW SLOTTING
Atkins & Co., Inc., E., C., Indianapolis.
Butterfield & Co., Inc., Rock Island, Q.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canda, Ltd., Dundas, Ont.

SAWS, SCREW SLOTTING
Atkins & Co., Inc., E. C., Indianapolis.
Butterfield & Co., Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWS, WOOD
E. C. Atkins & Co., Indianapolis, Ind.

SCALES
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Lufkin Rule Co., Windsor, Ont.

SCREENS
Dominion Engineering Works, Ltd., Montreal, Que.

SCREW DRIVERS, OPTICAL, JEWELRY AND NOVELTY
Strand & Co., N. A., Chicago, Ill.

SCREW MACHINE WORK
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Montreal, Que.

SCREW MACHINERY, WOOD AND LAG
Cook Co., Asa S., Hartford, Conn.

SCREW MACHINES
Brown & Sharpe Mfg. Co., Providence, Rhode Island.

SCREW MACHINES, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.

SCREW MACHINE PRODUCTS
National Acme Co., Montreal, Que.

SCREW PLATES
Butterfield & Co., Inc., Rock Island. Que.
Jardine & Co., A. B., Hespeler, Ont.

SCREWS, CAP AND SET
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

SCREWS, SAFETY, SET
Galt Machine Screw Co., Galt, Ont.

SECOND-HAND MACHINERY
See last page of directory.

SEPARATORS, MOISTURE AND OIL
Bowser, S. F., & Co., Ltd., Toronto, Canada.

SEPARATORS, OIL AND WASTE
Bowser, S. F., & Co., Ltd., Toronto.

SHAFTS, FLEXIBLE
Strand & Co., N. A., Chicago, Ill.

SHAFTING
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
Williams Machinery Co., A. R., Toronto.

SHAPES, COLD-DRAWN SPECIAL STEEL
Union Drawn Steel Co., Hamilton, Ont.

SHAPING MACHINES
Hendey Machine Co., Torrington, Conn.
Morton Mfg. Co., Muskegon, Mich.
Williams Machinery Co., A. R. Toronto.

SHEARS HAND
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

SHEARS, POWER
Bliss Co., E. W., Brooklyn, N. Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Stoll Co., Inc., D. H., Buffalo, N. Y.
Williams Machinery Co., A. R., Toronto, Ont.

SHEARING MACHINES, ANGLE, IRON BAR AND GATE
Bertrams Ltd., Edinburgh, Scotland.

SHEET LEAD
Canada Metal Co., Ltd., Toronto, Ont.

SHEET METAL WORKING MACHINERY
Bliss Co., E. W., Brooklyn, N. Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Stoll Co., Inc., D. H, Buffalo, N.Y.

SHEETS, NICKEL, MONEL AND FIBRE
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.

SHEETS, O.P.C.R. & B. A. AND BLUE ANNEALED
Steel Co., of Canada, Ltd., Hamilton, Ont.

SIDE FRAMES, LOCOMOTIVE
Can. Steel Foundries, Montreal, Que.

SLOTTING ATTACHMENTS
Brown & Sharpe Mfg. Co., Providence, R.I.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

SLOTTING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.

SOLDERS
Canada Metal Co., Ltd., Toronto, Ont.

SPECIAL MACHINERY AND TOOLS
Brown Engineering Corp., Ltd., Toronto.
Gisholt Machine Co., Madison, Wis.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.
National Acme Co., Cleveland, O.

SPIKES, RAILWAY AND PRESSED
Steel Co of Canada, Ltd., Hamilton, Ont.

SPINNING LATHES
Frybil Machine Co., P., New York City.

SPRING, MILLED
Barnes & Co., Wallace, Hamilton, Ont.

SPRINGS, SMALL SPIRAL HELICAL, COMPRESSION, EXTENSION, TORSION AND SPECIAL
Barnes Company, Wallace, Hamilton.

SPRINGS
Barnes Company, Wallace, Hamilton.
Cleveland Wire Spring Co., Cleveland, O.
Steele Ltd., James, Guelph, Ont.

SPRINGS, FLAT STEEL, BRUSH HOLDER, CLOCK, SMALL FLAT SPRINGS
Barnes Company, Wallace, Hamilton.

SPROCKETS AND CHAINS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Renold Hanson of Canada, Ltd., Montreal, Que.

SQUARES
Brown & Sharpe Mfg. Co., Providence, R.I.
Lufkin Rule Co., Windsor, Ont.
Steel Co. of Canada, Ltd., Hamilton. Ont.

STAMPING, METAL
American Pulley Co., Philadelphia, Pa.
Barnes Company, Wallace, Hamilton.
Diamond Saw & Stamping Works, Buffalo, N. Y.
Parmenter & Bulloch Co., Gananoque, Ont.

STAMPS, STEEL
Diamond Saw & Stamping Works, Buffalo, N. Y.

STEEL CONCRETE REINFORCEMENT
Steel Co. of Canada, Ltd., Hamilton.

STEEL PLATE
British Empire Steel Co., Montreal, Que.

STEEL AND IRON BARS
Steel Co. of Canada, Ltd., Hamilton.

STEELS TOOL
British Empire Steel Co. Montreal Q.

STEEL, COLD-ROLLED STRIP
British Empire Steel Co., Montreal, Q.
Barnes Company, Wallace, Hamilton.

STEEL, CRUCIBLE, SPRING
Barnes, Company, Wallace, Hamilton.
British Empire Steel Co., Montreal, Q.

SHEETS, OPEN HEARTH STEEL
Steel Co., of Canada, Ltd., Hamilton.

STEEL, SHAFTING AND FREE CUTTING SCREW
Union Drawn Steel Co., Hamilton, Ont.

STEEL, SHEET
British Empire Steel Co., Montreal, Q.
Rice Lewis & Son, Ltd., Toronto, Ont.

STEEL, STAINLESS
Steel Co., of Can. Ltd., Hamilton, Ont.

STEEL STAIRS
Roelofson Elevator Works, Galt, Ont.

STEELS, ALLOY AND CARBON
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Can. Steel Foundries, Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton Ont.

STEELS, HIGH-SPEED
Armstrong Bros. Tool Co., Chicago, Ill.
Atkins & Co., Ltd., Wm., Sheffield, England.
British Empire Steel Co., Montreal, Q.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton.

STEEL TUBING, CLOSE JOINT AND WELDED
Standard Tube & Fence Co., Ltd., Woodstock, Ont.

STERN FRAMES, CAST STEEL
Can. Steel Foundries, Montreal, Que.

STRAIGHTENING MACHINERY
Bertram Ltd., Edinburgh, Scotland.
Williams & Co., Ltd., J. H., Brooklyn, N.Y.

STUDS
Geometric Tool Co., New Haven, Conn.
Galt Machine Screw Co., Galt, Ont.

SWAGING MACHINES
Atkins & Co., Inc., E. C., Indianapolis, Indiana.

SWITCHES, RAILWAY
Can. Steel Foundries, Montreal, Que.

TACHOMETERS
Bristol Co., Waterbury, Conn.

TANKS AND PUMPS, OIL
Bowser, S. F., & Co., Ltd., Toronto.

TAP HOLDERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
William L. Procunier, Chicago, Ill.

TAPER PINS
Galt Machine Screw Co., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

TAPES, MEASURING
Starrett Co., L. S., Athol, Mass.
Lufkin, Rule Co., Windsor, Ont.

TAPPING MACHINES AND ATTACHMENTS
Burke Machine Tool Co., Conneaut, O.
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.
Wm. L. Procunier, Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

TAPS AND DIES
Butterfield & Co., Inc., Rock Island, Q.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Herbert, Limited, Alfred, Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

TAPS, COLLAPSING
Geometric Tool Co., New Haven, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.

TEETH, DREDGE BUCKET
Kennedy & Sons, W., Owen Sound, Ont.

THERMOMETERS
Bristol Co., Waterbury, Conn.
Flexible Shaft Co., Ltd., Toronto, Ont.
Taylor Instrument Co., Toronto, Ont.
Greenfield Tap and Die Corp., Galt, Ontario.

THREAD-CUTTING TOOLS
Butterfield & Co., Inc., Rock Island, Q.
Greenfield Tap and Die Corp., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

THREAD CUTTING MACHINES
Landis Machine Co., Inc., Waynesboro, Pa.

THREADING MACHINES
Acme Machinery Co., Cleveland, Ohio.
Geometric Tool Co., New Haven, Conn.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Williams Tool Corp., of Can. Ltd., Brantford, Ont.

THREAD LEAD TESTING MACHINES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

THREAD-ROLLING MACHINES
Bliss Co., E. W., Brooklyn, N. Y.

TIE PLATES
Steel Co. of Canada, Ltd., Hamilton.

TIME RECORDERS
International Business Machine Co., Ltd., Toronto, Ont.

TONGS
Hepburn Ltd., John T., Toronto, Ont.

TOOL CASES
Rice Lewis & Son, Ltd., Toronto, Ont.

TOOL HOLDERS
Armstrong Bros., Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Bertrams Ltd., Edinburgh, Scotland.

TOOL POSTS, LATHE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Williams & Co., Ltd., J. H., Brooklyn, N.Y.

TOOLS, SMALL
(See Machinists' Small Tools)
Armstrong Bros. Tool Co., Chicago, Ill.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Lufkin Rule Co., Windsor, Ont.
National Machine Tool Co., Racine, Wis.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S. Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A.R., Toronto.

TOOL WORK
Brown Engineering Corp., Ltd., Toronto, Ontario.

TORCHES, BLOW
Rice Lewis & Son, Ltd., Toronto, Ont.

TRACKWORK, RAILWAY
Can. Steel Foundries, Montreal, Que.

TRACKWORK, MANGANESE STEEL
Can. Steel Foundries, Montreal, Que.

TRANSMISSION MACHINERY
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound.
Renold, (Hans) of Canada, Ltd., Montreal, Que.

TROLLEYS AND TRAMWAYS
Can Link-Belt Co., Toronto, Ont.
Northern Crane Works, Walkerville, Ont.
Wright Mfg. Co., Lisbon, Ohio.

TROLLEY WHEELS
Langley & Austin, Galt, Ont.

TROWELS, PLASTERING
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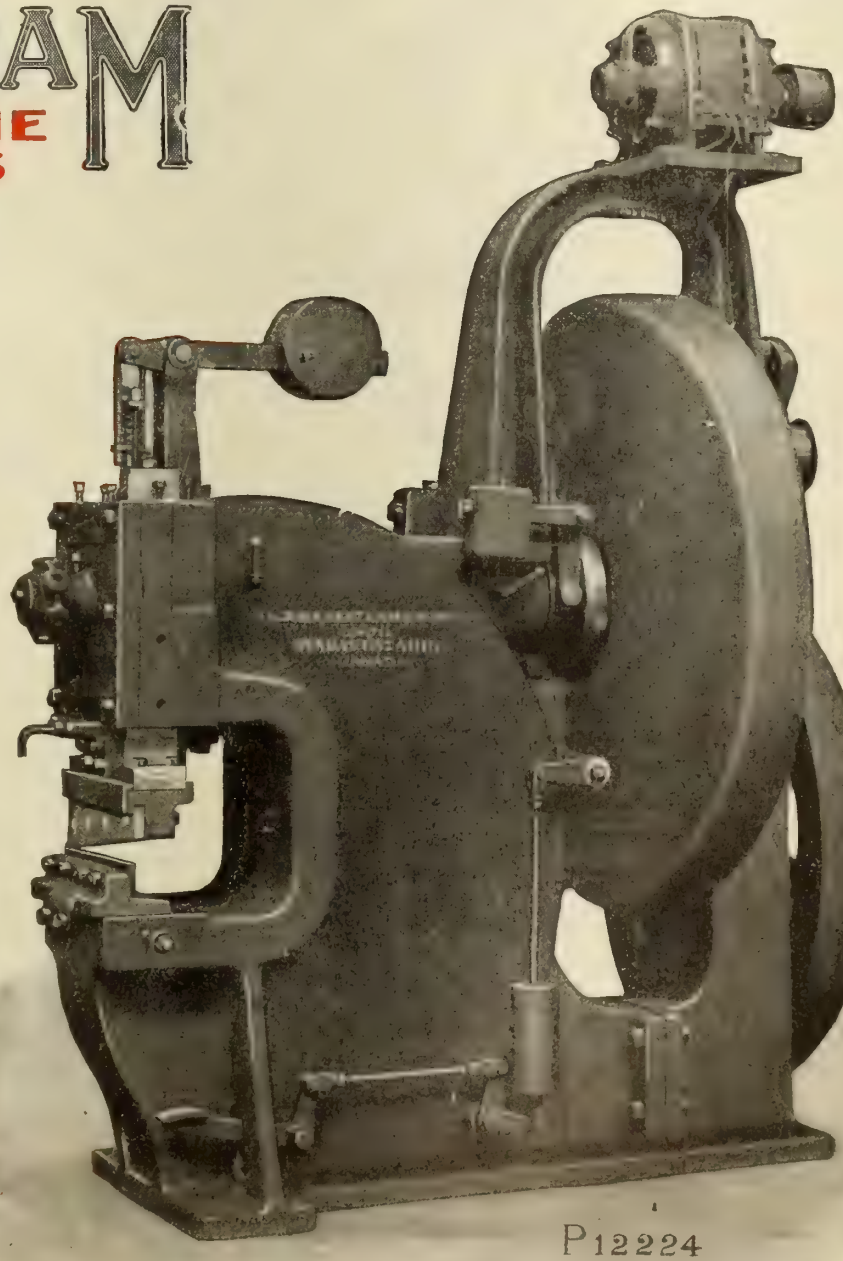
Vol. XXVIII. No. 21 | Published Weekly by the MacLean Publishing Company, Limited, Toronto, Ont. | Nov. 23, 1922 | $4.00 a Year Subscription Price

READ AND PASS TO	Check	See Page	READ AND PASS TO	Check	See Page

BERTRAM MACHINE TOOLS

Illustration shows our No. 4 Single Punch and Shear, 12″ Throat, Motor Drive through belt, fitted with plate shearing attachments.



Capacity

To punch 1″ hole through 1″ Plate
To shear 1″ Plates
To " 6″ x 1″ Flat Bars
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Write for full particulars re any machine or machines in which you are interested.

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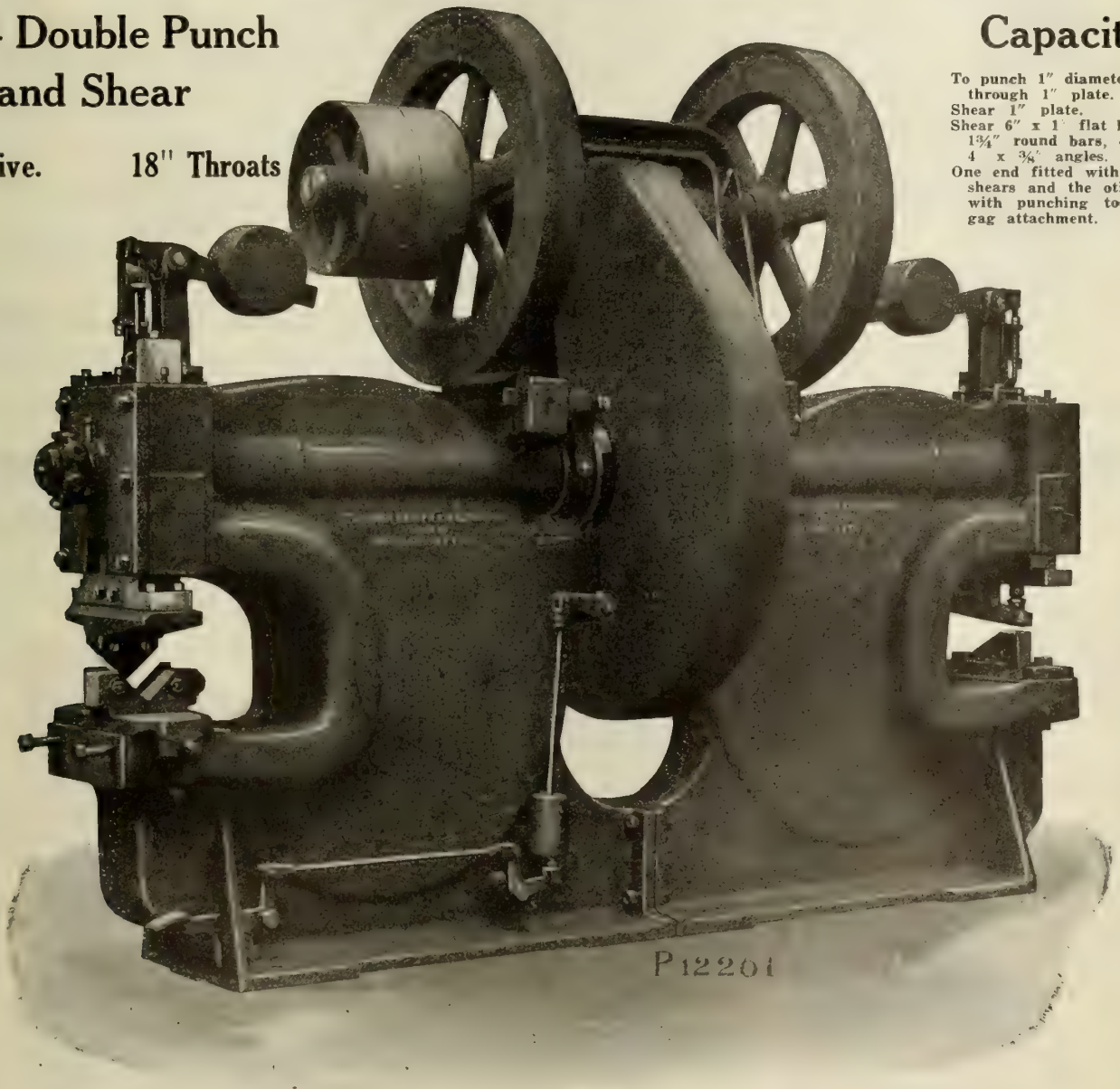
The BERTRAM Page

MACHINE TOOLS

No. 4 Double Punch and Shear

Belt Drive. **18" Throats**



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To punch 1" diameter holes through 1" plate.
Shear 1" plate.
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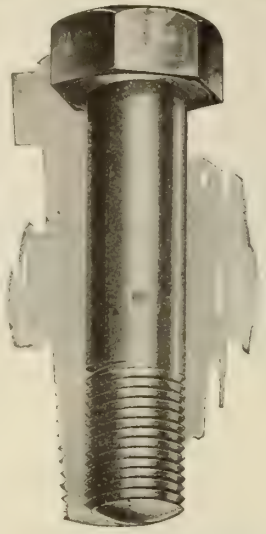

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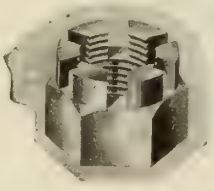

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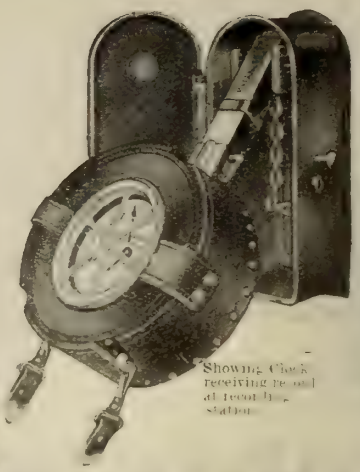

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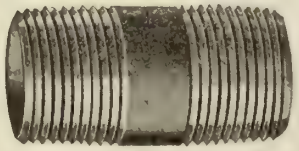

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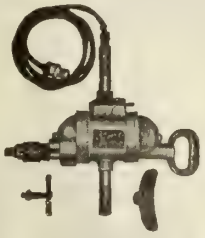

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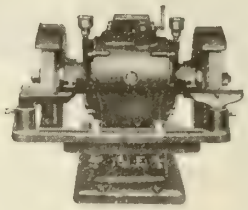

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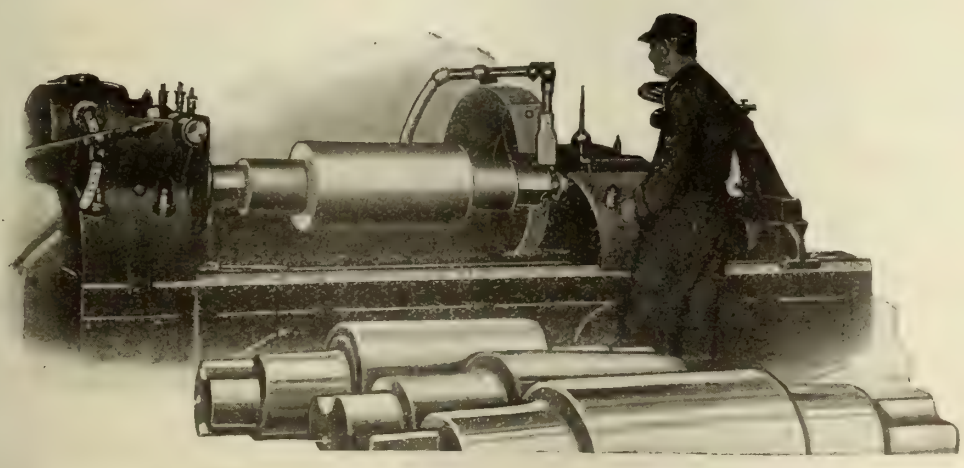

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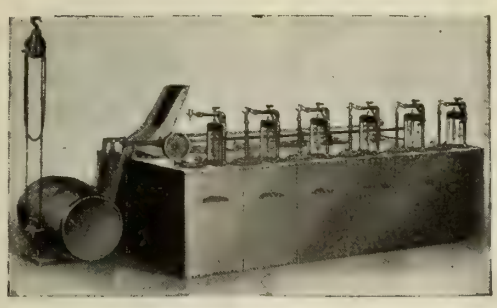

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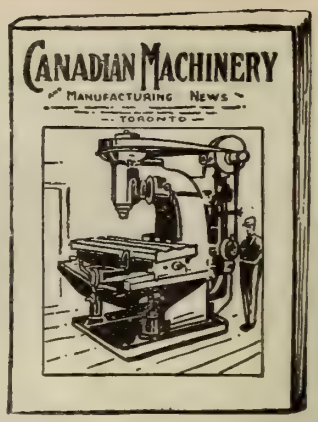

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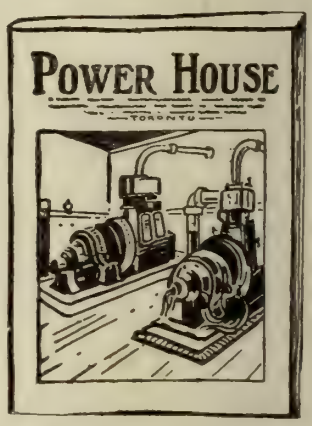

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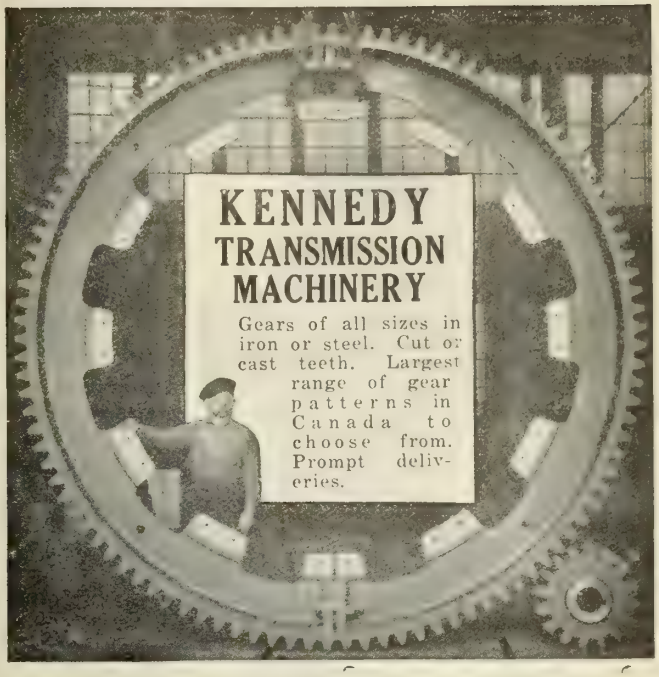
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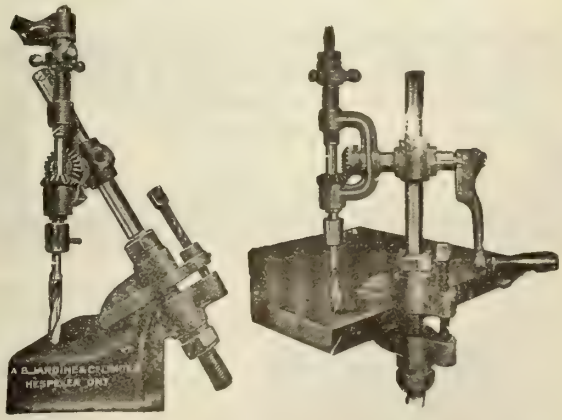

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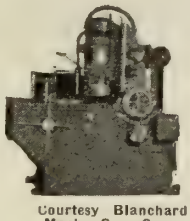

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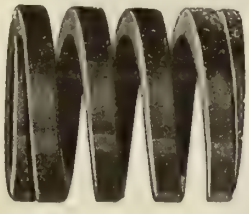

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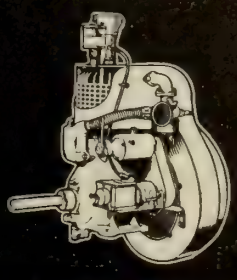

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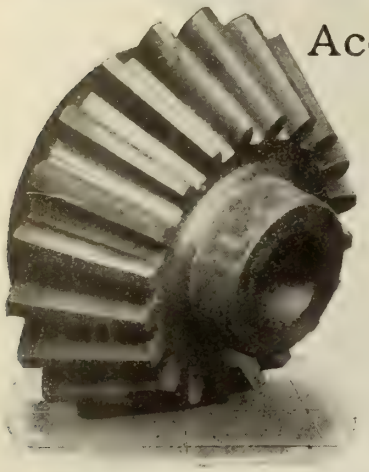

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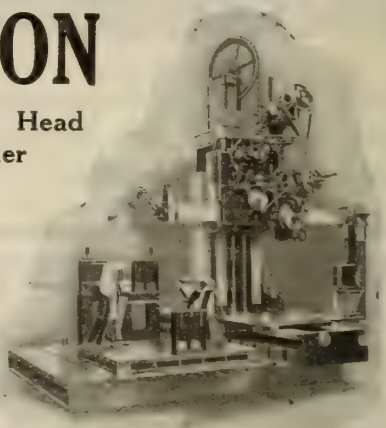

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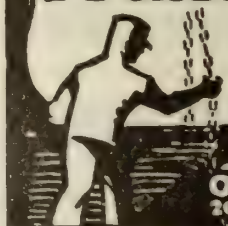

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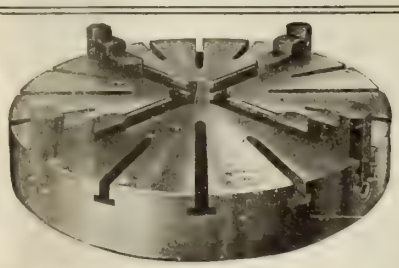

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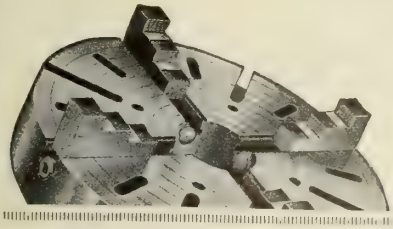

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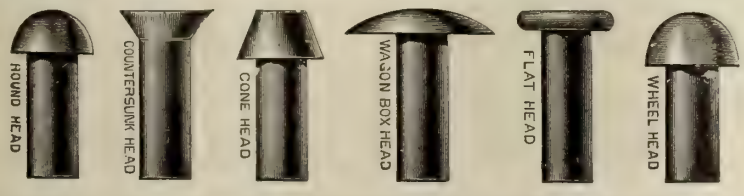

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CANADIAN MACHINERY
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VOL. NO. XXVIII, No. 21. NOVEMBER 23, 1922

Making The Cutter Stand Up To The Work

Maximum Rigidity Essential for Heavy Duty Milling—Interlocking and Staggering of Inserted Teeth—Special Appliances for Performing Heavy Work on Light Machines—Duplex Fixtures

In order to make the cutter stand up to the work it is necessary to give considerable thought to the part on which the operations are to be performed. Full appreciation must be given to the cutting action of the tool so that metal will be removed with the minimum of effort on the part of the cutters. To avoid any tendency of the tools chattering spring in the arbor or work-holding fixtures should be eliminated by providing adequate bearing support for the former and clamping facilities for the latter. Proper rake and keen cutting tools are very essential.

PROBABLY one of the most essential factors in any problem involving the cutting of metal is the need of maximum rigidity of support, both of the work-holding fixtures and the tools that are performing the actual operation of removing the material. Vibration in any form lessens the efficiency of the machine and requires operation at a reduced speed, consequently resulting in a loss of production. Steady cutting under heavy feeds and high speeds is only possible when every tendency to develop chatter has been given careful attention and provision made for its elimination.

A good example of heavy duty milling is illustrated in Fig 1. This job has usually been considered as one best handled on a shaper or on a planer, but the performance of the miller on this particular piece indicates that it can be economically machined by this method, provided proper equipment is supplied for the purpose. The gang of cutters shown in Fig. 1 consists of two large side mills, 14 in. in dia., flanking a pair of inserted interlocking cutters. The surfaces finished in this operation are the outer and inner faces of both flanges and the bevel portion between the flanges. The work is performed at a feed of 11¼ in. per min., removing from 3/16 to 5/16 in. of cast iron from the various surfaces.

It will be seen that the large side mills have the inserted teeth placed in such a way that positive rake is given both to the face and peripheral sides of the teeth. The cutters on the interlocking mills are ground on the periphery only, and the blades are staggered in order to make for smoother action. A feature in the construction of the large cutter heads is the added length on the hub, providing increased bearing on the arbor. The auxiliary steady head extending down from the overhead arm is located to give maximum rigidity to the cutter under the heavy cut. Special clamps are used to allow the cutters to pass completely over the work.

A somewhat unusual operation for a milling machine is that shown in Fig. 2. Here the high-power plain milling machine is adapted to the cutting of wing rails used on ordinary frogs and switches. The material is .70 carbon open-hearth rail steel, and the taper cut calls for the removal of metal from zero to about 1¾ in. at the end of the rail. The smooth cutting is clearly indicated by the condition of the machined surface and the chips removed. The cutters are ground on the face of the teeth so that the resistance to the curling of the chip is reduced to the minimum. The cutters are constructed with exceptionally strong teeth so that they will stand up to the work under the heavy cuts. The rail-holding fixture is designed to accommodate two sections of rail and placed far enough apart to permit of locating the auxiliary steady bearing between the two cutters, thus making for

Illustrations and information supplied through the courtesy of the Cincinnati Milling Machine Co., Cincinnati, Ohio.

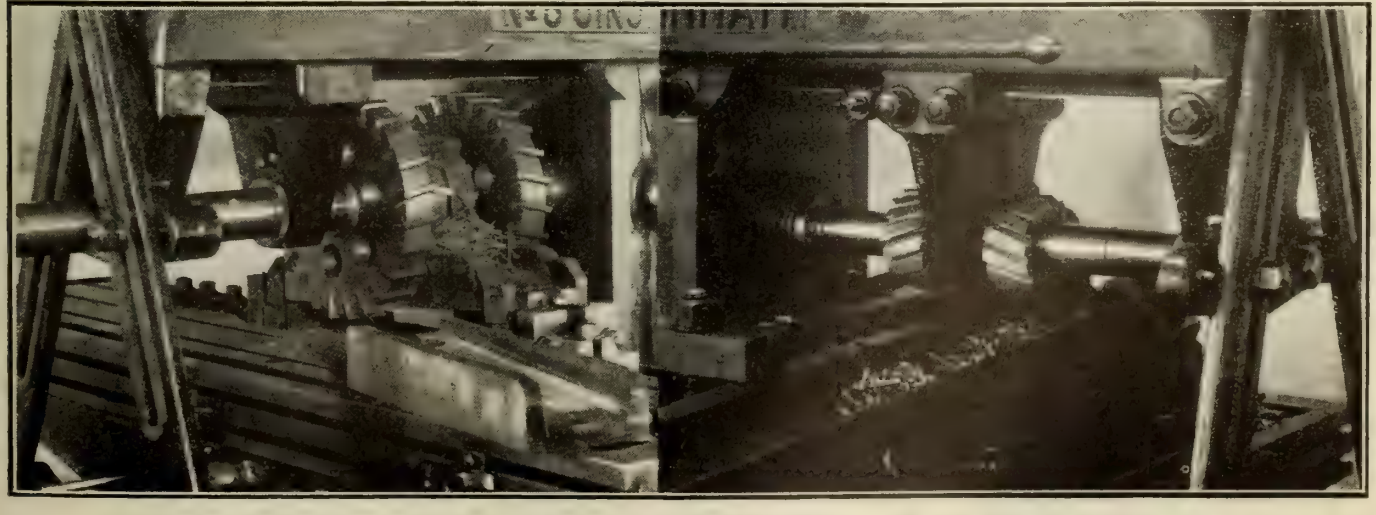

Fig. 1—Left: heavy milling work on driving box wedges. Fig. 2—Right: tapering steel rails for frogs and switches.

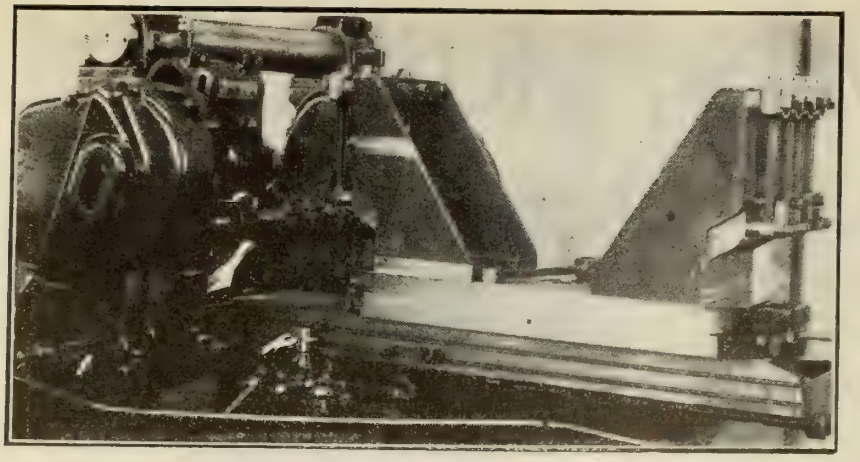

Fig. 4—Duplex milling machine at work on connecting rods.

extreme rigidity under exceptionally heavy cutting.

Fig. 3 shows a very interesting gang of cutters performing a rather difficult operation on a comparatively small milling machine. The cut is clearly indicated by the sample, and you will note that it consists of a deep slot and the milling of a boss. The cutters themselves are mounted in rather unusual fashion, the mounting being designed to reduce the necessary cutter diameter to a minimum. The slotting cutter is at best a very delicate and expensive tool, and one which because of its diameter and weak section does not act ideally.

It will be seen that the teeth of the side mill have both face and peripheral rake, also that they are all of one hand. The mill itself is bolted directly to the face of the spindle by four screws in much the same way as the face mill, and it drives from the two slots which mesh with the driving keys on the spindle. Through the spindle is fitted a special stub arbor which is held back by the draw-in bolt in the usual way. This stub arbor drives from the other pair of slots in the side milling cutter. On the arbor is mounted the special slotting cutter, the drive for which is obtained from a keyway cut across the face of the hub. The mill itself is held on the arbor by a special washer and hollow set screw combination. Note the long hub on the slotting cutter to give it stability and driving strength. Also note the shape of the teeth of the cutter staggered alternately right and left with ample side clearance. The total width of the teeth is considerably less than the width of the slot, so that the chip produced by each tooth will be less in width than the slot, insuring that the chips will not pack up in the slot, but will come out freely.

Another interesting thing about the gang is that the keyways are arranged so that the teeth in the side mill and in the slotting cutter are staggered. This gang of cutters is able to take the following cut on the No. 1 universal: Slot 2¼ inch deep by 9/16 inch wide, plus 3/16 inch removed from the boss, at a feed of 3⅞ inch per minute.

Fig. 4 shows a 48 inch duplex machine being used as a plain miller for performing the operation of milling the rounding on the wrist pin end of large truck connecting rods. There are four interlocking form mills used, 7 inch in diameter. They are relieved in such a way that ten degrees front rake is secured. Each cutter is made in two parts, interlocked first for maintaining size, and second, for improving the cutting action. Note that the teeth of all the cutters when in position on the arbor lie in approximately a spiral around the arbor. This arrangement has a tendency to break up the cut, and eliminate the heavy pounding so noticeable on many large form cutter gangs. Each individual cutter, of which there are four, is made in two parts, and each part has two keyways. One of the keyways in each half is located so that the front faces coincide. The other keyways do not coincide. The first keyway is used for grinding, and the second for driving on the arbor. This particular operation is going through smoothly, and the time per piece is about one-third of a minute. The duplex fixture provides for continuous operations as one end may be loaded with work while cutting is proceeding on the other.

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Special alloy heat-resisting pots are by far the best investment when compared to cast iron, malleable iron and cast steel. The round pot will be found to give a greater life than the square pot, due to the equalization of expansion and contraction stresses. The cored or chimney pot is only efficient, considering its added cost, where the chimney is 5 in. in diameter or over. Too large pots should be avoided for small work. The round pot will be found most satisfactory for pinion and ring gear work. It offers the advantage of even heating, and prevents the tendency to overcrowd the furnace hearth space.

Square or rectangular pots are best for splined shafts, but the work must be packed with due regard to the transference of heat. The size of the pot should not be greater than the work demands. This is imperative from the standpoint of handling, slowness of heating and the subsequent unevenness of carbon penetration from centre of pot to outside. It is also imperative that the pot should not be greater than is required by the work on account of the slowness of cooling where work is pot-cooled, with the subsequent separation of the carbon zones.

The best dimensions of the pot depend largely on the furnace. Too high pots are as bad as those too large in diameter. The average furnace varies greatly in temperature from top to bottom, and this variation increases with the arch height. A well-proportioned pot never exceeds in height the greatest width or the diameter. The height is best made between five-eighths and seven-eighths of the greatest width or diameter. All pots should be cast with legs to allow circulation of heating gases. For this same reason the floor of the furnace should be scraped clean after each heat. Great care should be used in sealing of the pots. The tighter the seal the more uniform the results.

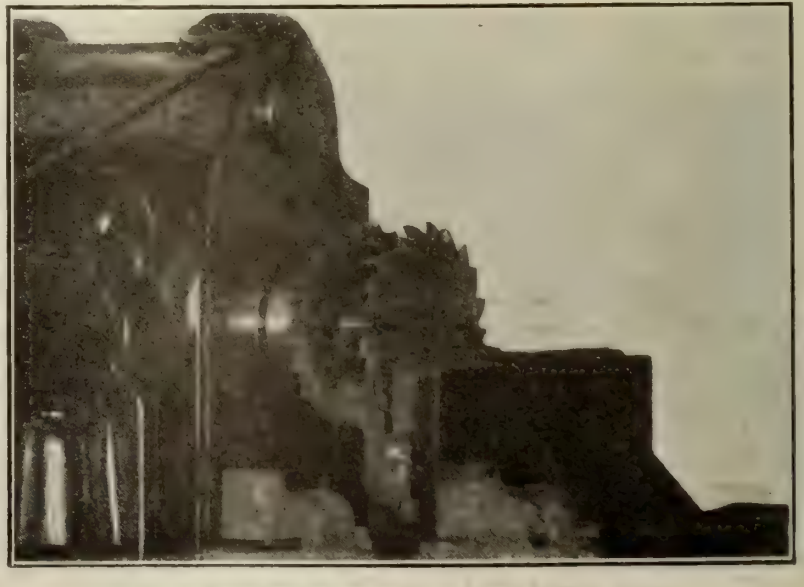


Fig. 3—Exceptionally heavy job on small milling machine

Suggested Standardization of Machine Tools

Benefits and Cost Compared—Work-holding and Tool-holding Fixtures—Uniformity in Interchangeable Parts—Research Will Aid the Movement—Considering Elementary Details First

By FRED H. COLVIN and K. H. CONDIT

THERE are two outstanding phases of the problem of standardization of machine tools, one as it affects the builder and the other its effect on the user of the machines. The former can be left to the builders themselves, as it affects the cost of manufacture and the amount of capital invested. The latter, the effect of standardization on the user, is of direct interest to all.

One of the first considerations in making or advocating any change from existing practice is whether the benefits to be derived are worth the cost. This holds good with the proposals for standardization of machine tools, and this question of cost very frequently makes what we are pleased to call standardization really a matter of elimination. We usually eliminate unnecessary sizes and make those which we retain the standard, rather than adopt an entirely new standard which is the result of careful investigation, calculation, and experiment. And while this may not be the ideal procedure, it is the practical solution in most cases. Devising a new standard too often means simply adding another variety rather than eliminating many which are now in use.

Advantage of Uniformity

Those who deprecate this unscientific method of standardization should remember that one of the greatest advantages of standardization, perhaps the greatest, lies in uniformity rather than in perfection as to the standard adopted. Taking the gear shift of an automobile as an example, the question of superiority in any particular shift sinks into insignificance in comparison with the advantages of having any one of the gear shifts adopted as standard on all cars. The typewriter keyboard is another excellent example of this.

Standardization of machine tools from the standpoint of the user can be confined to two specific points, work-holding and tool-holding devices. The former affect principally the spindle noses of lathes and the T-slots of planers, milling machines, boring machines, driling machines, and the like. Tool-holding devices affect the spindle noses of milling machines and drilling machines, turret holes, tool posts, grinding-wheel spindles, etc. And while these look innocent enough on the surface, it does not take long to find that it involves the old controversy as to tapers, which is enough to start a heated argument in any shop.

Interchangeability and Accuracy

Every mechanic who has handled precision work knows that it is not practicable to interchange lathe chucks on very accurate work with the idea that the chuck will run dead true on more than one machine. On the great majority of work, however, the ability to change chucks from one lathe to another, without the bother of making adapters (which usually add considerably to the overhang) would be of great service in many shops. In the same way fixtures should be interchangeable from one machine to another by the use of standard T-slots in the tables and probably a standard distance of the first slot from the edge of the table.

The inability to use given turret tools in more than one machine imposes an unnecessary expense on the shop overhead and also directly affects future sales of the machines in question. The builder whose machine has odd sizes of turret holes, for example, will have a hard time securing an order from a shop equipped with machines having a different size, even though one be as logical as the other. And while an order once secured might tend to force a continued use of this machine, it is apt to prevent an order at least as often as to secure one.

T-Slots

The standardization of T-slots is probably the easiest place to make a beginning, and here again it will undoubtedly result in the elimination of perhaps half the sizes, retaining only those which are necessary. A canvass of the total number of each size of T-slot cutters sold should make it easy to select the sizes most in use.

But even T-slots have several points to be considered: the width of slot opening, the width and depth of the T for the bolt head, and the depth of metal over the slot to resist pulling out a piece of the table. Uniformity as to this latter feature is, however, less important than the width, as that is what affects the use of tongs for locating milling fixtures and the like. The distance of the outside T-slots from the edge of table is also important.

It may be well to emphasize right here that no matter what is being standardized, it must be remembered that tolerance must be given in each case. And in considering tolerances, let us bear in mind that the modern tendency is toward an unilateral tolerance—a plus tolerance on the slot or hole and a minus tolerance on the part which fits it. Let us get away from the "plus or minus" tolerance on the same piece. Standardizing T-slots also involves the standardizing of the T-bolts which are to be used in them. Carl Barth has given this careful attention and his recommendations have been taken up by H. Cadwallader, Jr., of Philadelphia, who now manufactures T-bolts to the Barth standards.

Another point to be considered in standardizing work and tool-holding devices is to have the same size on as many machines as may be practicable. It may often be convenient to use the same chuck on a 14-in. and a 24-in. lathe. This is probably too big a range to be adequately covered by the same spindle nose, but it is quite possible that the same size of nose might be used on two or three sizes of machines. Some builders already use the same feed box on different sizes of machines, which is a very sane and sensible practice.

There is considerable talk of standardizing machine capacities, such as the swing of a lathe. But while it would be more convenient all around to know just what was meant by a 14-in. lathe, this is really a problem of the salesman and the buyer. If the seller prefers to cut prices by selling a 17-in. lathe under the name of a 14-in. lathe, it hardly affects the user so long as the work-holding or tool-holding devices on the lathe are standardized.

The milling-machine builders have perhaps done more in this line than builders of any other machine tools. A No. 1 machine now has approximately the same capacity in nearly all makes. The use of numbers, however, has little to commend it, whether it be milling machines or wire gages, and it is believed that main dimensions as to capacity would be more satisfactory to users.

Standardization Does Not Hamper Progress

One of the stock objections to standardization is that it prevents progress and the development of new ideas and designs. If, however, we consider that the Society of Automotive Engineers has done more in the way of standardization than any one else and then note the development in the automobile industry, this objection is easily answered. Is it likely that automobiles or other machinery would be more highly developed if each building used a special-sized nut with a special thread?

Material prepared by the authors and presented at a recent meeting of the American Society of Mechanical Engineers.

Standardization of such parts as nuts, piston pins, and other parts simply means that the designer calculates his requirements, such as to the kind of loads and stresses, and selects the standard part which meets his needs instead of designing an entirely new nut or pin of a slightly different size. It must also be remembered that standards are not as fixed as the pyramids, but can be changed whenever occasion really demands.

While all our efforts at standardization at this time should be devoted to such details of machine tools as affect the user, such as work- and tool-holding devices as have been pointed out, it is quite probable that the machine-tool builders themselves may find further standardization desirable. Research may show that bearings of certain dimensions are best for given spindle loads and speeds. Designers would then determine the load to which the spindle of a new machine would be subjected, and after considering all the conditions, would select the proper bearing from a list of standards. This would simplify manufacture and greatly reduce the number of tools and gages to be carried in stock, as well as the stock of bearings themselves. This phase of the matter, however, does not concern the user of the machine, and he will do well to confine his efforts at securing standardization to such features as concern him directly.

Securing The Adoption of Standards

In addition to the engineering and economic aspects of machine-tool standardization, there is the adoption phase—for all practical purposes this is a selling problem. The best engineers of the United States, or of the world for that matter, may gather in solemn conference and decide that certain standards shall be established, but they have no power to do anything more. If the manufacturer concludes that his present practice is sufficiently satisfactory and is not convinced of the need for innovation, there is little that the standardizers can do.

Very often the problem is essentially a "selling" problem and one for which the average engineer is temperamentally unsuited. Diplomacy, tact, persuasiveness—the stock in trade of the salesman—are needed at this stage of the game. Even they would be futile if no means were at hand for gathering together the men who must make sacrifices if a standard is to be adopted, for lacking such means the task of reaching each man individually and reconciling his views with those of all the others, would be herculean.

The machinery for handling the engineering and industrial problems connected with this phase of standardization already exists in the American Engineering Standards Committee, and the rules of procedure of this committee are designed to bring about the early adoption of approved American standards. To this end all sectional committees are required to include in their personnel representatives of all organizations which are in any way interested in the manufacture or use of the standard under consideration. Since these organizations are officially represented on the committee which prepares the standard, it is obvious that the members of these organizations are committed to the adoption of the standard to the extent that any individual or firm is committed by the actions of an organization to which he or it belongs. Just how well this arrangement is going to work out when it comes to universal adoption of a standard it is too soon to say, but at least the plan shows promise.

It may be that the division of simplified practice of the U. S. Department of Commerce recently organized by Secretary Hoover will have a part to play in securing the general adoption of the standards for small tools and machine-tool elements which are to be developed by the sectional committee sponsored jointly by the National Machine Tool Builders' Association and the American Society of Mechanical Engineers. This, of course, will be determined as the work of the committee progresses.

So far the division has done its best work in fields of industry not closely connected with engineering. It is cooperating, however, to the fullest extent with the American Engineering Standards Committee in furthering the establishment and introduction of standards.

Standardization is a tremendous job and it may prove to be one beyond the capacity of any standards body yet organized.

BABBITTING A LOOSE PULLEY

When a pulley is to be babbitted on a shaft and in the position it is to occupy when finished, and the tight pulley is already in place and known to run true, the loose pulley may easily be located by means of the other. When using an arbor, first secure in a perfectly upright position, put a collar on it that will form a support for the lower face of the pulley hub. After the pulley is placed on, seal the joint with some suitable material as cardboard, felt or putty. Before placing the pulley on, it is well to cover the shaft with a layer of thin oiled paper, winding the same with heavy cord in a spiral form, the helix running toward the center of the hub in the direction in which the pulley is to run. The grooves left in the babbitt after pouring will serve as ample oil channels and will likewise tend to keep the lubricant in the bearing instead of throwing it out at the ends. Should it be advisable to locate the shaft in a vertical position, the alternative would be to level the shaft horizontally and using a plumb line across the sides of the pulley. By this method it is necessary to use a sealed collar on each end and it is also suggested to use a pouring hole in the hub instead of an oil hole, as the latter would afterwards require to be drilled out.

MACHINING PISTON RINGS

By John Magee

The majority of piston-ring manufacturers prefer to make rings with the finished surfaces ground to size. It is easier to hold accurate dimensions on a grinding machine than it is on a lathe. However, hard castings and hard spots in castings are machined without difficulty or detection by grinding. For this reason piston rings with a turned finish on the diameter dimension should be specified. Neither the scleroscope nor the Brinell hardness test will disclose hard spots in castings. A ground finish may cover up many hard spots or a hard scale. The production of a turned surface is a somewhat slower process for the manufacturer, but it guarantees a uniform soft wearing surface.

Flatness is very essential, since a serpentine condition will allow leakage around the back of the ring through the ring groove. If all of the internal stresses are not removed during the process of machining, the ring is apt to warp sidewise. Therefore width dimensions should be inspected with a light gage instead of with a micrometer. With the ring lying on a perfectly flat surface, a side warp will cause it to register oversize. With measurements at intervals the two points of the micrometer might indicate a parallel width on a ring considerably warped.

The most common defect in the manufacture of piston rings is the elliptical ring, generally termed "out-of-round;" tolerance may vary according to the amount that the ring is likely to be worn in on the block. At best it is desirable to keep the variation within very low limits, say, 0.00025in. to 0.00050in. If the tolerance is expressed in light-gage terms, it is much more simple for inspection, because the light gage is at present the most practical inspection device for locating out-of-round rings.

No accurate data are available for determining the poundage or wall pressure of piston rings to accomplish definite purposes. Actual experiments conducted at different times for different purposes seem to indicate that a poundage in excess of 4 lb. per sq. in. of bearing surface is needed to prevent collapse under pressure. Therefore a poundage of 5 lb. per sq. in. has commonly been specified for all purposes.

There seems to be a diversity of opinion as to the proper gas opening or expansion allowance. This is probably due to the difference in the estimated temperatures to which a piston ring is subjected. Using 0.0000056 per in. per deg. as the coefficient of expansion of cast iron, a minimum opening allowance for maximum expansion is obtained by multiplying this coefficient by the circumference of the ring.

Extract from Mechanical Engineer.

Operations and Tools Used in Making Gas Engines

Cross-head Tends to Equalize Wear on Cylinder and Piston—Economic Jig and Fixture Construction—Method of Locating Parts in the Jigs—Uniform Product Turned Out

By ROBT. MAWSON

THE marked difference in the design of these particular engines over the usual type is that they are made with a cross-head placed between the crankshaft and piston head, similar to a steam engine. In the usual construction of gas engines it is the practice to attach the connecting rod directly to a trunk piston, which is used as the cross-head. In this engine the wearing parts of the cross-head are placed where they are always cool and can be readily reached and adjusted. Further by removing from the piston head the angular thrust of the connecting rod the cause of extreme wear on the bottom and top of the cylinder more than the sides, and therefore out of round, is removed.

To the reader who has had experience with steam engines and the usual type of gas engines the argument here stated carries sufficient weight. The steam engine cylinder always tends to wear equally, the gas engine (trunk piston type) always wears the cylinder top and bottom, and the reason is the difference in attaching the crank and connecting rod to the piston.

When machining the various elements used in the building of these gas engines many interesting tools and methods are used and some of these will be shown and described in this article. Fig. 1 shows the jig used when drilling the bracket for the rocker arm. This casting has been milled on the sides of the two arms in a previous operation. The casting is then dropped into the jig with the clamp A swung out of the way. The two screws B are next tightened against the piece and these force the casting back to the two stop plates C, thus locating it in relation to the outside circular portion of the large diameter. The clamp A is now swung back, being held with the set screw D and the set screw E, which is past the center line of the large boss, therefore holding the element securely in the jig. Two ⅞ inch holes are then drilled in the piece through the guide bushings F and two holes for ½ inch standard tap are also drilled through the bushings G. The jig and casting is then reversed with the top surface resting on the machine table and a hole for ½ inch standard tap drilled in the boss H, the drill being also guided through a bushing in the wall of the jig.

Drilling Rocker Arm Bracket

Fig. 2 shows the jig used for drilling the rocker arm bracket. This casting has been machined on the face of the flange and also both ends of the long boss before coming to the drilling department. The piece is then placed into the jig and the screw A tightened against the inside face of the flange as shown, which forces it back against the machined surface. The screw bushing B is now screwed down, and as this is made with a cup surface it fits over the upper end of the long boss and forces the casting down, in a straight line, as the piece is held in contact with the wall of the jig by means of the screw A.

The advantage of this method of locating the casting is, that the hole machined in the large boss will be at the proper distance from the machined flange and also parallel to it, which is very important in this piece. The following holes are then machined; two 21/32 inch drilled through the bushings C and one ⅞ inch drilled and reamed through the long boss, the tools being guided through the screw bushing B.

The illustration Fig. 3 shows one of the larger jigs used at the plant, being the tool used when drilling the pump housing, the casting coming to this jig after the base A has been machined in a milling machine. The casting is then slid into the jig with the strap B swung back; the strap is placed in position as shown and the set screws C force the casting back against the locating stops.

The following holes are then drilled, fourteen to suit ½ inch standard tap, two ¼ inch, three 2¼ inch bore, three 1-1/16 inch bore and one hole drilled at the lower surface for ½ inch tap. It will be noticed that this tool has been made as light in construction as possible, holes being cored wherever possible so that it can be handled as conveniently as the size of the jig and casting will allow.

Drilling the Air Valve

In the Bessemer gas engine there is but one air and gas valve body. The valve is of the disc type and the valve action is vertical, so that gravity aids the springs in seating it. On the smaller sizes this valve is composed of only one disc, while the larger sizes have two discs. The advantage of the disc valve is its extreme lightness, less lift required on account of there being an opening on the inside of the disc as well as the outside. Less weight and less lift results in a much quicker acting valve, hence better efficiency.

Fig. 4 shows the jig used when drilling the air valve. The valve consists of the body proper, a cage and either one

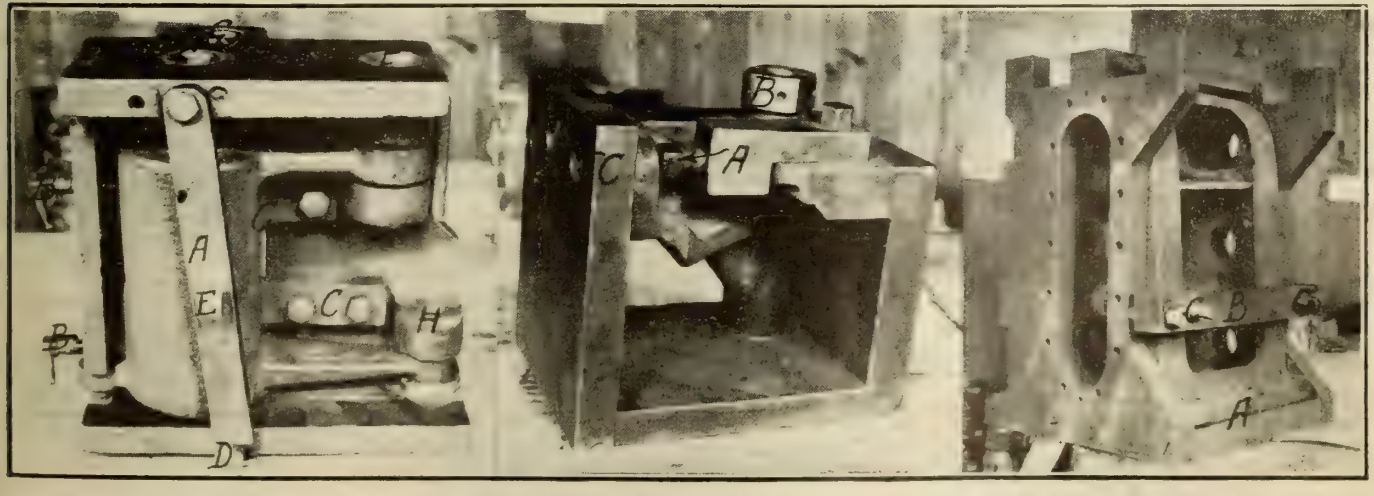


Fig. 1—Left: drilling bracket for rocker arm. Fig. 2—Centre: jig for drilling rocker arm bracket. Fig. 3—Right: jig for pump housing.

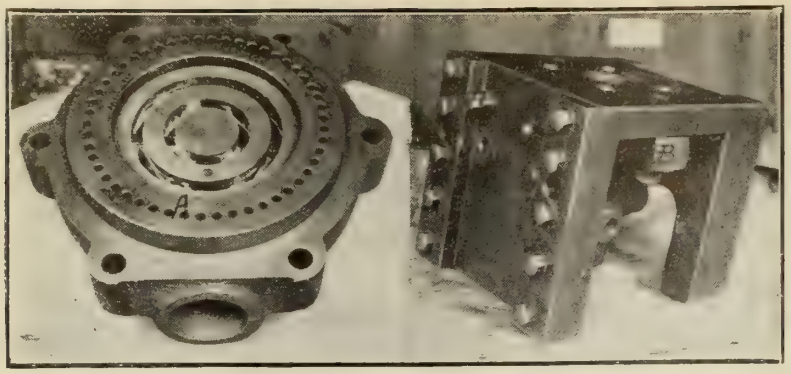


Fig. 4—Left: drilling the air valve. Fig. 5—Right: jig for air starter body.

or two flat steel discs, depending whether the valve is for a small or large engine. The body is first faced perfectly flat on the joint surface, and the bolt holes drilled, also the gas and air openings. The cage is also drilled to suit three springs which are used in the construction. The discs are ground on their faces and afterwards lapped in contact with the valve body until a perfect bearing is obtained.

The jig A is then placed onto the valve body, being located by means of a recess which fits over a machined register on the casting. Fifty ¼ inch holes are then drilled in the body, the drill being guided through the bushing holes shown in the jig. The holes drilled are used to admit the gas into the valve which comes in contact with the air in the mixing chamber to form the proper explosive mixture.

The jig shown in Fig. 5 is used when drilling the air starter body. This casting is first bored and a register turned and the face machined square with the bored hole. The piece is then placed into the jig being located with the turned register which fits into a recess in the face of the tool. The screws A are then tightened to bring the piece square in the jig and the clamps B hold it securely for the drilling operation. The following holes are then drilled four ⅞ inch and one ¾ inch through the upper wall and two ¼ inch through the left hand vertical wall of the jig, bushings being provided as shown to enable the parts to be produced of an interchangeable nature.

It will be seen that all the tools used at this plant are somewhat simple in their design and do not require an enormous outlay either in their design or manufacture, but it is only by the use of jigs and fixtures that accurate and interchangeable parts can be obtained. The advantage is two-fold, the first cost is much lower when making the new engines, and what is of equal if not more importance is the fact that repair parts can be supplied to any part of the world knowing that when these parts arrive they will be accurate and fit without the need of so much as a file being used.

Pattern Changes Save Money

By D. A. Hampson

A very slight change in pattern design will often make a great difference in the time taken to make the subsequent castings and in the quality of those castings. Sometimes, the nature of the change may take on a mere simplification of shape, it may mean the elimination of cores or the addition of a core to a solid piece, again the pattern or patterns may have been arranged for bench moulding and have been altered so as to go on a machine, or it may be that frail and uncertain wood patterns are replaced by metal ones.

In any case, the object aimed at is to get out smoother castings, castings that are lighter, and that require less metal to be removed on the machines in the shop. No matter whether half a dozen castings only are required or whether the job is a "manufacturing" proposition, it is always in order to scan the patterns for possible improvements. And the biggest single aid to the machine shop man is a frank talk with the foundry superintendent.

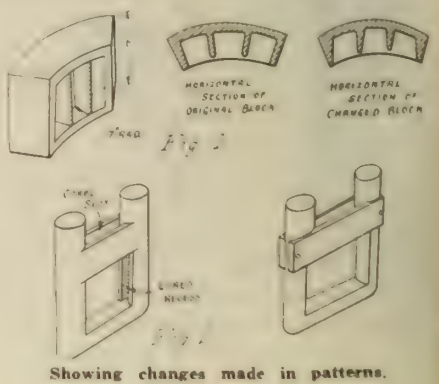
An engineering plant was buying 40 tons a year of a certain casting weighing 900 lbs. and paying 4½ cents a lb. for the iron. The foundryman suggested a certain change but it was of such a nature that an entirely new pattern would be required, and this at a cost of about $150. Finally the plant agreed to make the change, more to please the foundry people who really turned out superior work than with thought of actual gain. To their surprise they got those castings for 3½ cents a lb. from that time.

Fig. 1 shows a part that was made up in lots of one and two hundred. It is a packing block, or parallel, to be used on a hydraulic press. The interior is cored for lightness. One can see at a glance that the core is simple but yet it took time to make each one and time to set it in the mould. A change in shop executives took place and this job came under the scrutinizing eye of the new man. He had a new pattern made in which the ribs were parallel instead of radial as in the original. With the radial ribs, a core was necessary—with parallel ribs, the pattern made its own core; thus, the moulder's time was saved and there was no core work at all. There was a little more iron in the casting—about 4 cubic inches — where the ribs were given draft and the filling in required at the outsides but the cost of this was offset several times by the savings effected.

A smaller flask could be used, the moulder had an easier pattern to handle, there was no knocking out of cores afterwards, and there were no delays due to cores being behind time. This is a fine example of a very simple piece, yet one on which able men fail to see the shortest way. Just because a relatively small number were required at a time, the thing was not given intensive thought.

An example will be given of a saving on a manufacturing job. Fig. 2 shows an iron specialty used in the clothing field. It has a core 3/8 inches x 1-3/4 inches through one end, thus leaving 1/8 inch bridges joining the two posts. Jaws were fitted in this cored slot and as a consequence it had to be filed out smooth. Literally, hundreds of castings were broken in the work of cleaning the slots in the shop. And an equal number were returned because inspection showed that the casting could not be cleaned or saved. Several good foundries were given trials on this work, extending over a reasonable period, but the result was always the same. The fins and little chilled lumps that stuck to the bridges had to be ground, chipped, or filed according to their location and interior core imperfections had to be laboriously filed down. Because of the large number of rejections, the foundries charged an average of 12 cents a lb. for the castings, which was not unreasonable for cored work at that time. When the cost of breakages and of labor on good castings was added to the foundry charge, it was discovered that the castings ready for shop processes cost about 22 cents a pound.

Some study in the planning department resulted in the changed design shown. Steel plates were used for the bridges, riveted to the prongs of the castings. By this change, the castings were made without cores. There was so little time spent in snagging that it was negligible. Rejections and breakages did not run over 1 per cent total.



Showing changes made in patterns.

Various Methods of Fastening and Driving Gears

Accuracy in Concentricity is Essential Factor—Reaming and Grinding the Bores—Broaching Revived the Square Shaft Drive —Transmission of Power—Service of Different Gears

By CHESTER B. HAMILTON, JR., B.A.Sc., M.E.

THE great majority of gears have plain cylindrical bores and drive or are driven by a key. Gears which are pressed or shrunk on the shaft drive through the fit, which may be considered an exaggerated case of friction drive, the minute irregularities of surface being forced to interlock. When a key is provided in such cases it is as a precautionary measure or to ensure alignment in assembling, as in some styles of pair-geared crank presses. The cylindrical bore must be, within close limits, truly cylindrical and of accurate diameter if the gear is to give a satisfactory performance in service. Tightening up with the key is bad practice anywhere, but is intolerable with gears. The actual limits required depends on the class of work and its size. The standard subdivisions and limits are set forth in a later section.

Use of Set Screws

Set screws are frequently used as a means for fastening gears. While these are satisfactory for pulleys, levers, etc., they are an indifferent fastening for gears where they have to take the driving torque, except in quite small work, or cases of light duty. The use of set screws to prevent gears shifting along a shaft is however, quite another matter, and is good practice. This often occurs where the gear has to be slipped over a sunk key in the shaft. Such a key is very difficult to fit, and is often made quite slack.

The holes in high grade gears are always reamed if the gear is not to be heat treated, but hardened gears are ground in the bore after hardening. For this operation the gear is chucked by the teeth, using rollers in the chuck jaws which bear at the pitch line at three points only. Thus the bore is ground concentric with the pitch circle to very close limits. If the end face of hub is required to bear against any other part as it revolves, it is usual in good work to grind it also true to the pitch circle, and generally at the same setting as the bore.

Taper Bore Drive

A taper bore is often used in gears that are mounted on the overhanging end of the shaft, so that a retaining nut can be used. This is more common with pinions than gears, as it is not good practice to overhang a gear if it can be avoided. The commonest examples of taper bored pinions are the driving pinions of most automobiles, which mesh with the crown or ring gear in the rear axle, and the street railway motor pinions. It is almost universal practice to use a parallel key, or a Woodruff key, with a taper bore. Set screws and taper keys are bad, as they apply a side pressure which directly tends to loosen the pinion. If the taper of the bore is slight, such a pinion can drive by shrinking almost as well as with a cylindrical shrink fit. Street railway pinions have a taper of 1¼ inches per foot and standard practice requires them to be shrunk on from a temperature of only 212 degrees Fahrenheit after being driven home on their conical seat with a sledge. Even at this low temperature difference the shrink pressure is sufficient to drive for all operating conditions. The key is only provided in case the retaining nut should work loose and permit the pinion to shift down the taper and free itself. Taper bores must be accurate to taper as well as the other dimensions, and within quite close limits, otherwise the extra expense of making in this form is wasted.

Driving With Square Shaft

The square shaft drive is a very old form and was much favored in the old days of hand-made machinery. It fell into disuse, until it was revived by the development of the modern broaching machine. The pull broaching process opened up many new avenues of machine construction, and the use of specially shaped holes in gears was one of them. For most automotive and similar class of work the square has now been superseded by multiple spline shafts, but for a long time it held a leading place on account of the simpler shaft and the lack of means at that time for accurately and cheaply furnishing the splined shaft. Standard sizes and standard limits have been adopted by the Society of Automotive Engineers for the square holes and square shafts for both fixed and sliding fits.

Multiple Splined Shafts

Multiple splined shafts and broached holes have also been standardized by the Society of Automotive Engineers in the four, six and ten spline forms. The six and ten spline forms are specified with three different depths of spline, for permanent fit, to slide when not under load, and to slide when under load. The pressure per unit of bearing area on the sides of the splines is of course the governing factor, the greater depth of spline being required in the last mentioned case. The four spline form is designed for only the first and second cases, and not to slide under load, as with only four splines to carry the load, the depth required to provide the needed bearing area would give a badly proportioned cross section of shaft.

Suitable limits specified in each case for the diameter of shaft body and diameter over the splines. All allowances for fit are made on the shaft. The standard dimensions are for the soft broached hole before hardening. Such gears are practically always hardened. They are usually also ground in the bore, and therefore the fit is on the smaller diameter of the shaft, and the height of the splines on the shaft is reduced for clearance. No other way would be right on the four spline form, but on the multi-spline forms the widths of the land and of the grooves are nearly equal, and if the grooves in the gear come from hardening clean and smooth enough, and if the shrinkage is uniform enough, it is quite possible to take the fit on the bottom of the broached grooves in the gear and the top of the spline on the shaft. In this case accuracy of fit would be obtained by grinding the outside diameter of the shaft on a cylindrical grinder. In other case, where the bore of the gear is ground, a particularly close fit or smoothness of sliding can be obtained by also grinding the small diameter of the shaft with a concave face wheel with its axis at right angles to the axle of the work.

Forming the Splines

If a form wheel is used of profile to agree with sides of the splines as well as the bottom of the groove, a close limit can be maintained on the width of spline. This is important, for slackness at this point is a very bad feature in a gear and conduces not only to noise therein, but a hammer blow under fluctuating speeds and loads is transmitted to the remainder of the mechanism which is very destructive. The form of face of the grinding wheel, while complicated, is not as difficult to maintain as might be thought. Three diamonds are mounted in separate holders combined into one dressing fixture. Two of them slide in inclined guides to dress the bevelled flanks of the wheel face, and the centre diamond swings about a pivot to dress the radius in the middle of the face. All three are separately adjustable to positions dictated by the inspection of the product.

As to transmission of power, the duty required of gears may be classified under four heads according to the severity of the service. First, they may be required to transmit motion only, with negligible force, and velocity not a factor in the design. Such gear applications are found in clocks, meters, indicators and some indexing devices. Sometimes in fine work the correctness of the tooth form to give uniform angular velocity at all phases of the tooth action is important. In such cases the generated involute is the natural choice. These gears are fine pitch and small.

Load at Low Velocity

The second class of gear applications covers cases where they are required to transmit load at negligible velocity. These are mostly heavy, coarse, slow moving jobs or hand power applications, and include hand power winches and hoists, some indexing mechanisms where the gears must do the holding between motions as well as the moving, and the final pair of gears in a great many trains of gears, where the object is to apply slow motion, as in traversing a gantry or opening a swing bridge. These gears are coarse pitch, of substantial design and common workmanship, sometimes not even with cut teeth, but only rough moulded.

High Speed Drive

The third kind of application calls for gears that can transmit load with velocity, and includes the general run of gear work, and the great majority of cases. Unless otherwise specified gears are designed for this class of service. The ordinary factor of safety provided for overload also taking care of incidental minor shocks. On account of the velocity, the tooth form and workmanship are important factors, of which greater account must be taken as the velocity increases. The style of gear is also a factor, as helical or double helical gears can be run at very much higher speeds than straight toothed gears.

Providing for Shock

Of the fourth class, are those applications where power must be transmitted, not only with velocity a factor, but also with provisions for shocks. This is the most difficult case for which gears have to be designed, as frequently the shock may be much more important than the continuous load that it accompanies. Typical illustrations are found in rolling mill work, in punch press gears, ship steering gears, rock crushers, clashing change gears in automobile transmissions, etc. In this class of work the material is of paramount importance, toughness being an essential quality. Steel, often high grade alloy steel, or special bronzes are required. First class workmanship and correct tooth form are important for the shocks, and throbbing due to bad meshing and defective tooth action should not be added to the peaks of the applied load. The form of the gear is also important. Pinions of small number of teeth are bad, because of poor tooth action, and also the weakness inherent in a pinion due to narrowness across the roots of the teeth. Double helical gears are at a premium on account of the smoothness and continuity of tooth action. Where small numbers of teeth are necessary, the double helical pinion of wide face, cut solid on the shaft will often save an otherwise impossible situation.

PIG IRON OUTPUT SHOWS AN INCREASE

Pig iron production in Canada during October showed an increase of 11,194 tons or 47.7% over the record for September, and amounted to 36,888 tons as compared with 24,974 tons in the previous month, according to a report issued by the Dominion Bureau of Statistics. The increased tonnage was almost wholly basic pig iron manufactured for use by the firms reporting. The production of this grade increased from 16,976 tons in September to 28,922 tons in October or 70.4%.

Although the October production showed an encouraging increase and was the greatest since March of this year when an output of 41,733 tons was reached, it was still below the monthly average for 1921.

During the ten months ending October, the average monthly production of pig iron was 31,287 tons this year as compared with a monthly average of 50,673 tons in the same period last year. The cumulative output was, correspondingly, 312,877 tons in the past ten months as against 506,730 tons in the first ten months of 1921.

The number of active furnaces at the end of October was unchanged at four, viz: one at Sault Ste. Marie, one at Hamilton and two at Sydney.

The production of ferro-alloys remained practically the same as in September at 1,823 tons comprised wholly of ferro-silicon of 15 to 80% grades. Of this amount 68.6% was of 15% ferro-silicon.

Steel Ingots and Castings

The output of steel ingots and castings in Canada during October amounted to 52,735 gross tons, an increase of 47.3% over the September production of 35,787 tons. Basic open hearth ingots produced for further use by the firms reporting, amounted to 50,851 tons in October as compared with 33,815 tons in September, an increase of 50.4%. The average monthly output of basic open-hearth ingots during 1921 was 53,489 tons and for the first ten months of the current year averaged 37,052 tons. The month of October therefore showed a decrease of 4.9% from the average production for 1921 and an increase of 37.2% over the average for the first ten months of this year.

Basic open-hearth castings made during the month amounted to 974 tons, an increase of 137 tons or 15.2% over the preceding month, and most of the production was made for sale.

The output of Bessemer castings declined slightly from 180 tons in September to 125 tons in October, a decrease of 30.6%. Electric castings also fell off 10.6%, the actual production being 831 tons in September and 743 tons in October.

The cumulative production of ingots and castings for the ten months of the current year amounted to 387,570 tons as compared with 549,792 for the same period of last year, a decrease of 29.5%.

The average monthly production for 1922 is 31,000 long tons of pig iron and 39,000 long tons of steel, the lowest in five years.

Textile Machinery Marvels:—At a recent textile machinery exhibition in Great Britain an original type of machine caused a great deal of interest. This machine is known as a cotton "opener" and its function is to release the cotton fibres. It consists of a slowly revolving perforated horizontal cage, in the lower part of which is a rapidly revolving mechanism of great ingenuity. A series of stampings of special form are whirled round in such a way that they subject this cotton to a series of light and very rapid taps. The fibre thus released is blown away by a strong current of air, and the result is that all the fibre is obtained without the least damage. Another interesting machine at this Exhibition was for the purpose of humidifying or imparting to the atmosphere of the factory the exact degree of dampness required to give the best results in cotton spinning. In this apparatus a very fine jet of water is met by a jet of compressed air which expands with such force that it vapourises the water with extraordinary fineness. The molecules or drops of water are in fact so minute that they are absorbed into the atmosphere without condensing or leaving any dampness on objects in the factory.

Giant Machine Tool:—The enormous range of the modern machine tool may be realised by comparing the tiny electric drill, with which the dentist tortures us for our own good, and a huge machine such as that recently constructed by a British firm for surfacing and boring the casing of steam turbines. This machine weighs about one hundred tons and is probably the largest of its kind yet built. It is capable of boring out large casings and of surfacing them without the casing being removed. It is driven by a thirty horse power motor, with an auxiliary motor for shifting the tool. All the latest improvements are embodied in this giant machine, which carries out every variety of operation with the greatest accuracy and at maximum speed.

Analysis Versus Brands in Buying Tool Steel

Present Methods of Purchasing Steel Based on Better Knowledge of Analysis and Requirements—Hardening Performed on an Intelligent Basis and Guess Work Eliminated

By K. A. JUTHE

FOR YEARS the purchasing departments of large industrial concerns have been working under a severe handicap when requisitions for a particular brand of tool steel have been sent in, and endless discussions have taken place. The results of catering to the individual have been most unsatisfactory from an economic standpoint, readily ascertained from the periodic inventories taken. Very often every tool steel manufactured has been represented, causing a lot of unnecessary work in the stock room and accounting department, and representing doubtful value as to investment.

Almost every worth-while purchasing agent is to-day essentially a purchasing engineer and naturally is interested in the why's and wherefore's of requisitions.

Earlier Conditions

A good many years ago only a few tool steel manufacturers were represented in this country. The use of tool steel was confined to the straight carbon variety, all manufactured under most identical conditions, and this was ordered by the buyer for the purpose for which it was required and no one was interested or cared about carbon content. Hardening and working directions were supplied by the seller. Industrial concerns adopted one brand or another, based largely on local conditions or because the salesman was a likeable chap, but most likely somebody's grandfather had used it. There was no need of selling arguments, prices were established, metallurgy was almost an unknown quantity, and efficiency experts had not put in their appearance.

The writer was for many years a tool steel salesman and the reason given by many users for sticking to a particular brand of tool steel would make very interesting reading. We have an instance on record where a foreman of a fairly good-sized plant yearly sent to England for several hogsheads of water to quench tool steel made from an English brand, having found that he could not get satisfactory results from tools quenched in water procured in this country. There is no doubt but that in times past, when the toolmaker not only made tools but also personally did the hardening and tempering, the familiarity with a certain brand inspired confidence, and if a cracked tool was the result the steel was never blamed.

As time passed more efficient methods of specializing have been adopted, and it is now necessary to furnish the hardening department with full data as to the analysis of steel—at least as far as the deciding elements are concerned—so that the hardening can be performed on an intelligent basis and guess-work eliminated. It is, of course, quite true that buying steel or anything else on a purely price basis is a short-sighted method, and it is quite possible to make poor steel on an analysis specification. Instead of using the term "analysis," which is a more or less misleading term as far as tool steel is concerned, the term "specifications" should be the basis of purchase.

The war changed a great many methods of manufacture and developed the science of metallurgy to a high degree. The manufacture of tool steel is no longer a mystery, and, as no manufacturer has been able to monopolize brains, the competition on acceptable specifications will be fully as keen as when tool steel is sold as "brands."

Groups of Tool Steel

Tool steel is headed under three groups: high speed, alloy and carbon. The elements on which each group is based have been thoroughly classified. Each element has its own particular function, and tests running over years have been made to ascertain the different percentages of each element to accomplish sought-for-results; in fact, it is not due to the steel mills that the thousand-and-one different brands are on the market, but very largely due to calls for steel on a particular analysis specified by some metallurgist for test purposes. If the results of such tests were satisfactory the mill would immediately tag it and advertise the wonderful new brand it placed on the market.

When tool is ordered by the "brand" the purchasing agent is specifying a certain analysis. The difference is, however, that he is also specifying the particular manufacturer of this brand, thereby cutting out competition. The government decided some years ago to analyze the different brands of steel that gave satisfactory results, and now purchases by analysis, also specifying "to be made by either the crucible or electric process" and giving Brinnell hardness desired.

A great many of the large users of tool steel have also adopted the specification method, which invites competition and makes it possible for the purchasing agent to choose several sources of supply, take advantage of better delivery, and possibly save something on freights. The mere fact that a mill has been manufacturing steel for one hundred or more years, and that all the experience gained in this time is solely for the customers' benefit, is of doubtful value. A firm's reputation for honesty and good service as an asset of the very best kind should be recognized, but the statement that a certain brand has been made for a number of years is not conclusive proof that the same analysis cannot be made equally as well in some other mill.

Similarity of Brands

The facts are that the same analysis of every "brand" is manufactured by the different mills by either the crucible or electric process. The stages of manufacture throughout the different operations are very much the same, and no mill can afford the least carelessness in the inspection of its out-put while in process. Competition is too keen, and there is not the least danger of any inferior material being delivered if purchased on "specification" instead of "brand."

It is not the sense of this article to recommend the purchase of tool steel by either one of the two methods, but simply to state from a metallurgical and engineering standpoint that the purchaser is a freer agent when buying steel on an approved "specification" and can no doubt save a great deal of time, particularly on deliveries, when having more than one source of supply.

If only small quantities of tool steel in any one or all of the different groups are used, there is not any decided advantage in analysis specifications, but where the quantity is large, the different steels which have given the best results should be analyzed and specifications should state, "to be manufactured by either crucible or electric process," the limits as to size of rolling, free from all defects, limits of the different elements, Brinnell hardness, annealed or unannealed, acceptance subject to certain predetermined shop tests and delivery.

It will be impossible under such specifications not to cover an analysis not bearing a "brand" name from at least 90 per cent. of tool steel manufacturers and this, therefore, eliminates the possibility of slighting the established reputation gained by the manufacturer of the particular analysis specified.

Safe Practices in Acetylene and Oxygen Welding

Accidents Relatively Small Compared to Volume of Business—Danger When Acetylene is Generated in the Open From Calcium Carbide—Care Must be Exercised in Lighting Storage Rooms

THE RECORD of the oxy-acetylene industry is a wonderfully good one, and the number of accidents that occur are really infinitesimal when one takes time to consider the exceedingly rapid growth of the process and the enormous extent to which it is now employed. I do not think it is possible to-day to cite a single industry in some of the ramifications of which oxy-acetylene welding is not employed.

There have been some serious accidents in which oxy-acetylene has been involved, but practically in every case, such accidents would have been avoided if common sense had been used and if the recommendations made by the National Safety Council had been followed.

One of the troubles the oxy-acetylene industry has had to contend with in the past has been that the heads of the establishments have not appreciated the importance of their welding work; consequently they have not personally, taken the trouble to learn much about it, and have left matters relating to it entirely in the hands of subordinates, without first assuring themselves that the subordinates delegated to look after the work knew sufficient about it, and without making sure that the right sort of equipment was being employed, properly installed, and safely operated.

Calcium Carbide itself does not constitute a fire hazard, but when brought in contact with water, acetylene is generated, and acetylene is an inflammable gas. Therefore Calcium Carbide should be stored only in dry and well ventilated places. Many users store their Calcium Carbide in the same building or compartment in which their acetylene generator is housed. When the Calcium Carbide is stored in the same compartment with the acetylene generator, the Carbide should be placed on a platform at least 6 inches higher than the main floor level, so as to keep the drums clear of any water that might get on the floor when the generator is being flushed or when the floor is being washed. It is always essential to see that drums, the contents of which have been partly used, have their screw cover put back after a part of the carbide has been removed from the drums. Otherwise moist air will attack the carbide in the open drum and generate acetylene gas, which might accumulate in the premises.

It should be appreciated that no matter whether Calcium Carbide is stored in a separate building or in an acetylene generator house, the location should only be illuminated with incandescent electric lights, which should be properly guarded so as to prevent the globes from being broken by accident; and all switches should be outside the building as should other spark emitting devices, including the telephone. In cases where Calcium Carbide is stored in large quantities, and a separate building or compartment is used for this purpose only, it is desirable, where feasible, to have the floor of the building level with the floors of railway cars and trucks. This will facilitate unloading and prevent a certain amount of damage being done to the drums, which frequently occurs through rough handling when the drums have to be lowered to the ground from a car or truck. When unloading Calcium Carbide received from the shipper, any drum that has been damaged in transit to the extent that a hole has been made in it, should be set to one side for immediate use, or the contents should be transferred to another package. This would show that it is desirable to keep on hand a few empty packages for such emergency use.

In the matter of storage of cylinders of compressed oxygen and compressed acetylene, it is bad practice to have these stored and located indiscriminately all around your premises. Where compressed gases are used, you will naturally have to have a cylinder of oxygen and a cylinder of acetylene at each point where the welding work is being carried on, but cylinders on hand in excess of those in actual use should be properly and methodically stored.

With regard to the acetylene cylinders, it is considered good practice to store these in the room or building employed also for the storage of calcium carbide, but the storage space should be used for no other purpose except the storing of Calcium Carbide and cylinders of Compressed Acetylene. If the room or location in which the acetylene cylinders are stored is artificially heated, the cylinders should not be located close to the regulators. It will be noted that there is no need whatever to heat the locations in which Calcium Carbide or Compressed Acetylene are stored.

Acetylene cylinders, when being unloaded for storage, should be handled carefully. As in the case of Carbide, it is desirable where possible, to have the warehouse in which the acetylene is to be stored, to have a floor level with car and truck floors, but naturally this is only possible in establishments having their own car sidings.

Always insist that workmen employed in unloading cylinders of acetylene for storage, exercise care in lowering the cylinders from the truck or car to the ground. Workmen get careless on this job, and it frequently occurs that cylinders are dropped from truck or car floors to the ground, sometimes on to concrete. The cylinders are very strong and will stand an enormous amount of abuse, but is should be appreciated that they have pressure in them and that there are of necessity safety fittings which project from the surfaces of the cylinders. Many acetylene cylinders have fuse plugs located in their bottoms. These plugs are protected by a band which prevents their striking or coming in contact with the floor when the cylinder is properly and sanely handled; but nevertheless they can be damaged if the cylinder is dropped from a height, so as to cause the protecting band to be driven off the shell, or if it is dropped on to a rough surface. If one of the fuse plugs is broken off or loosened, gas will escape from the cylinders and may be ignited.

Oxygen cylinders can be safely and properly stored in your regular plant stock or supply rooms. However, they should not be stored close to radiators or adjacent to combustible materials. Above all things, be sure that they are not stored adjacent to oil or grease. If a warehouse is provided for the storage of oxygen, compressed acetylene and Calcium Carbide, the Calcium Carbide and Acetylene may be properly stored in the same compartment, but Oxygen should never be stored in the same compartment that Acetylene is stored in. The reason for making this recommendation is as follows:

Suppose for some reason or other, there was a fire in the building—the fuse plugs in the acetylene cylinders would melt at a comparatively low temperature, would release the gas from the cylinders, and the acytelene would be ignited. The heat from the burning acetylene would cause the pressure in the oxygen cylinders to increase and build up to a point where the frangible bursting discs, which are generally employed as the safety devices in oxygen cylinders, would be released, with the result that oxygen also would escape, and you can imagine what a terrific heat and blaze there would be with thousands of cubic feet of Acetylene combining with pure oxygen in the same room.

?? Questions and Answers ??

WOULD CONVERT RIFLE LATHE

Question.—I have a 16-inch swing speed lathe for which I wish information as to the cost of a cross-feed and a tail-stock for the same. This lathe is one that was in the Ross rifle factory. Please let me know if this lathe can be re-modeled so that it will cut the standard threads the same as other lathes, and if so what it would cost for the above named parts together with the necessary changes, if such changes can be made satisfactorily. I wish to ask also what the numerous different speeds of feed, which are on the lathe at present, are used for, as I understand there must be a screw shaft on the side to be able to cut thread.

Answer.—A 16-inch lathe that was used in the Ross rifle factory was probably made for special purpose in boring out small barrels. If that is the case, there was no necessity for cross carriage. It may be that the parts referred to could be purchased from the maker. The serial number of the machine will probably be found on the end or side of the ways. It is practically impossible to give much information until the make of lathe and serial number is obtained. To convert this machine as described, would run into quite a sum of money, as wood patterns would have to be made and all gears cut. The extent to which the machine could be used on threads would depend upon what train there is on the end. Whatever make it is, there would not be as many gears as there would be if the machine had been built for general purposes, rather than for rifle work exclusively. Further information might be given if more detailed description could be obtained.

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STEEL AND IRON IMPORTS

Question:—Of Canada's imports during the past year, what amount was represented by metals from the United States and what from the United Kingdom? C. L., Cobourg.

Answer:—For the twelve months ending September, this year, which are the latest statistics available, iron and products from United States amounted to $107,472,696; non-ferrous metals, $28,235,357; non-metallic minerals $91,567,530. From the United Kingdom, we imported in iron and products $10,646,334; non-ferrous metals, $2 948,848 and non-metallic minerals, $7,868,461. The total exports from the United Kingdom were $127,437,704; while those from United States, $492,965,967. It is notable that for September the amount of pig iron from the United Kingdom was 2028 tons, valued at $44,851, while from the States the amount was 2,544 tons valued at $60,529. According to these figures the British pig carried an import value of $22.15, while the American pig iron cost $23.80. No pig iron was imported from the United Kingdom in September of last year.

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SHIPBUILDING INDUSTRY

Question:—Have you any information with reference to employment on construction of metal steamships in Canadian yards in 1921?—C. W., Vancouver B. C.

Answer.—The number of metal ships built in Canadian yards in 1921 was 24 with a gross tonnage of 92,722 and a net tonnage of 55,917. In 1920, Canadian yards built 159,551 tons or about 112,000 tons less than in 1919. It may be of interest to know that the cost of shipbuilding in 1920 was about 275 per cent. higher than in 1913-14. There has been considerable falling off in the activity in Canadian yards since the Government's shipbuilding program was completed during 1921. Quite a number of ships have been built from time to time, for foreign interests.

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CANADA'S AUTO TRADE

Question:—Please inform me as to the number of motor cars, freight and passenger, imported and exported by Canada during the past year. How does the record compare with last year?—C. W. D., Toronto.

Answer:—Statistics are available up to the end of September. Freight autos imported 1921, 1,020; value, $1,965,932; 1922, 790; value, $1,584,515. Passenger cars, 1921, 5,975; value $11,015,689. Auto parts, imported, 1921, $8,457,250; 1922, $12,042,708. Exports, freight autos, 1921, 2,929, valued at $1,555,248; 1922, 2,186 valued at $995,522. Passenger cars, 1921, 10,236, value $5. 743,435; 1922 26,909; value, $15,370,858. Auto parts exported 1921, $3,433,175; 1922, $1,559,304.

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PROSPECTS IN SOUTH AFRICA

Question.—What are conditions in South Africa at the present time? Has business generally been affected there to the same extent as in Canada and other British colonies? How do imports compare with the year preceding?—J. H. W., Toronto.

Answer.—According to reports issuing from financial circles, recovery from depressing effects of the past two years has been slow throughout the Union. As regards the industrial situation, however, indications generally appear to be favorable, and there is an absence of adverse factors of importance in recent developments that augurs well for business in the near future. The agricultural outlook, thanks to the abundant rainfall of the winter months and the satisfactory tone of the European wool market, is brighter than it has been for some years, while the greatly improved position of the gold-mining industry, based upon much more healthy conditions than have existed in recent difficult times, foreshadows a period of progressive development the beneficial effects of which should be of a far-reaching character. Under present-day conditions in the Union, the industries mentioned are of fundamental importance, and their prosperity should react throughout the country. Nevertheless, complete restoration of normal trade activity can only be achieved with the alleviation of the present chaotic European economic conditions. The trade returns for British South Africa for the first five months of the year show imports amounting in value to £20,570,506 and exports valued at £21,763,312, the figures for the corresponding period of 1921 being imports £29,521,149 and exports £25,611,999. It is satisfactory to note that the figures for April and May show an excess of exports over imports of £639 285 and £504,728 respectively, the trade of the five months showing a favorable balance of £1,194,806, despite the contraction in the gold output for the first three months caused by the industrial disorganisation.

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METAL SPRAYING MACHINE

Question.—During the war there was featured in your paper an apparatus used in building up shells by spraying with other metal. Will you please tell me who were the manufacturers of this equipment. I think it was described as a gun.—D., Toronto.

Answer.—This was an apparatus, which employed what is known as the Schoop process, and was handled during the war by The Metals Cooling Co., of Canada, Versailles Building, 90 St. James St., Montreal. As an example of its use, short weight shells were copper coated by this process and thus built up to correct weight.

Col. John A. Currie, president of the Imperial Steel and Wire Corporation at Collingwood, recently returned from a trip to the prairie provinces, reports that building operations have been brisk in Regina and Edmonton. Bumper crops had greatly improved the outlook so far as business credits were concerned.

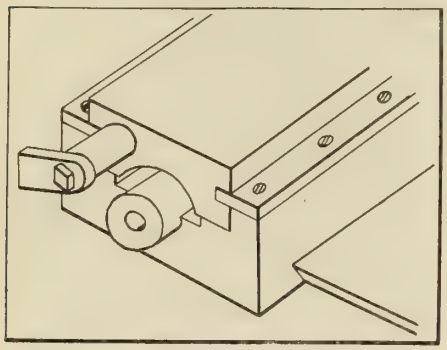
Practical Ideas From Practical Men

STOP FOR MILLING MACHINE TABLES

By D. A. Hampson

There are thousands of Lincoln type milling machines in daily use in manufacturing shops. Many of these are from a half to a quarter of a century old but, set up for one job and left that way year after year, they turn out acceptable work at a profitable price.

The usual table feed is through a nut on the underside of the table, the nut being moved by a screw which is pivoted and gear driven from the rear end of the saddle. This feed is highly satis-



Stop for milling machine table.

factory. But it seems to be characteristic of Lincoln millers to have a short screw and, consequently, a short feeding length. The result is that the operator is constantly in danger of running the nut off the end of the screw. He runs the table back to give himself more room to load and clean at the end of each cut and to keep his hands clear of the cutters, which are not usually stopped.

Every time the table is run off the end of the screw (in shop parlance, the "table" is run off and not the "nut") there is a loss of time in getting it back on again. Often it takes quite a little time and sometimes it takes an assistant. In our shop we avoid this loss by equipping all the millers with a stop. The drawing shows the stop as applied to the older machines. It consists merely of a piece of pipe, a 3-in. piece of flat stock, and a bolt tapped into the end of the table. The length of the pipe is such that the nut has a full bearing on the screw at all times. There can be no running off and, because he does not have to be careful in moving the table back, the operator works much faster—in fact the stop pays for itself in one week in time so saved, regardless of other considerations.

In the drawing the gear drive and the screw are omitted for clearness. The stop may be applied to either side or the end may be pointed downward. On some of the machines a stop made of cast iron is used. This is done chiefly in a single piece, as where a chip guard or oil basin is desired at the rear.

One of the worst losses that a table stop avoids is that of nut renewal. When the screw is turned out of the nut the last thread drags and gets burred up as well as bruising the first thread in the nut. Then, in starting on again the end of the threads chew each other up while the workman turns the hand feed as he, or some husky, pushes the table up so it will catch. If it is a babbitted nut, the trouble is aggravated. It is not an uncommon thing for a workman to complain of lost motion in the nut which, upon investigation, is found to be lost threads, for two-thirds of the nut may have been chewed away.

A stop avoids all these losses. A positive stop at the rear is better than a stop placed in the table slot on the side. The latter is not positive and it is apt to be removed when setting up the machine.

EXPANDING BORING ARMS

By Hubert Bentley, A.M.I.M.E.

The accompanying drawings show two very useful expanding boring bars for use in boring, turret and capstan lathes, drilling machines, etc. By their use the stock of tool steel is considerably reduced, there is no waiting for forging by the operator and adjustments of bore are made instantly. Fig. 1 shows the boring bar in section, with a massive square shank for bolting in the lathe tool rest, while Fig. 2, an outside elevation, has a Morse taper shank. The bar can be provided with a steady or pilot from 6 ins. to 8 ins. long, when it is desired to use the same as an ordinary boring bar, but possessing the advantage of boring any size within the top and bottom limits without change of cutters.

Before inserting the cutters CC, the expansion spindle B is pushed back into its inmost position. The cutters are then placed in the slots to rest firmly on the incline and the cap nut N is tightly locked. A loose washer W is arranged between the cutters and the cap nut. The slot hole for the cutters is shown in the small detail. A peg P, fitting in a groove in the expansion spindle, prevents the same rotating independent of the bar. To expand the two cutters, the nut A is turned causing the expansion spindle to be withdrawn and expanding the two cutters to the desired limit of bore, this being adjusted by calipers or micrometer. With the cutters set, the bar is now ready for the boring operation. In a bar 2 ft. long by 2 ins. diameter the range of bore is from 2½ins. to 3½ ins.

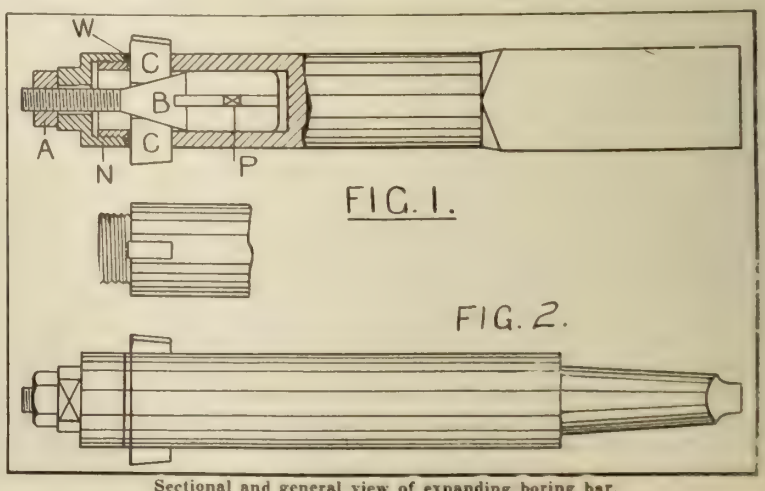
(See cut.)

VALVE SEAT FINISHING TOOLS

By Harry Moore

It requires two different tools, a rougher and finisher, to produce a good valve seat, although admittedly, very often, one tool only is used on this operation, the seats produced by the one tool method cannot be correctly termed good; at any rate not when the tool has been in use for any length of time. To state that a good valve seat must be smooth and uniform is to say something that everyone already knows, but the description of a few finishing tools designed to ensure this very necessary smoothness and uniformity will perhaps be of interest to many whose experience has not yet included this particular line of work. It should be understood the subject is herein treated as a manufacturing one, with particular reference to work of medium size.

Taking flat seats first, the principal troubles encountered are usually the difficulty of keeping the seats actually flat



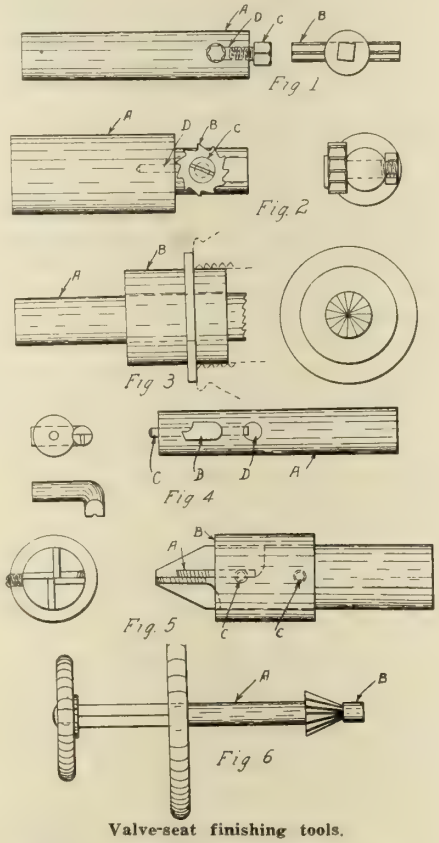
Sectional and general view of expanding boring bar.

and the annoyances connected with chattering, which once started are so difficult to stop. A very effective flat seat finishing tool is shown in Fig. 1. The shank A is drilled through at one end to take the fluted tool B which is tightened in place by screw C bearing on the Vee pad D. The length of B is such as will allow it to enter the bonnet hole in the valve and the diameter of A is equal to the diameter of the valve seat hole and so pilots the tool when cutting. A perfectly flat, smooth seat is produced by this tool when properly made, and all six cutting edges can be used before regrinding is necessary, which, since the tool is only used for finishing and consequently does not have to remove much metal, is not very frequent. The flat seat tool shown in Fig. 2 is for use on what may be called exposed seats, that is, seats made on the surface of work—the bosses on machine castings furnishing a good illustration of what is meant. The shank A, may be made any convenient size, but the front end is, as before, made to enter the valve seat hole in order to steady the tool B, which is a circular piece held on a screw C passing through the shank at right angles. A pin D is driven into the shoulder of A to prevent the tool moving under the cut. The same advantage of several cutting faces is presented in this tool.

Fig. 3 shows a simple rectifying tool for reseating flat seats, which have, for this purpose, been returned for some reason or other. It is out of the question, of course, to rechuck such returned valves in the special chucking fixtures used on this kind of work, but with the aid of such a tool as shown a valve can be reseated in exact alignment. Part A is held in the chuck of a speed lathe, and B, which is a running fit on A, is gripped in one hand while the machine is running and the valve bonnet threaded opening pushed onto it up to the shoulder. A and B thus practically take the place of the valve stem and bonnet, and when the valve is pushed up against the cutting edge of the reseat will be exactly in line with the working parts.

A raised seat finished tool is shown in Fig 4. This is used, together with a flat roughing tool, on brass castings. The flat rougher has a concave groove cut out on both sides of the cutting face, but the finishing tool has but one cutting edge as shown and better seats have been made than with a double edge tool. The shank A is drilled at right angles for tool B which is made of drill rod bent as shown, the best cutting edge nesting in a shallow groove cut in the side of A. A pin C driven in the shank from the end holds the tool snugly in place and is driven out when required from hole D at the other end. By making up a dozen tools at a time they are produced at small cost, the shank A being hardened, is used as a jig for drilling the pin holes.

A common type of angular valve seat finishing tool is shown in Fig. 5; with an auxiliary tool for removing the objectionable burr thrown up by this in operation. As shown, one flute is milled further along than the rest and a flat piece of steel A is laid on the face and held in place by a collar B tightened by screws CC. A is adjusted in or out to slightly chamfer the top of the seat and being used only for this purpose can be kept with a very keen edge. In the last figure a hand finishing tool is shown for use in cases where the work cannot be brought to a machine. Although shown with an angular seating tool the same idea can be used of course on any shaped seat. The tool itself A, is squared on the shank for about half the distance and an ordinary valve wheel driven on to the end of square. A turned down portion on the end carries a smaller wheel, resting on a washer at one side and riveted over at the other, care being taken to leave the wheel a running fit. Different sizes of pilots B are used to take care of various sizes of valves and the tool is made to cut by turning the big wheel with one hand and applying pressure on the small wheel with the other. With proper fitting pilots this tool produces a well finished seat, very little pressure being required.



Valve-seat finishing tools.

STANDARDIZATION IN GRINDING

By R. Harrison

It is clearly recognized by all parties concerned, and particularly by the manufacturers, that an adequate basis of standardization is one of the fundamental requirements which will have to be provided if the work of reconstruction in the mechanical engineering industry is to be of the permanent character so earnestly desired. With this object in view, the British Engineering Standards Association has organized a series of panels of the leading engineers of the day, who by conference, research, and direct co-operation have evolved various measures whereby the limits of inaccuracy in manufactured products may be so controlled and defined that the products of one firm will interchange with those of another.

This process of standardization, of course, involves the provision of manufacturing plant capable of turning out work with a high degree of accuracy, and it is on the precision grinding machine alone that the manufacturer can rely, to produce work of the desired quality on a thoroughly commercial and competitive basis. Absolutely alive to the importance of this aspect of modern manufacture, many firms have been investigating the various applications of grinding peculiar to their particular products, and the machine tool makers report that never before have they been confronted with so many new and varied problems. It will be readily conceded that this is an extremely healthy sign of new development, and it is in fact the best of the very few consoling features of the generally unhappy state of the machine tool industry of to-day.

The position of the grinding machine manufacturer is somewhat different to that of the other machine tool makers inasmuch that his field of endeavour is constantly and rapidly widening, the rate of progress being only impeded by the financial stringency resulting from the present extended period of bad trade.

While the above remark applies only in a minor degree to the bulk of the machine tool trade, they are further handicapped by the unburdening by the Disposal Board of war stocks of new and partially used tools, all of which find a readier market than would be the case if conditions were more normal and first cost a matter of less importance. It is, however, a noticeable feature of the second-hand market that precision grinding machines of first class command a ready sale, and this in itself is an indication of the greatly increased appreciation on the part of the smaller manufacturers of the prestige attached to a shop in which grinding is a regular operation.

Much of the rapid development in the design of precision grinding machinery attained during the last 10 years can be traced to the improved efficiency of the grinding wheel available—the position between the wheel makers and the machine makers is very much akin to that existing in the armour plate and projectile making industries—there is intense but what might also be called co-operative competition to turn out a combined product of machine and wheel with shall be as near as 100 per cent. efficient as possible. Great strides have been made in the perfection of the electric furnace process whereby the artificial abrasives are made and wheel makers are to-day in a position to supply grinding wheels of consistently good quality throughout.

Construction Features of All-Steel Power Brake

Open Throat Type of Housing—Self-Aligning Features Facilitate Reassembly—Automatic Sight Feed Lubrication—Electric Welding Used in Fabrication—Greater Speed of Operation

A MACHINE that is stated to be a radical departure from the usual design of heavy brakes has been placed on the market. The outstanding changes in the design are the adoption of steel plate, which has seldom been done before in the manufacture of heavy forming brakes, and the use of the open-throat type of housing, giving absolutely clear and extended working space in front of the machine. Another advance not evident in the cut is the use of electric welding in the fabrication and assembling of the steel. This eliminates to a large extent dependence upon bolts and rivets for combining the component parts and unites the various members into one, so as to secure the action of a solid whole rather than of a built-up section. Where bolts are used in solid members to draw the plates down into place, the bolts themselves are welded as well as the plates, so that they become an integral part of the member and all chance of working loose is gone. The necessities of convenient erection, of course, demand the use of bolts at certain connections. The number of these connections, however, have been greatly reduced and simplified both for simplicity in erection and also as an added means of securing a powerful machine.

The driving mechanism is completely contained within the housing, as in an individual press, and the housings are shipped with the mechanism assembled, so it is only necessary to place them on their foundations and attach the cross members and the drive shaft. The tool is in fact shipped as four main pieces, with the drive shaft and cross brace in addition, making a total of six parts only, which must be assembled. For erecting this machine at the plant, self-aligning features have been incorporated so that the brake will go together in the customer's shop exactly as assembled on the floor of the factory.

This line of brakes has been designed with open side in order to facilitate the handling of material. As most bends are made near the edge of the plate, the full length of the die holding surface can be utilized. Thus for most classes of work a machine can be rated with respect to the length of the die holding surface instead of the distance between housings, which means the use of a narrower, more rigid machine, and a saving in cost and floor space. In addition to freedom from all interference at the front of the machine, there is an absolutely clear space between the housings at the rear, for convenience in stacking finished work. Where more than one operation is required, the work can be passed back and forth through the machine, avoiding the inconvenience of turning end for end.

The bed and ram are constructed entirely of heavy steel plates and billets, which, together with the cross ribs, are welded to each other, thus making what is virtually a heavy solid steel beam of box section with the metal placed to the best advantage. The housings are framed of steel plate, having cast steel members interlocked and welded to the plates. These members are provided with heavy trunnions for supporting the bed. The machine is designed in the simplest manner possible for accomplishing all its mechanical operations, and all elements are combined to secure the essentials of power, rigidity, speed, and convenience of operations.

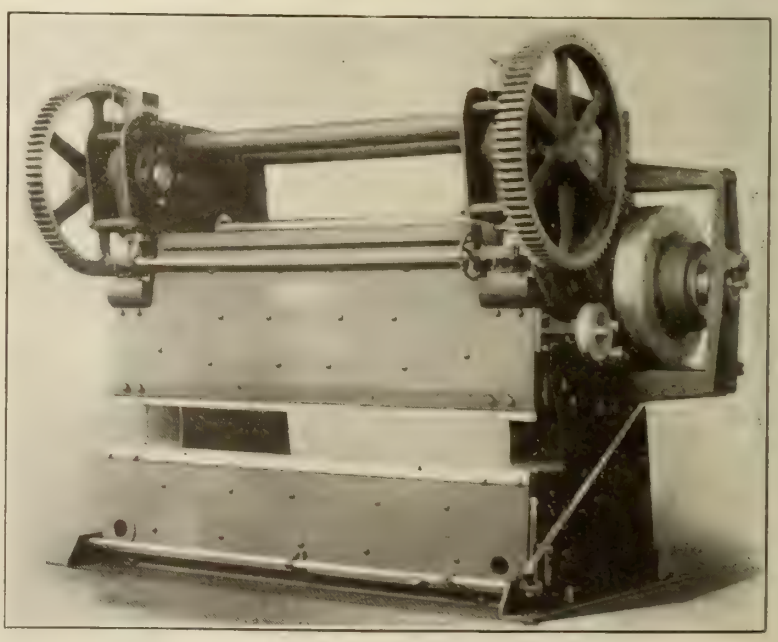
In order to determine definitely what force must be dealt with in brakes of different capacities, a series of tests on bending and forming various thicknesses of metal, under a variety of conditions, was conducted through the courtesy and assistance of the Engineering College of the University of Cincinnati. These brakes were then designed to develop the requisite power, with ample strength, and a minimum of deflection.

As the characteristics of all materials entering into this brake are well known, the whole can be properly designed and built with confidence as to its ultimate performance and avoid placing dependence upon the unknown qualities of castings. A large factor of safety is used throughout, but its purpose is not for protection against possible defects, but to provide additional strength under accidental or excessive overloading.

Automatic sight feed lubrication is provided on all power driven bearings. This is an important feature, insuring adequate oiling with a saving in time on the part of the operator. Lack of lubrication is one of the chief causes of repairs, and the resulting loss of production. The fly wheel, clutch, worm and worm wheel ram adjusting device, and the power drive for this, all run in a bath of oil. All shafts are of high carbon steel. The eccentric shafts are .50 to .60 carbon forgings with the eccentrics forged integral with them. All main shaft bearings are of special bronze. A splined trip shaft runs the full length of the machine, on which is mounted an adjustable foot treadle which enables the operator to engage the clutch from the most convenient position. The ram is gibbed endways as well as sideways. This is essential when using the machine as a gang punch.

When the machine is to be motor driven, the motor is mounted on a bracket attached to the housing. The drive is through a belt, held in tension by a weighted idler pulley on the slack side. To meet the demand for increased production these machines have been designed to operate at a greater number of strokes per minute than has been

(Continued on page 28)



All steel power press brake.

New Things in Shop Equipment

ELECTRIC CHAIN HOIST

An electrically operated material handling hoist intended for service in places where the travelling crane or the hand hoist would not be convenient or economical, has been placed on the market recently. The hoist may be transported to any desired location and easily erected for temporary service. The apparatus consists of a standard chain hoist modified in design to be operated by a small heavy-duty motor, which drives the chain block by means of reduction gearing and a slip friction clutch; all this mechanism is mounted on a malleable iron supporting bracket. While the electric-driven hoists are regularly furnished as complete units, the motor attachment is so designed as to be readily fitted to existing chain hoists. In the event of stoppage of electric power the hoist can be operated by hand in the usual manner. The devices are made in sizes to be applied to hoists ranging from ¼ to 10 tons capacity. The armature shaft and driving worm are supported in heavy-duty ball bearings and ample provision is made for adequate automatic lubrication. Only one hand is required to operate the pendant controller, the other one being free to steady and guide the load. Strength and lightness are features of construction. The weight of a one-ton hoist will be approximately 148 lbs. These electric chain blocks are made by the Motorbloc Corporation, Summerdale, Philadelphia, Pa.

HIGH-SPEED ATTACHMENT

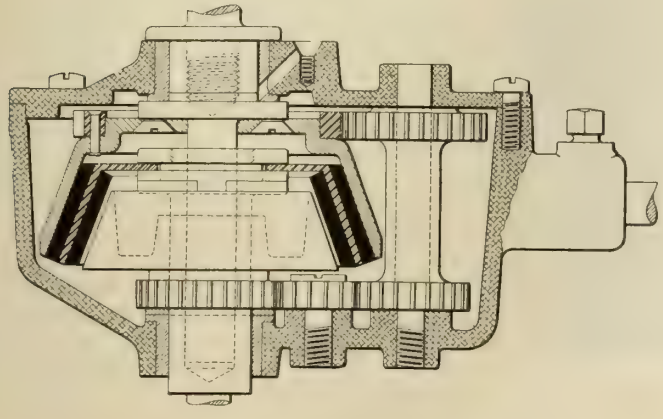
Many taps are broken just after the hole has been tapped and the tap rotation is reversed to remove it from the hole. This is invariably caused by the chips forcing themselves between the threads of the tap and the wall of the tapped hole. The stress required to overcome this resistance frequently results in a broken top. To eliminate or at least minimize this source of trouble, an attachment has recently been developed which is equipped with a friction drive both for feed and reverse. A sectional view of the operating mechanism is shown in Fig 1 while Fig. 2 illustrated a general exterior view of the device, which has a capacity for tapping holes up to 3-16 in. dia. in steel and up to ¼ in. in cast iron and brass.

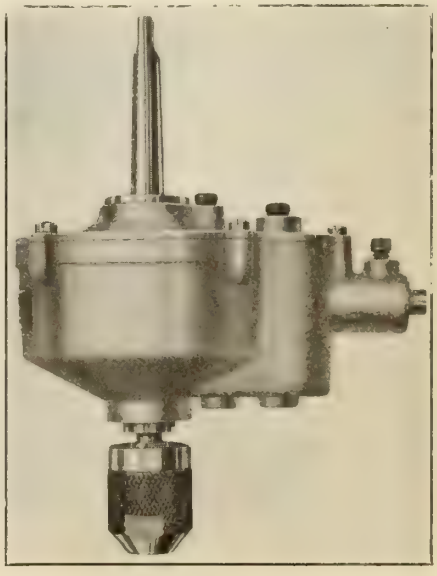
In feeding the attachment, which is placed in the spindle of a drilling machine, the chuck and the leather-faced drive cone remain stationary until the tap is brought into contact with the part to be tapped. An additional 1-16 in. movement brings the second cone into contact with the outer conical surface. The outer cone is secured to the shank of the attachment and when in contact drives the chuck spindle in the proper direction for tapping. The speed of tapping may be regulated by the degree of pressure applied to the feed-lever. When a hole has been tapped or should any undue resistance come upon the tap it stops revolving by complete stoppage of the cones. When the feed-lever is raised the tap remains stationary until the spindle rises 1-16 in. when engagement is made with the reversing cone which is driven through gearing from a ring gear on the outer cone. Should the adhesion of chips cause the tap to jam, the cones will slip as previously stated and the possibility of breakage is averted. An Oldham coupling is used for transmitting power from the cone to the chuck spindle; this connection allows the centre cone to float sufficiently to insure a uniform contact at all times with the cast iron cones. The speed ratio of feed to reverse is 1 : 2. After a little service the leather surfaces become so glazed and sensitive that they respond to the slightest pressure and slippage takes place when this pressure becomes greater than normal. The total weight of the attachment does not exceed 3¾ lbs. The distance from the chuck nose to drill spindle is 5¼ in. These chucks and tapping attachments are made by the Eastern Tube & Tool Co., Brooklyn, N. Y.

MULTI-PURPOSE ATTACHMENT

An attachment that can be used on lathes, shapers, planers and drilling machines, for performing a diversity of operations, has been placed on the market recently. It is known as the "Millerette," and is built in three sizes adaptable to lathes from 12 to 24 in. swing. By this device a lathe may be converted to do milling machine operations such as the cutting of gears, both spur and bevel, surface milling, angle cutting and spline and keyway cutting. The device is particularly serviceable in small shops and garages where a milling machine is not available, or where a small milling job is required. The device is designed to be clamped in the ordinary tool-post rest, the lathe supplying the necessary power with the cutter supported on an arbor between the centres. Longitudinal and cross feeds are provided for, both from the compound rest on the lathe and slides on the attachment. Provision is also made for swiveling to any desired angle. When used on a drilling machine the device can be used for accurately spacing of holes. The index head in connection with the change gears may be set up quickly, as only two gears are used at a time. The gears to be used for any desired spacing are indicated on the index plate; divisions are available from 2 to 360. These devices are made by the Production Machine Tool Co., Cincinnati, Ohio.

Fig. 1—Right: general view of tapping attachment. Fig. 2—Left: sectional view, showing position of driving cones and gearing.





STEEL SURFACE PLATES

A new line of hardened and lapped precision surface plates has just been placed on the market. These plates are intended for use in the shop as well as in the tool room and are claimed to have a degree of accuracy in advance of hand-scraped cast iron surface plates. When being made they are tested for planeness by means of light waves. The plates are made in diameters of 5, 8 and 10 in., and shipped in wooden boxes. The hardened surface is less subject to wear than hand-scraped cast iron plates. They are made by the Van Keuren Co., Boston, Mass.

INSIDE MICROMETER GAUGE

A micrometer gauge, primarily intended for measuring the diameters of automotive cylinders, has recently been offered to the trade. The feature of the device is the aligning base as the gauging points are exactly on the diameter when the feet of the base are resting on the wall of the bore. The gauges are made in three sizes with an aggregate range of from 2½ to 4½ in. One turn of the screw advances it 0.050 in., and the barrel is graduated to read in thousandths. Figures indicating steps of .005 in. are placed on both barrel and spindle, which act as a check for accurate reading. Both gauging points and base edges are hardened and ground. When in use the base is pressed against one side of the cylinder and the spindle turned out until the points engage the bore. These instruments are made by the L. O. Beard Tool Co., Lancaster, Pa.

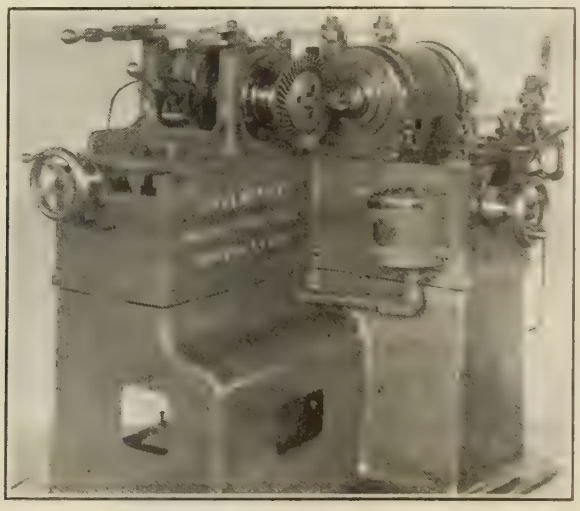
GEAR TESTING MACHINE

A machine especially designed for the testing of spiral bevel gears has been developed and placed on the market recently. In the manufacture of this type of gear it is essential that they be as perfect as possible, tests being made covering the bearing on the teeth, quiet running, and the centre distance at which they run with the best bearing and the least noise. Special attention has been paid to rigid construction of the machine and to such devices as will promote rapidity of operation.

Both of the head stocks holding the gears have large bearing surfaces on the bed and a deep dovetail slide with a taper gib the entire length of the slide. In addition to this, provision is made for tightly clamping the head stock to the bed by means of bolts passing through the head stock into blocks and T-slots in the bed. These bolts are as close as possible to the bearing, making the head stock and the bed practically one piece during the test. Inasmuch as there is usually but little adjustment on the left hand head stock—on which the crown gear is mounted—it is clamped down by a lever attached to one of the hold-down bolts with an adjustable connection to the second bolt, thus insuring equal tightening of both at the same time.

As the right hand head stock is moved quite a distance each time a pinion or gear is changed for testing, provision has been made for quickly operating this by air pressure. A cylinder is mounted on the back side of the machine which moves the slide a fixed distance and, after the slide has drawn back and the pinion changed, a new pinion is brought into mesh with the crown gear in exactly the same position at which the last one was tested, or at any other position as may be desired by the operator. This is controlled by a hand wheel with graduated dial located underneath the right hand head stock. Due to the fact that the right hand head stock is moved so many times a day, provision is made for clamping it with an air cylinder and there is also an air chuck fitted to the machine for quickly clamping the pinions.

The three valves on front of the machine are used: first, for clamping the work in the spindle; second, moving the slide so that the pinion and gear mesh; third, clamping the head stock. A similar movement of all handles performing these operations in the proper sequence, and reversing the motion of the handles, unclamps the head stock, moves back the slide and releases the pinion. Both spindles have large Hess-Bright ball bearings on each end with an arrangement for keeping the oil in the bearings at a constant height.



General view of gear testing machine.

The machine is equipped with an electric motor controlled by a switch which permits the spindles being driven in either direction. The motor is mounted inside the base, connections to the slide insuring the correct tension of the belt as the slide moves back and forth. Air cylinder exhaust, which is piped to the brake band on the crown gear head stock, cools the brake or, if preferred, water may be circulated through the brake for that purpose. The machine has a capacity for all sizes of gears used in motor cars. Four feet square floor space is required for the machine. It is operated by a 3 h. p. motor. This gear testing machine is made by the Davenport Machine Tool Co., Rochester, N. Y.

LARGE ROLL LATHE

A large roll machine, with a capacity for turning chilled rolls up to 42 in. dia. and 120 in. long, has been placed on the market recently. The lathe is driven by a 20 h.p. variable-speed motor, with a range of speeds from 400 to 600 r.p.m. The gear box is arranged for two changes of speed, and each change can be employed with the full range of motor speeds. The faceplate speed varies from 0.4 to 1.6 rev. per min. The main spindle is 7¾ in. dia., and all gears are machine cut. The machine is especially designed for heavy duty. It has an approximate weight of 17½ tons and is made by the Reading Iron Co., Reading, Pa.

ALL-STEEL POWER PRESS BRAKE

(Continued from page 26)

customary in brakes heretofore. The flywheel is mounted on high duty ball bearings having hardened steel inner and outer races. All gears are accurately cut and the pinions are of steel.

The clutch is of multiple disc type, especially designed and developed for this particular tool and operates in oil. It is accessible and simple to adjust. The clutch is highly efficient, very low unit pressures being used in its operation, and has showed some remarkable results under tests. For instance the clutch, while adjusted to pick up the full load under a standing start, that is, with the ram down against the work, has been repeatedly thrown into engagement when the dies were together, thereby stopping the flywheel in a very short period of time. The clutch has proved its ability to withstand such severe service without injury. A test of this sort is a demonstration of the action which may be expected when the dies are brought together accidentally, generally the cause of breakage in machines of this type.

These brakes are built in capacities ranging from 80 to 600 tons for working material 10 gauge to ¾ in. in thickness. The width between housings vary from 6 ft. 6 in. to 14 ft. 6 in. These machines are being built by the Cincinnati Shaper Co., Cincinnati, Ohio.

CANADIAN MACHINERY
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Great Scope for Industry

REPORTS that the Bethlehem Steel Corporation, and an English Sheffield firm are considering the operation of plants in Canada, are significant.

East and west, industrial growth seems closely associated with iron and steel. As the basic commodity, it identifies itself first and always with the important essentials of the country's progress. It contributes to and benefits by increasing market influence, and cannot but prove to be a strong factor in the upbuilding of specialized industry. Although the past two years have not been up to normal, manufacturers know what the country is capable of in a producing sense, and they are aware, likewise of the country's increasing importance in the matter of export trade.

For the twelve months ending September, a year far below normal, Canada imported iron and its products to the value of $119,297,888, and exported $35,000,000. Of the amount imported, $10,885,362 was in electric apparatus and $22,498,264 was machinery. Engines and boilers were valued at $5,644,117; tools, $1,258,858; rolling mill products, $26,372,403; tubes, pipes and fittings, $2,281,978; while autos represented $11,015,689. The number of passenger cars imported was 10,088, exported, 26,909. These are a few representative items that may be classified as products of iron and steel. They indicate scope for industrial development.

Clearing House for Facts

CRITICISMS are sometimes made to the effect that the Department of Trade and Commerce at Ottawa has not developed its statistical department to an extent comparable in any degree with that of the United States or other countries. Manufacturers should know that this is a somewhat erroneous idea. Up to 1918, each department of the Government looked after its own statistics, or the information relating to that particular branch of the country's business. Since then, however, this work has been centralized in the Dominion Bureau of Statistics, under R. H. Coats, Dominion Statistician. The work of the bureau has developed to such an extent that it has almost outgrown the quarters provided, and the work has been directed along such practical lines that no phase of the country's trade and industry, capable of being compiled or reduced to figures, is being overlooked in the records.

It is pointed out that Canada's expenditure per capita on useful statistics is probably equal to that of any country in the world. Notable examples are the branches relating to iron and steel, railway and general transportation, internal and external trade, agriculture and labor in general, whereby monthly surveys of the outstanding activities of the country are possible.

The bureau may be said to have its hand upon the commercial and industrial pulse of the country. Collection and compilation of information is in charge of practical men to a far greater degree than is generally supposed, and while efficiency has not reached a point that represents the actual ambitions of the department heads, much has been accomplished. Work in connection with the census is in itself stupendous, but quite as extraordinary is the extent to which it has been simplified by means of "humanized" electrical apparatus. The actual cost of census collecton last year was about $2,000,000 or 20 cents per head. Equipment used by the bureau is said to represent an outlay of $200,000.

The bureau is a place where a manufacturer may very often locate more facts about the industry in which he is engaged then he knows himself, and yet, to an extent, it represents much co-operation on the part of the manufacturer. It should be borne in mind that it was statistics and their application that contributed largely to Germany's potentiality in the war business.

Direct by Mail to Basket

SOME DAY an uncanny genius will rise up and announce the tonnage of wasted paper represented in direct-by-mail advertising which goes direct through the waste paper basket to oblivion.

The story is told of a manufacturer who tried to keep a month's record of this kind of material coming to his desk. He gave up in despair at the end of two weeks, and on looking over the list he had compiled, found that he had been invited to concentrate on the merits of the following: Phonographs, oriental rugs, lubricating oils, electric beaters, electric heat-treating furnaces, shop equipment and furniture, monthly calendars linking up works of art with small tools, roofing materials, fertilizers and furnaces and a host of literature advising him about opportunities in gold mines and industrial ventures.

Much of the material, he said, should never have been distributed to business offices, but was really intended to reach members of the staff; much of it, he admits, came in attractive and expensive form. None of it had an appeal because when it came to buying an article, he preferred to see what the other fellow had to say. This he could only find through his technical papers. There he had his market, with the merits of the different wares intelligently discussed, and there he found his most practical buying guide. He eliminated direct-by-mail from his advertising appropriation. So far as he could see, it was diverting but had no merit in what he described as the competitive buying information so essentially available in business papers.

Deliveries Weeks Behind on Large Steel Tonnages

Production Continues Slightly Above 75 Per Cent. Capacity—Motor Trucking Being Resorted to for Urgent Delivery—Corporation Has Seven Million Tons Unfilled Orders

STEEL HOOPS STRONG IN SHORT MARKET

SURVEY of conditions and trends in the Pittsburgh steel markets indicates that both buyers and sellers have had their innings on a somewhat even basis. Since April 1, it is pointed out, everything has been in favor of sellers, and mills are today reporting less irregularity in prices. An example of this is found in bars, shapes and plates in which the $2.00 price is being sustained. The Steel Corporation shows 6,902,287 tons of unfilled orders. Deliveries on Canadian contracts have been running behind with little sign of improvement. The demand has slackened in the past few weeks, particularly on structural material. Not only is the Corporation pretty well sold up, but some of the larger independents report that their present bookings are good for two months at possible rates of delivery. Steel output continues at about 75% of capacity.

Demand for such building materials as merchant pipe still continues strong and the mills are under pressure for supplies of material. Skelp is coming through slowly in little more than hand-to-mouth quantities, and movements cannot be accelerated by making Canadian cars available. It is reported that motor trucking is being resorted to in some sections of the States and that deliveries are being made as far west as Detroit from the eastern steel centres.

Toronto market is now fairly well supplied with sheets and bars and the prices are practically unchanged since last week. Quite a movement is developing in steel hoops and a shortage seems imminent. Prices have stiffened, the range being from $4.50 to $4.75.

In pig iron and non-ferrous metals the situation suggests very cautious buying on the part of foundries. The drop in domestic pig iron of $2.50 a ton has not accelerated the demand, in spite of the fact that production costs trend slightly upward. The mills express the opinion that $25 pig iron, by the end of the year, is ridiculous and there are those who advise buying to cover a reasonable period, say three months. Copper is assuming a stronger position in the market, while tin is holding at high levels, as the result of Old Country speculation. There have been fluctuations in this market but there is nothing to indicate lower price bases.

Pittsburgh reports a downward movement in coke prices—ranging from 25 to 50 cents. Foundry pig iron, valley furnaces, is down from $29 to $27.50, while Bessemer remains at $32. Buffalo is quoting foundry iron at $27 and can, therefore, ship pig iron into Pittsburgh on the same basis as valley.

Not much can be said with regard to the demand for machine tools. Mill supplies, particularly steam goods, are moving well. On certain lines of millers and shapers an advance of 10 per cent. has been made.

Montreal markets report a fair volume of business, but that supplies of certain lines, especially semi-finished steel, were on a somewhat precarious basis. Relief was secured, in one instance, by sending empty cars to the mills. Shipping difficulties do not indicate that relief can be hoped for from this direction with any degree of confidence.

Toronto

November 22, 1922.

THAT there has been an improvement in general business in the past week, is the report in the iron and steel market. The forepart of November seemed to indicate that the advent of cold weather would cause a serious falling off in demand, especially on those lines used for structural purposes. There was a slight lapse and, as one salesmanager put it, "there was a feeling that we were in for a bad month," but a change for the better has set in. As might be expected, the month may not average up with October and September, but there is no reason for discouragement. Although buying is going along cautiously, the demand is steady and conditions are such as to maintain prices. There is no factor developing that might have a tendency to upset the stability of the market. There is quite a short supply in some lines, due to poor delivery, and this phase of the situation promises to have little betterment. Statistics on the production of iron and steel show that there has been a slight improvement in last month's production over that of the month preceding, and though the level is at the lowest in some years, the movement is upwards.

Iron and Steel.—The one item that appears entitled to any prominence at the present time is that of steel hoops. The market has been fairly well supplied up to two weeks ago, but stocks have gradually diminished and dealers have had to make replacements. The Pittsburgh price ranges from $2.90 to $3, and at the Toronto price of $4.50 it is claimed that the margin has become somewhat close. The range, therefore, swings upward, from $4.50 to $4.75. Boiler tube demand is still a feature of the market with prices firm, while sheets are easier owing to improved supplies. Bars are meeting with a steady demand and while instances are known where as low as $3.15 has been quoted, the market appears to be pretty well agreed on a range of $3.25 to $3.40. Current prices:

Iron bars	3 25	3 40
Steel bars	3 25	3 40
Reinforcing bars	3 15	3 25
Steel hoops		4 75
Tire Steel		3 50
Spring steel	7 00	14 00
Band steel, No. 10 gauge and 3-16 in base		3 90
Small shapes		3 50
Sheets, black, No. 28		4 60
Sheets, blue, ann., No. 10		3 95
Canada plates, dull, 52 sheets		4 90
Canada plates, all bright		5 40
Galvanized Sheets, No. 28		6 25

Non-Ferrous Metals.—Foundry demand is reported to be somewhat spasmodic, but representing on the whole a very fair volume. The interesting phase in ingot metals is hardly the local demand so much as the features of the world market. Tin has been passing through a rather strenuous period of speculation, and while it has come out of a series of fluctuations a trifle easier at times, the average has been well maintained. The trend of the copper market is upward, with the minimum price in New York well established at 13.87½. Output at the mines has been steadily increasing. Germany has been best foreign buyer while France and England have been taking fair tonnages. Local prices:

Lake copper	17 25
Electrolytic copper	17 00
Castings, Copper	16 50
Tin	41 00
Lead	7 50
Spelter	9 50
Antimony	8 50
Aluminum	22 00

Old Material.—This market, in a sense, reflects conditions in the pig iron market. There is very little pronounced movement. Blast furnaces are not the heavy buyers they usually are, and it is hinted that some adjustment of prices may be necessary before they appear as strong factors. However, it is held that a more normal business situation would correct the problem, and that supplies of old material are not so plentiful as to warrant radical price changes. Buffalo reports a strong demand for railroad malleable and machinery cast iron and that the visible supply is quite limited.

Dealers' average buying prices are as follows:

Copper, light	9 00
Copper, crucible	11 50
Copper, heavy	11 50
Copper wire	11 00
No. 1 composition	9 00
New brass cuttings	7 00
Red brass turnings	7 00
Yellow brass turnings	5 25
Light brass	4 50
Medium brass	6 00
Scrap zinc	3 50
Heavy lead	4 50
Tea lead	3 00
Aluminum	11 00
Boiler plate, per gross ton.	9 00
Heavy melting steel	10 00
Axles (wrought iron)	20 00
Rails (scrap)	11 00
Malleable	10 00
No. 1 machine cast iron	18 00
Pipe, wrought	7 00

Pig Iron.—Recent reductions in pig iron prices have not caused any marked activity in this market. Foundries are doing very little advance buying, while producers state that costs are increasing, rather than easing to such an extent as to warrant further reductions. It is stated that the prospect of reduction below present figures is very remote.

Owing to scarcity, turpentine maintains a high figure of $2.25 per gallon in single barrel lots. Raw linseed oil is quoted at $1.03.

Machine tool demand continues somewhat featureless. There is an occasional sale and there is fair inquiry. Price advances of 10% have gone into effect on certain makes of millers and shapers. Lathes have not been affected. The supply business is good. Quite a strong seasonal demand for steam goods has developed.

The transportation problem, so far as it affects materials from the other side, shows no improvement. One large mill reports that it is practically running only from day to day. In this particular instance there is a shortage not only of materials but great difficulty in securing supply owing to demand in American markets.

Montreal

November 23, 1922.

NOTHING of more than passing interest is to be reported this week from this district. There have not been any price changes and on the whole the demand for steel commodities has slackened off a good bit. This was expected in most quarters but is believed to be only of short duration.

Some of the large manufacturers here who are wholly dependent on supplies of semi-finished steel from Pittsburgh were able to persuade the Canadian roads to send a supply of empty cars to the mills for the transportation of material which was in storage awaiting shipment and secured relief in this way. But it is realized that this cannot become a general practice, and the smaller interests throughout the country are suffering severely from the inability of the American mills to secure cars for the shipment of material. It is reported that the system of trucking material from the Pittsburgh district mills, so highly developed during the war to relieve the railway situation, is again coming into existence and tonnage is being trucked as far as Boston and Detroit.

Iron and Steel.—Buying has been so good for the past several months that a temporary lull in demand is not surprising, and when the large supplies which have recently been imported from the Old Country mills, particularly galvanized sheets, black sheets and pig iron, have been absorbed, fresh buying is sure to develop. Shipping difficulties at the several American points of shipment are increasing and are undoubtedly becoming worse without any promise of betterment. A new departure has been inaugurated by a local warehouse firm which will fill a long-felt want on the part of machinery and allied manufacturers, that is—the stocking of large steel bars up to 12 in. dia. The largest side bars rolled in Canada are about 5½ in. and in the U. S. 7 in., but the British mills can produce up to 12 in. and a complete range of sizes up to this limit is now available here, and the price is understood to be very reasonable. Local prices:

Iron bars, base	3 15 to 3 25
Steel bars, base	3 15 to 3 25
Reinforcing bars, base	3 15 to 3 25
Steel hoops	4 00
Tire steel	3 25 to 3 40
Spring steel	7 00
Band steel, No. 10 gauge and 3-16" base	3 65 3 75
Small shapes	3 40
Sheets, black, No. 28	4 75
Shets, blue, ann., No. 10	4 10
Canada plates, dull, 52 sheets	5 50
Canada Plates, all bright	7 00
Galvanized Sheets, No. 28	6 50

Pig Iron.—The recent reduction in the price of Canadian iron has not stimulated fresh buying owing chiefly to the fact that foundries are presently well supplied and the market cannot consume new tonnage. The importation of Scotch and English brands has ceased with the close of sailings to the St. Lawrence, and on fresh demand developing later on Canadian pig will control the market.

"The reduction in price of Canadian pig iron recently made," a dealer states, "has stimulated inquiries somewhat, but, as yet, actual purchase does not seem to have increased, as prices on English and Scotch iron are still below Canadian prices in Montreal and district." Local prices:

Algoma, No. 1, car lots on tracks, nominal quotation		36 15
Summerlee, 30-ton lots, dock	35 00	
Carron, 30 ton lots	35 00	
Do., 5 ton lots, ex. warehouse	40 50	

Non-Ferrous Metals.—The ingot metal situation is somewhat easier this week than it has been recently and there is little doubt but that zinc has probably reached almost its highest point. The reaction in tin is not surprising in view of the sharp advance, but while it may go off slightly further, we would not be surprised to see a fresh advance in a week or two.

With regard to the practices made by dealers in ingot metals with regard to the tendency on the part of large manufacturers to import direct, thereby avoiding a 2¼ per cent. tax as from wholesaler to manufacturer, a Montreal dealer states: "This tax applies not only to ingot metals but to all goods. At present we are forced to sell as far as possible for direct import from abroad to the manufacturer here, who pays 3¾ per cent. tax when passing entry. We are, of course, compelled to carry a certain amount in stock on which we also pay the same tax and then charge a further 2¼ per cent. on sales from stock. It naturally places a penalty on our stock business and as such is objectionable, but the situation has gradually righted itself having been in force now for some time, and while we would like to see this removed there is no particular objection on the part of the trade here. As previously mentioned, this does not apply to tin alone, but to all imported goods, and if there is any talk of going to Ottawa to make a protest we think it is a waste of time."

Local prices in the non-ferrous metal market follows:

Lake Copper	17 50
Electrolytic Copper	17 25
Castings, Copper	17 00
Tin	40 00
Lead	7 50
Spelter	9 50
Antimony	7 50
Aluminum	22 00

Pittsburgh

November 22, 1922.

OPERATION of the steel industry continues at slightly above 75 per cent. of capacity. There are no striking cases of any mill curtailing its output on account of lack of orders, although a month ago it seemed not entirely improbable, on account of the heavy shipments being made, that something of this sort would occur well before the end of the year. Thus the situation from the mill standpoint is perhaps somewhat stronger than might have been expected. Another point is that mills report less irregularity in prices of bars, shapes and plates than a week ago, i.e., the 2c market price is being sustained better.

That it is no foregone conclusion that the steel market has to stay strong, with producers having continuously the upper hand over consumers, is obvious from a survey of conditions and trends. In the long run the alternate innings of buyers and sellers even up rather well, and since about April 1, the date when the coal strike began, everything has been in favor of sellers.

Large Tonnage Absorbed

The situation as to production and consumption can be put in clear and concise form. In 1921 there was drastic liquidation of material, both stocks of steel in the hands of buyers and stocks of manufacturers of steel, including

hardware, tools, agricultural implements, machinery, etc. Production of steel ingots was about 19,000,000 tons against about 41,000,000 tons in 1920. The country must have been practically bare of stocks of all sorts April 1 of this year. From that date to October 1 the production of ingots averaged 34,500,000 tons a year. Consumption could not have been at a greater rate than the production, there being no stocks to draw upon. Since October 1 production of ingots has been at a rate of 40,000,000 tons a year, or 15 per cent. more. If steel is not growing more plentiful it has to be shown that consumption, with winter approaching, is considerably greater than in spring, summer and early autumn, and that is something that does not normally occur.

The Steel Corporation's last report showed 6,902,287 tons of unfilled obligations, equal to nearly six months of production at 75 per cent., though, of course, the orders and contracts are not equally distributed among the different departments. At any rate, the Steel Corporation is really very well sold up. For a long time the independents, as a whole, have not had nearly as heavy order books, partly because their prices have frequently been higher than those of the corporation.

In some quarters it has been expected of late that before the end of the year some of the independents would find themselves with so little business that they would have to choose between curtailing operations and going out to seek additional business by the price-cutting route. The common opinion has been that in such case choice would be made of the latter alternative. At the present time, however, some of the large independent mills that were supposed to have the leanest order books state that they can run for two months at their present rate without booking additional business. Then the question arises whether their customers will continue to take shipments at the present rate. Some of them may ask shipments to be curtailed or discontinued for a time. There have been such experiences in the past, two years ago, for instance.

Building Materials Strong

There continues to be pressure upon pipe mills for better deliveries of butt weld merchant pipe, both black and galvanized. The mills seem to be considerably in arrears. Wire mills are likewise under some pressure for delivery of nails. They are said to be six weeks behindhand in nail shipments. It is only in these two lines that mills are under pressure. In other finished steel deliveries seem to be fully adequate and as indicated above there is room for suspicion that customers may suggest before the end of the year that the rate of shipping be reduced. The pressure for small merchant pipe and for nails reflects, of course, the remarkable boom that has been in progress for nearly a year in garage and dwelling house construction, a boom that seems to be quite lively still.

The market is quotable as follows: Billets and sheet bars, nominal at $38, Pittsburgh or Youngstown; bars, shapes and plates 2.00c; ordinary hoops, including cooperage stock, 2.90c, with higher prices for narrow hoops and light gauges; black sheets, 3.35c; galvanized sheets, 4.35c to 4.50c; blue annealed sheets, 2.50c to 2.75c; plain wire, 2.45c; wire nails, $2.70; merchant steel pipe, 66 per cent. basing discount.

Coke and Pipe Iron

Connelisville furnace coke is down 25 cents and foundry coke 25 to 50 cents in the week. Furnace coke of good grade can be picked up at $6.75 to $7.25, according to tonnage and delivery. A week ago foundry coke was quotable at $8.00 to $9.00 according to brand, the $9.00 price being for the best brands. These are now quotable at $8.50, the concrete development being the announcement that Jamison coke on adjustment contracts would be priced at $8.50 beginning November 16. Ordinary brands, merely of standard quality, can usually be picked up at $7.75, or 25 cents lower than a week ago. This is standard coke. There is off-coke at less.

The further decline in furnace coke does not particularly please the furnaces now in operation, for the reason that on the drop some five weeks ago from a firm level of $12 to a range of $8.00 to $8.50 the furnaces covered pretty generally to the end of the year. They cannot take advantage of the lower coke prices to any extent, while the decline in coke exerts an adverse sentimental effect on pig iron, which is weak and declining in all districts. Foundry pig iron at valley furnaces is down from $29 to $28.50 and is by no means strong at the lower price. Basic, quotable nominally a week ago at $29, valley, has sold at $28, valley furnace, while Cleveland furnaces are understood to have sold to Massillon and Canton at prices that it would require $27, valley, to match, so that basic is weak or nominal at $28, valley. Bessemer remains quotable at $32, valley.

Iron Down at Buffalo

Buffalo foundry iron is down to $27, furnace, and Birmingham is off $2 to $23, Birmingham. At these prices, with valley foundry at $28.50, all three districts can put pig iron into Pittsburgh at approximately the same price, an unusual alignment and one that makes Pittsburgh consumers expect lower prices on valley iron, apart from their expectation of lower prices on account of production being heavier and coke declining. Naturally inquiry is very light and is confined to the supplying of immediate necessities, which are not large on account of the deliveries now being made on old contracts.

According to government figures for 1920, the pulp and paper industry employed an invested capital of over $347,000,000, of which slightly more than half was in the Province of Quebec. In the first six months of 1922, Canadian mills produced over 516,000 tons of newsprint as compared with 612,000 produced by United States mills. The Canadian newsprint output during this six months period is stated to have been 93.6 per cent. of mill capacity.

Electrification of railroads in France calls for a program by which a 200-mile stretch is to be completed by next summer. Ultimately there will be 6,000 miles in operation, by which time France will have developed her waterpowers.

Cheap Roller Bearings:—The success of ball bearings on bicycles and other light machines led inventors to design a more powerful type of bearing for heavier machinery. Rollers were substituted for balls so as to afford greater strength and larger bearing surface; and in many cases great success has been achieved by their use, especially where economy of power is of great importance. The development of the roller bearing has, however, been hindered by its high initial cost. Consequently, it is good news to many engineers that a British firm has evolved a simplified form of roller bearing which competes with the ordinary solid bearing in price. The usual plan is to arrange the rollers in a cage, but in the new bearing the rollers are kept in position by intermediate distance pieces which are held in alignment by two projections which run in curves and thus serve the double purpose of keeping the distance pieces in line and of acting as oil rings. With the aid of this bearing the highest economy can be secured without heavy initial expense.

The total value of exports from Canada to India during the five months ended August, 1922, amounted to roughly $500,000 as compared with $650,000 during the corresponding period of 1921. This drop is probably accounted for by the fact that some special railway material was imported in 1921, while no Canadian railway materials so far figure in this year's returns. If the value of a cargo of 130,000 creosoted Douglas fir sleepers delivered at Madras a few weeks ago, were included, the figures for this year would now be in advance of last year. The export of Canadian-built motor cars shows a marked improvement over last year, 446 cars being imported from April to August this year as compared with only 165 during the corresponding period of last year. The increase of the tariff in March of this year from 20 per cent. to 30 per cent. ad valorem has had the effect of encouraging the importation of the cheaper American and Canadian built cars at the expense of the higher-priced English cars. Only 96 English cars were imported into India during April to August this year, as compared with 207 during the corresponding period of last year.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Toronto price:—

Silicon, 2.25% to 2.75%	$33.80
Algoma, No. 1, Montreal	36 15
Summerlee, Scotch, Montreal dock	35 00
Summerlee, Warehouse, 5-ton	40 50
Carron, Montreal docks	35 00
Grey forge Pittsburgh	29 77
Lake Superior, charcoal. Chicago	36 15
Standard low phos., Philadelphia	38 00
Bessemer, Pittsburgh	32 77
Basic, Valley furnace	28 00

METALS

	Montreal	Toronto
Lake copper	$17 50	$17 25
Electrolytic copper	17 25	17 00
Castings, copper	17 00	17 00
Tin	40 00	41 00
Spelter	9 50	9 50
Lead	7 50	7 50
Antimony	7 50	9 00
Aluminum	22 00	22 00

Prices per 100 lbs.

BILLETS

F. O. B. Pittsburgh

	Per gross ton
Bessemer billets, 4 in. x 4 in. and larger	38 00
Open hearth billets	38 00
O. H. Sheet bars	38 00
Forging billets	45 00
Bessemer rods	46 50

IRON AND STEEL

Per 100 lbs. to large buyers

Iron bars, base, Toronto	$3 25	3 40
Steel bars, base, Toronto	3 25	3 40
Small shapes, base		3 50
Iron bars, base, Montreal	3 15	3 25
Steel bars, base, Montreal	3 15	3 ?5
Reinforcing bars, base	3 15	3 40
Steel hoops		4 50
Tire steel, base		3 50
Spring steel	7 00	14 00
Band steel, No. 10 gauge and 3-16 in. base		3 90
Chequered floor plate ¼" and heavier	6 25	7 00
Chequered plates ¼-in. and heavier, sunken diamond		5 40
Bessemer rails heavy at mill		2 35

PITTSBURGH MILL

Steel bars	2 00
Tank plates	2 00
Structural shapes	2 00
Steel hoops	2 90 to 3 00

F. O. B. Chicago Warehouse

Steel bars	2 80
Structural shapes	2 90
Plates	2 90
Small shapes under 3-in.	2 90

PLATES

Plates 3-16 in.	$3.85	$3 60
Plates, ¼ up	3 50	3 40

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$ 4 60	$5 10
Sheets, blue ann., No. 10	3 85	4 20
Canada plates, dull, 52 sheets	5 25	4 90
Can. plates, all bright	6 50	5 40
Galvanized sheets, No. 28	6 75	6 25
Queen's Head, 28 B.W.G.	7 25	
Fleur de Lis, 28 B.W.G.	7 00	
Gorbal's best, No. 28, U. S. G.	6 10	
Colborne's Grown, No. 28		
Premier 28	6 10	6 35
Premier 10¾ oz.	6 80	6 75
Zince sheets	10 25	10 75	11 00

FREIGHT RATES

Pittsburgh to Following Points	Per 100 lbs. C.L.	L.C.L.
Montreal	52	65½
St. John, N. B.	76	96
Halifax	77½	97
Toronto	34	48½
Guelph	34	48½
London	34	48½
Windsor	31½	45½
Kingston	48½	61

OLD MATERIAL

Dealers' Average Buying Prices

	Montreal Per Ton	Toronto Gross
Boiler plate	$ 9 00	$ 9 00
Heavy Melting Steel	10 00	11 00
Axles (wrought iron)	20 00	16 00
Rails (scrap)	11 00	11 00
Malleable scrap	10 00	11 00
No. 1 Machine cast iron	22 00	18 00
Pipe, wrought	7 00	6 00
Car wheel	17 00	16 00
Steel axles	15 00	15 00
Mach. shop turnings	4 00	6 00
Stove plate	16 00	14 00
Cast boring	4 00	6 00
Copper, light	9 00	9 00
Copper, crucible	11 50	11 50
Copper, heavy	11 25	11 25
Copper, wire	11 25	11 00
No. 1 machine composition	9 00	9 00
New brass cuttings	6 00	7 00
Red brass turnings	6 50	7 00
Yellow brass turnings	5 25	4 85
Light brass	4 50	3 50
Medium brass	6 00	4 50
Scrap zinc	3 50	4 00
Heavy lead	4 50	4 50
Tea lead	3 00	3 00
Aluminum	11 00	11 00

COLD ROLLED STEEL

(At Warehouse)

Rounds and squares	$4 75 base
Hexagon and flats	$5 75 base
Cumberland ground shafting, base	$6 00 base

COPPER PRODUCTS

Prices per lb.

	Montreal	Toronto
Copper bars, 1¼ to 2 in.	30-31	.28
Plain sheets, 16 oz. in. 30 x 72 hot rolled	31-32	.29
Copper sheet, tinned, 16 oz.	.36 00	.36
Copper sheet, planished, 16 oz. base	40 00	.46
Braziers', in sheets, 6 x 4 base	.30	.29
Copper tubing, seamless		.33

LEAD SHEETS

Roll Lot Prices

	Montreal	Toronto
Sheets, 3 lbs., sq. ft.	$10 35	$10 50
Sheets, 3½ lbs. sq. ft	10 25	10 50
Sheets, 4 to 6 lbs. sq. ft.	10 10	9 50
Cut sheets, ¾c. per lb. extra		
Cut sheets to size, 1c. per lb. extra		

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in.	22
Brass sheets, 24 gauge and heavier base	25
Brass tubing, seamless	30

STANDARD BUTTWELD PIPE S/C

Per 100 feet.

Price List No. 57. November 2, 1922.

	Steel Blk.	Steel Galv.	Gen. Wrot. Iron Blk.	Gen. Wrot. Iron Galv.
⅛ in.	6 00	8 00	....	....
¼ in.	3 96	6 00	7 20	9 30
⅜ in.	3 96	6 00	7 20	9 30
½ in.	5 02	6 55	7 31	8 93
¾ in.	6 10	7 82	8 86	10 70
1 in.	8 67	11 22	12 75	15 47
1¼ in.	11 73	15 18	17 25	20 93
1½ in.	14 03	18 15	20 63	25 03
2 in.	18 87	24 42	27 75	33 67
2½ in.	29 84	38 61	....	....
3 in.	39 02	50 49	....	....
3½ in.	50 60	64 40	....	....
4 in.	59 95	76 30	....	....

STANDARD LAPWELD PIPE

Per 100 feet.

Below dividing line—price per foot.

	Steel Blk.	Steel Galv.	Gen. Wrot. Iron Blk.	Gen. Wrot. Iron Galv.
2	22 20	27 75	31 08	37 00
2½	32 76	41 54	46 80	56 16
3	42 84	54 32	61 20	73 44
3½	51 52	65 32	73 60	88 32
4	61 04	77 39	87 20	104 64
4½	71 12	90 17	1 07	1 27
5	82 88	105 08	1 24	1 48
6	1 08	1 36	1 61	1 92
7	1 40	1 79	2 07	2 50
8L	1 48	1 88	2 18	2 63
8	1 70	2 16	2 51	3 02
9	2 07	2 62	....	....
10L	1 92	2 43	2 82	3 63
10	2 47	3 13	3 63	4 37

Prices Ontario, Quebec and Maritime Provinces.
Terms—2% Cash discount if paid within 30 days.
Provinces

WROUGHT NIPPLES

4-in. and under, close and short, 55 per cent.

4½-in. and larger, close and short, 45 per cent.

4-in. and under running thread, 35%.

Standard couplings 4-in. and under 25%.

Do., 4½-in. and larger 5 per cent.

MALLEABLE FITTING LIST

1 in. elbow	.32	.53
2 in. elbow	1.05	1.70
1 in. tee	.43	.70
2 in. tee	1.45	2.40
1 in. coupling R. & L.	.33	.53
1 in. locknut R. & L.	.15	.23

Discount to dealers—70 per cent.

BOILER TUBES

Sizes	Seamless Lapw'ld Toronto		Seaml'ss Lapw'ld Montreal	
1 in.	20.00	.....	23.80	.....
1¼ in.	22.00	.....	23.80	.....
1½ in.	24.00	.....	23.80	.....
1¾ in.	24.00	.....	24.50	24.00
2 in.	22.00	19.00	21.00	19.75
2¼ in.	24.00	21.50	24.00	22.25
2½ in.	27.00	23.50	27.00	23.25
3 in.	34.00	28.50	34.00	29.50
3¼ in.	36.00	.....	36.00	.....
3½ in.	38.00	33.00	38.00	34.25
4 in.	50.00	42.00	49.00	43.50

Prices per 100 ft., Montreal and Toronto

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, 7-16 and up	30
Carriage bolts, ⅜ in. and smaller 6 in. and shorter	40
Coach and lag screws	45
Stove bolts	72½
Wrought Washers	60
Do., corru. head	60
Machine bolts, 7-16 and over	35
Machine bolts, ⅜-in. and less	35
Blank bolts	35
Bolt ends	35
Machine screws, fl. and rd. hd., steel cut thread	37½ & 10
Machine screws, o. and fil. hd., steel cut thread	30
Machine screws, o, and fil. hd., brass cut thread	15
Standard couplings, 4-in. and under, brass cut thread	30% 30
Nuts, square, blank off net list	$1.00
Nuts, square, tapped off net list	50c.
Nuts, hex., blank off net list	50c.
Nuts, hex., tapped net list	
Copper rivets and burrs, list less	32c.
Burrs only, list plus	10%
Iron rivets and burrs	47%
Boiler rivets, base ¾ in and larger	$5.75
Structural rivets, as above	5 65
Wood screws, O. & R., bright	80
Wood screws, flat, bright	82½
Wood screws, flat brass	77½
Wood screws, O. & R., brass	75
Wood screws, flat, bronze	72½
Wood screws, O. & R., bronze	70

NAILS AND SPIKES

Wire nails, base	$3 65
Cut nails, base	4 35
Miscellaneous wire nails	72½%

MILLED PRODUCTS

(Prices on unbroken packages)

Set screws	65
Square and hexagon head cap screws	60
Round head cap screws	20
Fillister head cap screws	35
Flat head screws	25
Button head cap screws	20
Studs	45
Semi-finished nuts up to and including 9/16 in.	70
Semi-finished nuts ⅝ to 1¼ in.	65
Semi-finished nuts 1⅜ to 2 in	35
Coupling bolts	35
Taper pins, up to and including No. 5	65
Taper pin No. 6 and over	55
Planer bolts without fillet	10
Planer bolts with fillet	Net
Patch bolts	Plus 10%
Hollow set screws	20
Thumb screws	50
Thumb nuts	70

CARBON DRILLS AND REAMERS

	Discount.
S. S. drills, wire size	60
Can. carbon cutters	plus 10
Standard drills, all sizes	60
3-fluted drills, plus	10
Jobbers and letter sizes	60
Bit stock	50
Ratchet drills	25
S. S. drills for wood	10
Wood boring brace drills	50
Electricians' bits	30
Sockets	50
Sleeves	30
Taper pin reamers	20
Drills and countersinks	20
Bridge reamers, carbon	30
Centre reamers	Net
Taps, machine screw	55 to 60
Taps, hand, ¼ in. to ⅜ in	40 to 45
7/16 in. to. ⅝ in.	40 to 50
11/16 in. to 1 in.	35 to 45
Chucking reamers	20 off
Hand reamers	20
High speed drills, list	40
Can. high speed cutters	plus 10
American	plus 40

FILES AND RASPS

Globe	60/5
Vulcan	50
P. H. and Imperial	60
Nicholson	35/5
Black Diamond	35/5
Heller	40
Jowitts	net
J. Barton Smith, Eagle	55
McClelland, Globe	50
Delta Files	20
Disston	40
Disston	50
Great Western-American	50
Kearney & Foote, Arcade	60/5

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

PROOF COIL CHAIN

B. B. B. CHAIN

⅜ in., $16.45; 7-16 in., $14.00; ½ in., $12.95; 5-8 in., $13.15; ¾ in., $12.75; ⅞ in., $12.25; 1 in., $11.85; 1⅛ and 1¼ in., $10.55. Fire weld chain same sizes respectively are $14.00; $11.50; $10.40; $10.55; $10.15; $9.75; $9.35; and $8.25.

ELECTRIC WELD COIL CHAIN B.B.B.

⅛ in. $20.00; 3-16 in. $16.50; ¼ in. $15.50; 5-16 in. $12.70.

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	30%
Standard	30 and 10%
Cut leather lacing, No. 1	1.75
Leather in side, (Lacing)	1.50

RUBBER BELTING

Standard 36 ....28% Best grades 28%

TAPES

Chesterman Metallic, 50 ft.	$5 00
Lufkin Metallic, 603, 50 ft.	3 17
Admiral Steel Tape, 50 ft.	3 00
Admiral Steel Tape, 100 ft.	4 50
Major Jun. Steel Tape, 50 ft.	3 75
Rival Steel Tape, 50 ft.	4 00
Rival Steel Tape, 100 ft.	8 75
Reliable Jun. Steel Tape, 50 ft.	5 25

PLUMBING SUPPLIES

Plumbers' oakum, per cwt.	6 00
Navy oakum, cwt.	13 00
Solder, strictly	0 25
Solder, guaranteed	0 26½
Soldering coppers, lb.	0 62½
White lead, pure, cwt	13 20
Red dry lead, 100-lb. kegs, per cwt.	9 75
Wood alcohol, per gal.	1 75
Whiting, plain, per 100 lbs.	3 00

ROPE AND PACKING

Packing, square braided	0 38
Packing, No. 1 Italian	0 31
Packing, No. 2 Italian	0 24
Pure Manila rope ¾ and larger, base	0 20
British Manila rope	18
New Zealand hemp	0 18
Jute packing, fine	15c
Jute packing, coarse	11c

OILS AND COMPOUNDS

Castor Machine Oil, per lb.	34½
Royalite, per gal. bulk	21
Machine oil, per gal.	39
Black oil, per gal. (Summer)	19
Cylinder oil, Capital	69½
Turp., single bbls., gal.	2 25
Linseed oil, raw, single bbls.	1 03
Premier gasoline	29 00
Fuel oil, bbls., gal.	11 80

WASTE

XXX Extra	16
Atlas	18
Peerless	21
X Empire	13
XX Grand	15
Ideal	18
Superior	20
X Press	11½
X L C R	14

Colored

Lion	12
Fancy	13½
Standard	10½
Popular	9
No. 1	13
Keen	7½

Wool Packing

Arrow	24
Anvil	16
Axle	20

Washed Wipers

Select White	18
Dark colored.	13
Mixed Colored	14

This list subject to trade discount

PLATING SUPPLIES

Polishing wheels, felt	$3 25
Polishing wheels, bull-neck	1 60
Emerey in kegs, Turkish	7½
Pumice, ground	3 to 4½
Emery glue	18
Tripoli composition	6 to 8
Crocus composition	12
Emery composition	11
Rouge, silver powder	60
Rouge, powder, nickel	35

Prices per lb.

ANODES

Nickel	40 to .45
Copper	22to 24
Zinc	14 to 14½

PLATING CHEMICALS

Acid boracic	.20
Acid, hydrochloric	.03¾
Acid, nitric	.10¼
Acid, sulphuric	.03¾
Ammonia, aqua	.20
Ammonium, Carbonate	.15
Ammonium, chloride	.13
Ammonium, hydrosulphuret	.75
Ammonium, sulphate	.10
Arsenic, white	.18
Copper carbonate, anhy.	.26
Copper, sulphate	8 to 10
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.14
Nickel carbonate	.32
Nickel sulphate	.14
Potassium sulphide (substitute)	.40
Silver chloride (per oz.)	.85
Silver nitrate (per oz.)	.70
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium evanide, 127-130%	.31
Sodium hyposulphite	.08
Sodium phosphate	.10
Tin chloride	.50
Zinc chloride, C. P.	.30
Zinc sulphate	.06

Prices per lb. unless otherwise stated

News From the Industrial Field

Building permits issued by Toronto City architect for the past ten months amounted to $5,000,000. For the first half of November permits amounting to $260,-500 were issued.

Ore shipment by water will wind up about Nov. 25, according to reports from Cleveland. Boats have been lined up for all the ore that will be sent forward.

The Imperial Oil Co. has just completed two large storage tanks at Sydney, N. S. This will form part of the plant now being erected. These tanks have a capacity of 10,000 gallons each.

Business activity in Montreal is reflected in the increased number of incorporations recently. During the past two weeks the authorized capital of new companies formed aggregate approximately $44,000,000.

Asbestos mines near Thetford, Ont., are operating on an average of 50 per cent. capacity. Operators report that enquiries from the iron and steel and building industries are good. The outlook is better than for some time.

Development of the Lackawanna Steel plant at Buffalo is now proceeding on a large scale. Enlargements will cost $15,000,000. Charles M. Schwab gives as a reason for this expenditure the prospect of an era of prosperity directly ahead.

Canadian National Railways recently let contracts for over one million ties. This order will mean something to the lumbering industry. It is stated that operations in all the camps this winter will be one-third to one-half greater than last year.

Walkerville:—Owing to a so-called price-war, manufacturers of twist drills in this district declare that lower-than-cost levels make business somewhat unattractive. The Canadian Detroit Twist Drill Co. here are fairly active. They ahave a motor valve department employing three men at present.

Shipping at the port of Montreal has taken on considerable activity during the past few weeks as compared with corresponding period of last year. Customs and excise receipts for October at the Port of Montreal amounted to $8,-452,171, and represented one of the biggest month's business in the history of the port. This is a gratifying increase as compared with October, 1921. and September, 1922, when the totals amounted to $5.950,913 and $7,232,830 respectively. In one day collections totalled $1,029,312.

Boiler insurance companies are giving the question of fuel costs some attention and their inspectors are making good suggestions by way of regular service. One manufacturer saved 35% in overhead by making certain alterations and adopting methods that were brought to his attention in this way.

The Wear-Rite Textile Co., Toronto, are building a two story brick factory costing $100,000 at the corner of Empire Ave. and Queen St. E., Toronto. It is understood that they intend making cotton and wool-combing products when the factory is completed. J. E. Hoare is in charge of the Toronto office.

Next week's issue of Canadian Machinery will contain the second article by A. Luenberg on factory costs. The subject discussed will be "Prime Cost and How to Find It." The article will contain proper forms and charts adaptable to practical use.

Walkerville:—It is understood that the plant of the Walker Twist Drill Co. is to be sold. At present it is occupied by Canadian Production Tool Co., who have 15 men employed. Running on normal basis the former Walker Twist Drill Co. employed about 200 men.

Walkerville:—General Motors production schedule for the coming five months exceeds that of the same period a year ago. Although fewer men are employed, production is greater. With 800 men as against a high peak of 1,200 more units are being turned out than at any previous time. The whole plant is practically on a piece-work basis.

Ogden R. Adams of Rochester, N. Y., who for the past eighteen months has been associated with the Seneca Falls Mfg. Co., in the capacity of president and general manager, has severed his connection with that corporation, his resignation becoming effective Nov. 1st. Mr. Adams will hereafter devote his entire time to his business interests in Rochester, Buffalo and Syracuse.

"Cut-throat competition is not included in the perfect competition of economic theory. As economic competition is directed to gaining some economic advantage from a particular sale or purchase, it will always cease when economic gain is completely eliminated. It does not involve defeating one's rivals at whatever cost."

Walkerville:—Former Windsor Machine Tool Co. interests are considering a proposition to locate in St. Thomas or Tillsonburg, when they would operate a plant on pistons and piston rings.

Brantford Brass Foundry Co, which last winter operated in a small brick structure, subsequently added a machine shop and storage shed. Part of the latter was converted into a core room, and at present an extension of the foundry building is proposed. A staple line of products, builders' hardware and artware is being established. The furnaces are fired with fuel oil instead of coke.

That Canada will require 80,000 motor cars yearly in replacement needs and that farmers own one-third of the cars in Ontario, is the report that Felix S. S. Johnson, U. S. consul at Kingston, makes to Washington. Approximately 500,000 passenger cars and trucks have been turned out of Canadian factories during the past six years.

That surplus machinery of Canadian plants be distributed in the United States where the industrial revival has created a demand for machine tools, is suggested by Frederick Hudd, Canadian Trade Commissioner, New York. Production machinery has been but slowly absorbed in Canadian plants since the post-armistice boom. Large tools and rebuilt woodworking equipment he says is in demand on the American market.

It is the opinion of K. L. Swenson, secretary Rockford Lathe and Drill Co., Rockford, Ill., who was in Toronto recently arranging agency connections, that while there is a great amount of used machinery moving, manufacturers are beginning to realize that this is not the kind of equipment that will be required when industry recovers its normal stride. Already there is an increasing enquiry and movement in high standard equipment.

Walkerville:—Ford Motor Co., are soon to award contracts for the proposed extension to their plant. A notable change is being made at present by the conversion of their 2,200 machines from belt to direct motor drive. Direct motor drives are required and it is understood that the contract for the work has been secured by the Westinghouse Co. Equipment of the new plant will represent a large investment in machine tools, but dealers state that there will be no move in this direction before spring.

MUCH STEEL USED IN QUEBEC CONTRACTS

Quebec.—Prior to 1910 there was very little steel used in building construction in this city and district. This being the center of the timber and lumber trade, wood was almost exclusively used in construction work. With the establishment of the Eastern Canadian Steel and Iron Works, Limited, in Quebec in 1910, there came a change. This plant is practically owned by local capital, with Edmund Taschereau, president, Arthur Picard vice-pres., and Thos. G. Leonard, general manager. The plant is adjacent to the C.N.R. St. Malo shops, and has up-to-date equipment for the fabrication of steel. It employs 150 workmen, and uses on an average of 1,000 tons of steel per month. The plant has, at present orders on hand to keep it busy until the end of February. As indicating the relations existing between employers and employees, it is sufficient to say that not one difficult situation has arisen since the opening of the plant to the present time.

Thos. G. Leonard, in an interview with your correspondent, discussed business prospects and the condition of labor in connection with the plant. They had furnished the steel for the building of several bridges, including a cantilever over the Saguenay for the firm of Price Bros., Ltd., which took 325 tons of steel, bridges in the counties of Levis and Champlain and others in the province. They had also supplied 1,500 tons of steel for the New Bank National building; 350 tons for the addition to the parliament buildings; 350 tons for new Quebec court house; 250 tons for St. Sacrament church; steel for viaducts and bridges on provincial highways; for the monastery of the Redemptorist Fathers; for the new college at St. Anne de la Pocatierre and Rimouski and the institute of Ste. Anne de Beaupre.

Speaking of labor conditions, Mr. Leonard said: "We have not had the least difficulty with our employees, who are all French-Canadian, good and steady workmen." Pointing to a regular village, a short distance away, surrounding the plant, Mr. Leonard said, "That sight is sufficient evidence to show you the class of workmen we have in our employ. When we established our industry in this locality, to be close to the C. P. R., there was not another dwelling within a quarter of a mile of our plant. These buildings were practically all built by our workmen and their families. This is a living example of the sane mentality of labor in Quebec."

Discussing the facilities for steel construction in Quebec and district in the future, Mr. Leonard said he had good hopes, as investers were building these days to escape the high cost of insurance, and was fully convinced that from now on, all public and big business buildings in Quebec would be of steel.

FACTORY TO TILLSONBURG

Tillsonburg.—Wilkie Products Co., Limited, representing interests formerly associated with Windsor Machine Tool Co., Windsor, Ont., are to be given aid to establish a factory here.

The company asks a free site to cost not more than $1,000, exemption from taxation except for school purposes, and a guarantee of their bonds to the value of $40,000. As security they will give the town a first mortgage on the land, buildings, $100,000 worth of machinery and equipment, which is considered to be ample security against loss in any event that might occur. They will build a modern factory 200 x 400, one-storey brick to cost $40,000. The company agrees to repay the bonds in 18 equal instalments, with interest at the rate of six per cent., and to employ not less than 50 hands within a year.

The products they will manufacture are staple articles, in constant demand the entire year, piston and piston rings as the main products to be manufactured. In addition to their own hands, they will require a tonnage of 40 tons of casings per month, which will necessitate many extra moulders in the local foundries. There is every indication that the bylaw will carry by a big majority, in which case at least 50 new houses will be required in the spring as the house shortage is acute at the present time, despite the fact that Tillsonburg has enjoyed one of the best building seasons in the history of the town. If the by-law passes, the board of trade will immediately deal with another excellent industry, with every indication of locating them by spring.

Port Arthur.—A terminal elevator with a capacity of 1,500,000 bushels will be erected here by James Stewart, president of the Maple Leaf Flour Mills and of the James Stewart Grain Company, according to authoritative information. The cost will approximate $850,000 and construction will be commenced during the forthcoming Winter. The site selected is near the Thunder Bay elevator.

Sarnia.—Dominion Alloys Steel Corporation, who propose erecting a three-million dollar steel plant on the St. Clair river below the city, are making payments to the Indians on the Sarnia reservation on the $200,000 purchase price for the required site. Individual payments range from $350 to $3,500, and those Indians who have not other holdings will purchase new land on the reserve. It is learned that the industrial site will be surveyed and cleared forthwith, and the development will entail the closing of the river road in the spring. The plans foreshadow great industrial development along the St. Clair River front, as, besides the Steel Corporation, the Wills St. Claire Company, automobile manufacturers, of Marysville, Michigan, and other industrial concerns, are interested in property in this vicinity.

PUMP CONTRACT LET FOR BIG B.C. PROJECT

Montreal.—Dominion Engineering Works, Limited, have been awarded the contract for pumping equipment in connection with the Sumas reclamation project. The work calls for four 54-inch spiral vertical type centrifugal pumps, two of which will be driven by speed moters capable of developing 1,250 h. p., the other two by three speed motors, each capable of developing 485 h. p. at the highest speed.

The pumps will be used in connection with the lagrest reclamation of dyking scheme of the kind ever attempted in Canada. Its success will mean the establishment of one of the greatest dairying centres in Canada, the farmers having the advantage of every modern convenience, both in their dwelling houses and in their farm buildings.

Power lines have been brought down to the mouth of the Sumas River and the Vedder Canal from the British Columbia Electric Railway Company's main line to Chilliwack, and no building will be without electric light and motor power.

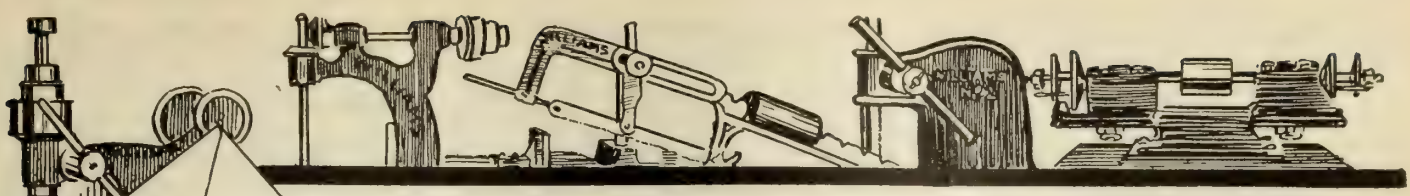
The Vedder Canal is deep enough to permit of river boats like the "Skeena" calling for produce, and there are two railway systems at present operating, one on either side of the prairie. Sheltered between the Vedder and Sumas mountains the climate of the prairie is ideal, and hay has been cut as late as November at times.

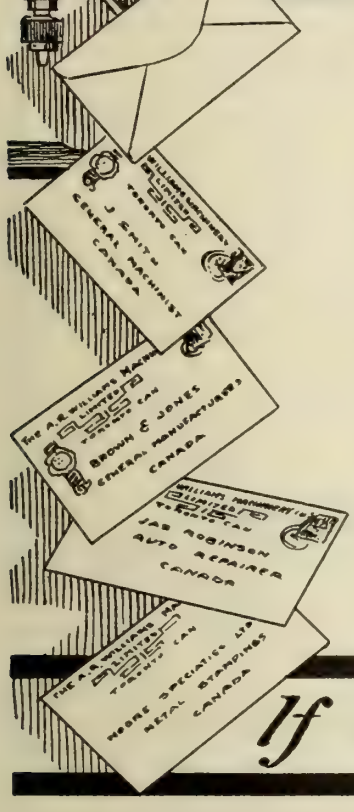
According to a report from Vancouver, the work involves the erection of a dam on the Sumas river. Five big pile drivers recently have been hammering in the piles for reinforced concrete foundations of the dam, which will be four hundred feet wide, when completed.

With the emptying of the Sumas Lake, no longer fed by the Vedder River, the pumps on this great dam will have to take care of the water from the Sumas River and the Sumas Lake canal, together with all drainage water flowing into them. The Sumas River is not a large one, and the Sumas Lake canal will only carry drainage water.

The Sumas River dam will not only have to take care of the water mentioned, but in conjunction with the Sumas River dyke, which joins the west dyke of the Vedder Canal, it will have to bear the brunt at Fraser flood times. The Fraser will back up the Vedder canal and the Sumas River as far as the dam. It is for this reason that the dam is considered the key of the whole stuation, and the government has gone to considerable expense in taking special precautions at this point.

In order to make room for British exhibits, it is now proposed to make additions to the Pure Food Building at Toronto National Exhibition, costing $100,000. The addition would give 19,000 feet more exhibition space.





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No matter what your requirements, our huge stock of Metal-working, Wood-working Machinery and Supplies assures the prompt and intelligent filling of your order. Just now we have some extra good "buys" in re-manufactured machinery—each machine guaranteed to be as good as new for all practical purposes. It will pay you to investigate.

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If its Machinery—Write "Williams"

ARMSTRONG Safety Clamp Lathe Dogs

THIS Dog is so constructed as to combine a wide range of adjustment with the convenient features of the Clamp Dog and the Simplicity and Strength of the ordinary Lathe Dog.

It is specially adapted for use on finished work which would be liable to be damaged by the set screw of a common Lathe Dog.

A distinct advantage of this Dog is that it can be applied without removing work from centres.

Ask for Catalogue B-20.

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"THE TOOL HOLDER PEOPLE"

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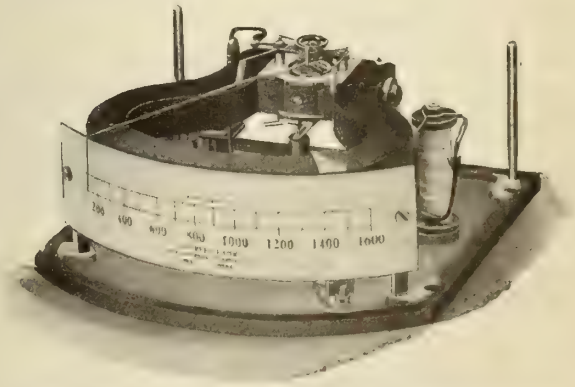
STRONG STRONG

PYROMETER



ANOTHER FACTOR FOR ACCURACY

The Bristol Automatic Cold End Compensator with which our pyrometers are now equipped serves merely to increase the precision of instruments already recognized for their accuracy. This exclusive feature is a simple device located within the instrument itself which automatically compensates for any variation in the temperature of the cold end. The full details are in Catalog I-1401. Now at your service in Philadelphia.

THE BRISTOL CO., Waterbury, Conn.

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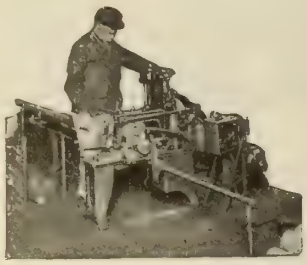

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HACK SAW BLADES

Hack Saw Machines equipped with Simonds Blades produce more work at a minimum of expense. These blades cut rapidly, hold their cutting edge longer and do not shell teeth.

They are made of special steel and heat treated by an exclusively Simonds method to bring out the utmost in cutting efficiency and lasting qualities.

Write for catalog and prices.

SIMONDS

Canada Saw Co.
LIMITED

"The Saw Makers"

MONTREAL - QUEBEC

St. John, N.B. Vancouver, B.C.

PETROL DRIVEN TRAINS

So successful have been the experiments with four petrol motor driven trains on the suburban service that the Chicago Great Western Railroad is preparing to expand this branch of its equipment to fifteen such trains, which will be used mainly in the thickly populated districts of Iowa. The trains consist of a specially constructed motor car, equipped with a high-power petrol engine and a trailer which resembles an ordinary inter-urban electric coach, although more heavily built. The motor car has room for freight and baggage at the back of the compartment occupied by the engineer. The four trains now in use in Iowa are making runs of from 100 to 150 miles a day.

BELT SPEED

Belt speed is determined by the rim velocity of either the driving or the driven pulley. It is equal to the diameter of the pulley times 3.1416 times the revolutions per minute of the pulley. If the pulley diameter is given in inches, divide the answer by twelve to get the speed in ft. per min. Example: 14 in. dia. pulley running 600 r.p.m.

$$\frac{14 \times 3.1416 \times 600}{12} = 1675 \text{ f. p. m.}$$

Avoid crossed belts on short center distances. Avoid crossing wide belts anywhere. If crossing is necessary, see that the rubbing of the belt surface does not have a tendency to open up the laps.

Use a wide enough pulley so a small amount of belt irregularity does not make it run off. Allow at least ½ inch on machine pulleys, and 1 inch or more on countershaft and lineshaft pulleys. Use crowned pulleys where possible.

If possible, use a horizontal belt with large center distances and the pulling side at the bottom. In a horizontal drive, the slack side of the belt at the top of the drive increases the belt contact.

To obtain a given amount of power, better use a narrow belt running at high speed than a wide belt at low speed.

Where possible, use a belt speed of 3,000 ft. per minute, but no more than 3,600 ft. per minute.

In ordering belting to be put on with clamps it is a safe rule to deduct one-eighth of an inch for every foot of the actual length required, because the clamps will probably stretch the belt slightly.

MILLIONS SAVED ON FUEL

Of interest to shipping interests in particular and to industry in general is the fact that the American Bureau of Shipping announces that fuel conservation tests conducted at the request of Shipping Board, under the supervision of a committee of marine engineering experts, during the last round trip of the United States Lines steamship "America," indicate a possible saving to the board's fleet of more than 3,000,000 dollars a year. Prior to the commencement of the outward voyage certain forms of grate bars and appliances calculated to obtain from the coal used a greater degree of combustion and heat were installed. Particular attention was given to the application of consumption of energy that is generally wasted in the form of smoke. Captain McAllister, of the "America," reports that the test showed the following results:

(1) An average saving of 23 tons of coal a day, based on the record showed by the ship in eight previous voyages.

(2) An average increased speed of .84 knots over that shown by the eight previous voyages.

(3) Proof that the saving in coal for the "America" alone would be 50,000 dollars a year.

Farwell Foundry Co., Kitchener, makers of soil pipe, have made two recent additions to their plant.

Marcus A. Grossman, metallurgist for the Atlas Steel Corporation of Dunkirk, N. Y., will discuss "Alloy Steel" at the November meeting of the Toronto Chapter, American Society for Steel Treating, Friday, Nov. 24, 8.15 p. m., 124 Richmond St., W.

In connection with the irrigation scheme for the extension of cotton growing in the Sudan which will cost £4,000,000 a large amount of heavy equipment is called for. According to a report from London, the contractors have placed an order for 13 large dragline excavators with a Lincoln firm. There was severe competition in this business from American firms. The machines, some of which will weigh over 70 tons, will all be mounted on caterpillar tracks.

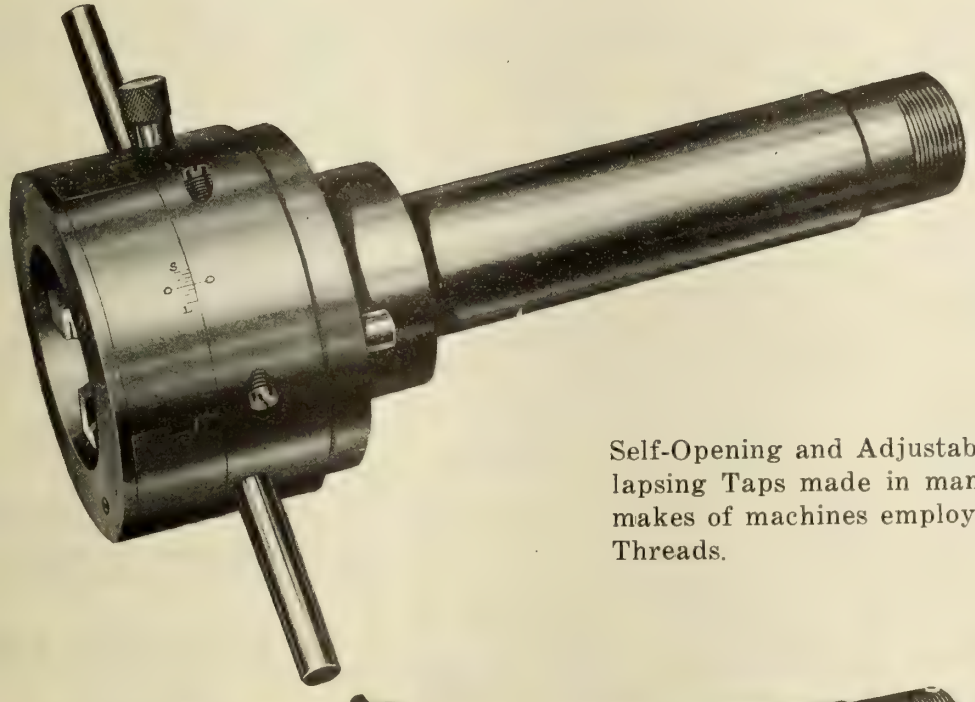
According to reports from Washington, Canada purchased more iron and steel in the United States in September than any other country, the tonnage being 41,417. Japan held second place with 22,328 tons. The shipments to other important markets were: Cuba, 7,656 tons; Mexico, 6,193; Brazil, 6,133; China, 5,689; United Kingdom, 4,306; Chile, 4,229; Argentine, 4,145; Chosen, 3,403; India, 2,909; Australia, 2,403; Colombia, 2 303; Philippine Islands, 2,224; Peru, 1,562; Rumania, 1,463; Venezuela, 1,304; Hongkong, 1,074; British South Africa, 979; and Panama 978 tons.

F. C. Cronin, Detroit, sales manager of the Hoffman Combustion Engineering Co., of that city, has been in Toronto recently making agency connections. Their representatives in Ontario are J. H. Fryer & Co., 186 King St., W., Toronto and Dugold Turner & Co., Clyde Bldg., Hamilton. It is claimed for their product, the Hoffman grate, that it increases fuel efficiency 50 to 70 per cent. as the result of pre-heating and the even distribution of air through the fuel bed by forced draft. It is thus said to be possible to burn efficiently, lower grades of hard and soft coal, costing less per ton.

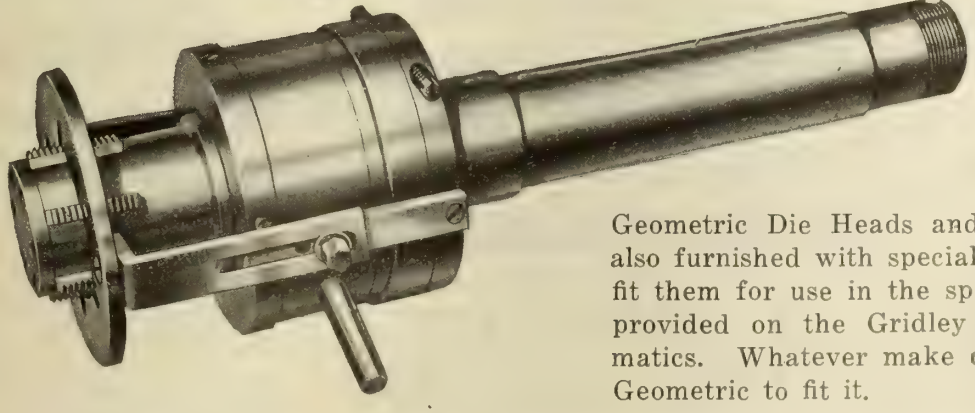
GEOMETRICS

For Cutting Screw Threads

Right on the Lead



Self-Opening and Adjustable Die Heads and Collapsing Taps made in many styles for the many makes of machines employed in producing Screw Threads.



Geometric Die Heads and Collapsing Taps are also furnished with specially threaded shanks to fit them for use in the special threading fixture provided on the Gridley Single Spindle Automatics. Whatever make of machine, there is a Geometric to fit it.

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We have a complete Belknap Equipment for sale. This equipment is still in use in our Subscription Department and is in excellent working order. We have placed an attractive price on this outfit, and would advise manufacturers or merchants having a mailing list to let us tell you how it will save you money. We will give a guarantee as to the proper working condition of this equipment.

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TAYLOR SAFES FOR SALE—RARE OPPORtunity to secure a safe at small cost. They are in splendid condition. Inside dimensions and prices are as follows: 15" deep, 2 ft. 6" wide, 3 ft. 11½" high, fitted with built-in compartment. Price $250.00. 18" deep, 2 ft. 8" wide, 4 ft. 5" high, fitted with steel compartment. Price $200.00. Apply Box No. 817, Canadian Machinery.

WE BUY ANYTHING IN BOILERS, TANKS, general shop, mill and factory machinery, electric motors, gas engines, air compressors, etc. The A. R. Williams Machinery Co., Limited, 64 Front Street West, Toronto. Mention Canadian Machinery when writing.

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Light and Medium-Bench and Floor Repetition Castings; Capacity 15 tons per day.
Expert Metal and Wood Pattern Work. Our advice and estimates will save you money
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ASK US
THE KATIE FOUNDRY, GALT, ONT.

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We make a complete line of Bench and Floor Grinding Machines, equipped with Patented Adjustable Guards and Tool Rests, and Special Mounting Means. We also design and manufacture special machinery for any purpose. Let us have your enquiries.

SUMBLING MACHINERY Company Ltd.
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Japanning and Varnishing Ovens heated by Gas, Electricity, Steam or Coal, Kernchen and Apex Siphonage Ventilators, Bakers' Ovens, trucks, casters, etc. Write for Booklet.
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Brantford, Canada

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Air Pressure Tanks, Air Receivers, Steel Plate Tanks, Pneumatic Tanks, Tote Boxes, Shop Barrels, Steel Factory Equipment, Smoke Stacks, Gasoline Tanks.
Write For New Catalogue
THE STEEL TROUGH & MACHINE CO. LTD.
TWEED - ONT.

CLOSING TIME

Advertisements for this section must be in our composing room Tuesday morning prior to day of issue.

In order that the announcements of your wants, machinery for sale, etc., etc., shall not be delayed, please try to have them in our office with the Tuesday morning mail.

Canadian Machinery

PATTERNS

TORONTO PATTERN WORKS, 65 JARVIS Street, Toronto. Patterns in wood and metal for all kinds of machinery. (ctfm)

BRANTFORD PATTERN WORKS ARE PREpared to make up patterns of any kind—including marine works—to sketches, blue prints or sample castings. Prompt, efficient service. Bell 'Phone 631; Machine 'Phone 733. Brantford Pattern Works, 49 George St., Brantford, Ont. (ctfm)

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MANAGER OF FOUNDRY MACHINE SHOPS desires a larger opportunity. Age 45. Can personally run office, foundry and machines. Practical training as draughtsman, pattern maker and machinist. Can handle iron, brass and aluminum. References the best. Box 816. Canadian Machinery.

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BERTRAMS LIMITED
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Carloads or less. Suitable for making Iron Washers.

The Graham Nail Works
Toronto

If you want something unusual

and it isn't advertised here, the logical thing would be to advertise for it. You'll find that a small ad. in the Classified Advertising Section will save you a great deal of time in locating men or machinery. Look over these pages and if you don't see what you want, send us your copy to-day for next week's issue.

CANADIAN MACHINERY
Classified Advertising Section
143-153 University Avenue
TORONTO

The Brown-Boggs Co., Limited
HAMILTON, ONT.
Grey Iron.

Fisher Motor Co., Limited.
ORILLIA, ONT.
Die Castings.

Sully Brass Foundry, Limited
618 Brock Ave., TORONTO, ONT.
Brass, Bronze, Copper and Aluminum.

Canadian Rumley Co., Limited
Queen West and Abell Streets,
TORONTO, ONT.
Grey Iron.

Galt Malleable Iron Co., Ltd.
GALT, ONT.
Malleable.

S. Vessot & Company
JOLIETTE, QUE.,
Grey Iron, Brass and Aluminum.

Miller Bros. & Sons, Limited,
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Grey Iron, Semi-Steel Castings up to 10 tons.

Can. Mead-Morrison Co., Ltd.,
MONTREAL, P.Q. WELLAND, ONT.
Grey Iron Machinery Castings up to six tons.

Hugh Park Foundry Co., Ltd.,
OSHAWA, ONT.
Grey Iron, Patterns, Etc.

Hull Iron & Steel Foundries Ltd.
HULL, CANADA.
Steel, Manganese, Chrome.

John T. Hepburn, Limited
TORONTO, ONT.
Grey Iron.

Can. Hanson & VanWinkle Co.
LIMITED
TORONTO, ONT.
Monel, Aluminum, Brass, Bronze, Grey Iron.

Tallman Brass & Metal, Ltd.
HAMILTON, CANADA
Brass, Bronze, Manganese Bronze, Aluminum.

Dom. Foundries & Steel, Ltd.
HAMILTON, CANADA.
Steel Castings all sizes.

Manitoba Steel Foundries, Ltd.
Office Winnipeg. Works Selkirk, Man.
Steel Castings up to 5,000 lbs.

Brantford Brass Foundry Co.
BRANTFORD, ONT.
Aluminum, Brass, Bronze, Specialty.

The Katie Foundry
GALT, ONT.
Grey Iron, Semi-Steel, Brass, Aluminum.

William Kennedy & Sons, Ltd.
OWEN SOUND, ONT.
Steel, Malleable and Heavy Grey Iron.
See Advertisement Page 7

Machinery & Foundries, Ltd.
BROCKVILLE, ONT.
Light and Medium Grey Iron.

A. F. McCulloch
OSHAWA, ONT.
Brass, Alum. Castings—Wood, Metal Patterns.

Corbet Foundry & Machine Co. Ltd.
OWEN SOUND, ONT.
Grey Iron, Brass.

Fittings Limited,
OSHAWA, ONT.
Malleable, Grey Iron, Brass, Aluminum.

W. W. Wells
370 Victoria Street, TORONTO, ONT.
Nickel and Monel Metal.

The Robert Mitchell Co., Ltd.
64 Belair Ave., MONTREAL.
Light Grey Iron.

Canadian Steel Foundries, Ltd.
MONTREAL, QUE.
Steel and Ferro-Alloy.

Langley & Austin,
GALT, ONT.
Copper, Bronze, Brass and Aluminum.

Maxwells, Limited
ST. MARYS, ONT.
Light Grey Iron, Tinning same a specialty.

The Eureka Planter Co., Ltd.,
WOODSTOCK, ONT.
Specialty Light Grey Iron.

Lindsay Foundry and Pattern Works, Limited
Victoria Avenue. LINDSAY, ONT.
Grey Iron and Semi-Steel to 75 tons.

Dominion Engineering Works, Limited
MONTREAL, QUE.
Grey Iron and Semi-Steel to 75 tons.

Smith's Falls Malleable Castings, Limited
SMITH'S FALLS, ONT.
Malleable.

Imperial Foundry Company
2167 St. Clair Ave., TORONTO, ONT.
Grey Iron Castings. Phone Junction 7935.

International Malleable Iron Company, Limited
GUELPH, ONT.
Malleable.

YOU ARE INVITED

The foundries represented on this page are well equipped, progressive, and their product is of known high quality. If you are a foundry owner and you can say the same of your service and product, we shall be glad to list you in this department. Write us for particulars.

Canadian Machinery & Mfg. News
153 University Ave., Toronto.

Canadian Machinery BUYERS DIRECTORY

If what you want is not here, write us, and we will tell you where to get it. Let us suggest that you consult also the advertisers' index— last page of book, after having secured advertisers' names from this directory. The information you desire may be found in the advertising pages. This department is maintained for the benefit and convenience of our readers. The insertion of our advertisers' names undr proper headings is gladly undertaken, but does not become part of an advertising contract.

ABRASIVE DISCS
Lion Grinding Wheels, Limited, Montreal, Que.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John, London, S.E., Eng.

ABRASIVE MATERIALS
Lion Grinding Wheels, Limited, Montreal, Que.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John, London, S.E., Eng.

ACETYLENE, DISSOLVED
Dominion Oxygen Co., Toronto.
Liquide Air Company, Toronto.

ANCHOR BELTS
Steel Co. of Can. Ltd., Hamilton, Ont

ANGLE BARS
Steel Co. of Can. Ltd., Hamilton, Ont.

ANVILS
Atkins & Co., Inc., E.C., Indianapolis, I.

ANCHOR BOLTS
Steel Co. of Can., Ltd., Hamilton, Ont.

ARBORS
Atkins & Co., Inc., E. C., Indianapolis,
Brown & Sharpe Mfg.Co., Providence,R.I.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.

BELLS, BRASS, BRONZE and STEEL
Canada Foundries & Forgings Co., Welland, Ont.
Canadian SKF Co., Toronto, Ont.

BARS, BORING
Armstrong Bros. Tool Co., Chicago, Ill.
Bertram & Son Co., td., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

BARS, BORING, PORTABLE
Underwood Corp., H. B., Philadelphia.

BARS, STEEL
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
British Empire Steel Corporation, Montreal, Que.

BEARINGS, BALL
Canadian SKF Co., Toronto, Ont.

BEARINGS, ROLLER
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

BELT CEMENT
D. K. McLaren, Limited, Montreal,
McLaren Belting Co., J. C., Montreal, Que.

BELT DRESSINGS AND FILLERS
Dom. Belting Co., Ltd., Hamilton, Ont.
D. K. McLaren, Limited, Montreal,

BELT FASTENERS
Bristol Company, Waterbury, Conn.
D. K. McLaren, Limited, Montreal,
McLaren Belting Co., J.C., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

BELT HOOKS
Bristol Co., Waterbury, Conn.
D. K. McLaren, Limited, Montreal,

BELT LACING
Bristol Company, Waterbury, Conn.
D. K. McLaren, Limited, Montreal,
McLaren Belting Co., J. C., Montreal,

BELT LACING, STEEL
Bristol Company, Waterbury, Conn.

BELT LACING MACHINES
D. K. McLaren, Limited, Montreal,
McLaren Belting Co., J. C., Montreal, Que.

BELTING, CHAIN
Can. Link-Belt Co., Toronto, Ont.
Fittings, Limited, Oshawa, Ont.
Jones & Glassco, Montreal, Que.
real Que.
Renold (Hans) of Canada, Ltd., Montreal, Que.

BELTING, FABRIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Dom. Belting Co., Ltd., Hamilton, Ont.
D. K. McLaren, Limited, Montreal,
McLaren Belting Co., J. C., Montreal, Que.

BELTING, LEATHER
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Can. Fairbanks-Morse Ltd., Montreal, Q.
D. K. McLaren, Limited, Montreal,
McLaren Belting Co., J. C., Montreal, Que.

BELTS, ABRASIVE
Oakey & Sons, Ltd., John, London, S.E., Eng.

BENDING MACHINES, POWER
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bertrams Ltd., Edinburgh, Scotland.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

BILLETS, BLOOMS and SLABS
Steel Co., of Can. Ltd., Hamilton, Ont.

BLAST GATES
Rockwell Co. W. S., New York, N Y

BLOCKS
Wright Mfg. Co., Lisbon, Ohio.

BORING TOOLS
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.

BUCKET CARRIERS, Pivoted
Can. Link-Belt Co., Toronto, Ont.

BUFFERS
Pryibil Machine Co., New York, N.Y.

BUFFING OR POLISHING MACHINES
(See Polishing and Buffing Machines)
Blount Co., J. G., Everett, Mass.
Herbert, Limited, Alfred, Toronto, Ont.
Pryibil Machine Co., New York, N.Y
U. S. Electrical Tool Co., Cincinnati, O.

BUILDING MATERIALS
Bertram & Son Co., Ltd., The John Dundas, Ont.

BURNERS, OIL AND GAS
Rockwell Co., W.S., New York City.

BURRS
Steel Co. of Can. Ltd., Hamilton Ont.

CABINETS, OIL
S. F. Bowser & Co., Ltd., Toronto, Ont

CALIPERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Starrett Co., L. S., Athol, Mass.

CHUCKS, DRILL AND TAP
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canadian SKF Co., Toronto, Ont.
Cushman Chuck Co., Hartford, Conn.
Geometric Tool Co., New Haven, Conn.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn
Union Mfg., New Britain, Conn.

CHUCKS, LATHE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Cushman Chuck Co., Hartford, Conn.
Geometric Tool Co., New Haven, Conn.
Gisholt Machine Co., Madison, Wis.
Herbert, Limited, Alfred, Toronto, Ont.
Ker & Goodwin Machine Co., Brantford, Ont.
Pryibil Machine Co., New York, N.Y.
Skinner Chuck Co., New Britain, Conn
Union Mfg. Co., New Britain, Conn.

CHUCKS, MAGNETIC
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CHUCKS, PLANER
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cushman Chuck Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

CHUCKS, TAPPING
William L. Procunier, Chicago, Ill.

CHUCKS, VERTICAL BORING MILL
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

CLAMPS, MACHINISTS'
Brown & Sharpe Mfg. Co., Providence,
Starrett Co., L. S., Athol, Mass.

CLEANERS, METAL, WASTE, GENERAL
Oakley Chemical Co., New York, N. Y.

CLOCKS
Chicago Watchman's Clock Co., Chicago,
Hardinge Bros., Limited, Toronto, Ont.

CLOCKS, TIME
Gisholt Machine Co., Madison, Wis.

CLOCKS, WATCHMEN'S
Chicago Watchman's Clock Co., Chicago, Ill.
Hardinge Bros., Limited, Toronto, Ont.

CLUTCHES, FRICTION
Can.-Link-Belt Co., Toronto, Ont
Johnson Machine Co, Carlyle, Manchester, Conn.

COAL AND ASH HANDLING MACHINERY
Can.-Link Belt Co., Toronto, Ont
Rocklofson Elevator Works, Galt, Ont

COAL-STORAGE SYSTEMS
Can. Link-Belt Co., Toronto, Ont.

COLLARS, SHAFT OR SET
Canada Foundries & Forgings Co., Welland, Ont.
Can. Link-Belt Co., Toronto, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

COLLETS
Butterfield & Co., Inc., Rock Island, Que.
Geometric Tool Co., New Haven, Conn.
Hardinge Bros., Inc., Chicago, Ill.
Hendley Machine Co., Torrington Conn.
Kearney & Trecker Co., Milwaukee, Wis
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

COMPOUNDS, CLEANING
Oakley Chemical Co., New York, N.Y.

For list of Dealers see the last page of This Buyers Directory

BLOCKS, CHAIN (See Hoists, Hand)
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

BLOCKS, DIE
Canada Foundries & Forgings Co., Welland, Ont.

BLOCKS, PILLOW
Can. Link-Belt Co., Toronto, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

BLOWERS
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Flexible Shaft Co,, Ltd., Toronto, Ont.

BOLT AND NUT MACHINERY
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Montreal, Que.

BOLT AND NUT MACHINERY, Automatic
National Acme Co., Cleveland, Ohio.

BOLTS AND NUTS
British Empire Steel Corporation, Montreal, Que.
National Acme Co., Montreal, Que

BOLT THREADING DIE HEADS
Landis Machine Co., Inc., Waynesboro Pa.

BOLTS, TRACK
Steel Co. of Canada, Ltd., Hamilton, Ont.

BORING and TURNING MILLS, Vertical
Bertram & Sons Co., Ltd., The John Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

BORING, DRILLING and MILLING MACHINES, Horizontal.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
Herbert, Limited, Alfred, Toronto, Ont.
Landis Tool Co., Waynesboro, Pa.
Vertical
Can. Fairbanks-Morse Co., Ltd. Montreal, Que.

CAMS
Canada Foundries & Forgings Co., Welland, Ont.

CAN-MAKING MACHINERY
(See Sheet Metal Working Machinery)
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Bliss Co., E. W., Brooklyn, N. Y.
Smooth Mfg. Co., Jersey City, N. J.

CEMENTS, IRON CENTERING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.

CHAINS (See Sprockets and Chains)
Reynold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg Co., Lisbon, Ohio.

CARD CLOTHING
D. K. McLaren, Limited, Montreal.

CASTINGS, ALUMINUM, BRASS, BRONZE, COPPER, DIE-MOLDED, FERRO-ALLOY, IRON, SEMI-STEEL, STEEL.
See "Where to buy your castings" Section. Page number may be found by turning to Advertisers' Index

CHAINS, DRIVING
Can. Link-Belt Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont
Jones & Glassco, Montreal, Que.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

CHASERS
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, a.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CHUCKING MACHINES
Acme Machine Tool Co., Cincinnati, O
Brown & Sharpe Mfg. Co., Providence, R. I.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

BUYERS' DIRECTORY

COMPOUNDS—CUTTING, DRILLING, GRINDING, SCREW CUTTING
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Oakley Chemical Co., New York, N.Y.

COMPRESSORS, AIR AND GAS
Can. Fairbanks-Morse Co., Ltd., Montreal.

CONES, FRICTION
Norton Co., of Can. Ltd., Hamilton, Ont.

CONNECTING RODS AND STRAPS
Canada Foundries & Forgings Co., Welland, Ont.

CONTRACT WORK
Dominion Engineering Works, Limited, Montreal, Que.
Victoria Foundry Co., Ltd., Ottawa, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

CONVEYORS AND ELEVATORS (SEE ELEVATORS)
Jones & Glassco, Montreal, Que.

COTTERS
Steel Co. of Canada, Ltd., Hamilton, Ont.

COUNTERBORES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

COUNTERS, REVOLUTION
Starrett Co., L. S., Athol, Mass.

COUNTERSHAFTS
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Johnson Machine Co., Carlyle, Man.
Kempsmith Mfg. Co., Milwaukee, Wis.

COUNTERSINKS
Butterfield & Co., Inc., Rock Island, Que.
Pratt &Whitney Co., of Canada, Ltd., Dundas, Ont.

COUPLERS, CAR AND LOCOMOTIVE
Can. Steel Foundries, Montreal, Que.

COUPLINGS
Steel Co. of Canada, Ltd., Hamilton, Ont.

COUPLINGS, SHAFT
Can. Link-Belt Co., Toronto, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

CRANES, ELECTRIC
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can.-Link-Belt Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Northern Crane Works, Walkerville, Ont.
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.

CRANES, LOCOMOTIVE
Can. Link-Belt Co., Toronto, Ont.

Bertram & Son Co., td., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Northern Crane Works, Walkerville, Ont.

CRANK PIN TURNING MACHINE
Underwood Corp., H.B., Philadelphia, Pa.

CUTTERS, GEAR
Brown & Sharpe Mfg. Co., Providence, R. I.

Butterfield & Co., Inc., Rock Island, Q. Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CUTTERS, HIGH SPEED
Atkins & Co., Inc., E. C., Indianapolis.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CUTTERS, MILLING
Brown & Sharpe Mfg. Co., Providence, R. I
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.

CUTTERS, STAY BOLT
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.

CUTTING-OFF MACHINE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Starrett Co., L. S. Athol, Mass.

CUTTING OFF MACHINES, PIPE (SEE PIPE-CUTTING AND THREADING MACHINES)
Landis Machine Co., Inc., Waynesboro, Pa.

CUTTING-OFF TOOLS
Armstrong Bros. Tool Co., Chicago, Ill.

CUTTING OIL FILTERS (SEE OIL FILTERING SYSTEMS
Bowser, S. F. & Co., Ltd., Toronto.

CUTTING, OXY-HYDROGEN
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

DETACHABLE CHAIN
International Malleable Iron Co., Guelph, Ont.

DIAMONDS, BLACK AND ROUGH
Can Desmond-Stephan Mfg Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

DIAMOND TOOLS
Can. Desmond-Stephan Co., Hamilton,
Wheel Trueing Tool Co., Windsor, Ont.

DIAMOND CROSSINGS
Can. Steel Foundries, Montreal, Que.

DIAMONDS, IMPORTERS
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Co., Windsor, Ont.

DIES, SCREW AND THREAD CUTTING
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.

DIES, SHEET-METAL AND SUB-PRESS (See Tool Work)
Brown, Boggs & Co., Ltd., Hamilton, Ont.

DIES, FORGING
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

DIES, SCREW AND THREAD CUTTING
Morse Twist Drill & Machine Co., New Bedford, Mass.

DIES, SELF-OPENING, ADJUSTABLE
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Landis Machine Co., Inc., Waynesboro,
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DIES, THREADING-OPENING
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DIVIDING HEADS
Burke Machine Tool Co., Conneaut, Ohio.
Hendey Machine Co., Torrington, Conn.
Kearney & Treacker Co., Milwaukee, Wis.

DOGS, LATHE AND MILLING MACHINE
Armstrong Bros. Tool Co., Chicago, Ill.

DRAFTING MATERIALS
American Lead Pencil Co., New York City, N.Y.

DRESSERS, GRINDING WHEEL
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ont.
Norton Co., of Can., Ltd., Hamilton.
Wheel Trueing Co., Windsor, Ont.

DRESSING TOOLS
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Co., Windsor, Ont.

DRILL HOLDERS
Armstrong Bros. Tool Co., Chicago, Ill.

DRILLING MACHINES, BENCH
Burke Machine Tool Co., Conneaut., Ohio.
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Hardinge Bros., Inc., Chicago, Ill.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, ELECTRIC AND HAND
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, GANG
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

DRILLING MACHINES, HEAVY DUTY
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
Herbert, Limited, Alfred, Toronto, Ont.

BORING, DRILLING AND MILLING MACHINES, (HORIZONTAL.)
Gisholt Machine Co., Madison, Wis.
Herbert, Limited, Alfred, Toronto, Ont.

DRILLING MACHINES, Multiple Spindle
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
National Acme Co., Cleveland, Ohio.

DRILLING MACHINES, Pneumatic
Cleveland Pneumatic Tool Co., Toronto, Ont.

DRILLING MACHINES, PORTABLE
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, RADIAL
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Herbert, Limited, Alfred, Toronto, Ont.
Williams Machinery Co., A. R., Toronto,

DRILLING MACHINES, SENSITIVE
Burke Machine Tool Co., Conneaut, O.
Herbert, Limited, Alfred, Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Williams Machinery Co., A. R., Toronto.
Wisconsin Electric Co., Racine, Wis

DRILLING MACHINES, TURRET
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wisconsin.
Williams Machinery Co., A. R., Toronto.

DRILLING MACHINES, VERTICAL
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Herbert, Limited, Alfred, Toronto, Ont.

DRILLS, CENTRE
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DRILLS, ELECTRIC
U. S. Electrical Tool Co., Cincinnati, Ohio
Black & Decker Mfg. Co., Ltd., Montreal, Que.

DRILLS, HIGH SPEED TWIST
Butterfield & Co., Inc., Rock Island, Que
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Cleveland Twist Drill Co., Cleveland, O.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DRILLS, RATCHET
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

DRILLS, TWIST AND FLAT
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.

DROP FORGINGS
Steel Co. of Canada, Ltd., Hamilton

DUMB WAITERS
Roelofson Elevator Works, Galt, Ont.

DUST HANDLING EQUIPMENT
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

ELECTRIC DRILLS AND GRINDERS
Black & Decker Mfg. Co., Ltd., Montreal, Que.
U. S. Electrical Tool Co., Cincinnati, Ohio.

ELECTRIC STEAM GENERATORS
Dominion Engineering Works, Limited, Montreal, Que.

ELECTRICAL INSTRUMENTS
Bristol Co., Waterbury, Conn.

ELECTRICAL SUPPLIES
Atkins & Co., Inc., E. C., Indianapolis.
Diamond State Fibre Co., Toronto, Ont.

ELECTRIC TOOLS
U. S. Electrical Tool Co., Cincinnati, Ohio.

ELEVATORS AND CONVEYORS
Can. Link-Belt C., Toronto, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.

ELEVATORS, FREIGHT AND PASSENGER
Roelofson Elevator Works, Galt, Ont.

EQUIPMENT, ELEVATOR SAFETY
Jones & Glassco, Montreal, Que.

EMERY WHEELS (See Grinding Wheels)
Lion Grinding Wheels, Limited, Montreal, Que.
Atkins & Co., E. C., Indianapolis, I.
Norton Co., of Canada., Ltd., Hamilton.

ENGINES, CAPSTAN
Kennedy & Sons, Wm., Owen Sound, Ont.

ENGINEERS, MECHANICAL
Dominion Engineering Works, Limited, Montreal, Que.
Gisholt Machine Co., Madison, Wis.
Hamilton Gear & Machine Co., Toronto,

EXPANDERS, TUBE
Jardine & Co., A. B., Hespeler, Ont.

FANS, ELECTRIC
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

FANS, EXHAUST
Can. Blower & Forge Co., Ltd., Kitchner, Ont.

FANS, VENTILATING
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

FIBRE
Diamond State Fibre Co., of Can. Ltd., Toronto, Ont.

FILES AND RASPS
Nicholson File Co., Port Hope, Ont.
Simmons Canada Saw Co., Montreal, Que.

FILLER, IRON (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J.

FIRE ESCAPES
Roelofson Elevator Co., Galt, Ont.

FITTINGS, PIPE
International Malleable Iron Co., Guelph.
Fittings, Limited, Oshawa, Ont.

FLEXIBLE SHAFTS
Flexible Shaft Co., Ltd., Toronto, Ont.
Strand & Co., N. A., Chicago, Ill

FLUXES, WELDING
Dominion Oxygen Co., Ltd, Toronto
Liquide Air Company, Toronto, Ont.

FORGES
Flexible Shaft Co., Ltd., Toronto, Ont.

FORGING MACHINERY
Acme Machinery Co., Cleveland, Ohio
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown Boggs & Co., Ltd., Montreal.
National Machinery Co., Tiffin, Ohio.
Steel Co. of Canada, Ltd., Hamilton.

FORGINGS, DROP
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Ltd., Toronto, Ont.

FORGINGS, HAMMER
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Hepburn Ltd., John T., Toronto, Ont.

FOUNDRY EQUIPMENT
Rice Lewis & Son, Ltd., Toronto, Ont.

FOUNDRY SUPPLIES
Rice Lewis & Son, Ltd., Toronto, Ont.

FROGS, SPRING OR RIGID
Can. Steel Foundries, Montreal, Que.

FURNACES, ELECTRIC
Rockwell Co., W. S. New York City.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

FURNACES, HEAT TREATING COAL
Rockwell Co., W. S., New York City.

FURNACES, HEAT TREATING OIL AND GAS
Bellevue Industrial Furnace Co., Detroit, Michigan.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Flexible Shaft Co., Ltd., Toronto, Ont.
Rockwell Co. W. S., New York, N. Y.

FURNACES TEMPERING AND ANNEALING
Bellevue Industrial Furnace Co., Detriot, Mich.
Brown & Sharpe Mfg., Co., Providence R. I.
Flexible Shaft Co., Ltd., Toronto, Ont.
Rockwell Co., W. S., New York City.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

FURNACES AND OVENS, ELECTRIC
Rockwell Co. W. S., New York, N. Y.
Starrett Co., L. S., Athol, Mass.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

BUYERS' DIRECTORY

GAGES, MEASURING (See Tool Work)
Brown & Sharpe Mfg. Co., Providence, R. I.
Greenfield Tap & Die Corp., Galt, Ont.
Lufkin Rule Co., Windsor, Ont.
Starrett Co., L. S., Athol, Mass.

GAGES, RECORDING
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GAGES, SPECIAL MEASURING
(See Tool Work)
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GAGES, THREAD
Brown & Sharpe Mfg. Co., Providence R. I.
Herbert, Limited, Alfred, Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

GALVANIZING
Fittings, Limited, Oshawa, Ont.

GAS, COAL COMPRESSED
L'Air Liquid Society, Toronto, Ont.

GAS, COMPRESSED
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

GASKETS
Diamond State Fibre Co. of Ca., Ltd., Toronto, Ont.
Smooth Mfg. Co., Jersey City, N. J.

GAUGES VACUUM AND PRESSURE
Taylor Instrument Co., Toronto, Ont.

GEAR BLANKS
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.
Dominion Engineering Works, Limited, Montreal, Que.

GEAR COUNTERS
Hart Mfg. Co., R. A., Battle Creek, Michigan.

REAP CUTTING MACHINES
Bertram & Sons Co., Ltd., The John, Dundas, Ont.

Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Fellows Gear Shaper Co., Springfield, Vt.
Whiton Machine Co., D. E., New London, Conn.

GEAR TESTING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.

GEARS, CAST
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Hull Iron & Steel Foundries, Hull, Que.
Dominion Engineering Works, Limited, Montreal, Que.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

GEARS, CUT
Brown & Sharpe Mfg. Co., Providence, R. I.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Gardner & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto, Ont.
Hepburn Ltd., John T. Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

GEARS, DRESSED
Kennedy & Sons, Wm., Owen Sound, Ontario.

GEARS, FORGED
Canada Foundries & Forgings Co., Welland, Ont.

GEARS, HERRINGBONE
Hamilton Gear & Machine Co., Toronto, Ont.

GEARS, RAWHIDE (See Gears, Cut)
Hamilton Gear & Machine Co., Toronto.

GEAR, SILENT CHAIN
Gardner & Son, Robt., Montreal, Que.
Can. Link-Belt Co., Ltd., Toronto, Can.
Hans Renold of Canada, Ltd., Montreal, Quebec.

GEARS, WORM
Hamilton Gear & Machine Co., Toronto.

GENERATORS ACETYLENE
L'Air Liquide Society, Toronto, Ont.

GOGGLES, SAFETY
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

GRAB BUCKETS
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Cleveland Twist Drill Co., Cleveland, O.

GREASE CUPS, PRESSED STEEL AND BRASS
Can. Winkley Co., Ltd., Windsor, Ont.

GREASES, LUBRICATING
Canadian SKF Co., Toronto, Ont.

GRINDERS, ELECTRIC
Black & Decker Mfg. Co., Ltd., Montreal, Que.
U. S. Electrical Tool Co., Cincinnati, Ohio.

GRINDERS TOOL POST
U. S. Electrical Tool Co., Cincinnati, Ohio.

GRINDING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Norton Co., of Canada, Ltd., Hamilton

GRINDING MACHINES, ABRASIVE BELT
Norton Co. of Can. Ltd., Hamilton, Ont.

GRINDING MACHINES, AUTOMATIC
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, BENCH
Blount Co., J. G., Everett, Mass.
Geometric Tool Co., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co. of Canada, Ltd., Hamilton, Ont.
Pratt & Whitney Co. of Canada, Ltd.

GRINDING MACHINES, CENTER
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES, CUTTER AND REAMER
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, CYLINDRICAL
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.
Norton Co., of Canada, Ltd., Hamilton.

GRINDING MACHINES, DIE
Geometric Tool Co., New Haven, Conn.
National Acme Co., Cleveland, O.
National Machinery Co., Tiffin, Ohio.

GRINDING MACHINES, DRILL
Bellevue Industrial Furnace Co., Detroit, Mich.
Bertram & Son Co., Ltd., The John, Dundas, Ont.

GRINDING MACHINES, ELECTRIC
Strand & Co., N. A., Chicago, Ill.

GRINDING MACHINES, FLOOR AND TOOL
Blount Co., J. G., Everett, Mass.
Herbert, Limited, Alfred, Toronto Ont
National Acme Co., Cleveland, Ohio
Norton Co. of Canada, Ltd., Hamilton, Ontario.
Greenfield Tap & Die Corp. Galt, Ont
U. S. Electrical Tool Co., Cincinnati, Ohio.

GRINDING MACHINES, INTERNAL
Garlock Machinery Ltd., Toronto, Ont
Greenfield Tap & Die Corp., Galt, Ont
Cleveland Pneumatic Tool Co., Toronto Ont.
Wisconsin Electric Co., Racine, Wis

GRINDING MACHINES PORTABLE
Strand & Co., N. A., Chicago, Ill

GRINDING MACHINES, SNAGGING
Blount Co., J. G., Everett, Mass
Norton Co., of Can. Ltd., Hamilton, Ont
U. S. Electrical Tool Co., Cincinnati, Ohio

GRINDING MACHINES, SURFACE
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, THREAD
Pratt & Whitney Co., of Canada, Ltd., Scund, Ont.

GRINDING MACHINERY, TOOL POST
Gisholt Machine Co., Madison, Wis.
Grenfield Tap & Die Corp., Galt, Ont.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES, UNIVERSAL
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Herbert, Limited, Alfred, Toronto, Ont.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co., of Canada, Ltd., Hamilton Ontario.

GRINDING WHEELS
Lion Grinding Wheels, Limited, Montreal, Que.
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Norton Co. of Can., Ltd., Hamilton, Ont.

GUN-BARREL MACHINERY
Steinle Turret Machine Co., Madison, Wisconsin.

HACK SAWS, POWER
Atkins & Co., Inc., E.C., Indianapolis, Indiana
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.

HAMMERS, CHIPPING
Cleveland Pneumatic Tool Co., Toronto, Ont.
High Speed Hammer Co., Rochester.

HAMMERS, DROP
Bertram & Son Co., Ltd., The John Dundas, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

HAMMERS, ELECTRIC
Brown, Boggs & Co., Ltd., Hamilton, Ont

HAMMERS, PNEUMATIC
Can. Steel Foundries, Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto Ont.

HANGERS, SHAFTING
Canadian SKF Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Hamilton Gear & Machine Co., Toronto.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

HOBBING MACHINES
Shore Instrument Co., Jamaica, N.Y.

HARDENING, CASE-HARDENING AND TEMPERING
Barnes Company, Wallace, Hamilton
Gisholt Machine Co., Madison, Wis
Cleveland Pneumatic Tool Co., Toronto Ont

HAMMERS, POWER
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Jardine & Co., A. B., Hespeler, Ont.

HOBS
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

HOISTS, ELECTRIC
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Northern Crane Works, Walkerville, Ont
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.

HOISTS, HAND
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio

HOISTS, PNEUMATIC
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

HOLDERS-ON, PNEUMATIC
Cleveland Pneumatic Tool Co., Toronto Ont.

HYDRAULIC MACHINERY
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Dominion Engineering Works, Limited, Montreal Que
Kennedy & Sons, Ltd., Wm., Owen

IGNITERS, GAS ENGINE
Canada Foundries & Forgings Co., Welland, Ont.
Burke Machine Tool Co., Conneaut, O

INDICATORS, SPEED AND TEST
Brown & Sharpe Mfg. Co., Providence, R.I.

INSULATION
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.

IRON BARS
Steel Co. of Canada, Ltd., Hamilton, Ont.

JACKS, HYDRAULIC
Norton, A. O., Boston, Mass.

JACKS, PLANER
Armstrong Bros. Tool Co., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

JAPANNING AND VARNISHING OVENS
Brantford Oven & Rack Co., Brantford, Ont.

JIGS AND FIXTURES (SEE TOOL WORK)
Fisher Motor Co., Ltd., Orillia, Ont.
Gisholt Machine Co., Madison, Wis.

KEYSEATING MACHINES
Morton Mfg. Co., Muskegon, Mich.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

KEYS, MACHINE
Can. Drawn Steel Co., Hamilton, Ont.
Morton Mfg. Co., Muskegon, Mich.

KNIVES, MACHINE
Atkins & Co., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

KNURL HOLDERS
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

LATHE ATTACHMENTS
Hendey Machine Co., Torrington, Conn.

LATHE TOOLS
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

LATHES, AUTOMATIC AND SEMI-AUTOMATIC
Gisholt Machine Co., Madison, Wis.
Herbert, Limited, Alfred, Toronto, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, BENCH
Hardinge Bros., Inc., Chicago, Ill.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

LATHES, BORING
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, CHUCKING (SEE LATHES, HORIZONTAL TURRET, AND LATHES, VERTICAL TURRET)
Acme Machine Tool Co., Cincinnati, O
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis
Herbert, Limited, Alfred, Toronto, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, ENGINE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hendey Machine Co., Torrington, Conn
Herbert, Limited, Alfred, Toronto, Ont

LATHES, EXTENSION AND GAP
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis
Herbert, Limited, Alfred, Toronto, Ont
National Acme Co., Cleveland, O
Steinle Turret Machine Co., Madison, Wis.

LATHES, PRECISION
Hardinge Bros., Chicago.

LATHES, RELIEVING
Hendey Machine Co., Torrington, Conn.

BUYERS' DIRECTORY

LATHE, UNIVERSAL HAND
Brown & Sharpe Mfg. Co., Providence, Rhode Island.

LATHE, SPEED AND HAND
Blount Co., J. G., Everett, Mass.

LATHES, SPINNING
Pryibil Machine Co., Torrington, Conn.

LATHES, VERTICAL TURRET
Bertram & Son, Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

LATHES, WOOD TURNING
Blount, Co., J. G., Everett, Mass.
Can. Fairbanks-Morse Co., Ltd., Montreal.

LEAD PIPE
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

LEATHER FILLET
D. K. McLaren, Limited, Montreal.

LINOLEUM MILL MACHINERY
Bertrams, Ltd., Edinburgh, Scotland.

LIQUID AIR PLANTS
L'Air Liquide Society, Toronto, Ont.

LOCKERS, CLOTHES
Dennis Wire and Iron Works, London, Ont.

LUBRICANTS
Oakley Chemical Co., New York, N.Y.

LUBRICATING SYSTEMS
Bowser, S. F., & Co., Ltd., Toronto, Canada.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Ltd., Welland, Ont.
Ker & Goodwin Machine Co., Brantford, Ont
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R. Toronto Ont.

MANGANESE STEEL
Can. Steel Foundries, Montreal, Que.

MANDRELS, EXPANDING
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont.

MANDRELS, SOLID
Greenfield Tap & Die Corp., Galt, Ont.
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Pratt & Whitney Co. of Canada. Ltd., Dundas, Ont.

MEASURING MACHINES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MECHANICS' FINE TOOLS
Lufkin Rule Co., Windsor, Ont.

METALS, ALLOY
Canada Metal Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.

METAL WORKERS
Parker Co., Charles, Meriden, Conn.

MICROMETER CALIPERS
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Rice Lewis & Son, Ltd., Toronto, Ont.

MILLING ATTACHMENTS
Burke Machine Tool Co., Conneaut, O.
Hendey Machine Co., Torrington, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.

MILLING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Burke Machine Tool Co., Conneaut, O

MILLING MACHINES, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence, R. I.
Hardinge Bros., Inc., Chicago, Ill.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

MILLING MACHINES, BENCH
Burke Machine Tool Co., Conneaut, O.
Hardinge Bros., Inc., Chicago, Ill.

MILLING MACHINES, HAND
Brown & Sharpe Mfg. Co., Providence
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MILLING MACHINES, HORIZONTAL PLANER TYPE.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Kearney & Trecker Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto.

MILLING MACHINES, PLAIN
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, O.
Hendey Machine Co., Torrington, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.

MILLING MACHINES, THREAD
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MILLING MACHINES, UNIVERSAL
Brown & Sharpe Mfg. Co., Providence,
Hendey Machine Co., Torrington, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.

MILLING MACHINES, VERTICAL
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, O.
Herbert, Limited, Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto.

MILLING TOOLS, ADJUSTABLE HOLLOW
Geometric Tool Co., New Haven, Conn.

MOTORS, ELECTRIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Roelofson Elevator Co., Galt, Ont.
Williams Machinery Co., A. R., Toronto,
Wisconsin Electric Co., Racine Wis.

NAILS AND STAPLES
Canada Metal Co., Ltd., Toronto, Ont.

NIPPLES
Canada Metal Co., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton.

NITROGEN
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

NUT TAPPERS
(See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Oh'o.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
National Acme Co., Cleveland, Ohio.

NUTS, FINISHED and SEMI-FINISHED
Galt Macine Screw Co., Galt, Ont.
National Acme Co., Montreal, ue.

NUTS (Up to 4-in.)
Steel Co. of Canada, Ltd., Hamilton.

NUTS, S.A.E., PLAIN AND CASTELLATED
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

OIL FILTERING AND STORAGE SYSTEMS
Bowser, S. F., & Co., Ltd., Toronto,

OIL STORAGE ENGINEERS
Bowser, S. F., & Co., Ltd., Toronto.

OIL HOLE COVERS
Can. Whitney Co., Ltd., Windsor, Ont.

OILS, SOLUABLE
Brantford Oven & Rack Co., Brantford, Ontario.

ORNAMENTAL IRON AND WIRE WORKS
Roelofson Elevator Works, Galt, Ont.

OXYGEN
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

OXY-ACETYLENE APPARATUS
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Atlas Press Co., Kalamazoo, Mich.

PAPER MILL CONVEYORS
Bertram Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd., Montreal, Que.

PAPER MILL MACHINERY
Dominion Engineering Works, Limited, Montreal, Que.

PATTERNS, WOOD AND METAL
Fittings, Limited, Oshawa, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.
Victoria Foundry Co., Ltd., Ottawa.

PHOSPHOR TIN
Canada Metal Co., Ltd., Toronto, Ont.

PHOTOGRAPHIC DUPLICATING MACHINES
Photostat Corp., Providence, R. I.

PIPE BENDING MACHINES
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Underwood Corp., H. R., Philadelphia, Pa.
Williams Machinery Co., A. R., Toronto.

PIPE CUTTING AND THREADING MACHINES
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.

PIPE
Canada Metal Co., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.

PIPE FITTINGS
Canada Metal Co., Toronto, Ont.
International Malleable Iron Co., Guelph Ont.

PIPE AND NIPPLE THREADING MACHINES
Landis Machine Co., Inc., Waynesboro, Pa.

PIPE FITTERS' TOOLS
Rice Lewis & Son, Ltd., Toronto, Ont.

PIPE THREADING DIE HEADS
Landis Machine Co., Inc., Waynesboro, Pa.

PISTON-RING MACHINES
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

PLANING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Williams Machinery Co., A. R., Toronto.

PLANING MACHINES, ROTARY
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Herbert, Limited, Alfred, Toronto, Ont.

PLATE ROLLS
Bertram & Son Co., Ltd., The John, Dundas, Ont.

PNEUMATIC TOOLS
Cleveland Pneumatic Tool Co., Toronto.

POLISHING AND BUFFING MACHINES
Lion Grinding Wheels, Limited, Montreal, Que
Blount Co., J. G. Everett, Mass.
Brown & Sharpe Mfg. Co., Providence.
Pryibil Machine Co., New York, N.Y.

PRESSED STEEL PARTS
American Pulley Co., Philadelphia, Pa.

PRESSES, ARBOR
Atlas Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

PRESSES, DROP AND FORGING
Brown, Boggs & Co., Ltd., Hamilou.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

PRESSES, FOOT AND HAND
Brown, Boggs & Co., Ltd., Hamilton

PRESSES, HYDRAULIC
Bertram & Son Co., Ltd., The John Dunidas, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Perrin Ltd., W. R., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

PRESSES, POWER
Bliss Co., E. W., Prooklyn, N. Y.
Brown, Boggs, & Co., Ltd., Hamilton.
Hepburn Ltd., John T., Toronto, Ont.
Stoll Co., Inc., D. H., Buffalo, N.Y.

PRESSES, SCREW
Brown, Boggs & Co., Ltd., Hmilton.

PROFILING MACHINES
Prit & Whitney Co., of Canada, Ltd., Dundas, Ont.

PROTRACTORS
Brown & Sharpe Mfg. Co., Providence
Lufkin Rule Co., Windsor, Ont.

PROPELLERS
Kennedy & Sons, Wm., Owen Sound Ontario.

PULLEYS, CORK INSERT
American Pulley Co., Philadelphia, Pa.

PULLEYS, METAL AND FIBRE
American Pulley Co., Philadelphia, Pa
Can. Fairbanks-Morse Ltd., Montreal, Q
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.
D. K. McLaren Co., Limited Montreal, Que.

PULP AND PAPER MILL EQUIPMENT
Dominion Engineering Works, Ltd., Montreal, Que.

PUMPS, HYDRAULIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Dominion Engineering Works, Ltd. Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont

PUMPS, LUBRICANT AND OIL
Bowser, S. F., & Co., Ltd., Toronto.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Hepburn Ltd., John T., Toronto, Ont.

PUMPS, POWER
Bowser, S. F., & Co., Ltd., Toronto.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hepburn Ltd., John T., Toronto, Ont.

PUNCHES, CENTER
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

PUNCHES, HAND
Brown Boggs & Co., Ltd., Hamilton.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Jardine & Co., A. B., Hespeler, Ont.

PUNCHES, POWER
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

PUNCHING MACHINES, HORIZONTAL
Bertrams Ltd., Edinburgh, Scotland.

PYROMETERS, ELECTRIC
Bristol Co., Waterbury, Conn.
Flexible Shaft Co., Ltd., Toronto, Ont.
Taylor Instrument Co., Toronto, Ont.
Hiram Walker & Sons Metal Products Co., Walkerville, Ont.

RACKS, CUT
Hamilton Gear & Machine Co., Toronto.

RACKS, STORAGE
(See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ontario.

REAMER HOLDERS
Simonds Canada Saw Co., Montreal, Q.

REAMERS, ELECTRIC
U. S. Electrical Tool Co., Cincinnati, Ohio.

REAMERS, EXPANDING
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

REAMERS, SOLID
Butterfield & Co., Inc., Rock Island, Q.
Morse Twist Drill & Machine Co., New Bedford, Mass.

REAMERS, TAPER
Brown & Sharpe Mfg. Co., Providence, R. I.
Butterfield & Co., Inc., Rock Island, Q.
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canad, Ltd., Dundas, Ont.

RECORDERS, TEMPERATURE
Taylor Instrument Co., Rochester, N. Y.

RECORDERS, TIME
Gisholt Machine Co., Rochester, N. Y.
Taylor Instrument Co., Toronto, Ont.

REGULATORS, TEMPERATURE
Taylor Instrument Co., Toronto, Ont.

RIVETS AND BURRS
Parmenter & Bulloch Co., Gananoque, Ont.
Steel Co., of Canada, Ltd., Hamilton.

RIVET-MAKING MACHINERY
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

BUYERS' DIRECTORY

RIVETING MACHINES
Can. Fairbanks-Morse Ltd., Montreal Q.
High Speed Hammer Co., Rochester, N.Y.
Parmenter & Bulloch Co., Gananoque Ont.

RUDDER FRAMES, STEEL
Can. Steel Foundries, Montreal, Que.

RUBBER MILL MACHINERY
Bertram Ltd., Edinburgh, Scotland.

RULES, STEEL AND WOOD
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Windsor, Ont.

RUST PREVENTATIVES
Oakley Chemical Co., New York, N. Y.

SAND EQUIPMENT
Can. Link-Belt Co., Toronto, Ont.

SAND RAMMERS, PNEUMATIC
Cleveland Pneumatic Tool Co., Toronto.

SAW FRAMES AND BLADES, HACK
Atkins & Co., Inc., E. C., Indianapolis.
Diamond Saw & Stamping Works, Buffalo, N. Y.
Rice Lewis & Sons, Ltd., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWING MACHINES, POWER HACK
Atkins & Co., Inc., E. C., Indianapolis.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

SAW SHARPENING MACHINES
Atkins & Co., Inc., E. C., Indianapolis.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

SAWS, CIRCULAR METAL
Atkins & Co., Inc., E. C., Indianapolis.
Pryibil Machine Co., New York, N. Y.
Gisholt Machine Co., Madison, Wis.

SAWS, HAND
Atkins & Co., Inc., E. C., Indianapolis
Simonds Canada Saw Co., Montreal, Q.

SAWS, HOT AND COLD
Atkins & Co., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Q.

SAWS, HIGH SPEED STEEL
Atkins & Co., Inc., E.C., Indianapolis, I.
Butterfield & Co. Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWS, METAL BAND
Atkins & Co., E. C., Indianapolis, I.

SAWS, METAL CUTTING
Brown & Sharpe Mfg. Co., Providence,
Butterfield & Co., Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.
Starrett Co., L. S., Athol, Mass.

SAWS, SCREW SLOTTING
Atkins & Co., Inc., E., C., Indianapolis.
Butterfield & Co., Inc., Rock Island, Q.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canda, Ltd., Dundas, Ont.

SAWS, SCREW SLOTTING
Atkins & Co., Inc., E. C., Indianapolis.
Butterfield & Co., Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWS, WOOD
E. C. Atkins & Co., Indianapolis, Ind.

SCALES
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Lufkin Rule Co., Windsor, Ont.

SCREENS
Dominion Engineering Works, Ltd., Montreal, Que.

SCREW DRIVERS, OPTICAL, JEWELRY AND NOVELTY
Strand & Co., N. A., Chicago, Ill.

SCREW MACHINE WORK
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Montreal, Que.

SCREW MACHINERY, WOOD AND LAG
Cook Co., Asa S., Hartford, Conn.

SCREW MACHINES
Brown & Sharpe Mfg. Co., Providence, Rhode Island.

SCREW MACHINES, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.

SCREW MACHINE PRODUCTS
National Acme Co., Montreal, Que.

SCREW PLATES
Butterfield & Co., Inc., Rock Island. Que.
Jardine & Co., A. B., Hespeler, Ont.

SCREWS, CAP AND SET
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

SCREWS, SAFETY, SET
Galt Machine Screw Co., Galt, Ont.

SECOND-HAND MACHINERY
See last page of directory.

SEPARATORS, MOISTURE AND OIL
Bowser, S. F., & Co., Ltd., Toronto, Canada.

SEPARATORS, OIL AND WASTE
Bowser, S. F., & Co., Ltd., Toronto.

SHAFTS, FLEXIBLE
Strand & Co., N. A., Chicago, Ill.

SHAFTING
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
Williams Machinery Co., A. R., Toronto.

SHAPES, COLD-DRAWN SPECIAL STEEL
Union Drawn Steel Co., Hamilton, Ont.

SHAPING MACHINES
Hendey Machine Co., Torrington, Conn.
Morton Mfg. Co., Muskegon, Mich.
Williams Machinery Co., A. R. Toronto.

SHEARS HAND
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

SHEARS, POWER
Bliss Co., E. W., Brooklyn, N. Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Stoll Co., Inc., D. H., Buffalo, N. Y.
Williams Machinery Co., A. R., Toronto, Ont.

SHEARING MACHINES, ANGLE, IRON BAR AND GATE
Bertrams Ltd., Edinburgh, Scotland.

SHEET LEAD
Canada Metal Co., Ltd., Toronto, Ont.

SHEET METAL WORKING MACHINERY
Bliss Co., E. W., Brooklyn, N. Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Stoll Co., Inc., D. H, Buffalo, N.Y.

SHEETS, NICKEL, MONEL AND FIBRE
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.

SHEETS, O.P.C.R. & B. A. AND BLUE ANNEALED
Steel Co., of Canada, Ltd., Hamilton, Ont.

SIDE FRAMES, LOCOMOTIVE
Can. Steel Foundries, Montreal, Que.

SLOTTING ATTACHMENTS
Brown & Sharpe Mfg. Co., Providence, R.I.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

SLOTTING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.

SOLDERS
Canada Metal Co., Ltd., Toronto, Ont.

SPECIAL MACHINERY AND TOOLS
Brown Engineering Corp., Ltd., Toronto.
Gisholt Machine Co., Madison, Wis.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.
National Acme Co., Cleveland, O.

SPIKES, RAILWAY AND PRESSED
Steel Co of Canada, Ltd., Hamilton, Ont.

SPINNING LATHES
Prybil Machine Co., P., New York City.

SPRING, MILLED
Barnes & Co., Wallace, Hamilton, Ont.

SPRINGS, SMALL SPIRAL HELICAL, COMPRESSION, EXTENSION, TORSION AND SPECIAL
Barnes Company, Wallace, Hamilton.

SPRINGS
Barnes Company, Wallace, Hamilton.
Cleveland Wire Spring Co., Cleveland, O.
Steele Ltd., James, Guelph, Ont.

SPRINGS, FLAT STEEL, BRUSH HOLDER, CLOCK, SMALL FLAT SPRINGS
Barnes Company, Wallace, Hamilton.

SPROCKETS AND CHAINS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Renold Hanson of Canada, Ltd., Montreal, Que.

SQUARES
Brown & Sharpe Mfg. Co., Providence, R.I.
Lufkin Rule Co., Windsor, Ont.
Steel Co. of Canada, Ltd., Hamilton. Ont.

STAMPING, METAL
American Pulley Co., Philadelphia, Pa.
Barnes Company, Wallace, Hamilton.
Diamond Saw & Stamping Works, Buffalo, N. Y.
Parmenter & Bulloch Co., Gananoque, Ont.

STAMPS, STEEL
Diamond Saw & Stamping Works, Buffalo, N. Y.

STEEL CONCRETE REINFORCEMENT
Steel Co. of Canada, Ltd., Hamilton.

STEEL PLATE
British Empire Steel Co., Montreal, Que.

STEEL AND IRON BARS
Steel Co. of Canada, Ltd., Hamilton.

STEELS TOOL
British Empire Steel Co. Montreal Q.

STEEL, COLD-ROLLED STRIP
British Empire Steel Co., Montreal, Q.
Barnes Company, Wallace, Hamilton.

STEEL, CRUCIBLE, SPRING
Barnes, Company, Wallace, Hamilton.
British Empire Steel Co., Montreal, Q.

SHEETS, OPEN HEARTH STEEL
Steel Co., of Canada, Ltd., Hamilton.

STEEL, SHAFTING AND FREE CUTTING SCREW
Union Drawn Steel Co., Hamilton, Ont.

STEEL, SHEET
British Empire Steel Co., Montreal, Q.
Rice Lewis & Son, Ltd., Toronto, Ont.

STEEL, STAINLESS
Steel Co., of Can. Ltd., Hamilton, Ont.

STEEL STAIRS
Roclofson Elevator Works, Galt, Ont.

STEELS, ALLOY AND CARBON
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Can. Steel Foundries, Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton. Ont.

STEELS, HIGH-SPEED
Armstrong Bros. Tool Co., Chicago, Ill.
Atkins & Co., Ltd., Wm., Sheffield, England.
British Empire Steel Co., Montreal, Q.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton.

STEEL TUBING, CLOSE JOINT AND WELDED
Standard Tube & Fence Co., Ltd., Woodstock, Ont.

STERN FRAMES, CAST STEEL
Can. Steel Foundries, Montreal, Que.

STRAIGHTENING MACHINERY
Bertram Ltd., Edinburgh, Scotland.
Williams & Co., Ltd., J. H., Brooklyn, N.Y.

STUDS
Galt Machine Screw Co., Galt, Ont.

STUD SETTERS, SELF OPENING
Geometric Tool Co., New Haven, Conn.

SWAGING MACHINES
Atkins & Co., Inc., E. C., Indianapolis, Indiana.

SWITCHES, RAILWAY
Can. Steel Foundries, Montreal, Que.

TACHOMETERS
Bristol Co., Waterbury, Conn.

TANKS AND PUMPS, OIL
Bowser, S. F., & Co., Ltd., Toronto.

TAP HOLDERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
William L. Procunier, Chicago, Ill.

TAPER PINS
Galt Machine Screw Co., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

TAPES, MEASURING
Starrett Co., L. S., Athol, Mass.
Lufkin, Rule Co., Windsor, Ont.

TAPPING MACHINES AND ATTACHMENTS
Burke Machine Tool Co., Conneaut, O.
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.
Wm. L. Procunier, Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

TAPS AND DIES
Butterfield & Co., Inc., Rock Island, Q.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Herbert, Limited, Alfred, Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

TAPS, COLLAPSING
Geometric Tool Co., New Haven, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.

TEETH, DREDGE BUCKET
Kennedy & Sons, W., Owen Sound, Ont.

THERMOMETERS
Bristol Co., Waterbury, Conn.
Flexible Shaft Co., Ltd., Toronto, Ont.
Taylor Instrument Co., Toronto, Ont.
Greenfield Tap and Die Corp., Galt, Ontario.

THREAD-CUTTING TOOLS
Butterfield & Co., Inc., Rock Island, Q.
Greenfield Tap and Die Corp., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

THREAD CUTTING MACHINES
Landis Machine Co., Inc., Waynesboro, Pa.

THREADING MACHINES
Acme Machinery Co., Cleveland, Ohio.
Geometric Tool Co., New Haven, Conn.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Williams Tool Corp., of Can. Ltd., Brantford, Ont.

THREAD LEAD TESTING MACHINES
Pratt & Whitney Co., of Canada, Ltd., Dundas. Ont.

THREAD-ROLLING MACHINES
Bliss Co., E. W., Brooklyn, N. Y.

TIE PLATES
Steel Co. of Canada, Ltd., Hamilton.

TIME RECORDERS
International Business Machine Co., Ltd., Toronto, Ont.

TONGS
Hepburn Ltd., John T., Toronto, Ont.

TOOL CASES
Rice Lewis & Son, Ltd., Toronto, Ont.

TOOL HOLDERS
Armstrong Bros., Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Bertrams Ltd., Edinburgh, Scotland.

TOOL POSTS, LATHE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Williams & Co., Ltd., J. H., Brooklyn, N.Y.

TOOLS, SMALL
(See Machinists' Small Tools)
Armstrong Bros. Tool Co., Chicago, Ill.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Lufkin Rule Co., Windsor, Ont.
National Machine Tool Co., Racine, Wis.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S. Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A.R., Toronto.

TOOL WORK
Brown Engineering Corp., Ltd., Toronto, Ontario.

TORCHES, BLOW
Rice Lewis & Son, Ltd., Toronto, Ont.

TRACKWORK, RAILWAY
Can. Steel Foundries, Montreal, Que.

TRACKWORK, MANGANESE STEEL
Can. Steel Foundries, Montreal, Que.

TRANSMISSION MACHINERY
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound.
Renold, (Hans) of Canada, Ltd., Montreal, Que.

TROLLEYS AND TRAMWAYS
Can. Link-Belt Co., Toronto, Ont.
Northern Crane Works, Walkerville, Ont.
Wright Mfg. Co., Lisbon, Ohio.

TROLLEY WHEELS
Langley & Austin, Galt, Ont.

TROWELS, PLASTERING
E. C. Atkins & Co., Indianapolis, Ind.

WRENCHES, MACHINISTS'
Armstrong Bros. Tool Co., Chicago, Ill.

TRUCKS
Can. Fairbanks-Morse Ltd., Montreal, Q.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.

BUYERS' DIRECTORY

TUBING, SEAMLESS STEEL, BRASS AND COPPER AND FIBRE
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.

TURRET HEADS
Bertram & Son Co., Ltd., The John Dundas, Ont.

TURRET MACHINES
(See Lathes, Herizontal Turret)
Acme Machine Tool Co., Cincinnati, O.
Cook Co., Asa S., Hartford, Conn.
Gisholt Machine Co. Madison Wis.
Herbert, Limited, Alfred, Toronto, Ont.
National Acme Co. Cleveland O.
Pratt & Whitney Co. of Canada Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin

TURRETS, TOOL POST
Gisholt Machine Co. Madison, Wis.

UNIONS, PIPE
Fittings, Limited, Oshawa, Ont.

VALVES
Canada Metal Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Mon-
Dominion Engineering Works, Limited. Montreal, Que.

VISES, DRILLING MACHINE
Burke Machine Tool Co., Conneaut, Ohio.
Charles Parker Co., Meriden, Conn.
Cleveland Pneumatic Tool Co., Toronto, Ontario.
Kempsmith Mfg Co., Milwaukee, Wis.

VISES, PIPE
Charles Parker Co., Meriden, Conn.

VISES, PLANER AND SHAPER
Bertram & Son Co., Ltd., The John Dundas, Ont.
Philip Gies Foundry, Kitchener, Ont.
Hendley Machine Co., Torrington, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.

VISES, WOOD WORKERS'
Charles Parker Co., Meriden, Conn.
Parmenter & Bulloch Co., Gananoque, Ontario.

VOLTMETERS
Bristol Co., Waterbury, Conn.

WAGON LEADERS
Can. Link-Belt Co., Toronto, Ont.

WASHERS, LOCK, SPLIT AND SPRING
Barnes Company, Wallace, Hamilton.

WATER POWER PLANTS
Dominion Engineering Works, Limited, Montreal, Que.

WELDING APPARATUS, OXY-ACETYLENE
L'Air Liquide Society, Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto, Ont.

WELDING APPARATUS
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.

WELDING, ELECTRIC, ARC, SPOT AND BUTT
International Malleable Iron Co., Guelph, Ont.

WELDING MACHINES, OXY-ACETYLENE
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.

WELDING, ELECTRIC
McLaren Belting Co., J. C., Montreal, Que.
Steel Co. of Canada, Ltd., Hamilton.

WELDING ROD, TOBIN, MANGANESE, BRONZE AND ALUMINUM
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto, Ont.

WELDING SUPPLIES
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.

WHEELS, INDUSTRIAL
American Pulley Co., Philadelphia, Pa.
Hull Iron & Steel Foundries, Hull, Que.
Kennedy & Sons, Wm., Owen Sound, Ontario.

WINCHES, HEADGATE
Kennedy & Sons, Wm. Owen Sound, Ontario.

WINCHES, STOPLOG
Kennedy & Sons, Wm., Owen Sound. Ontario.

IPING PRODUCTS
Sanitary Wiping Products Co., Toronto, Ont.

WIRE
Barnes Company, Wallace, Hamilton.
Canada Metal Co., Ltd., Toronto, Ont.
Dennis Wire & Iron Works, London, Ontario.
Greening Wire Co., B., Hamilton, Ont.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

WIRE, BLACK TEMPERED, MUSIC PHOSPHOR BRONZE AND PREMIER
Barnes Company, Wallace, Hamiltor

WIRE, COPPER AND BRASS, FINE AND HEAVY
Steel Co., of Canada, Ltd., Hamilton, Ontario.

WIRE STRAIGHTENING AND CUTTING MACHINERY
Brown, Boggs & Co., Ltd., Hamilton, Ontario.

WIRE, WELDING
L'Air Liquide Society, Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.

WIRES, SPECIAL
Dennis Wire & Iron Works, London, Ontario.
Greening Wire Co., B., Hamilton, Ont

WOODWORKING MACHINERY
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Williams Machinery Co., A. R., Toronto, Ontario.

WRENCHES, DROP FORGED
Armstrong Bros. Tool Co., Chicago, Ill
Canada Foundries & Forgings Co., Welland, Ont.

Buying made easy

By grouping together these manufacturers of Special Machinery, Gears, Gauges, Dies, etc., we are making buying easy for you. Here you have a directory of the firms who can fill your requirements on any of these lines. When you are in need of any of the above, consult the firms listed here

CANADIAN MACHINERY

Buyers' Directory

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DIRECTORY OF DEALERS

THE Buyers' Directory of CANADIAN MACHINERY was originally intended to contain information regarding lines actually manufactured by our advertisers. We now carry the advertising of leading machinery dealers, some of whom represent scores of manufacturers in addition to being manufacturers themselves in some cases. We recommend, therefore, if our subscribers cannot find what they want in our Directory that they communicate with the dealers whose names appear herewith.

MACHINE TOOLS, ETC.

Bertram & Sons, Ltd., John, Dundas, Ont.
The Canadian Fairbanks-Morse Co., Montreal, Que.
Garlock Machinery Ltd., Toronto.
Herbert Ltd., Alfred, Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

SHOP and FACTORY SUPPLIES

The Canadian Fairbanks-Morse Co., Montreal, Que.

Garlock Machinery Ltd., Toronto.
Herbert Ltd., Alfred, Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

POWER EQUIPMENT, ETC.

The Canadian Fairbanks-Morse Co., Montreal, Que.
Herbert Ltd., Alfred, Toronto, Ont.

WOODWORKING MACHINERY

The Canadian Fairbanks-Morse Co., Montreal, Que.

Garlock Machinery Ltd., Toronto.
Herbert Ltd., Alfred, Toronto, Ont.

A. R. Williams Machinery Co. Toronto, Ont.

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Vol. XXVIII. No. 22 | Published Weekly by the MacLean Publishing Company, Limited, Toronto, Ont. | Nov. 30, 1922 | $4.00 a Year Subscription Price

READ AND PASS TO	Check	See Page	READ AND PASS TO	Check	See Page

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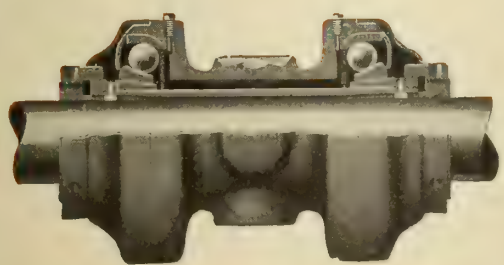

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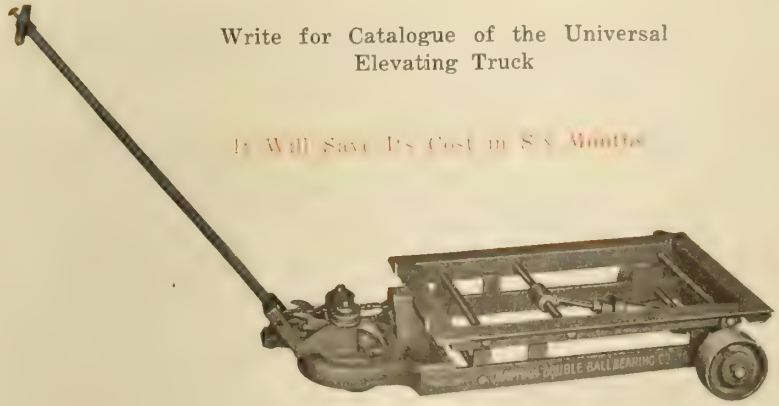

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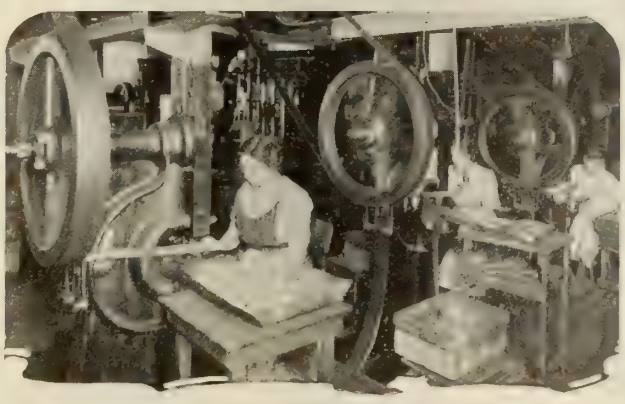

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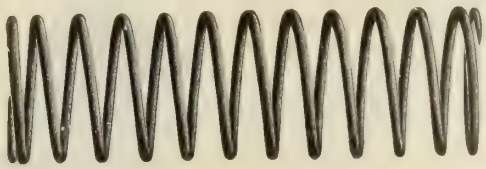

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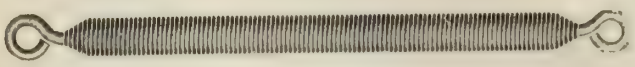

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1,000	3/8″	16
10,000	1/2″	18
500	1/2″	16
4 500	7/16″	20
2,500	1/2″	20
500	5/8″	18
4,000	3/4″	18
10 000	7/8″	20
6,000	1-1/4″	20
1,000	1-1/2″	20
100	2-1/16″	13
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A machine of POWER
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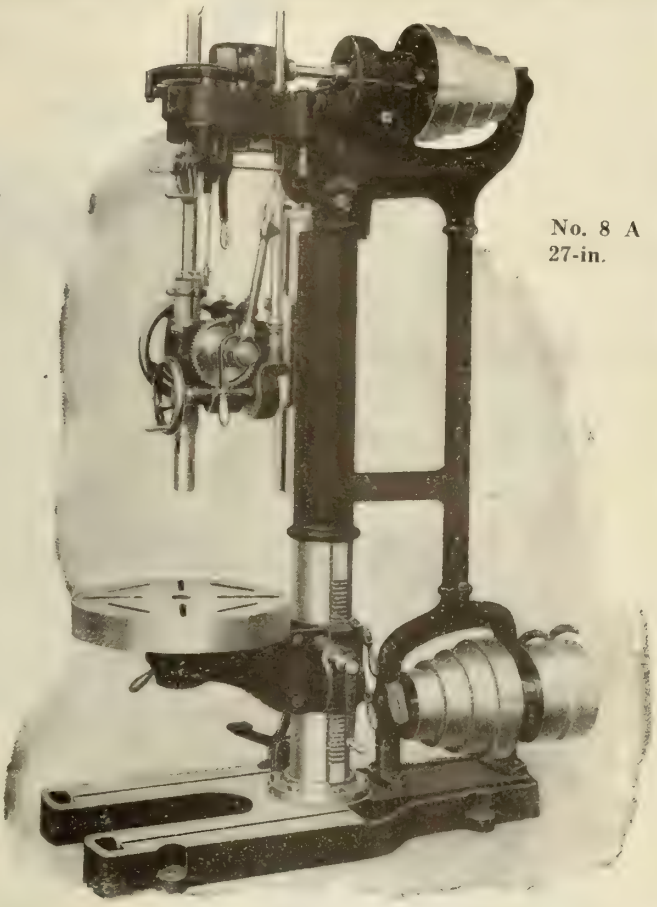
For dependable all-round service this new model "Corona" is without a peer. **Send for specification data sheet.**



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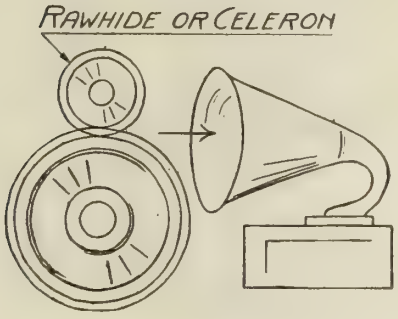

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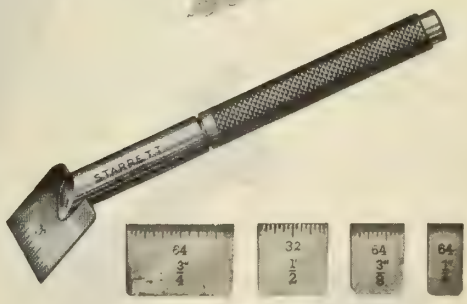

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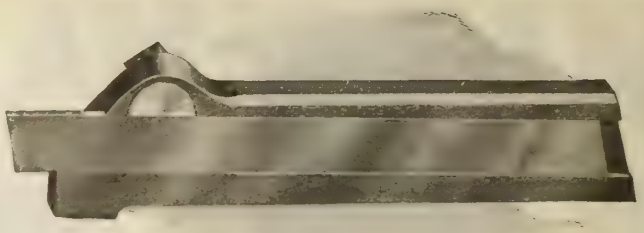

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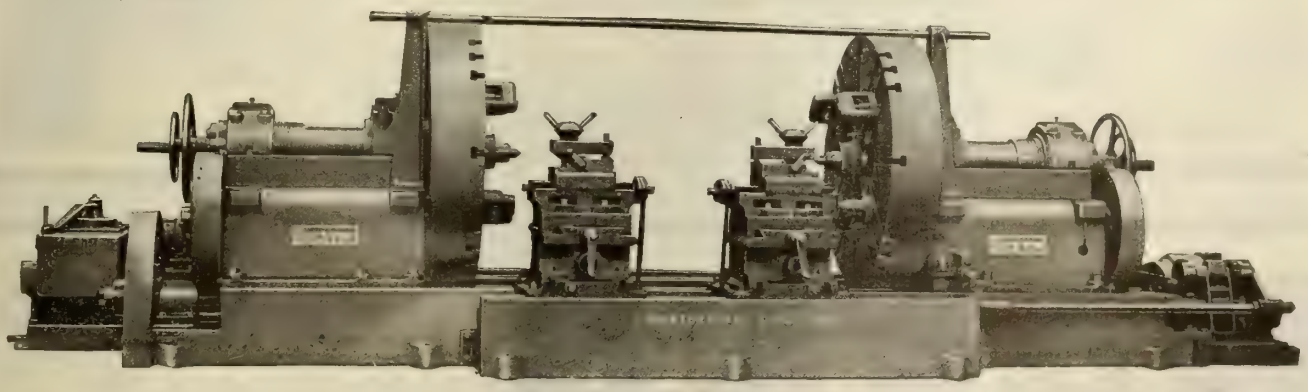

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Has a
Single Sliding Shipper Sleeve
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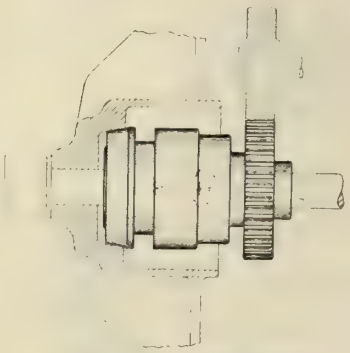
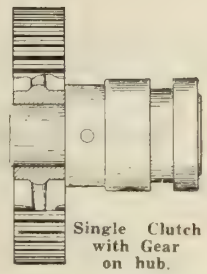


In order to stop the spindle quickly on the Springfield Engine Lathe the sliding sleeve of the Johnson Single Clutch is made to act as a brake.

Johnson Clutch with Taper Braking Feature

There is no limit to the many ways the Johnson Friction Clutch may be made special to meet particular conditions.

GET EXPERT ADVICE ON YOUR CLUTCH PROBLEMS FROM OUR ENGINEERS.



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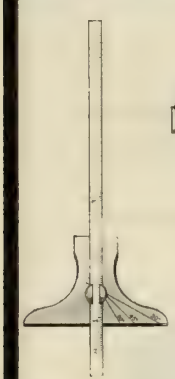

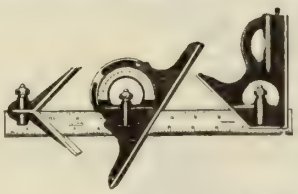

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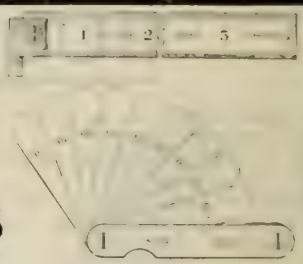

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Their nicety of design and finish appeal to the eye. Their performance day in and day out will hold your approval.

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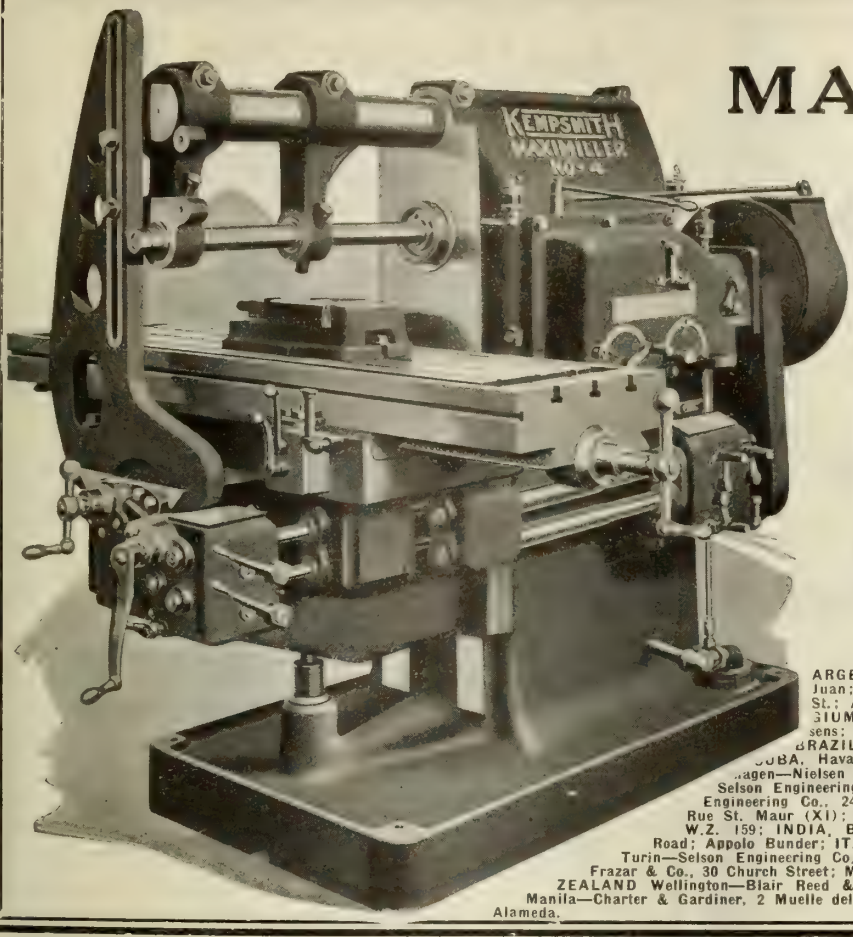

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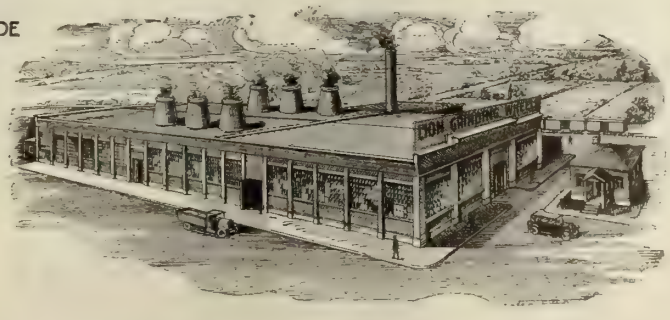

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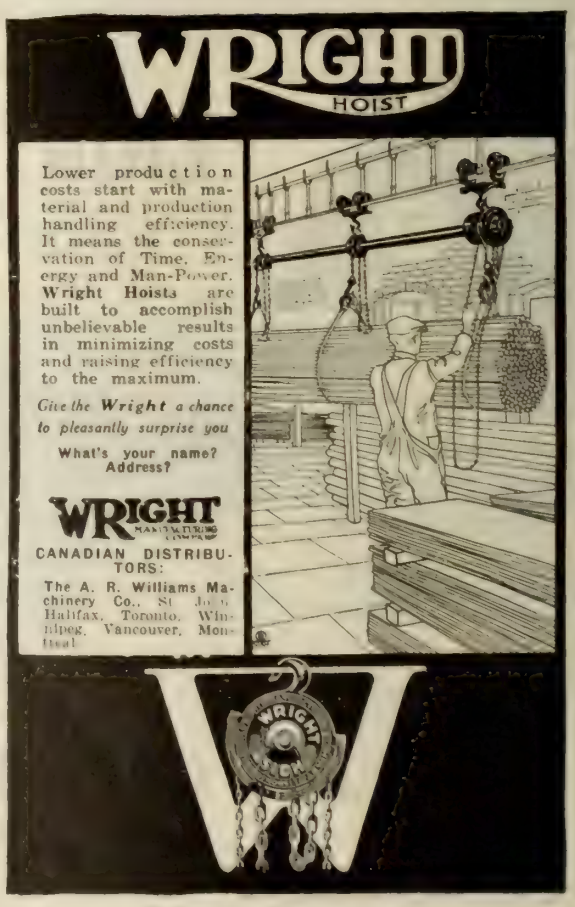
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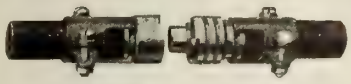

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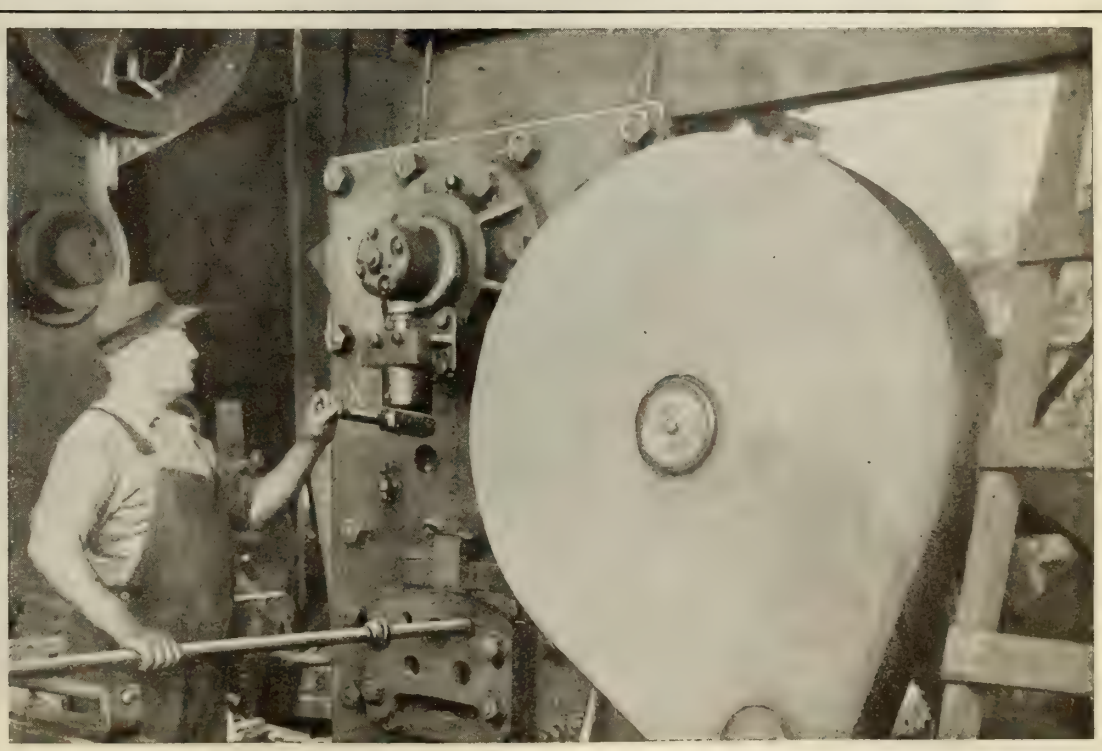

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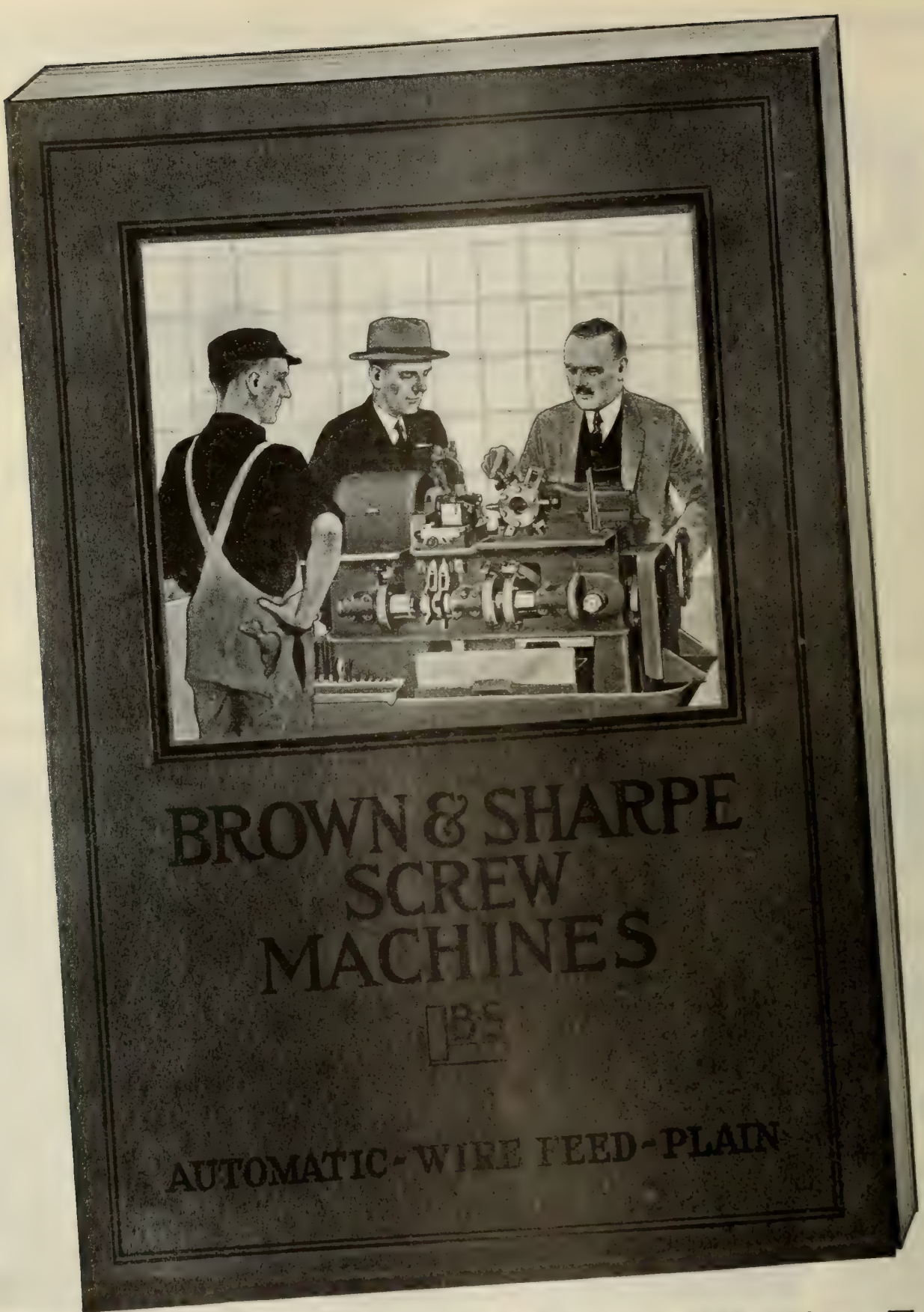

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CANADIAN MACHINERY
AND
MANUFACTURING NEWS

VOL. NO. XXVIII, No. 22. NOVEMBER 30, 1922

Conditions Create Demand For Labor-Saving Tools

E. F. DuBrul, of National Machine Tool Builders, Predicts Prosperity in 1923—See Labor Shortage—Would Enforce Contracts —October More Favorable Month—Must Look Ahead

Demand:—All signs point to a period of prosperity for 1923. Industrial construction shows some expansions. The outlook for machine tools is better.

Capital:—Rise in commercial rate indicates increasing business. There is a plentiful supply of capital to carry on general business. Because a number of factors may limit the length of the prosperity period, good authorities think it would be well not to anticipate the prosperity stage continuing beyond next fall.

Labor:—Labor shortage is more confirmed and will be one of the limiting factors to the continuance of the prosperity period.

Material:—Iron production has increased 25 per cent. over last month. Indications are that there will be a sufficient supply of iron to meet requirements. Prices of iron show a tendency to decline from the recent high prices, but transportations being bad, supplies should be gotten in for some months.

Fuel and Power:—Coal production is less than the peaks of 1917-18-19 or '20, or the spring of this year—held down probably by car shortage and price restrictions. Electric power demand is higher than ever known before.

Transportation:—Car shortage is apparent. Bad transportation will bring about duplication of orders and consequent cancellations, and undoubtedly help to shut off business.

Equipment:—Labor shortage is creating opportunities for the replacements of present equipment with labor saving machinery and tools.

IN THE above summary of business and industrial conditions, E. F. Du Brul, general manager of the National Machine Tool Builders' Association, Cincinnati, sees every reason for optimism in 1923. Analyzing the growth of demand he states:—

Signs of Prosperity

"In most lines of industry, excess stocks have been worked off, and with orders accumulating, unprofitable prices have disappeared. Many industries that had been working in the red right along are now showing a monthly profit on their operations. This is due not only to increased prices, but to larger volumes at the higher prices. Business men are now beginning to think of plant expansions of various sorts. In some cases there is an indication of pressure on manufacturing capacity, as shown by the F. W. Dodge figures for contracts awarded. In the northeastern states these show a growing volume of industrial contracts in spite of advancing building costs, and this volume must certainly be followed by additional orders for machine tools.

"Col. Leonard Ayres, Vice-President of the Cleveland Trust Co., and a leading industrial statistician, at a recent meeting of the Harvard University Committee on Economic Research, predicted a good period of prosperity in 1923. He pointed out that interest rates, wages, railroad car loadings, automobile output, money in circulation, cost of living, unfilled orders of the Steel Corporation, traffic on the Great Lakes, and rediscounts with the Federal Reserve Banks were all advancing. All these are signs of activity. So, too, are the declines in the price of bonds, the number of failures, the reserve ratio, bank investments, and building construction. He likewise pointed out the statistical probability of an increased number of marriages, a decreased number of divorces, and a decreased number of suicides, as these are regular accompaniments of a period of prosperity.

Advises Against Overstock

"Col. Ayres estimates that the present business expansion will be halted by a shortage of labor complicated by a shortage of railroad transportation, and that these two shortages seem to be already on the way toward becoming serious. Therefore, it is estimated that the present cycle will not be of very long duration.

"This estimate of Col. Ayres has a lesson for the machine tool builder, who is so easily caught with an overstock at the crest of the cycle. In a short cycle, about the time he gets into good full production he finds his orders dropping off. If this cycle works out as seems to be likely, it would be well to watch the order sheets. The machine tool builder must remember that the complications of the machine tool business are such that a lot of thought is going to be necessary.

An Order is a Contract

"The machine tool builder should make it perfectly clear to his customers that **an order is a contract**, and instead of being subject to cancellation, will be enforced at law to the fullest extent. One influential dry goods house in New York has been enforcing its contracts, engaging one of the highest priced firms in New York to prosecute violators of contracts, who had to pay up the damages or go into bankruptcy. Curiously enough, very few went into bankruptcy as a consequence of the enforcement. This is a very good lesson for the machine tool builder. If the same policy is pursued throughout this industry the commercial morality of the customers of this industry will be considerably improved and the machine tool builder will not be left to carry an undeserved burden, as he was in the last slump.

"It is particularly desirable to give due notice of the intention of this industry to enforce contracts in view of the fact that the automobile industry has such a large excess of productive capacity. Many automobile companies are not making money, although they are making a lot of cars. Many of those will in desperation attempt to cut down their production cost by ordering new machinery. But if they do not have the money to pay for the machinery

and to run their business as well, it is not as it should be.

Motor Car Outlook

"We look for more automobile failures and reorganizations, due to the unprofitable state of the automobile industry. A wild scramble for automobile orders is shown by the continued reduction in prices. While one company increases its price, this is only logical if that particular company had such a large participation in total orders in its class, as to demonstrate that the consumer was valuing the product at a higher price than the company itself was asking. Most concerns would increase capacity, rather than price, and so increase the pressure in the industry as a whole to sell more cars. As the market does not now absorb the full capacity of the industry, there will likely be some futher price reductions and additional bankruptcies.

"An evidence of approaching saturation is the congestion in every city in the U. S., where there cannot be very many more cars accommodated in the business sections than are now on the streets. One does not hear this sort of discussion from the automobile trade, but those selling the automobile trade would do well to consider these facts in shaping their business policies and particularly their credit policies.

Machine Tool Demand

"Indexes of contracts awarded for industrial buildings would be a very good index of some future demand for machine tools. Demand for machinery is of two kinds; expansion demand, and replacement demand. A case of the latter kind recently came to our attention. An automobile company bought a machine for $3,000 which replaced two machines that had cost $3,000.00 apiece. One man on the new machine produced as much as four men previously on the old machines. This buyer respected the machine but not the man that sold it. The replacement saves the cost of the new machine in about six months, so it was an investment netting 200 per cent. a year. We have heard of some other instances in which the user was able to secure a 300 per cent.-a-year investment from the machine tool builder.

"Shrewd buyers in that industry do not seem to be able to pick such bargains out of the pockets of sellers of other goods. Selling ability of that kind is very properly rewarded with a loss instead of a gain.

"Our reports of machine tools indicate a more favorable situation during October than during September. A number of percentage reports are climbing up into the higher classes. The zero class has almost disappeared, and the reports in the upper classes are evidence of more unit activity than the curve shows, because the dollar basis of these reports is materially lower than it was in the base period of the first quarter of 1920. Nearly 80 per cent. of the industry are operating at less than 30 per cent. of the dollar volume of the first quarter of 1920. This industry is still in the red ink stage.

"Costs are not likely to be any lower than present levels. By the time the machine tool builder has rebuilt his force of labor to produce the machines he is now contracting to build, the costs will be higher.

Must Look Ahead

"The machine tool builder should look ahead when he takes contracts. He need not be surprised when this winter is over to find himself unable to get labor at the price ruling when he took his contracts. Better salesmanship in this industry can make it possible for the machine tool builder to pay his force as much as they can earn in the shops of his customers. Of course his customers must get a profit from the use of the machine, or they will not buy, but that profit can be something less than 300 per cent. a year, and still be worth while.

Cover Needs in Material

"Prices on steel seem to have a tendency to further advance, while prices on pig iron have a tendency to decline. Recent advances in pig iron prices were due to the bidding customers who had no spot iron and were compelled to resort to the spot market to supply their wants. The spot market was cleaned up because of the car and fuel shortage. The fuel shortage being removed, production has increased 25 per cent. over last month. While the car shortage of labor will eventually work to hold down general production and therefore the demand for pig iron, if prices soften further it would be well to cover one's needs for some months to come. As to steel, the situation seems rather the reverse. The Steel Corporation is getting well booked up and this shows that some further price advances seem probable. Here again labor shortage is likely to restrict production to 70 per cent. of capacity.

Fuel and Power

"Charts of bituminous coal production issued by the U. S. Geological Survey, show that the weekly loadings of coal since September 2nd have been at about a stable point, there being very slight variation from week to week since that time. But this point is considerably below high points reached in 1920 and 1918, also considerably below the fall season loadings of 1918, 1919, and 1920.

"A higher price will certainly bring out more coal than a lower price. Last spring the railroads could and did handle considerably more coal than they are handling to-day. Artificial interference with supply and price in such a sensitive market as coal is merely going to create a scarcity of coal and leave the miners in better shape to enforce greater demands next spring than they have at any other time. The radicals among them choose to make the demands and the radicals dominate that union. The forehanded business man will discount this probability.

Car Shortage Growing

"While the railroads are using every possible effort to reduce the number of bad order cars they are not catching up on industrial activity, and the car shortage is growing. The new car orders being placed are considerably smaller than in a number of previous years. These cars are not being delivered as fast as the railroads can use them, because of labor shortage at the car works, and material shortage due to the car shortage. At the first sign of severe weather the railroads are going to suffer very greatly and that restriction will slow down business. It will also create a lot of duplicating of orders in some lines and a lot of cancellation will follow later. In some industries a hectic winter is likely. Get your material in as soon as you can.

Production Not Pounds

"While general industrial equipment is still plentiful, labor scarcity gives an opportunity to interest buyers in high production types of machine tools. The prices being asked for them ought to be a temptation to the buyers to invest in them, especially if the salesmen sell 'Production, not Pounds'."

CLAIM SMOKE IS VALUABLE

Sheffield, Eng., steel manufacturers claim, not for the first time, a vested interest in smoke. In consequence of the introduction of the Smoke Abatement Bill a report was issued by a joint committee of the Chamber of Commerce, Sheffield and District Engineering Trades Employers' Association, Crucible Steel Makers' Association, Rolling Mill Proprietors' Association, and the Forgers' and Tilters' Association. This report contains the following observations:—

"Sheffield manufacturers practically stand alone in the country in dealing with high-carbon steels, and they claim that such steels cannot be dealt with satisfactorily in smokeless furnaces, either for forging, rolling, or annealing.

"Sheffield manufacturers know of no process for heating steel sheets for high-class finish which avoids a certain amount of black smoke.

"The reason for smoke being necessary under the last two items is that a smoky atmosphere does not decarburise the surface of the steel, whereas a clear flame will do so, and render the material useless for the purpose for which it is required.

"Sheffield manufacturers claim that attempts to use an excess of gas, for instance, in a gas-fired furnace in order to reduce the smoke trouble, have been a failure, and will continue to be a failure with present-day knowledge and with the staff and workmen at their disposal.

"Sheffield manufacturers believe that it is inconceivable that the Government would consent to pass an Act that would have the effect of shutting down the whole of such plant in Sheffield, and they look to them to safeguard their interests."

?? Questions and Answers ??

ENQUIRY FOR GREASE CUPS

Question:—Please advise where we may obtain pressed steel grease cups in Canada. Initial quantity required, 20,000 per annum.—A. B., Buenos Aires, Argentine Republic.

Answer:—Canadian Winkley Co., Windsor, Ont., are producers of grease cups in quantity.

SALES TAX ON USED MACHINERY

Question:—What are the sales tax requirements on second-hand machinery when taken in part payment?—C. H., North Bay, Ont.

Answer:—The Department of Customs and Excise has ruled that where a manufacturer or wholesaler, in selling goods, takes back an old machine in part payment, and makes an allowance for same off the selling price, the sales tax applies on the selling price without any deduction for the allowance. Thus if the selling price of the goods is $1,000 and the purchaser turns in an old machine or, in fact, any goods for which all allowance is made, say for example $200, sales tax applies nevertheless on the selling price of $1,000.

Where a manufacturer sells and delivers from his factory a second-hand machine the Department of Customs and Excise regards him as a wholesaler in respect of such sale and he is required to charge and account to the Government for a sales tax of 2¼ per cent. thereon. For example,—a manufacturer may take into his factory warehouse an old machine as part payment for a new machine, and when selling the second-hand machine, so accepted as part payment, the manufacturer is regarded as a wholesaler and the sale is subject to a tax of 2¼ per cent.

Note:—Where a manufacturer sells equipment discarded from his factory such sale is not regarded as taxable under the Act. This is by reason of the fact that the manufacturer when buying machinery and equipment for his own plant is regarded as a consumer and therefore a sale of such discarded equipment is a sale by a consumer and such sales do not come within the meaning of the Act.

Scrap:—The Department of Customs and Excise has ruled that scrap sold by a concern, which is a consumer thereof when the goods were purchased is not subject to payment of sales tax when sold by such concern.

That is to say—when a manufacturer is selling scrap or waste, being the deteriorated material of his plant equipment, or otherwise, but in respect of which he was rated as a consumer at the time of his purchase, the sale thereof by him in the condition of scrap or waste, is not subject to payment of sales tax.

But scrap produced in the process of manufacture,—such as clippings of brass, copper, etc., when sold to junk dealers, or scrap dealers, is subject to the payment of sales tax on the sale to such scrap dealer, since the manufacturer, producing the material, was not rated as a consumer at the time of his purchase of such material. The tax in such cases will be at the rate of 2¼ per cent.

RECEIVED VALUABLE REPLY

Editor Canadian Machinery.—Many thanks for your letter of 22nd inst. in reply to our enquiry. The information contained therein is of considerable value to us at this time.

The N.—Company

TENSILE STRENGTH OF BELTING

Question:—What is the tensile strength for leather belting as laid down in the specifications prepared by the Bureau of Standards, Department of Commerce at Washington? Are these specifications recognized here?—J. W., Belleville.

Answer.—These specifications were agreed upon in order to establish definite standards of quality, and to promote, particularly among buyers, a more certain knowledge of their requirements. There are no such specifications in force here, but the standards obtain pretty generally in the Canadian belting industry. It is required that all leather shall have a minimum tensile strength of 3,000 lbs. per sq. in. of cross section, and an average tensile strength for single belts of 3,750 lbs. per sq. in., and for double belts of 3,500 lbs. per sq. in. The average shall be determined with five test specimens selected at random from different parts of the sample being examined. Test specimens of the size and shape as shown above shall be cut with a metal die. The edges of the test specimen shall be cut perpendicularly. The minimum thickness inside the gauge marks shall be used in determining the area of the cross section of the test specimen.

Laps and plies.—The laps of both single and double belting shall not open when subjected to a tensile stress of 2,500 lbs. per sq. in. The opening of the laps shall be determined by testing two specimens cut across the point of the lap lengthwise of the sample. For double belting the test shall be made on the single ply.

The average elongation at a tensile stress of 2,500 lbs. per sq. in. shall not exceed 15 per cent. The average shall be determined with the same five test specimens used for determining the tensile strength.

To determine the amount of elongation, parallel gauge marks 2 in. apart shall be placed upon the restricted portion of the test specimens. The distance between the gauge marks shall be measured with a pair of spring dividers, at a tensile stress of 2,500 lbs. per sq. in. The amount of stretch shall then be determined by measuring the opening of the dividers on a scale.

This test will be made on each lot of two thousand feet, or fraction thereof.

The following stretch test shall be made on the finished belting up to, and including, six inches in width. Any section of a roll or belt shall be selected (which shall not be cut out) on which gauge marks shall be placed 10 ft. apart. Suitable clamps shall be attached on the marks so that the distance between the clamps shall be 10 ft. The section shall then be suspended in a vertical position from one of the clamps. Sufficient weight, including the weight of the clamp, shall be attached to the lower clamp to produce a tensile stress of 750 lbs. per sq. in. of the average cross section being tested. The section after being subjected to this tension for 15 minutes shall show a length between gauge marks not to exceed 10 ft. 7.2 in. (6 per cent. stretch).

Measure of Elasticity.—The clamps shall then be removed, and the section allowed to lie loosely on the floor for 17 hours, after which time the length between the gauge marks shall not exceed 10 ft. 1.6 inches (1-1/3 per cent. stretch).

Increasing demand for quarrying and stone cutting and handling equipment will result from the growing market in Eastern Canada, as the product of Manitoba's granite producing industries will bring about rapid development of these important industries. Both red and grey granite have been taken out during operation of the quarries within the last two years and it is expected the industry will develop rapidly since a market has been found in the East.

Sir Henry Thornton's Chances of Success on C.N.R.

Will Have to Overcome Exceptional Difficulties—Unanimous Support Required—Must Have Efficient Work From Employees —Rates Too Low in Proportion to Expense—Must Have Freedom

WHEN Sir Henry Thornton undertakes the work of putting the Canadian Government Railways on their feet, physically and financially, he will, simply because they are government railways, have to overcome difficulties such as the men who built up the great railway systems of the United States never encountered, writes Samuel O. Dunn, editor of Railway Age, discussing "Thornton's Chances of Success," in MacLean's Magazine.

"Sir Henry Thornton cannot tear up unprofitable lines without depriving some communities of railway service. Will they not bring political pressure to bear to prevent this? He cannot increase the average freight train load without reducing the speed and frequency of the freight service rendered to many communities.

"The writer was told on good authority some months ago that the Canadian Government Railways were taking live stock traffic away from the western lines of the Canadian Pacific because they were running live stock trains with smaller loads and on faster schedules than the management of the Canadian Pacific regarded as warranted on sound operating principles. Whether this was the case or not, it is undeniable that railways operated by the Canadian government have in the past furnished service the earnings from which did not anywhere near cover the expenses, because an unwise or wholly selfish local public sentiment demanded it.

"Will public sentiment support or resist Sir Henry Thornton if he attempts to make changes in service which are essential to economical operation? Undoubtedly the attitude assumed by the public will determine the attitude assumed by its representatives in parliament.

Unanimous Support Required

"Sir Henry may be favored in the early part of his work by an increase in traffic due to improving business which will cause the railways to need all the men they have and render it unnecessary in the interest of economy to reduce the number of employees. But there will be pressure brought to bear under these conditions to cause an unnecessary increase in the employees. Besides, every business, whether owned by a government or private company, has its periods of depression when good management requires a reduction in employees. There will be resistance to such reductions on the government railways when they are needed. The time will come when economic conditions will demand further reductions of the wages of the employees.

"Will Sir Henry Thornton be able to get the labor member of the board of directors to support him in his efforts to

SIR HENRY WORTH THORNTON

secure the most efficient work from employees and to avoid in periods of both good and bad business carrying any more of them on the payroll than are needed? Will he be able to get the support of the labor member for needed reductions of wages? If he cannot do so, will he be able to get the support of public opinion and the public men at Ottawa?

"While railway rates in both the United States and Canada are higher than they were before the war, it is easily demonstrable that they are too low in proportion to the expenses of most railways. This is conspicuously true of the government railways of Canada. If their rates and operating expenses bore a reasonable relationship to each other they would not be incurring the large deficits they are. Nevertheless, in both the United States and Canada there is a strong demand, especially from the western farmers, for reductions of freight rates. Railway rates in Canada are regulated by a board of railway commissioners. If Sir Henry Thornton opposes reductions of rates which he knows will result in large deficits continuing to be incurred indefinitely, will he be able to get the support from public sentiment necessary to make his opposition successful?

"It is easy to anticipate the argument that will be made in favor of reductions of rates. It will be said that high rates are imposing an undue burden upon producers and shippers, and preventing the development of the country. The argument that low railway rates are needed to develop business is always made in every country under either private or government ownership. In only one country in the world where government ownership has prevailed has the demand for low rates been so successfully resisted that the incurring of large deficits on state railways has been avoided. This was in Prussia before the Great War. The state railways of that country for years earned more than the interest on the investment in them; and they are the only system of government-owned and operated railroads which ever did this for a long period. Undoubtedly this was due to the fact that it was impossible to put effective political pressure upon the autocratic government of Prussia.

"Since the war Prussia has become a democratic country; and since the war her railways, like those of other democratic countries, have been incurring huge deficits. Is it not singular there are so many people, even including many business men, who cannot see, or refuse to see, that if railway rates are not made high enough to cover operating expenses and interest on the entire investment in a government system of railroads a deficit must be incurred which must be paid from taxes, and that a given amount collected in taxes imposes just as heavy a burden upon and tends just as strongly to hinder the development of the industry and commerce of a country as the same amount collected in railway rates.

"Furthermore, when the entire cost of furnishing railway service is covered by the rates, those who receive the service pay for it; while when the rates are not made high enough to cover the entire cost of the service, those who get the service pay only part of its cost, the rest being paid by the taxpayer. It is plainly inequitable to give railway service to some persons for less than the cost of furnishing it, and then force others who do not receive it to make up the difference in taxes. Furthermore, when the business principle of making railway rates and earnings cover all expenses and fixed charges is departed from, the door is left wide open for every kind of inefficiency and extravagance, the burden of which falls upon the taxpayer.

He Must Be Given Freedom

"Everyone who has looked into the facts knows what influences have prevailed in the management of the government-owned railways of Canada in the past.

"The government railways have had some very able men among their officers. When, however, one compares data regarding the operating results obtained

(Continued on page 19)

CANADIAN MACHINERY
AND MANUFACTURING NEWS

Published in the Interests of the Machinery, Manufacturing, Iron, Steel, and Metal Working Industries.

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Publicity the Remedy

FULL, FAIR and earnest publicity is the remedy that would be applied by Judge Gary, chairman of the United States Steel Corporation, to the "severe and unreasonable competition which has resulted in the steel business now being conducted at a loss."

The head of the Steel Corporation was being questioned in defense of the legality of the Pittsburgh basing practice. This, he points out, had been in force for years and was a method of quotation making for uniformity in marketing. It was explained that it meant a price agreed upon at Pittsburgh, plus the cost of shipment to the selling point.

Such a rule does not and cannot affect the law of supply and demand. The best evidence of this is that, during a buyers' market, the steel industry is as helpless as any other not half so well organized. Ruthless competition gives the buyer an opportunity which comes high to the manufacturer. Such problems create instability and expensive irregularity. It is absurd to suppose that in the light of what is taking place in the steel industry to-day, prices can be controlled or influenced in any way by means of secret agreement. It is not possible to harness world commodities in that manner.

There is probably no fundamental field of activity that is so persistently in the limelight as that which has to do with steel and iron production. All interests demand news of steel. Proper adjustments are regulated through publicity. Arbitrary rules, being impossible, are hastily eliminated.

Statistics are like prophets; it depends on where they come from. Business men seldom recognize the fact that much of the information forecasting Canadian conditions from another country, is based on information easily available to them at home.

Laxity in Contracts

IS AN order a contract? When a name appears "on the dotted line," is it to be regarded as merely a compliance with custom, or does it involve a two-sided responsibility as between seller and buyer?

There are those in the machine tool business, and, in fact, almost every business, who claim that, of recent years, there has been an unwarranted laxity on the part of customers. In fact, abuses have been such that some firms have taken the stand that an order is a contract and that contracts cannot be violated. The aggravation is keenest where money has been spent or obligated on the work before cancellation notice is given. In many such unreasonable cases the customer seems to consider himself entitled to exemption from responsibility. The manufacturer may consider it wise not to insist upon his rights and in some cases stands the loss. This is not good business. It injures the moral standards of the industry

E. F. DuBrul, president of the National Machine Tool Builders' Association, in emphasizing the importance of a close scrutiny of order sheets at the present time, has this to say:

"The machine tool builder should make it perfectly clear to his customers that an order is a contract, and instead of being subject to cancellation, will be enforced at law to the fullest extent. One influential dry goods house in New York has been enforcing its contracts, engaging one of the highest priced firms in New York to prosecute violators of contracts, who had to pay up the damages or go into bankruptcy. Curiously enough very few went into bankruptcy as a consequence of the enforcement. This is a very good lesson for the machine tool builder. If the same policy is pursued throughout this industry the commercial morality of the customers of this industry will be considerably improved and the machine tool builder will not be left to carry an undeserved burden, as he was in the last slump."

Pig iron production in Canada increased almost 50 per cent. in October over the month preceding. The output is still at lowest levels in five years, but there never was a graph that didn't show an upward swing, and this has now set in.

Not Placing For Future

THAT BUYING is being done very largely at the present time on a hand-to-mouth basis, and that there has been very little placing to cover winter requirements, is the report from quarters in close touch with the general situation. The foundry business is said to be the most notable example.

In the expectation of a drastic slump in prices there has been a very light market for pig iron. The same tendency is noticed in the United States and though price adjustments have been made in an attempt to develop demand, it is shown that results have not been as anticipated. Now it is evident that foundries have, to a certain extent, overstayed the market and are in distress because of transportation difficulties. It is thus that any advantage the buyer has had in the situation may soon merge into a more relative concern over the prospect of supply.

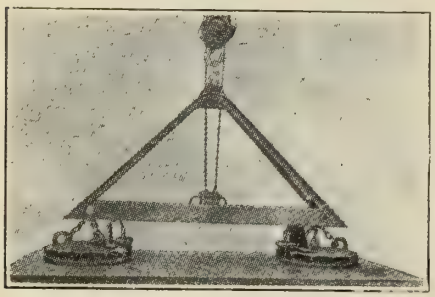
Pig iron production in Canada is hovering around the lowest levels in years. Furnaces have had no warrant for higher production while the market has been in a backward mood. Coal and rail strikes restricted output during the summer and conditions have not been such as to enable operation on a minimum cost basis. It is asserted that these factors discourage any prospect of lower prices. The present seems the time to consider the urgency of future requirements.

New Things in Shop Equipment

NOVEL LIFTING MAGNET

An interesting application of the use of electric lifting magnets is furnished by an order which has just been completed by the Witton Kramer Electric Tool and Hoist Company, Limited, Birmingham.

The illustration shows one of four similar equipments which are being shipped to Bombay for use in unloading steel plates. For a large pipe line which is being erected in Bombay, about 80,000 tons of steel plates will be used. The plates are being shipped to India flat, and will be rolled into shape on site.



Magnet hoist used in unloading steel plates.

The duty of the magnet is to pick up four plates, 19 ft. by 7 ft. 4 in. by ⅜ in. thick, or five plates, 15 ft. by 7 ft. 4 in. by ⅜ in. thick, either one at a time or in the complete bundle. They will then deliver the plates either into stock or into the bending machines one at a time.

In order to accomplish this, the magnets are arranged with special controllers, so that by varying the amount of current supplied to the magnet, it is possible to pick up one plate at a time. For example, starting with one plate, it is possible to go to another pile and pick up a second, move on to a third pile and pick up a third plate, and so on, and to drop them off one at a time alongside each of the four machines.

TAPER THREADING DIE

A new design of self-opening die, especially designed for cutting threads of any commercial taper, has recently been developed. The range of the taper obtainable is from zero up to 2 in. per foot. When working at maximum taper the die will cut a length of 1¾ in. of thread; this length is increased as the minimum taper is reached. This die may be used in conjunction with a second one cutting a parallel portion of the same bolt. These dies are supplied with the shank rough-turned so that they may be accurately fitted in the bore where they are to be used, so as to assure perfect alignment when in service. The bushing in which the operating pinion has its bearing is eccentric, so that the bushing may be partially rotated to compensate for any slight error in alignment of the machine. These tools are made in two sizes, one for cutting threads 1¼ in. dia. at large end, and the other for threads having a dia. of 2 in. at the large end. These dies are manufactured by the Jones and Lamson Machine Co., Springfield, Ohio.

SHAVING MACHINE FOR BOLTS AND CAPSCREWS

A new design of bolt head shaving machine has been placed on the market recently. The machine is driven from the line shaft, a countershaft being placed under the pan of the machine. Any number of machines may be placed together and operated from this countershaft. Separate carriers are provided for the cutting tools, one being used for facing the shoulder under the head while the other rounds the top, both tools cutting simultaneously. A feature of the design is the method of feeding the tools; as they advance to the cut they are drawn slightly towards each other, so that on the return movement the cutters are clear of the work and no dragging or marking takes place. Carriers are independently adjusted. As the screw drops from the feed race it is gripped by the shank and held firmly, leaving ample room for the shouldering tools to operate. The hopper on this machine is stationary and is supported by a hollow bracket, the upper end of which forms a bearing for the revolving shaft. To the upper end of the shaft is secured a four-armed spider, or agitator, which keeps the contents of the hopper constantly stirred up, causing the screws to be located in the annular groove in readiness for feeding to the machine. The action of the agitator causes the bolts to be pushed towards the outer edge of the hopper from where they enter the annular groove, the shank falling down by gravity and the screw being supported by the shoulder of the head. There is no danger of jamming. The rate of feed may be regulated to suit the speed of operation. The number of bolts in the hopper is immaterial as the bolts are gradually and evenly distributed up to the very last bolt. After the bolts enter the annular groove the feed is entirely by gravity. These machines are made to handle bolts and cap-screws up to ½ in. dia. and 4 in. long. They are manufactured by the Asa S. Cook Co., Hartford, Conn.

COMBINATION HAND VISE

A handy little general utility combination hand vise has just been placed on the market. The use of a ball end handle for tightening the jaws, instead of a wing nut, is particularly worthy of note. By this means far more leverage is possible and thus a common difficulty in hand vises is eliminated. The hand vise is furnished with a clamp permitting its use as a small bench vise on benches or shelves having an approximate thickness of ½ in. to 2⅛ in. As shown in the illustration, the change is effected simply by removing the handle and substituting the clamp. When used

Combination hand vise.

with the clamp the vise can be adjusted to any point in a complete circle to meet the convenience of the user. The clamp is made purposely large and strong so that it will withstand hard use. The jaws of this vise are tempered and polished drop forgings, 1½ in. in width. The capacity of the vise is about 1½ in. These tools are made by the L. S. Starrett Co., Athol, Mass.

WHEEL-TRUING DEVICE

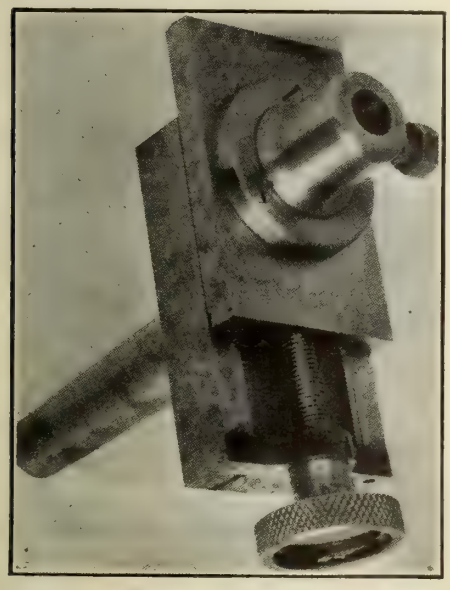
An angular truing device, especially intended for service in shops salvaging worn-out milling machine cutters, reamers and drills, as well as those making a specialty of stellite cutters and tools. The wheel can be quickly and readily formed to correspond to any desired contour. The cutting diamond is fed to the wheel by means of a knob at the top of the device, while cross feed is obtained by a crank that operates the tool holder, located in a slide. The device may be swiveled to any desired angle and accurately set by means of a graduated dial. The arrangement of the device is such that the set-up of the work need not be disturbed to dress the wheel. These devices are made by Wilmarth and Morman Co., Grand Rapids, Mich.

ADJUSTABLE END WRENCH

An instantaneously adjustable wrench has been placed on the market recently. All parts of the wrench are drop forged and treated to a carbonizing hardening process. The tool is light in weight but strongly made, and designed to work in cramped places. The handle is integral with the lower jaw which is notched on the inner side to engage with corresponding notches in the movable jaw, the latter being adjustable when the notches are disengaged. This is accomplished by simply pressing the thumb on a corrugated part of the movable jaw. Turning may be done in either direction. The tool is made in three sizes, 6, 9 and 12 in. in length, the large one weighing 20 oz. They are made by the Gellman Wrench Corp., Chicago, Ill.

PRECISION BORING HEAD

The Bruce Precision eccentric boring head illustrated here is designed for application to drill presses and milling machines for boring jigs and fixtures and also for index boring. It is graduated



Precision Boring Head.

in .001 in. and is provided with a gib to take up wear. It is furnished with adaptors which are so designed they will take various sizes of drills within the capacity of the tool, which permits drilling and boring. The head is made in four sizes as follows: No. 1, ⅜ in. to 1½ in.; No. 2, ½ in. to 2½ in.; No. 3, ¾ in. to 4 in.; No. 4, 1 in. to 6 in. This tool is furnished with a set of six boring tools, chuck and test indicator. It is being placed on the market by the Precision and Thread Grinder Mfg. Co., Philadelphia, Pa.

VERTICAL LIFT AIR HOISTS

Canadian Ingersoll-Rand Company, Montreal, have issued an informative booklet on their "Circo" direct vertical lift air hoists designed to meet requirements in rapid and economical handling of raw materials. These hoists are built in single-acting, double-acting and air-balanced types. The hoists are adapted to use in foundries, pulp mills, chemical plants or other places where dust, moisture, corrosive gases or chemical fumes are prevalent, as no air is drawn from the atmosphere in either the single-acting, double-acting or air-balancing types. Valves are of the poppet type, consisting of either two, three or four cylinders cast in one piece, and with hard brass valve seats. The valves are faced with soft rubber discs, making a tight joint, and may be renewed in a few minutes by unscrewing the caps at the bottom of each cylinder.

SIR HENRY THORNTON

(Continued from page 16)

on the Canadian Pacific with corresponding data regarding the operating results which have been obtained on the Intercolonial, and on the other railways which have been under government management a much shorter time than the Intercolonial, he can reach only one conclusion. This is that the government railways have not been managed with an efficiency and economy which approach the efficiency and economy attained on the Canadian Pacific.

"The difference in the results secured doubtless has been partly due to differences in official personnel. But undoubtedly it has been more largely due to the fact that the officials of the Canadian Pacific have had a free hand to manage that railway on business principles, while the officials of the government railways always have been subject, directly or indirectly, to political influences which have irresistibly compelled them, in many important matters, to subordinate business considerations to political considerations.

"In many countries where railways have been operated by governments attempts have been made completely to free the managements of the railways from political influences. Such attempts have been made in every one of the Australian states. Never, however, in any really democratic country has such an attempt been successful.

"The most important question that remains to be settled regarding Sir Henry Thornton's work as chairman of the Canadian government railways is whether he will, or even can, be given freedom and authority to manage them in practically the same way that he would manage them if they were owned by a private company and he were its president. If he is given this measure of freedom of action and authority he may succeed in time in accomplishing some such improvement in their physical condition, operating efficiency and financial results as was achieved in past years by Harriman, Ripley and Hill on the Union Pacific, the Atchison, Topeka & Santa Fe, the Northern Pacific and other western railways in the United States.

"If he does succeed in doing this he will confer benefits upon the people of Canada which the imagination cannot now even estimate. On the other hand, if a short-sighted and mistaken public sentiment causes political influences to interfere with what he tries to do to effect economies, maintain rates and carry out other policies essential to establishing a business-like relationship between the expenses and the earnings of the government railways, his work will not be successful; and the responsibility for its failure, as well as the losses which will have to be paid because of his failure, will fall upon the people of Canada.

"Sir Henry Worth Thornton is fifty-one years old. He received an engineering education at the University of Pennsylvania and entered railway service as a draftsman on the Pennsylvania Lines west of Pittsburg when twenty-three years old. The Pennsylvania has had a unique method of developing and training officers. On most of the railways of North America most of the officers have 'risen from the ranks.' They have come up from telegraph operators, clerks, brakemen, firemen and so on. The Pennsylvania alone has for many years followed systematically the policy of taking college-educated men, usually engineers, into its organization, and after advancing them step by step through its engineering department, transferring them to 'operating' positions. To make the meaning of this statement clear it should be said that the engineering department of a railway designs, constructs and maintains tracks, tunnels, shops, locomotives, cars and other physical properties. The 'operating' department has direct charge of the making up, breaking up and movement of trains. Almost every high operating officer of the Pennsylvania has graduated from the engineering into the operating department.

"Sir Henry Thornton worked his way up through the engineering department and was made superintendent of a division in 1901. He was superintendent of different divisions for ten years. Now, being superintendent on the Pennsylvania System means something. This railway has one of the densest businesses in the world. A large part of its mileage has double track and much of it four tracks. Under the Pennsylvania's organization the superintendent has duties and responsibilities comparable to those of the general manager of many large single track railways. When therefore, it is stated that Thornton was ten years superintendent on the Pennsylvania it means that he had a long and valuable experience and training as an operating officer. He was next made assistant general superintendent and then general superintendent of the Long Island Railroad. This is a subsidiary of the Pennsylvania which handles a large suburban business on Long Island into and out of New York City.

Practical Ideas From Practical Men

HANDY RADIATION CHART

By W. F. Schaphorst

The Stefan-Boltzmann radiation law is acknowledged to be as good as or better than any. The trouble is, however, most people who have to figure radiation do not like to use it because temperatures in it are given in deg. F. absolute raised to the fourth power which takes considerable time to compute. I have, therefore, prepared the accompanying chart which takes care of the absolute temperature feature and also takes care of raising to the fourth power and dividing by one hundred. The law is given by Stefan-Boltzmann as follows:

$$H = CA\ t\ \frac{(T)^4}{(100)}$$

Where H=heat radiated in b.t.u.
C=a constant
for smooth glass=0.154
for dull brass=0.0362
for lampblack=0.154
for slightly polished copper=0.0278
for dull oxidized wrought iron=0.154
for clean bright wrought iron=0.0562
for highly polished wrought iron =0.0467
for rough cast iron, highly oxidized =0.157
for water=0.112
for ice=0.106
A=area of radiating surface—sq. ft.
t.=time in hours
T=temperature in deg. F. absolute.

It is not very well known but it is a fact that this formula can be applied very nicely to problems where it is desired to determine the radiation due to increase or decrease in temperature. Using the chart the computation is accomplished as follows:

Find the temperature in deg. F. in Column A and in Column B the corresponding figure is the absolute temperature divided by 100 and raised to the fourth power all worked out. For example:—What is the radiation in 10 hours from a rough cast iron surface whose area is 10 sq. ft., the temperature of the cast iron being 40 deg. Fahrenheit?

Referring to the chart, find 40 degrees F. in Column A. Opposite in Column B is the figure 625. For cast iron the table gives us the constant 0.157. We, therefore, find the radiation to be—

0.157 x 10 x 10 x 625=9820 b.t.u.

If this is the normal temperature of a room and if the cast iron object is a radiator and it is desired to maintain the temperature of the radiator at 250 deg. F. how much heat is radiated in 10 hours?

Our formula now becomes—

$H = CA\ t\ (T_1 - T_2)$ where

T_1=the higher value given in Column B of chart;

T_2=the lower value given in Column B of chart.

Find 250 deg. F. in Column A. Opposite that figure in Column B is the figure 2550. Substituting in our formula we now have—

0.157 x 10 x 10 (2550—625)=30250 b.t.u.

Inversely, if the normal temperature of the room is 40 deg. F., and if the cast iron object is to be used as a "cooler" instead of as a heater and if brine is to be circulated in the cooler maintaining it at a temperature of 30 deg. F., how much heat will be absorbed by the cooler, or, "radiated into it" in 10 hours?

Opposite 30 deg. F. in the chart we find in Column B the figure 575. Substituting this in our formula we find that—

0.157 x 10 x 10 (625—575)=785 b.t.u.

This chart is made to include most of the temperatures dealt with in average practice. Where temperatures are extreme the original formula can be used which is as follows where there is a change in temperature.

$$H = CA\ t\ \frac{(T_1)^4 - (T_2)^4}{(100)\quad(100)}$$

Where all factors are as given above with the exception that—

T_1=higher temperature, absolute, in degrees Fahrenheit.

T_2=lower temperature, absolute, in degrees Fahrenheit.

To find the absolute temperature in deg. F., add 460 to the temperature as given on the thermometer. Thus, 40 deg. F. as given on the thermometer is equal to 500 deg. F. absolute.

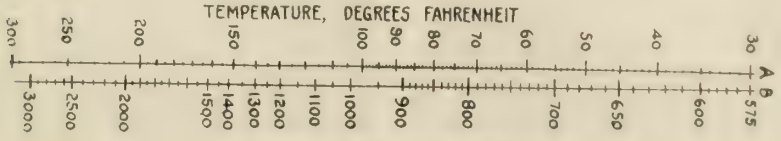
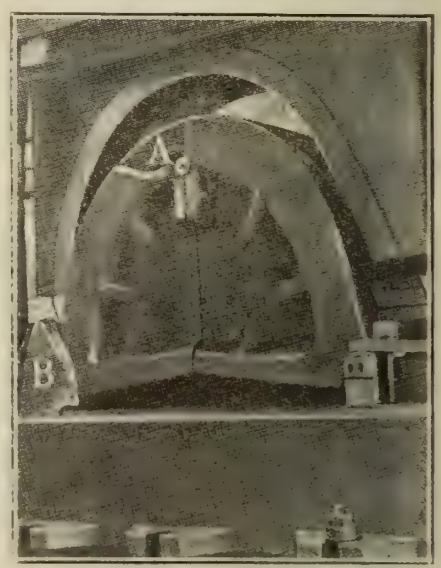


Chart for finding heat radiation.

Canadian Wire Weaving Co., Niagara Falls, Ont., makers of wire cloth used in paper-making processes, may shortly consider an extension of their plant. Since their incorporation three years ago their growth has reflected that of the pulp and paper industry.

Danger Unforeseen Result—Man Killed

A fatal accident occurred recently in connection with a large drawing press used for stamping out automobile fenders, states the Travelers' Standard. A portion of the upper part of the die, weighing about ten pounds, broke off when the ram came down upon it, and was thrown out with considerable force.



Breaking of this die cost one life.

A helper who was removing the stamped fenders at the back of the machine was struck in the face by the flying piece, and died within about ten minutes. The accompanying engraving shows the ram and die of the press—the proportion of the die that broke off being indicated by the letter "B" and its original position by the letter "A." The likelihood of an accident here described had not been considered and no provision had been made to prevent such an occurrence to guard the workman against its consequences. In the future, however, protection against the recurrence of a similar accident will be provided, in this plant, by attaching a steel plate flange to the press in such a way that if the pieces of the die break off they will be prevented from flying out, thus preventing injury.

Bethlehem Steel Co. are having two motor-driven ore carriers, each of 20,000 tons and measuring 560 feet in length and 72 feet in width, built in German shipyards. The boats will ply between Chile and United States.

Steel Men Anticipating Fair Sized Railway Orders

Speculation as to Sir Henry Thornton's Policy—November's Record One of Steady Demand—Plate and Structural Orders Being Cleaned Up—Light Market for Pig Iron

PRODUCTION of steel ingots according to advices from Pittsburgh, is on a basis of 75 to 80 per cent., the highest rate since October, 1920. One fact that emerges from the present situation is that since Oct. 1 steel production has been at a rate 15 per cent. above the average rate in the six months preceding. Stocks were decidedly low at the beginning of that period. Consumption could not have exceeded production, and it is evident, therefore, that it must be at least 15 per cent. heavier. This is a great point to consider in connection with industrial reviews suggesting that business is getting better and will continue to do so. There is some opinion that the inflationary period has not been entirely dissolved.

November's record in Canadian markets has been one of steady demand, although orders have not been remarkable for size. Slight improvement in shipments is reported and some of the outstanding orders on plate and structural steel are being cleaned up. Railroads are buying materials for car repairs, and just what Sir Henry Thornton's arrival will mean to the Canadian steel industry is at present a topic of interest among those who are inclined to be speculative. His approval, it is understood, is all that is necessary in order to set in motion rolling stock orders that have been hanging fire. To bring the national railroads up to highest standards of efficiency, it is evident that a very considerable sum of money will be spent, and Sir Henry is the man supposed to have the first and last word to say in the loosening-up process.

It had been expected that some readjustment of sheet and tin plates would be announced by the Steel Corporation for the first quarter of 1923, but no advance has been made. It is evident that old prices will stand in spite of the feeling that, as plate did not advance since March, new prices were imminent. On the other hand, it is claimed that $4.75 for 100-pound coke tin plate was rather a high one for conditions existing at the time and since. There has been no change in sheet prices, although the Canadian market is firmer. Bars, shapes and plates also show stability while the demand for pipe is very strong, with slow delivery of skelp supplies contributing to production problems.

Pig iron is moving slowly in a very conservative market. Foundries engaged on radiators or other building supplies, have had a good season. Pittsburgh reports that coal declined 75 cents a ton last week, and to show the lack of coherence in the market, coke, a coal product, advanced 50 cents and pig iron, which is made with coke, declined $1. Pittsburgh quotes steam coal $2.50 to $2.75; coke, $7.25 to $7.50; pig iron, Bessemer, $30; basic, $27; foundry $27.50.

Toronto

November 29.

WHAT Sir Henry Thornton will do in the matter of buying for railway requirements when he assumes control of the C. N. R., is a topic that is being discussed with considerable interest in Toronto markets at the present time. It is felt that large orders will be placed for rolling stock equipment and that several other important equipment items will be the subject of final decision. It is certain that the market has felt the absence of the railroad as a strong buying factor. Demand from this quarter has been the great incentive to the activity in the United States, and it is felt here that the time cannot be far distant when Canadian roads must show a similar movement. November has closed with a fair record. Orders have not been large, but the showing on the whole has been encouraging.

Iron and Steel.—Pittsburgh has not yet made announcement as to any marked changes that may apply in the first quarter, 1923. It was expected that the American Sheet and Tin Plate Company would make a move that would be of interest, but it is now declared that present quotations would stand. According to dealers, there appears to be no outstanding reason for price changing at the present time, in view of the somewhat conservative attitude of the market. Buyers still seem to be in control to a very definite extent, although difficult conditions surrounding production and delivery will tend to loosen absolute attitude. Dealers report a good demand for interior building materials, such as metal lath. Blue annealed sheets are also strong. Railroads have been buying considerable quantities of repair material. The sheet situation has stiffened. There is a steady market and, on the whole, business is good.

Steel imports are moving better, and contracts on plate and structural are being cleaned up gradually. The arrival of snow will not help the shipping situation. In fact those manufacturers who have been working on a hand-to-mouth basis owing to curtailed supplies, will now find their troubles multiplying. Current prices:—

Iron bars	3 25	3 40
Steel bars	3 25	3 40
Reinforcing bars	3 15	3 25
Steel hoops		4 75
Tire Steel		3 50
Spring steel	7 00	14 00
Band steel, No. 10 gauge and 3-16 in base		3 90
Small shapes		3 50
Sheets, black, No. 28		4 60
Sheets, blue, ann., No. 10		3 95
Canada plates, dull, 52 sheets		4 90
Canada plates, all bright		5 40
Galvanized Sheets, No. 28		6 25

Old Materials.—Markets both in Canada and United States are reported to be without feature. Furnace demand has slackened, and the opinion that there must soon be an adjustment of prices to meet the pig iron situation seems to be gaining ground. No. 1 machine cast iron is quoted at $18, and supplies available are somewhat short. A report from Pittsburgh makes this significant statement:—"The entire structure of the scrap iron and steel market is shaken by weakness. There has been a general decline in dealers' buying prices ranging from 50c to $1 per ton. Hardly a grade of scrap dealt in has escaped the decline. The market, of course, is a dealers' market entirely and the weakness is the result of forced sales, some dealers being anxious to sell material in view of the weakness in other co-related iron and steel products. Sales have been on a small scale, but they have been sufficient to cause dealers to endeavor to sell every prospect. Mills are not buying. The weakness in pig iron and the difficulty in disposing of finished steel products has caused mills which would otherwise be in the scrap market to hold off, in the expectation of a decline in prices." Dealers' prices on the Toronto market:—

Copper, light	9 00
Copper, crucible	11 25
Copper, heavy	11 00
Copper wire	11 00
No. 1 composition	9 00
New brass cuttings	7 00
Red brass turnings	7 00
Yellow brass turnings	5 25
Light brass	4 50
Medium brass	6 00
Scrap zinc	3 50
Heavy lead	4 50
Tea lead	3 00
Aluminum	11 00
Boiler plate, per gross ton.	9 00
Heavy melting steel	10 00
Axles (wrought iron)	20 00
Rails (scrap)	11 00
Malleable	10 00
No. 1 machine cast iron	18 00
Pipe, wrought	7 00

Non-ferrous Metals.—Notable features in this market centre in the tin situation. London reports heavy slump in prices and this has had a tendency to depress the market. Prices have eased. American buying is said to be negligible. Sales of copper are said to represent a fair volume. Competition among American sellers is said to have caused a slight shading of prices. Canadian quotations remain unchanged. Buying is being done on a very conservative basis,

although the month's volume is considerable. Current prices:—

Lake copper	17 25
Electrolytic copper	17 00
Castings, Copper	16 50
Tin	41 00
Lead	7 50
Spelter	9 50
Antimony	8 50
Aluminum	22 00

Pig Iron.—There is no forward buying to speak of. Small quantities only are moving, and it is said that this feature reflects the condition of business in many quarters although there are evidences that, taken as a whole, the demand for castings is fair. Radiator plants and those having to do with plumbing and heating operations, have had a good season.

Manufacturers of copper and brass products report that supplies are coming through in sufficient quantities to keep plants running. The demand is fairly brisk. It is hinted that any change in prices will tend upwards. Some houses are featuring fancy gift lines for Christmas trade for the first time and report encouraging sales.

Montreal

November 29.

THAT it is difficult to say very much of definite significance about Canadian steel markets, as there is so little of interest to mention, seems to indicate the general tenor of opinion here. "The economic conditions of the country," said a prominent dealer, "do not seem to be conducive to important undertakings being promoted and the most important customers which the Canadian Steel Mills and allied interests have always been depending upon as a basis of their business have almost entirely been missing this year—that is the Canadian Railways. Their buying has been extremely restricted and it is an accepted fact that if the railway interests of our country do not carry on normal buying for new equipment and repairs, conditions in the Canadian steel trade are not reckoned as being normal. There is no indication of the railways altering their policy of retrenchment, but a large section of the trade are hopeful that when the co-ordination of the government railways takes place after the new management gets into working shape, that this institution will anyway enter the market for a considerable amount of new equipment."

The current demand for general steel commodities continues fairly quiet and prices have not changed in any respect from what have been quoted during the last two weeks. Supplies in warehouses, such as plates, sheets, bars, boiler tubes shafting, etc., are none too large and if the demand was heavy there would be a complete shortage in many lines with consequent advances in prices. Delays at sources of supply are responsible for the reduced stocks and it would not be surprising if, in the course of a week or two, local warehouse prices were advanced anywhere from $2.00 to $3.00 per ton.

Iron and Steel.—The demand for these commodities continues quiet without any change in prices. Manufacturers of sheet metal and tinware products are understood to be fairly busy and are well supplied with sufficient raw materials to carry them over the next several months. Montreal firms have been importing heavily of late and plentiful supplies appear to be on hand to care for all the needs of the jobbing trade. The American Sheet Mills have just opened their books for first quarter business. The price of tin plates has been set at $4.75 base Pittsburgh, while black and galvanized sheets will probably be maintained on the present level, namely: $3.35 base for 24 gauge, one pass black, and $4.35 base for 28 gauge, gal., with blue annealed at $2.50 to $2.60 base for No. 10 gauge. All prices are f.o.b. Pittsburgh. Spelter, having recently suffered a considerable increase in cost, which is holding firmly, will not be an encouragement to users of galvanized products to expect lower prices in the near future.

Current prices:—

Iron bars, base	3 15 to 3 25
Steel bars, base	3 15 to 3 25
Reinforcing bars, base	3 15 to 3 25
Steel hoops	4 00
Tire steel	3 25 to 3 40
Spring steel	7 00
Band steel, No. 10 gauge and 3-16" base	3 65 3 75
Small shapes	3 40
Sheets, black, No. 28	4 75
Shets, blue, ann., No. 10	4 10
Canada plates, dull, 52 sheets	5 50
Canada Plates, all bright	7 00
Galvanized Sheets, No. 28	6 50

Boiler Tubes.—The demand is not very brisk at present, which is probably a good feature as supplies in warehouses have been reduced to a low level as a result of the backward conditions at the mills. Deliveries from mills have for some time been considerably deferred and supplies have not been replenished at anything like the rate at which they have been disposed of, and on this account there is a possibility of advances being announced shortly, as there are no appearances of improving shipping conditions at the various mills.

Pig Iron.—Pig iron market is somewhat more active, particularly as regards operations of two or three of the larger companies, and reasonable buying has been done for deliveries extending over the next three months. Fair inquiry has also been received from foundries throughout the province, but as yet most of the orders are being placed for import iron which continues to sell at under the prices asked for Canadian product. The season of navigation is now about to close and metal arriving is being disposed of by importers for shipment from the dock, but it is anticipated that once the direct import supplies have been shut off and such importers as have put iron into stock ask higher prices from warehouse than from the dock (this necessitated by additional charges in the way of cartage, storage, interest, etc.), Canadian producers will stand a better chance of securing what business is going. So far as I can learn, the tonnage of iron being put into store by importers here is comparatively small and will probably be peddled out in small lots at remunerative prices.

A rather quiet period during the balance of this year is anticipated, but the general feeling seems to be for a slower demand for product entering into building construction during the winter months, but the consumption of iron for use in general foundries manufacturing castings for machinery trade, etc., will probably show some improvement.

Prices on pig iron in the United States have shown considerable reduction during the past few weeks, but taking into consideration the present costs of manufacture it is felt that this has been somewhat overdone, and advices received by us from prominent manufacturers are to the effect that there will probably be better business, with upward trend in prices, after the beginning of next year. Premium prices for quick delivery on steel, made by U. S. manufacturers, have been more or less wiped out, and the basis is now somewhat lower than it was two or three months ago, but in view of the high costs of manufacture and probable further advances in labor costs, I do not see how prices can show much more reduction without serious loss to manufacturers. Generally speaking, the tone is hopeful, with fair amount of business moving. Current prices:—

Algoma, No. 1, car lots on tracks, nominal quotation	36 15
Summerlee, 30-ton lots, dock	35 00
Carron, 30 ton lots	35 00
Do., 5 ton lots, ex. warehouse	40 50

Non-ferrous Metals.—The metal market has been somewhat easier this week, especially in tin and zinc. The advance, however, in both of these metals has been so rapid that a reaction is not surprising. These two metals reflect an attitude on the part of both American and English producers and consumers, the one trying to depress and the other to advance prices. England is forced to come to the U. S. A. for zinc and naturally does not wish to pay more than is absolutely necessary. Tin, on the other hand, is controlled by Great Britain and they are naturally desirous of making the Americans pay as stiff a price as possible. Outside factors naturally have some effect but the situation at present is a fairly even one and it is not easy to say what the next movement will be. We are naturally entering into a quiet period of the year and with lessened consumption there may not be much change.

Business generally is better than at this time last year but somewhat quieter than a month ago. Business will probably be quiet until the turn of the year, when there should be an improvement. Current prices:

Lake Copper	17 50
Electrolytic Copper	17 25
Castings, Copper	17 00
Tin	45 00
Lead	8 00
Spelter	9 25
Antimony	7 50
Aluminum	22 00

Pittsburgh

November 29.

PRODUCTION of steel ingots is at a trifle above 40,000,000 gross tons a year, which was the rate in October. This represents an operation of the steel industry of between 75 and 80 per cent. of capacity. Production is at the highest rate since October, 1920.

In the past few weeks there have been numerous business reviews, from various sources, all suggesting that "business is going to be better." There has been such unanimity in these reports that the observer may easily be deluded. Presumably the average man does not wish to be deluded, but prefers to have the actual facts. There has been much talk in the past two years of "the business cycle," which has it that business improves for a time, stays good for a time, declines and then stays poor for a time. All these reviews say that business has been growing better, and then infer that it is going to continue growing better.

There has been a secondary inflation. At first the inflationary tendency was resisted strongly by the large and conservative banking and industrial interests, but when the United Mine Workers won their great victory last August, fastening upon the country a coal producing cost outrageously out of harmony with economic principles, this resistance was largely withdrawn, with idea that the inflation would perforce have to be allowed to run its course.

The question really is how much more of the course remains to be run? Already there are some observers who believe it is through. None can show that there are many more months. The business reviews infer that because business has been improving it is going to continue to improve, but that is no argument according to the business cycle principle or according to the fact that already there has been inflation. Steel production has been increasing since July, 1921, 18 months, which is rather a long time. Steel prices turned upward last March, eight months ago.

Consumption Increases

A very crucial fact, that should be kept prominently in mind, is that since October 1 steel production has been at a rate more than 15 per cent. above the average rate in the six months preceding, which period certainly began with no stocks, so that consumption could not have exceeded the production. Consumption now must, therefore, be more than 15 per cent. heavier in order to maintain a balance, and it is hard to expect this in view of the season of the year.

Markets are made by men as well as by materials, hence the psychology of the situation must be considered. The great coal strike was expected to interfere with production and men were disposed to buy as a safeguard. Now the coal strike is over, and the railroad congestion that was expected to follow has shown what it would amount to, the fears of buyers are removed, yielding to a feeling that one can get steel whenever he takes a notion to place an order. Sellers' market and buyers' market alternate. Capacity to produce steel increased since 1913 more than ability to buy steel, but great operating difficulties, practically unknown before the war, have intervened to prevent the full capacity being available for production, and on this account there has been more of a sellers' market than would otherwise have been the case.

Sheet and Tin Plate Prices

November 23 the American Sheet & Tin Plate Company (Steel Corporation) made its long-awaited announcement as to prices. Contrary to expectations, very generally entertained four to six weeks ago, and to some expectations that still survived, there were no advances, former prices being continued throughout. The company's prices are: $4.75 for 100-pound coke tin plate, first quarter to jobbers, first half to manufacturing consumers; sheets for first quarter to all buyers; blue annealed, 2.50c; black, 3.35c; galvanized, 4.35c; automobile sheets, 4.70c.

Talk of prospective advances has been so widespread that an explanation why there are no advances may be in order. It has been argued that tin plate did not advance since last March while all other steel products did, hence tin plate ought to advance now. The $4.75 price was, however, rather a high one for the conditions existing a year ago, and most of the time since then, until recently, it has been shaded by independents, sometimes deeply. Thus there really has been a market advance though not an "official" advance. In 1920 the Steel Corporation's prices were very far below the independent prices in all steel products, and in the past few months the corporation has in general been below the independents. The corporation wants a reputation in this respect and treasures it, and naturally it must have been very irksome for this relatively small commodity of tin plate to be an exception to the general rule.

In the matter of sheets, the independent market in September and October was well above the corporation level, but in the past few weeks black sheets first declined to the corporation price of 3.35c and then galvanized sheets declined to its 4.35c price. When the corporation advanced at the middle of last August, to the present prices, it was following advances previously made by independents. This time making an advance would have been taking the lead, and it is altogether doubtful whether the lead would have been followed, or at least maintained, up to April 1.

An argument was made about raw material, the $40 sheet bar price being cited. The practical fact is that the sheet bar market follows the sheet and tin plate market and does not make it. That is market history. It is merely theory to say that sheet bars are the raw material. Only a small proportion of the sheet and tin plate output is made from purchased bars, the great bulk being by mills that make their steel themselves. The market turnover is much smaller in sheet bars than in sheets and tin plate, in other words it is the subsidiary market. Sheet bars will have to come down. They are already down to $37.50 or $38, and probably they will be under $35 for first quarter delivery.

Bars, shapes and plates continue quotable at 2.00c as the ordinary market, but no effort is made to keep it secret that desirable orders can be placed at slight concession at least. Pipe is very strong, there being virtually a famine in ½ to 2-inch, on account of the unprecedented boom in garage and dwelling house construction. Nails for the same reason are strong and far from plentiful.

Coal, Coke and Pig Iron

That the general market situation is without coherence, with prices fortuitous instead of being logical and properly supported, is shown by the fact that last week coal declined 75 cents a ton, while coke, which it is well known is made from coal, advanced 50 cents and pig iron, which it is equally well known is made with coke, declined $1. Latest quotations are: Pittsburgh district steam coal, $2.50 to $2.75; Connellsville furnace coke, spot or prompt, $7.25 to $7.50; valley pig iron, $30 for Bessemer, $27 for basic and $27.50 for foundry. The pig iron prices given are practically asking prices and might yield on appearance of an interested inquiry.

STEEL PRODUCTION INCREASES

American Steel production passed the 1913 average in the second quarter of this year, with output of 8,906,000 tons, or 17 per cent. more than pre-war standards. British production in that period was 66 per cent. of the 1913 average. France and Germany are behind England in this regard.

American ingot production declined in the third quarter, as compared with the second, principally as a result of the coal and rail strikes, which forced closing of many plants. Production of pig iron was far below the average of 1913 in both England and the United States in the first three quarters of the present year. The American industry, however, led the British in approaching the pre-war average. British pig production was: First quarter, 977,900 long tons, or 38 per cent of the 1913 average; second quarter, 1,171,400 tons, or 45 per cent. and third quarter, 1,241,100 tons, or 49 per cent. American pig production was as follows: First quarter, 1,296,000 tons, or 89 per cent. or the average 1912 output; second quarter, 1,267,000 tons, or 87 per cent, and third quarter, 1,548,000 tons, or 81 per cent.

British coal mine owners hope to build up a permanent export trade in coal with Canada. Officials of the Canadian Government Merchant Marine are encouraging the idea.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Toronto price:—

Silicon, 2.25% to 2.75%	$33.80
Algoma, No. 1, Montreal	36 15
Summerlee, Scotch, Montreal dock	35 00
Summerlee, Warehouse, 5-ton	40 50
Carron, Montreal docks	35 00
Grey forge, Pittsburgh	28 77
Lake Superior, charcoal. Chicago	36 15
Standard low phos., Philadelphia	38 00
Bessemer, Pittsburgh	33 27
Basic, Valley furnace	$27 to $28

METALS

	Montreal	Toronto
Lake copper	$17 50	$17 25
Electrolytic copper	17 25	17 00
Castings, copper	17 00	17 00
Tin	45 00	41 00
Spelter	9 25	9 50
Lead	8 00	7 50
Antimony	7 50	9 00
Aluminum	22 00	22 00

Prices per 100 lbs.

BILLETS

F. O. B. Pittsburgh

	Per gross ton
Bessemer billets, 4 in. x 4 in. and larger	38 00
Open hearth billets	38 00
O. H. Sheet bars	38 00
Forging billets	45 00
Bessemer rods	46 50

IRON AND STEEL

Per 100 lbs. to large buyers

Iron bars, base, Toronto	$3 25	3 40
Steel bars, base, Toronto	3 25	3 40
Small shapes, base		3 50
Iron bars, base, Montreal	3 15	3 25
Steel bars, base, Montreal	3 15	3 25
Reinforcing bars, base	3 15	3 40
Steel hoops		4 50
Tire steel, base		3 50
Spring steel	7 00	14 00
Band steel, No. 10 gauge and 3-16 in. base		3 90
Chequered floor plate ¼" and heavier	6 25	7 00
Chequered plates ¼-in. and heavier, sunken diamond		5 40
Bessemer rails heavy at mill		2 35

PITTSBURGH MILL

Steel bars	2 00
Tank plates	1 90
Structural shapes	2 00
Steel hoops	2 90 to 3 00

F. O. B. Chicago Warehouse

Steel bars	2 80
Structural shapes	2 90
Plates	2 90
Small shapes under 3-in.	2 75 to 2 90

PLATES

Plates 3-16 in.	$3.85	$3 60
Plates, ¼ up	3 50	3 40

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$ 4 60	$5 10
Sheets, blue ann., No. 10	3 85	4 20
Canada plates, dull, 52 sheets	5 25	4 90
Can. plates, all bright	6 50	5 40
Galvanized sheets, No. 28	6 75	6 25
Queen's Head, 28 B.W.G.	7 25	
Fleur de Lis, 28 B.W.G.	7 00	
Gorbal's best, No. 28, U. S. G.	6 10	
Colborne's Grown, No. 28		
Premier 28	6 10	6 35
Premier 10¾ oz.	6 80	6 75
Zince sheets	10 25	10 75 11 00

FREIGHT RATES

Pittsburgh to Following Points	Per 100 lbs. C.L.	L.C.L.
Montreal	52	65½
St. John, N. B.	76	96
Halifax	77½	97
Toronto	34	48½
Guelph	34	48½
London	34	48½
Windsor	31½	45½
Kingston	48½	61

OLD MATERIAL

Dealers' Average Buying Prices

	Montreal Per Ton	Toronto Gross
Boiler plate	$ 9 00	$ 9 00
Heavy Melting Steel	10 00	11 00
Axles (wrought iron)	20 00	16 00
Rails (scrap)	11 00	11 00
Malleable scrap	10 00	11 00
No. 1 Machine cast iron	22 00	18 00
Pipe, wrought	7 00	6 00
Car wheel	17 00	16 00
Steel axles	15 00	15 00
Mach. shop turnings	6 00	6 00
Stove plate	16 00	14 00
Cast boring	6 00	6 00
Copper, light	9 00	9 00
Copper, crucible	11 50	11 25
Copper heavy	11 25	11 00
Copper, wire	11 25	11 00
No. 1 machine composition	9 00	9 00
New brass cuttings	7 00	7 00
Red brass turnings	7 25	7 00
Yellow brass turnings	5 25	4 85
Light brass	4 50	3 50
Medium brass	6 00	4 50
Scrap zinc	4 50	4 00
Heavy lead	4 50	4 50
Tea lead	3 00	3 00
Aluminum	11 00	11 00

COLD ROLLED STEEL

(At Warehouse)

Rounds and squares	$4 75 base
Hexagon and flats	$5 75 base
Cumberland ground shafting, base	$6 00 base

COPPER PRODUCTS

Prices per lb.

	Montreal	Toronto
Copper bars, 1¼ to 2 in.	30-31	.28
Plain sheets, 16 oz. in. 30 x 72 hot rolled	31-32	.29
Copper sheet, tinned, 16 oz.	36 00	.36
Copper sheet, planished, 16 oz. base	40 00	.46
Braziers', in sheets, 6 x 4 base	.30	.29
Copper tubing, seamless		.33

LEAD SHEETS

Roll Lot Prices

	Montreal	Toronto
Sheets, 3 lbs., sq. ft.	$ 9 90	$10 50
Sheets, 3½ lbs., sq. ft.	9 75	10 50
Sheets 4 to 6 lbs. sq. ft.	9 50	9 50
Cut sheets, ¾c. per lb. extra		
Cut sheets to size, 1c. per lb. extra		

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in.	22
Brass sheets, 24 gauge and heavier base	25
Brass tubing, seamless	30

STANDARD BUTTWELD PIPE S/C

Per 100 feet.

Price List No. 57. November 2, 1922.

	Steel Blk.	Gen. Wrot. Iron Galv.	Blk.	Galv.
⅛ in.	6 00	8 00	....	....
¼ in.	3 96	6 00	7 20	9 30
⅜ in.	3 96	6 00	7 20	9 30
½ in.	5 02	6 55	7 31	8 93
¾ in.	6 10	7 82	8 86	10 70
1 in.	8 67	11 22	12 75	15 47
1¼ in.	11 73	15 18	17 25	20 93
1½ in.	14 03	18 15	20 63	25 03
2 in.	18 87	24 42	27 75	33 67
2½ in.	29 84	38 61	....	....
3 in.	39 02	50 49	....	....
3½ in.	50 60	64 40	....	....
4 in.	59 95	76 30	....	....

STANDARD LAPWELD PIPE

Per 100 feet.

Below dividing line price per foot.

	Steel Blk.	Gen. Wrot. Iron Galv.	Blk.	Galv.
2	22 20	27 75	31 08	37 00
2½	32 76	41 54	46 80	56 16
3	42 84	54 32	61 20	73 44
3½	51 52	65 32	73 60	88 32
4	61 04	77 39	87 20	104 64
4½	71 12	90 17	1 07	1 27
5	82 88	105 08	1 24	1 48
6	1 08	1 36	1 61	1 92
7	1 40	1 79	2 07	2 50
8L	1 48	1 88	2 18	2 63
8	1 70	2 16	2 51	3 02
9	2 07	2 62	....	....
10L	1 92	2 43	2 82	3 63
10	2 47	3 13	3 63	4 37

Prices—Ontario, Quebec and Maritime Provinces.
Terms—2% Cash discount if paid within 30 days.

Provinces

WROUGHT NIPPLES

4-in. and under, close and short, 55 per cent.

4½-in. and larger, close and short, 45 per cent.

4-in. and under running thread, 35%.

Standard couplings 4-in. and under 25%.

Do., 4½-in. and larger 5 per cent.

MALLEABLE FITTING LIST

1 in. elbow	.32	.53
2 in. elbow	1.05	1.70
1 in. tee	.43	.70
2 in. tee	1.45	2.40
1 in. coupling R. & L.	.38	.53
1 in. locknut R. & L.	.15	.23

Discount to dealers—70 per cent.

BOILER TUBES

Sizes	Seamless Toronto	Lapw'ld Toronto	Seamless Montreal	Lapw'ld Montreal
1 in.	20.00	....	23.80	....
1¼ in.	22.00	....	23.80	....
1½ in.	24.00	....	28.80	....
1¾ in.	24.00	....	24.50	24.00
2 in.	22.00	19.00	21.00	19.75
2¼ in.	24.00	21.50	24.00	22.25
2½ in.	27.00	23.50	27.00	23.25
3 in.	34.00	28.50	34.00	29.50
3¼ in.	36.00	....	36.00	....
3½ in.	38.00	33.00	38.00	34.25
4 in.	50.00	42.00	49.00	43.50

Prices per 100 ft., Montreal and Toronto

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, 7-16 and up	30
Carriage bolts, ⅜ in. and smaller 6 in. and shorter	40
Coach and lag screws	45
Stove bolts	72½
Wrought Washers	60
Do., corru. head	60
Machine bolts, 7-16 and over	35
Machine bolts, ⅜-in. and less	35
Blank bolts	35
Bolt ends	35
Machine screws, fl. and rd. hd., steel cut thread	37½ & 10
Machine screws, o. and fil. hd., steel cut thread	30
Machine screws, o, and fil. hd., brass cut thread	15
Standard couplings, 4-in. and under, brass cut thread	30% 30
Nuts, square, blank off net list	$1.00
Nuts, square, tapped off net list	50c.
Nuts, hex., blank off net list	50c.
Nuts, hex., tapped net list	
Copper rivets and burrs, list less	32c.
Burrs only, list plus	10%
Iron rivets and burrs	47%
Boiler rivets, base ¾ in and larger	$5.75
Structural rivets, as above	5 65
Wood screws, O. & R., bright	80
Wood screws, flat, bright	82½
Wood screws, flat brass	77½
Wood screws, O. & R., brass	75
Wood screws, flat, bronze	72½
Wood screws, O. & R., bronze	70

NAILS AND SPIKES

Wire nails, base	$3 65
Cut nails, base	4 35
Miscellaneous wire nails	72½%

MILLED PRODUCTS

(Prices on unbroken packages)

Set screws	65
Square and hexagon head cap screws	60
Round head cap screws	20
Fillister head cap screws	35
Flat head screws	25
Button head cap screws	20
Studs	45
Semi-finished nuts up to and including 9/16 in.	70
Semi-finished nuts ⅝ to 1¼ in.	65
Semi-finished nuts 1⅜ to 2 in	35
Coupling bolts	35
Taper pins, up to and including No. 5	65
Taper pin No. 6 and over	55
Planer bolts without fillet	10
Planer bolts with fillet	Net
Patch bolts	Plus 10%
Hollow set screws	20
Thumb screws	50
Thumb nuts	70

CARBON DRILLS AND REAMERS

	Discount.
S. S. drills, wire size	60
Can. carbon cutters	plus 10
Standard drills, all sizes	60
3-fluted drills, plus	10
Jobbers and letter sizes	60
Bit stock	50
Ratchet drills	25
S. S. drills for wood	10
Wood boring brace drills	50
Electricians' bits	30
Sockets	50
Sleeves	30
Taper pin reamers	20
Drills and countersinks	20
Bridge reamers, carbon	30
Centre reamers	Net
Taps, machine screw	55 to 60
Taps, hand, ¼ in. to ⅜ in	40 to 45
7/16 in. to. ⅝ in.	40 to 50
11/16 in. to 1 in.	35 to 45
Chucking reamers	20 off
Hand reamers	20
High speed drills, list	40
Can. high speed cutters	plus 10
American	plus 40

FILES AND RASPS

Globe	60/5
Vulcan	50
P. H. and Imperial	60
Nicholson	35/5
Black Diamond	35/5
Heller	40
Jowitts	net
J. Barton Smith, Eagle	55
McClelland, Globe	50
Delta Files	20
Disston	40
Disston	50
Great Western-American	50
Kearney & Foote, Arcade	60/5

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

PROOF COIL CHAIN

B. B. B. CHAIN

⅜ in., $16.45; 7-16 in., $14.00; ½ in., $12.95; 5-8 in., $13.15; ¾ in., $12.75; ⅞ in., $12.25; 1 in., $11.85; 1⅛ and 1¼ in., $10.55. Fire weld chain same sizes respectively are $14.00; $11.50; $10.40; $10.55; $10.15; $9.75; $9.35; and $8.25.

ELECTRIC WELD COIL CHAIN B.B.B.

⅛ in. $20.00; 3-16 in. $16 50; ¼ in. $15.50; 5-16 in. $12.70.

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	30%
Standard	30 and 10%
Cut leather lacing, No. 1	1.75
Leather in side, (Lacing)	1.50

RUBBER BELTING

Standard 36 ....28% Best grades 28%

TAPES

Chesterman Metallic, 50 ft.	$5 00
Lufkin Metallic, 603, 50 ft.	3 17
Admiral Steel Tape, 50 ft.	3 00
Admiral Steel Tape, 100 ft.	4 50
Major Jun. Steel Tape, 50 ft.	3 75
Rival Steel Tape, 50 ft.	4 00
Rival Steel Tape, 100 ft.	8 75
Reliable Jun. Steel Tape, 50 ft.	5 25

PLUMBING SUPPLIES

Plumbers' oakum, per cwt.	6 00
Navy oakum, cwt.	13 00
Solder, strictly	0 25
Solder, guaranteed	0 26½
Soldering coppers, lb.	0 62½
White lead, pure, cwt	13 20
Red dry lead, 100-lb. kegs, per cwt.	9 75
Wood alcohol, per gal.	1 75
Whiting, plain, per 100 lbs.	3 00

ROPE AND PACKING

Packing, square braided	0 38
Packing, No. 1 Italian	0 31
Packing, No. 2 Italian	0 24
Pure Manila rope ¾ and larger, base	0 20
British Manila rope	18
New Zealand hemp	0 18
Jute packing, fine	15c
Jute packing, coarse	11c

OILS AND COMPOUNDS

Castor Machine Oil, per lb.	34½
Royalite, per gal. bulk	21
Machine oil, per gal.	39
Black oil, per gal. (Summer)	19
Cylinder oil, Capital	69½
Turp., single bbls., gal.	2 25
Linseed oil, raw, single bbls.	1 09
Premier gasoline	29 00
Fuel oil, bbls., gal.	11 80

WASTE

XXX Extra	16	Atlas	18
Peerless	21	X Empire	13
XX Grand	15	Ideal	18
Superior	20	X Press	11½
X L C R	14		

Colored

Lion	12	Fancy	13½
Standard	10½	Popular	9
No. 1	13	Keen	7½

Wool Packing

Arrow	24	Anvil	16
Axle	20		

Washed Wipers

Select White	18	Dark colored.	13
Mixed Colored	14		

This list subject to trade discount

PLATING SUPPLIES

Polishing wheels, felt	$3 25
Polishing wheels, bull-neck	1 60
Emerey in kegs, Turkish	7½
Pumice, ground	3 to 4½
Emery glue	18
Tripoli composition	6 to 8
Crocus composition	12
Emery composition	11
Rouge, silver powder	60
Rouge, powder, nickel	35

Prices per lb.

ANODES

Nickel	40 to 45
Copper	22to 24
Zinc	14 to 14½

PLATING CHEMICALS

Acid boracic	.20
Acid, hydrochloric	.03¾
Acid, nitric	.10¼
Acid, sulphuric	.03¾
Ammonia, aqua	.20
Ammonium, Carbonate	.15
Ammonium, chloride	.13
Ammonium, hydrosulphuret	.75
Ammonium, sulphate	.10
Arsenic, white	.18
Copper carbonate, anhy.	.26
Copper, sulphate	8 to 10
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.14
Nickel carbonate	.32
Nickel sulphate	.14
Potassium sulphide (substitute)	.40
Silver chloride (per oz.)	.85
Silver nitrate (per oz.)	.70
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium evanide, 127-130%	.31
Sodium hyposulphite	.08
Sodium phosphate	.10
Tin chloride	.50
Zinc chloride, C. P.	.30
Zinc sulphate	.06

Prices per lb. unless otherwise stated

Factory Cost—From Rough Castings to Product

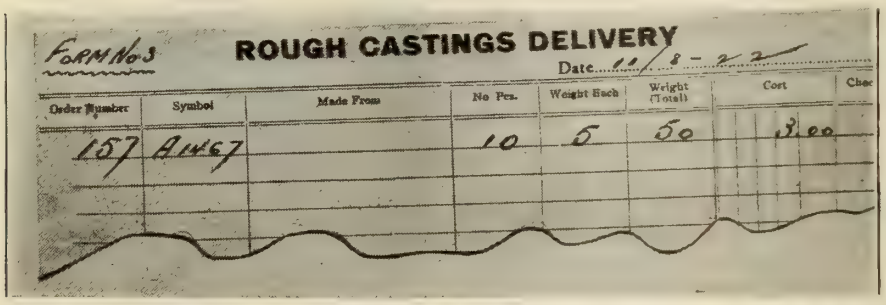
Prime Cost and How to Find It—Accurate and Practical Way to Record Foundry Operation—Time-Keeping Methods—Operators' Point of View Not Always Reliable

By A. LUENBERG

Article No. 2

TOTAL cost to manufacture and sell consists of raw materials, cost direct labor, indirect expense or overhead, and selling expense.

Cost of materials and cost of direct labor make up what is called "Prime Cost."


FORM No 3 ROUGH CASTINGS DELIVERY

Date 11/8-22

Order Number	Symbol	Made From	No Pcs.	Weight Each	Weight (Total)	Cost	Chec
157	A1467		10	5	50	3.00	

Form No. 3—Materials sent to production are listed on castings delivery sheets such as these.

Indirect expenses, overhead or burden added to prime cost give "Factory cost." The expense of selling product, added to factory cost, give "Total Cost" to manufacture and sell. Total cost, plus a fair profit, is price product should be sold for.

For the benefit of manufacturing concerns making their own castings and foundries, an accurate and practical way of how to find cost of rough castings was outlined in edition of November 9th.

Chart No. 1 of this issue, is very effective to show efficiency or deficiency of foundry. Every heat is marked down from heat reports showing percentage of good casting, foundry returns like foundry bad castings, drop, shot, gangway, etc., and shrinkage.

Indirect expense or overhead will be discussed in a later article.

How to Find Prime Cost

Costs may be made up of machine, piece, yard, ton, gallon, job, etc. No matter what unit of cost is wanted, cost of material, and cost of direct labor are the two components of prime cost.

Where cost of tonnage is wanted, prime cost is very easily found. Total tonnage produced in a given time is divided in wages paid workmen actually employed on product during that time. This done, result is direct labor cost per ton. Cost of raw materials used for a certain period, plus cost of direct labor for the same time, divided by tonnage give prime cost per ton of product.

Actual time spent by employees on jobs is in many cases taken from clock cards. Workmen entering plant in morning ring in and by leaving at night ring out their cards. It is taken for granted employees worked on jobs every minute of the day. Breakdowns and delays caused through repairs are not taken into consideration. Clock cards are summarized at end of period, totals of same entered on cost summary sheets and this is the end of finding direct labor cost. This method may work out for a manufacturer with no competition and making his own selling prices, but as to knowledge of cost to manufacture, he has none.

Time-Keeping Methods

Keen competition and large fluctuations in prices have made it necessary to install up-to-date time-keeping systems. In addition to the ordinary clock cards, daily time sheets like your No. 2 are used. Machining orders, like No. 5, are made out for stock as well as productive assembly orders showing order numbers, symbol numbers and name of parts, number of pieces ordered, production centers parts have to go through, date finished and received in stockroom.

Materials sent to production centers are listed on castings delivery sheets, form No. 3 or requisitions form No. 4, giving exact information as required on stock order No. 5. The stock order card follows material from production

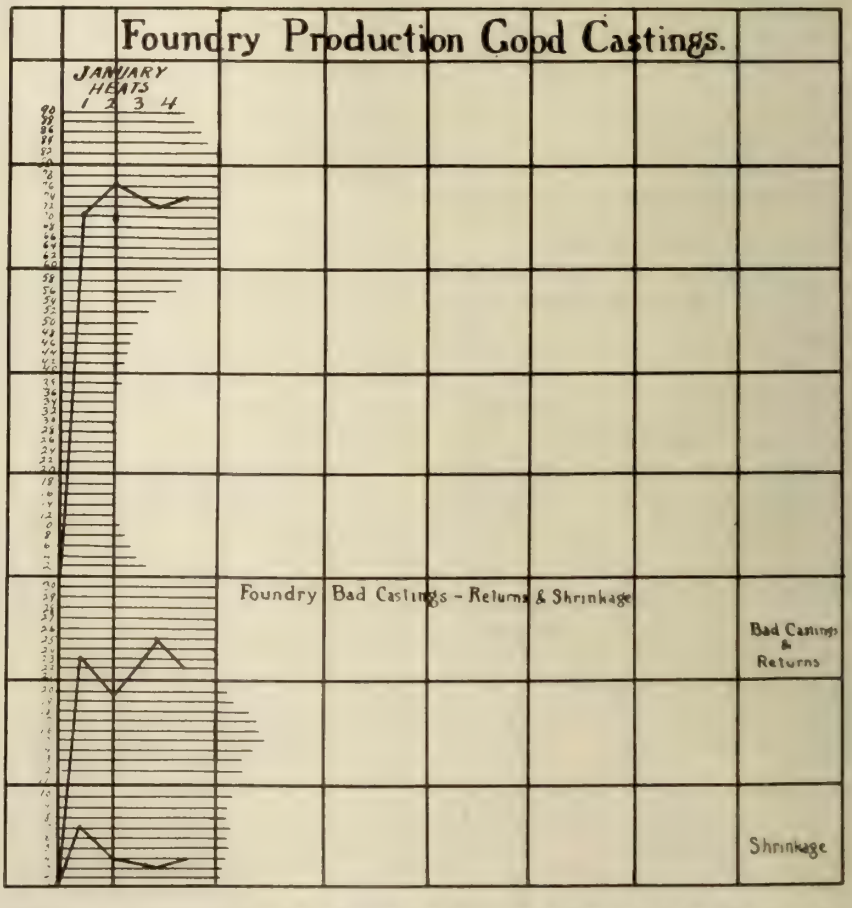


Chart No. 1—Useful in showing efficiency or deficiency of foundry. A complete record of production.

Dept. Milling Man No. 220
Mach. No. 190 DAILY TIME REPORT Hour Rate .60
Form 2

			Operation	No. Finish	Set Up	Dr. Lab.	Pc. Rate	PRICE	Stand Time	HOURS	AMOUNT	Order No.	No. Rec.	Symbol Part or Memo No.
		Stop												
		Start												
		Stop												
		Start												
		Stop												
		Start												
		Stop												
		Start												
		Stop										SC		IDLE TIME
	.4	Start								4	.24	2400		WAITING FOR TOOLS
11-10-22-5.0		Stop										S		
11-10-22-4.5	.5	Start	33	5						5	.30	405	5	767AE
11-10-22-4.3		Stop										S		
11-10-22-2.4	1.9	Start	37	1						1.9	1.14	157	10	A1467
11-10-22-2.2		Stop										M		
11-10-22-0.0	2.2	Start	36	7						2.2	1.32	193	6	B369
TOTALS	5.0									5.0	3.00			
Approved														

Form No. 2—Daily time sheets to supplement clock records.

center to production center until parts are finished and received at stockroom.

When making out rough castings delivery sheets as requisitions, great care should be taken as to exact weights. Only too often are materials handled in a very wasteful way and nobody seems to care about it, good money being paid for same just like that for direct labor.

Production center operations like planing, milling, drilling, etc., can be numbered for convenience and chart of same kept on back of daily time sheet.

Time consumed on stock order jobs or assembly orders should be filled in on time sheets as soon as work is done. This may be done by operator himself, foreman or special shop clerk.

Under no conditions should employees be allowed to make out their time sheets just before quitting time, especially where a large number of different orders are handled by each workman and individual time on jobs is sure to get mixed up.

Daily time sheets signed by foremen must not be accepted as indications of time being correct as detailed on them.

REQUISITION SHOP SUPPLIES USED FOR REQUIS. NO. 2000
FORM 4. REPAIRS FOR JOB NO. S405
DEPT. Raw Materials STOCK ENT.
DELIVER TO
DEPT. Lathe MACH. NO. DATE 11-8-22

BIN NO.	QUANTITY	WEIGHT	SYMBOL NO.	DESCRIPTION	UNIT	TOTAL COST
	5	40lb	767AE	1½" Rd x 10" C.R.	.05	1.00

RECEIVED B.B SIGNED A.M. Foreman

Form No. 4—Gives exact information to be entered on stock orders.

S405.
Form 5 ORDER FOR STOCK
Symbol 767AE Name Puller Stud No. Pcs. Ordered 5
No. Date 11/8-22 Drawing No. 10AE

Dept	Per. Del.	Date	Received by	Sent Ahead				Lost	Office Check
RM	4	11/10/22	C.R.						
L									
M									
SP									
S									

Pcs. Rec'd in Stock Room 5 Date 11/12/22 Storekeeper C.K.
Bin or Section No. 107 Weight of one piece 4½ lb

Form No. 5—These are made out for stock as well as productive assembly.

The operator, filling out his time sheet at the end of the day is more intent on showing he was working every minute while in the shop than giving information of actual time used on each job. No allowance is made for idle time, time used repairing machines, or wasted waiting for tools or other indirect labor performed by him.

For manufacturing concerns, where it is necessary to know cost of parts to arrive at cost of complete unit, time recorders are installed in every department and used in connection with daily time sheets. Time of start and stop is punched on recorder against every job or order number, giving the exact time it took to do the work. Standing order numbers are made out every month to take care of indirect labor performed by operators, totals of which are finally absorbed in general overhead expense. This system may look too far-reaching, complicated, and expensive, but as only intended for large concerns, it is, if once installed, easily operated, and through giving information sought, soon pays for itself.

The average small manufacturer can get along with the simple daily time sheet system made out by operator and signed by department foreman. If accurate cost is wanted and large competition to figure with, the time recorder system is preferable.

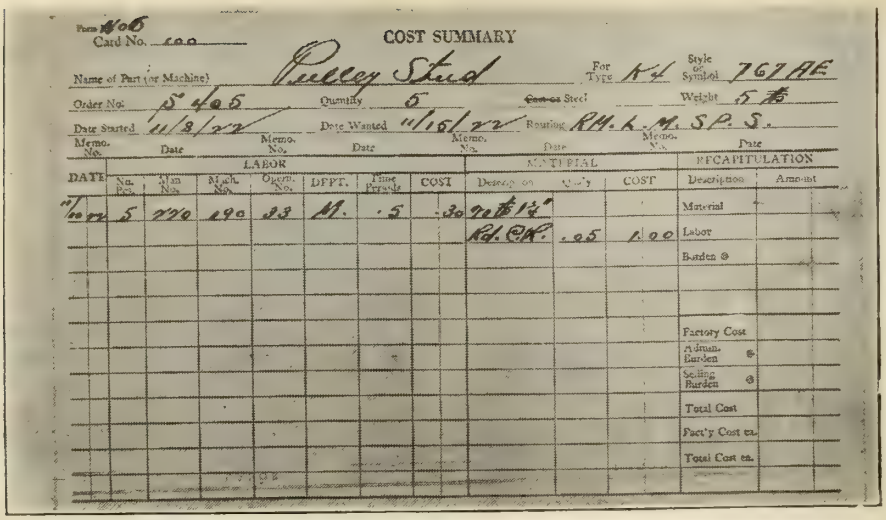
If you don't get to know how much it costs to manufacture, your competitor will and he is sure to beat you on the world market.

Cost systems, as a rule, are looked upon by employees as slave-driving monsters. In many cases very little is done on the side of workmen and foremen to keep system in proper function.

Employees demanding fair wages should bear in mind that manufacturer is entitled to a reasonable profit which can only be arrived at by ascertaining proper factory cost through efficient cost systems.

Daily Time Sheets

Cost summary cards like form No. 6 are made out and filed at cost department. Materials received at production centers are shown on delivery sheets and requisitions and prices summarized, and entered on cost summary cards.



COST SUMMARY

Name of Part (or Machine) Pulley Stud For Type K4 Style or Symbol 767AE

Order No. S405 Quantity 5 Cast or Steel Weight 5 lbs

Date Started 11/3/22 Date Wanted 11/16/22 Routing RM.L.M.S.P.S.

DATE	LABOR No. Pcs.	Man No.	Mach. No.	Operation No.	DEPT.	Time Hrs.	COST	MATERIAL Description	Quantity	COST
11/10/22	5	770	190	33	M.	.5	.30	70 #12" Rd. C.R.	.05	1.00

RECAPITULATION

Description	Amount
Material	
Labor	
Burden @	
Factory Cost	
Admin. Burden @	
Selling Burden @	
Total Cost	
Fact'y Cost ea.	
Total Cost ea.	

Form No. 6—Cost summary cards such as this are made out and filed at cost department.

Daily time sheets, where summarized, and distribution taken for payroll, are sent to cost department and time is entered on cost summary sheets against the order numbers as shown in form No. 6.

Nothing but actual time used by operators on jobs is entered on cost summary cards; any indirect labor done is chargeable against standing order numbers for such purposes.

All direct labor entered on cost summary cards for a certain period should show the same total as direct labor payroll for the same length of time. It is very important to make check like that once a month, to insure proper working of cost system and finding mistakes made either by cost clerks or time office. A cost system properly operated as outlined above is sure to give satisfaction.

When finished parts are received at stock room, stores receiving slip, form No. 7 is made out and sent to cost department indicating that direct labor is completed and cost summary card must be pulled and summarized. A stock record card like form No. 8 is made out for every part, showing in addition to all other information the factory cost price per piece.

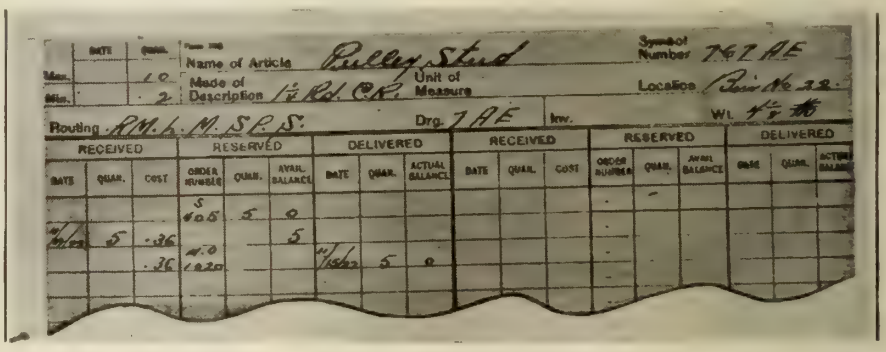
CANADIAN IRON ORES GOING TO GERMANY

A RECENT article in this paper from its Newfoundland correspondent, pointed out that much iron ore had been purchased during the past year by Germany from the British Empire Steel Corporation. Germany has been having difficulty in securing supplies of ore to meet manufacturing requirements and her metallurgists are thus turning their eyes towards Sweden and towards Canada or rather towards Newfoundland as sources from which iron ore may be procured. Much capital would be necessary to erect furnaces and re-establish the industry in Germany, but undoubtedly the capital would be forthcoming if the economical advantage of the investment was apparent.

It is very obvious that if Germany engaged in the iron industry in this way, manufacturing iron in Germany would speedily assume large proportions, writes Prof. James Mavor, Ph. D., in The Financial Post. The effect of this upon the demand for Canadian iron ore is obvious. The price of it would be driven up at once.

It is difficult to believe that the relatively high price of labor in Canada would permit of the competition of the iron manufacturers there with the French enterprises afflicted as they are with an excess of iron which they cannot sell, or even with the English manufacturers, so that the only real possibility of trade would lie in iron ore. If, however, the demand of Germany resulted in a prohibitive price for iron ore in this country, the blast furnaces in Nova Scotia would become idle. Under these circumstances, there might arise an irresistible demand for the imposition of a high export duty upon iron ore. Whether Newfoundland would or would not favor such a measure remains to be seen. It may be that Newfoundland would take the view that whether her iron ore went to Sydney, Cape Breton or to Bremen or Hamburg was economically a matter of indifference to her. Much, of course, would depend upon the quantity of iron ore available which was not subject to lease, or other contract obligations extending over future years. It is doubtful if Germany could get all the ore she requires from Sweden; but in any case demand for that product would stimulate the industry in that country as well as in Canada whether ore was exported from this country or not.

There is observable, however, an increasing disposition on the part of French industrial concerns to open up relations with the Germans to the end of mutual advantage.



Name of Article Pulley Stud Symbol Number 767AE

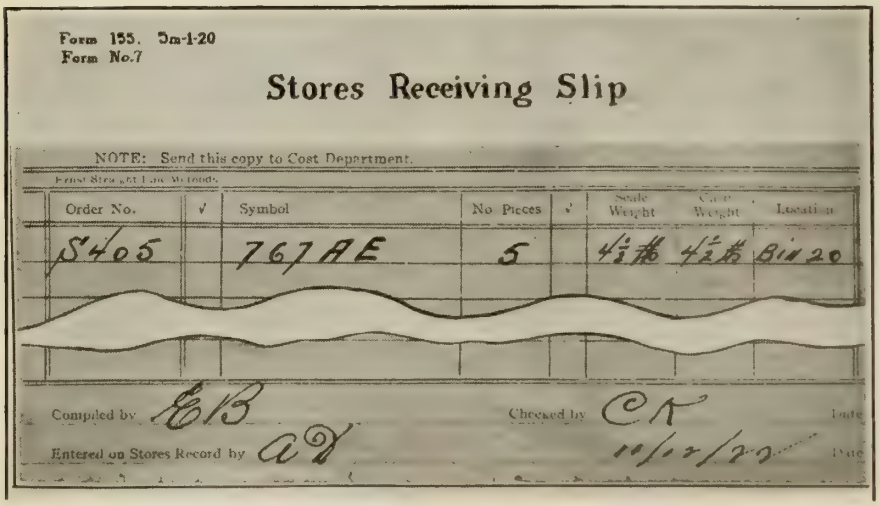
Made of Description ½ Rd. C.R. Unit of Measure Location Bin No 22

Routing RM.L.M.S.P.S. Drg. 7AE Inv. Wt. ½ lbs

RECEIVED DATE	QUAN.	COST	RESERVED ORDER NUMBER	QUAN.	AVAIL. BALANCE	DELIVERED DATE	QUAN.	ACTUAL BALANCE
			S 405	5	0			
11/10/22	5	.36			5			
		.36	1020			11/16/22	5	0

RECEIVED DATE	QUAN.	COST	RESERVED ORDER NUMBER	QUAN.	AVAIL. BALANCE	DELIVERED DATE	QUAN.	ACTUAL BALANCE

Form No. 8—Stock record card made out for every part.



Form No. 155. 5m-1-20
Form No. 7

Stores Receiving Slip

NOTE: Send this copy to Cost Department.

Order No.	√	Symbol	No. Pieces	√	Scale Weight	Case Weight	Location
S405		767AE	5		4½ lbs	4½ lbs	Bin 20

Compiled by EB Checked by CK Date

Entered on Stores Record by AV 11/12/22 Date

Form No. 7—Stores receiving slips are made out and sent to cost department.

News From the Industrial Field

Dominion Chain Co., Niagara Falls, Ont., report a marked improvement in business. They have a force of 105 men at present.

Ford Motor Co. have secured a site for a factory building on the south side of Danforth Ave., East Toronto. Structural operations are going forward at once.

Hanover:—A new company, Hanover Converters, Ltd., has started operations in the plant formerly used by the Hanover Cotton & Woollen Mills. They hope to employ 200 hands eventually.

W. M. Byers, one of the prominent industrial figures of Gananoque, is dead. He was largely interested in the Ontario Steel Products Co., the Gananoque Spring and Axle Co., and the Ontario Wheel Co.

The Conveyors Corporation of Chicago, through their Canadian agents, Cleaton Co., recently sold to Montreal Cotton Mills, Limited, Montreal, one of their ash conveyor systems, together with ash tank.

Bell Telephone are erecting an exchange, the first automatic of its kind in Toronto, on Main St., East Toronto. It will cost $100,000, and will be completed in January. P. H. Secord & Son are the contractors.

Battle Creek Toasted Corn Flake Co., of Battle Creek, Mich., are reported to have purchased a factory site on Danforth Ave. East Toronto, where they propose erecting a plant for cereal production.

St. Catharines.—The new collegiate institute and vocational school now being erected here will cost $475,000 and is to be occupied Sept. 1923. It will have 114 rooms, of which 45 will be classrooms; capacity 1,000 students. It is the only institution of its kind within a radius of 30 miles. The school will include one moving picture theatre for class and entertainment purposes, one auditorium, three lunchrooms, medical doctor's office, six executive offices, one library and two gymnasiums. S. B. Coon & Son, Toronto, are the architects; Geo. C. Cossaboom, resident engineer; W. H. Yates Construction Co., Hamilton, contractors.

Welland:—Canadian Atlas Crucible Steel Co. report improved business during the past month.

L. E. McKinnon, one of the founders of McKinnon Industries, St. Catharines, who was reported seriously ill a few weeks ago, is recovering.

William Rogers Mfg. Co.'s plant at Niagara Falls, Ont., has a production aggregating 300 gross articles per week. They make a line of silver plate and state that they are busier than at any time this year.

Skinner Bros. Mfg. Co., Inc., of St. Louis, Mo., manufacturers of the Baetz patent heaters, have decided to erect a Canadian plant in order to take care of Canadian and foreign business. Fred Skinner reports that they regard Canada as a field of great possibilities.

Calgary.—Up to the end of October, a total of 3,717 threshing machines had been registered in the province, a greater number than has been registered in any previous year. This is indicative of the large crop which is being harvested in the province this year and the consequent demand for more machines.

Welland.—Empire cotton mills are now operating with night and day shifts. There are said to be 800 hands employed. A solid brick extension, completed two weeks ago, is now being used. This company maintains club rooms with recreation and amusement facilities, such as bowling alleys, billiard tables, etc., for the benefit of employees.

Port Arthur:—Provincial Paper Mills, Limited, are putting in a 40-ton-a-day capacity book print mill and the Fort William Paper Co., two newsprint paper-making machines. Other extensions are proposed. Machinery at present being installed is arriving in 65 carloads, 25 for Port Arthur and 40 for Fort William.

Factory extensions now proceeding in Milton, Ont., include the remodelling of a building for the Milton Worsted Yarn Spinning Mills Co., new steel and cement warehouse and office for the P. L. Robertson Screw and Nail Co., and a new printing office for W. Panton. A knitting factory will start operations shortly. Brick-making plants are busy and are erecting new kilns.

Welland.—Page-Hersey Tubes are very busy. There is a strong demand for domestic pipe and shipments of skelp from Pittsburgh district are being maintained with difficulty.

Welland.—Site for the factory buildings of a new industry, Welland Cotton Mills, Limited, has been secured, and it is expected that building activities will shortly be under way.

American Cyanamid Co., Niagara Falls, Ont., manufacturers of air-nitrogen products used for agricultural, chemical and metallurgical purposes, are very busy at present. They have a working force of 800 men.

Welland.—Running 33 1/3 per cent. capacity, Canadian Mead Morrison employ 80 hands at present. Their machine shop for repair purposes on their rope-making machines is equipped with three engine lathes, drills, shaper, grinder and minor apparatus.

T. E. Webster, manager of the Toronto factory of the Diamond State Fibre Co., has just returned from Montreal. While there he looked over conditions in that field and reports improvement. The textile and sugar refineries are particularly active.

BUSY IN ST. CATHARINES

St. Catharines.—Industries here are fairly well employed. The present working forces of the concerns engaged in iron and steel and allied industries are as follows:—

McKinnon Industries, metal workers, 750.

English Electric Co., electrical equipment, 200.

Packard Electric Co., electrical apparatus, 100.

Canadian Yale and Towne Mfg. Co., locks and hardware specialties, 200.

Engineering and Machine Works, industrial and marine boilers, 150.

J. H. Williams Co., Canadian branch, tools, 100.

T. F. Shurley Co., formerly Metal Drawing Co., saws, 130.

McKinnon Columbus Co., welded chain, 125.

Welland Vale Mfg. Co., agricultural tools, 300.

General Forgings and Stamping Limited, Merritton, stampings, 50.

Each of the above firms reports marked improvement in business over the past few months. Several new industries are in prospect for location here.

STARTED WITH $500 AND A DRILL PRESS

"IF YOU keep on watching the time clock while you are supposed to be working, you'll never be more than one of the hands," is a true saying which should be taken to heart by anyone anxious to succeed. W. E. Corman has never set aside a certain number of hours as working hours, but believes in sticking to the task in hand, no matter how long it takes. It is this viewpoint, plus his varied experience and natural ability, that has carried him on. His company recently purchased the complete plant of the Chapman Double Ball Bearing Co., at 347-351 Sorauren Ave., Toronto.

Mr. Corman's career makes interesting and inspirational reading. Born on a farm at Stoney Creek in 1886, he showed and early preference for mechanics. He received his first schooling at the Hamilton Collegiate, and later attended the School of Applied Science in the Toronto University, taking up mechanical engineering. He graduated in 1909.

After finishing his schooling at the Hamilton Collegiate, he decided to study the practical side of mechanics before entering the University, so served his time as tool maker at the factory of the Hamilton Tool and Optical Co. The experience gained during his apprenticeship stood him in good stead as he passed through the University classes at Toronto. On graduating, he entered the service of C. H. and P. H. Mitchell, consulting engineers, and held the position of chief draftsman, finally becoming assistant engineer to C. H. Mitchell, now Brig. General Mitchell, dean of the Faculty of Applied Science and Engineering at Toronto University. While in this service, Mr. Corman acquired a wide range of practical knowledge in design, construction, etc., and supervised the erection of several buildings, installation of heating plants, hydraulic plants, had control over the erection of a number of dams, and also made a survey of certain parts in the Rocky Mountains. He travelled on engineering work as far as Vancouver, and secured a varied and valuable experience while engaged in this way.

The great war also helped to mould his career, and in the second year of the struggle, Mr. Corman was up to his ears in the munition game. He not only was engaged on shell work but entered the time-fuse field as well, and was the originator of many time saving tools to speed up production.

In 1919, the plant of the Corman Engineering Co. came into being, but in a small way. The capital consisted of $500, and a drill press. Although commencing modestly, the firm soon showed remarkable progress. Starting off with general jobbing work, they developed other lines, including cylinder grinding, tool and die-making, rubber moulds, etc., and one of the big features which helped to build up the business was their service to inventors. Speaking of this branch of the business, Mr. Corman says: "I have always liked to develop ideas. In many cases an inventor has a hazy idea of real merit, but does not know enough of the practical end of the business to put it into effect. We have developed our patent model end of the business to such an extent that we really act as patent advisers, and time

W. E. CORMAN

and time again have developed ideas from the very crude state to the finished article, even before the inventor applied for his patent. We have proved in the past that we do not steal secrets, and thus, the inventors trust us with the development of their ideas, knowing they are fully protected so far as we are concerned. I get more real enjoyment out of this end of the business than perhaps any other, for I enjoy creative work."

For some time past, the need of added space and equipment has been felt in the old plant at 58 Stewart St. When the chance came to purchase the Chapman plant, Mr. Corman realized it was what he required, and finally closed the deal. At present he has a number of men working in the new factory, and hopes to have everything moved over within a short time, and properly arranged. In order to avoid confusion, and have his intentions thoroughly understood, Mr. Corman states that in addition to the regular Chapman lines, which include lineshaft bearings, ball and socket pillow block bearings, loose pulley bearings, fan bearings, friction clutch bearings, annular and thrust bearings, automobile bearings, universal elevating trucks, transmission equipment, etc., they would still carry on in a larger way their service in cylinder grinding, rubber mould work, tool and die work, punch press work, job machine and grinding work, also their patent model and general engineering service activities.

In spite of his close attention to business, Mr. Corman finds time for social enjoyment, and in addition to being connected with several societies, he is a live member of the University Engineering Alumni Association, and has been active in keeping together the old boys of the school of Applied Science in Toronto.

LUMBER'S BIG PAYROLL

British Columbia's payroll for the lumber industry in 1922 will run over $20,000,000, according to officials of the provincial government who have based their calculations on returns from 532 firms, whose statistics show that in 1921 the payroll amounted to $18,180,962, with an average number of wage earners of 14,500.

The general resumption of building operations, followed by an increasing demand for lumber, has had the result this year of speeding up the industry. Many plants that were idle have resumed operations, and even those which kept going all the time through 1921 have increased their staffs.

It is confidently expected that this year will show a big increase over 1921, and the $20,000,000 mark is said to be on the conservative side.

CANADA MOST FAVORED

The Water Power Committee of the Conjoint Board of Scientific Societies of Great Britain has issued a report on the water-power resources of the world, showing the British Empire to be far in the lead, with 50,000,000 to 70,000,000 horsepower capable of immediate economic development. It is estimated that 75,000,000 horsepower is being used for the world's factories, electric lighting and street railways; 21,000,000 horsepower for railways, except street railways, and 24,000,000 horsepower for shipping.

Canada is the most favored country of all, in proportion to population. South America, Asia and Africa are left out of the calculation because they have had little development yet. As oil supplies diminish and the price of coal rises, the value of water power will increase, and the country that has abundance of this unfailing source of energy has an advantage in the industrial race. Canadians do not yet realize what a priceless asset nature has given them.

American railroads repaired and turned out from October 15 to November 1, last, the largest number of locomotives for any semi-monthly period in the last two years, reports received from the car service division of the railway association show. During those two weeks 13,490 locomotives were repaired. This exceeded by 2,086 the number turned out from October 1 to October 15 last.

Business Newspapers Inform Business Leaders

Select Class of 380,000 Readers Reached by These Publications —"Key Men" in Their Communities—Prosperity Depends Upon Exchange of Ideas and Experiences—Gospel of Intelligent Work

By HORACE T. HUNTER*

BUSINESS newspapers are specialized publications covering intensively some particular field. For example, there are 3,000 hardware merchants in Canada. "Hardware and Metal," the business newspaper in that field, has a paid subscription list of ninety per cent. of these merchants and in addition 800 manufacturers, wholesalers and travelers, who are also subscribers. Its influence and importance will be apparent, however, when you consider that its readers sell each year $170,000,000 worth of goods, and these readers look to this publication for information and advice with regard to all matters pertaining to their business.

Another publication, "Canadian Grocer," has a circulation of 6,000 which, although less than half the number of men engaged in the grocery business, yet our figures show that these 6,000 grocers who subscribe to their trade newspaper sell 75 per cent. of the groceries that are sold in Canada. This figure has been placed at over $200,000,000.

There are more than a hundred other business publications but these two will serve to show the thoroughness with which these papers cover their fields and the enormous business done by these fields.

Practical Technical Education

Do you realize that the industrial prosperity of Canada is, after all, merely the prosperity of these 100 lines of business; that the prosperity of any one line is dependent on the men in that industry exchanging ideas and experiences? In medicine the doctor is the heir to all research work that has been done up to the present time, but he must study and acquaint himself with thesee discoveries. That is a work that is never done. And so in every line of business more efficient methods are always being introduced and as they are tried out and proven successful they must be passed on to others. There is only one method of doing this in a systematic way and that is through the business publications.

If the business publication in most any field increases the efficiency of its readers only ten per cent., then they have added millions to the wealth of the country.

Broadening Out

Business publications are very largely the product of the last fifty to seventy-five years. Before business papers existed, a man looked on his competitor as an enemy from whom must be concealed all plans, methods and information concerning his business. To-day, most business men look on their competitors as associates and nearly every line is organized with a view to discussing and finding a solution for problems common to all. The business newspaper has played a large part in this broadening out attitude of business men. In the early days they found an odd man here and there who was broad enough to see that it would not hurt his business to give out information about it. They published these experiences and as no dire catastrophe overtook these men who had given out these business "secrets," others followed their example. This has opened up a great field for business papers. As you will realize, it is always of interest and value to one business man to know of some plan adopted successfully by another man in the same line of business.

The MacLean Organization

The MacLean Publishing Company, whom I have the honor to represent in Rotary, was established thirty-five years ago. We publish fourteen business newspapers and one general magazine.

We have a staff of upwards of four hundred and in addition correspondents scattered in all important centres throughout Canada, also in the United States and Great Britain.

We spend over $500,000 each year in securing news and information of one kind and another for our readers. This is exclusive of mechanical costs, circulation, accounting and other clerical expense.

Unprejudiced and Unbiased

We have no other entangling alliances. The directors of the company are not now and have never been financially interested in any other company whose interest could in any way conflict with giving an unbiased and unprejudiced service to our readers. Our readers pay us to give them all the informatioon we can gather that would be of interest and value to them. We accept this as a trust and have never suppressed such news even though we knew it would mean loss of advertising or subscribers, or estrangement of friendship on the part of readers who have desired to have information suppressed, or who have disagreed with our views. We have not done this merely on high moral grounds but because it pays—because it is the only foundation on which to build a successful newspaper.

Business newspapers in Canada have a circulation of approximately 380,000. This statement in itself means little until you examine more closely and find out that these 380,000 men are "key" men, they are leaders in the community in which they dwell. They are such men as are members of Rotary Clubs, Kiwanis Clubs, and other like organizations. They furnish employment for the entire industrial population of Canada. They manufacture the goods; they act as wholesale and retail distributors; they build railroads, steamships, hotels, homes and factories. They are the bankers who make the loans and they are at the same time the men who borrow the money from the banks to carry on their various industrial enterprises. They are the men who operate the mines and the lumber camps. They are the men who plan practically all industrial operations, for practically every industry has its specialized publication. They are, then, the officers of a great industrial army and, while I would not for a moment minimize the work of the private, if you want to keep up the morale of an army, if you want to train them in some new form of strategy, you must work through the officers. If you have poor officers you will have a poor army; but if you have brave, intelligent and resourceful officers you will have an army that will meet any emergency.

Field of Business Papers

This influential body of business leaders numbering nearly four hundred thousand, or five per cent. of the population, have many interests in common. Business newspapers are the only mediums which can express their viewpoint and give them the leadership that is necessary to weld them into united action. Daily newspapers cannot do this work for the interests of their subscribers are too diverse. A metropolitan daily with a circulation of a hundred thousand would have only about five per cent., or five thousand, of these industrial leaders as subscribers. The dailies with their mass circulation exert great influence and have great responsibility, but the editors of the biggest and best of these publications recognize that business publications should take the leadership with business men on business questions of great national importance. C. P. Scott, editor "The Manchester Guardian," stated recently:

"There never was a time when business newspapers could do a better stroke for the world than they can to-day by bringing it home to their readers and the great public that all the peoples

*Address delivered before the Rotary Club. Toronto. Mr. Hunter is Vice-President of the MacLean Publishing Company.

profit by the peace and prosperity of each other.

"They are the most practical of internationalists and through the sensitive machinery of the market can estimate from day to day the reactions of policy and the supreme value of a settled order in the relations of states.

"They, better than anyone else, can realize the fallacy of the view on which nations have too often acted that what is one nation's gain must be another's loss. The world as we see it to-day is largely what politicians and statesmen have made it. Is it not time for the business man to take a hand?"

Lord Burnham, proprietor "Daily Telegraph," London, expressed his views as follows:

"Everything that increases mutual knowledge of the achievements and possibilities of industry and commerce increases the welfare of the people and acts as a stimulus to further progress.

"In this respect business newspapers perform functions which no general newspaper can undertake, and a limit can be set to their useful development only when a limit has been set to the march of knowledge or science, whichever you prefer to call it, as applied to production, commerce and finance."

National Publications

Business publications are all national in scope and look at every question from the national viewpoint. I might touch briefly on a few of the more important questions they have dealt with during the past few years.

They have advocated business administration in municipal, provincial and federal governments; that the captains of industry who have made a success of their own business should be drafted into the public service. We believe business men would readily undertake public service work if they were assured that they would be immune from political influence or dictation. As a means to this end, they have urged that successful business men of high standing and character should be sent to parliament.

Elimination of Waste

War breeds extravagance. In spite of the noble ideals which inspired this nation to take up the great conflict across the sea, the inevitable result was the accumulation of innumerable waste and habits of extravagance. Business papers are exposing these wasteful methods wherever they can be found, and once the facts have been placed before business men the first step has been taken towards their elimination.

Waste of Time

The greatest waste of all is the waste of time, either through carelessness, laziness or inefficiency. As one business editor has put it: "We cannot talk ourselves into prosperity; we cannot argue ourselves into stability; but we can work ourselves out of the valley of depression and up to the heights of plenty." If business paper editors can instill into the 380,000 business leaders in Canada this gospel of intelligent work we will have performed a tremendous service.

Readjustment

Business papers reaching manufacturers, wholesalers and retailers aided and speeded the period of readjustment by urging the sale of goods at replacement values; by emphasizing week in and week out that the problem was an individual one; that every business man must have the courage and the energy to keep his own business going, and that if this were done business would resume. What we require during a period of business depression are not advertisements urging people to buy in order to aid employment and bring about prosperous conditions. What we require is that every individual business man should advertise his goods and show why those particular goods should be bought at that time. People will buy goods if they believe they are getting value for their money and I believe they will buy them for no other reason.

Co-operation With Government

In the United States the editors of business newspapers have a weekly conference with Mr. Hoover, secretary of Commerce. Mr. Hoover's job is to extend American business both at home and abroad. He discusses with these editors the business situation and outlines certain facts that come before him that he believes should be brought to the attention of business men. He knows that the editors of business papers who attend this conference can bring these facts before the respective fields covered by their papers in a forceful and attention-getting way that their experience fits them to do. We have urged such a plan on our minister of trade and commerce but the traditions of the Canadian department have evidently been to adopt what I might term more indirect methods. We are hoping the new minister, Mr. Robb, will realize the importance of the opportunity, that he will regard himself as the sales manager for Canada, and utilize the business press to keep in constant touch with the leaders of business in the various provinces of the Dominion.

Export Business

Those business newspapers carry representative advertisements in the field they cover. Every publication has scores of instances where their goods have been introduced into foreign countries through these advertisements being seen by buyers in these foreign countries. Some of these instances date back thirty years and during that time hundreds of thousands of dollars have been sold. This has helped to swell our export trade and put the Canadian dollar at a premium in every country in the world.

But the responsibility of business men, and therefore of business newspapers, does not stop with national issues. They must grapple with international questions. Our markets are affected by conditions in Russia, in Germany, in United States, Japan and all foreign countries. Business men cannot afford to make investments in new plants or in wider sales plans without knowing something of the world situation. Editors of business newspapers are close students of foreign conditions—some of them go abroad regularly to study conditions at first hand.

In 1915 "Canadian Machinery" issued four special Shell Numbers, March 18, April 29, July 1 and September 2. First in America, if not in the world, to enter munition shops and publish reliable information concerning shell manufacture, "Canadian Machinery" performed a distinct service to engineering concerns in several countries and to the Empire and Allied cause.

Working with the full consent and co-operation of the military authorities, our editors were able to secure the most detailed information and photographs. So valuable were our Shell Numbers considered that they were in demand in all allied countries and in the United States. The Munitions Committee of Australia reproduced in pamphlet form the entire editorial contents, illustrations and all, of our Shell Number of July 1, 1915.

The advertising pages in these special Shell Numbers as well as in regular issues proved of the greatest service in equipping shell shops.

Your Responsibility

This, then, is something of the work done by business papers. They have, however, only scratched the surface. There is much more important work still to be done. I would like, in conclusion, to leave with you this thought: You business men are vitally interested in the development of business papers. You are interested in the development of business newspapers just as you are interested in the building of railways and canals. Railways offer a means for the transportation of the goods, but the business papers have first exerted their influence to help you sell the goods. I say, therefore, in your own interests give business newspapers all the assistance and encouragement you can. Advertise in them and you will get not merely the value of the publicity but you will enable the publisher to spend more money on service to readers.

A couple of days ago Babson painted a very vivid picture of the 100,000 or more retail merchants scattered in towns and cities through Canada. He said that when prosperity is to be brought back it will be through the efforts of these merchants. For it is only as their shelves are cleared that more goods will be required. Therefore, he said, co-operate with them, give them ideas to help them sell the goods. Business newspapers offer the only direct line of communication with these merchants. They offer the only means of reaching them with publications they have subscribed for and which have become part of their business.

Williams Re-Manufactured Machine Tools

You can save a lot of money by buying our used machine tools, because you get machines that have been thoroughly re-manufactured and trued-up—machines that are guaranteed absolutely as good as new, much below new prices.

Why pay full price for a tool when a much smaller investment will give you equally satisfactory results?

Our name and reputation constitute a guarantee that any machine you buy will be exactly as represented.

Send us your name and address and we will send you our monthly Machinery List.

The A. R. Williams Machinery Co., Ltd.

64 Front Street W., TORONTO

HALIFAX ST. JOHN MONTREAL WINNIPEG VANCOUVER

If its Machinery—Write "Williams"

MONEY ORDER EXCHANGE WITH CHINA

Arrangements have been made between the Canadian Post Office Department and the Chinese Postal Administration for a direct exchange of money orders between Canada and China. The convention or agreement under which money orders are to be exchanged has been signed by the Chinese Director of Posts and by Hon. T. Charles Murphy, the Canadian Postmaster General, and will go into effect on the 1st of January next.

In times past, the negotiations of such an agreement would have been regarded as a sufficient reason for the visit of a cabinet minister to China, but a new order of things now prevails, and business matters are transacted in the ordinary business way by the exchange of correspondence.

Hitherto, money orders payable in China have had to be issued on British postal agencies at Hong Kong and Shanghai and some agencies of the Japanese Postal Administration, but under the new arrangement all orders issued in Canada payable in China will be reported on lists sent to the Chinese exchange office at Shanghai. The amount of each order will be converted into Chinese currency and a Chinese money order for the amount will be forwarded to the payee.

Orders issued in China for payment in Canada will be reported to the exchange office at Vancouver in dollars and cents. Canadian orders for the amounts in Canadian currency will be issued and forwarded from Vancouver to the payee.

Direct exchange of money orders with China has been contemplated for a considerable time, but action was deferred owing to the unstable rates of exchange that prevailed during the war and some time after.

BRITISH COAL SHIPPERS LOSE

According to a correspondent in Cardiff, Wales, for an English publication, business in coal with American buyers has not been as satisfactory as expected. The writer states; "By this time many of our merchants on this side of the Atlantic wish they had kept free of the whole business. No fortunes have been made out of it and heavy losses have been incurred. Its greatest advantage was the fillip it gave to business at a moment of considerable depression." There are said to be distinct signs that the business may continue almost indefinitely, however. Factors in the States are of this opinion, and negotiations for the remainder of the year are still continuing. This opinion is held notwithstanding the fact that domestic coals have been offering in larger quantities at the Atlantic seaboard ports. Supplies at Hampton Roads, we learn, are excessive and show some weakening in values. British coal in barges in New York Harbour is still a feature. This is being offered at 8 to 8¼ dols. alongside, but there are very few buyers. With the dollar at 4.45 to the £ it is not difficult to see that a considerable loss is entailed, which, of course, must be increased by unreasonable delay in sales. The cost of this coal at New York must be considered in relation to the interest on money outstanding, the cost of stocking in harbour, and the probability of deterioration in quality. This latter point must be serious, and is not likely to do the same justice to the country of its origin as if it was discharged straight into works.

Inquiry from United States for British pig iron is said to have become less of a feature. The Middlesborough district shipped 9,000 tons to Canada in October and 28,600 tons to United States.

That it will reduce the cost of bar manufacture by 50 per cent., is the claim made for a patent secured by a Pittsburgh roll turner. The present method of rolling a finished bar from which beams, channels, angles, rails, and all structural steel are made, requires two mills, one to reduce the bloom after it comes from the open hearth and one to roll the finished bar. It is claimed this invention shapes the bloom and finishes the bar in one mill, thus, according to the inventor, eliminating hand labor, the roughing rolls and reheating, reducing operations 60 per cent.

T. B. REID WITH JOLIETTE STEEL CO.

T. B. REID, well known in machine tool circles both in Canada and the United States, is now vice-president and sales manager for the Joliette Steel Products, Ltd., of Joliette, Que. His office is Room 115, Union Trust Building, Toronto.

Mr. Reid has had varied experience in machine tool and other work. In 1906 he went to the A. R. Williams Machinery Co., assuming charge of the machine tool department. He remained in this capacity until 1917, when he became secretary-treasurer and manager for the A. R. Williams Machinery and Supply Co. of Buffalo and Detroit, having his headquarters in Buffalo. During this time he was chiefly interested in war equipment, as his firm turned out some 18 special machines for munition purposes. He remained there until 1921, as it took about a year and a half to make adjustments with the American Government.

Since his return to Canada, he has been connected with the machinery sales end for equipment made by the Canadian General Electric Co. and the Russell Motor Co., and only recently completed arrangements to go with the Joliette Steel Products in the position already mentioned. Mr. Reid reports a very encouraging increase in business, and states that they have more than two months steady work ahead. Orders indicate improved railway buying and activity among large manufacturing plants. They are, in fact, reporting better business than for the past two years.

Having been so long associated with the machinery end of the business, Mr. Reid states it to be his intention, later, to open up a machinery department, but the actual policy of this section of the business has not yet been decided.

James L. Waldie, president of the Joliette Steel Products Ltd., is also president of the Canadian Tube and Steel Products Ltd., Montreal, and for the present, both firms will share the same office, Mr. F. Atkinson, the local manager for the latter mentioned firm, still being in charge of his end of the business. Later on, larger quarters will be sought.

MOTOR INDUSTRY USES MORE COPPER

THE rapid growth of the automobile industry and improvements in the methods of construction, motors, parts, etc., have brought with them a marked increase in the use of copper. During the war when the red metal was scarce, manufacturers turned to the use of substitutes, but these proved more costly in the long run and resulted in considerable dissatisfaction among car users. For the past year or more the tendency has been to use more copper, because of its durability and better service.

It is estimated that for the year 1922, the amount of copper consumed by the automobile industry of this country will amount to about 40,000,000 pounds.

This estimate is based on a total of 10 pounds of copper in each Ford car as follows: Radiator 8½ pounds, hub caps 1 pound, gasoline tubing ½ pound and various other parts ½ pound. Assuming a 1922 Ford production of 1,200,000 cars there should be a total consumption of copper by Ford of 12,000,000 pounds.

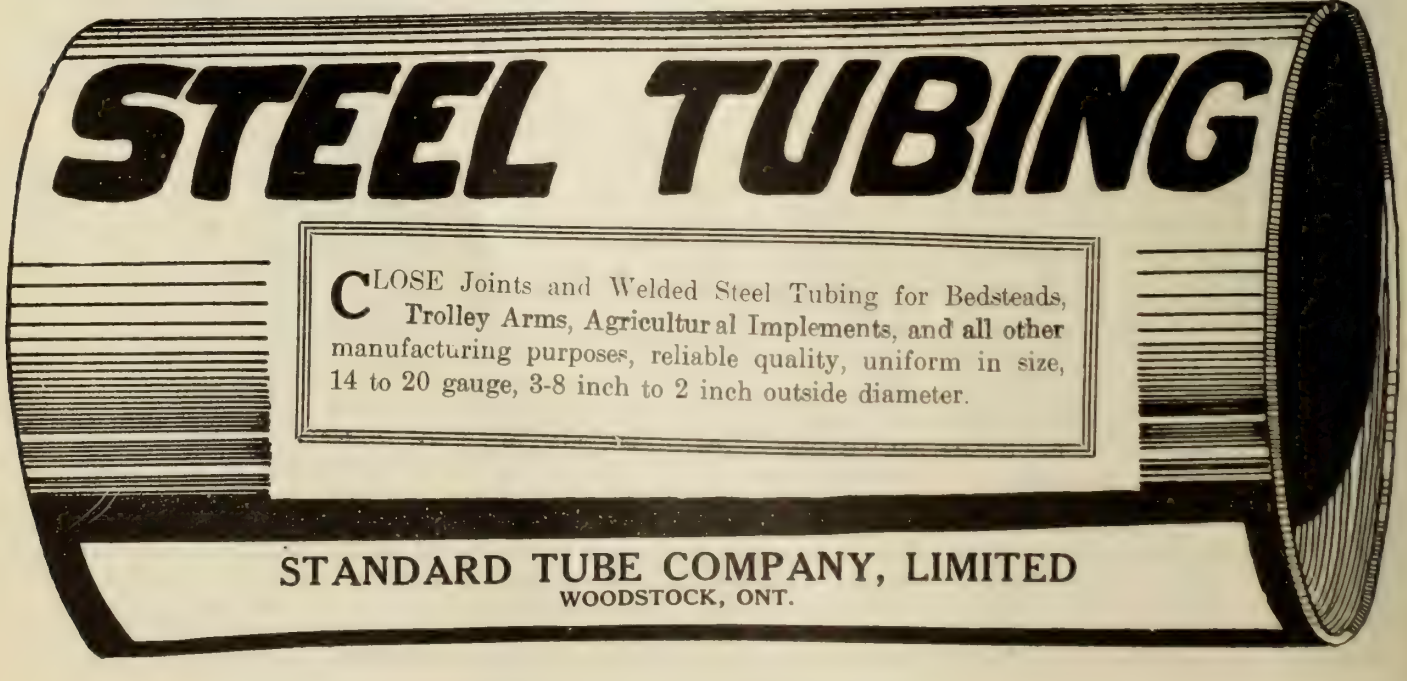
In a Chevrolet there are 16 pounds of copper in the radiator and 3 pounds in various other parts, total 19 pounds.

It is estimated that the average copper consumption a car for all cars except Ford will run at least 20 pounds. Therefore, on basis of 1922 estimated production of 1,500,000 cars other than Fords, copper consumption may be figured at least 30,000,000 pounds. Ford and other makers' consumption combined should be 42,000,000 pounds.

When Ford several years ago gave up use of copper radiator shells because of difficulties owners had in keeping the brass "shiny" about 3½ pounds of copper consumption a car was lost. This meant a loss of from 3,000,000 to 3,250,000 pounds a year to the producers, but it has since been more than compensated for in the increased number of cars manufactured.

All radiator parts with which water comes in contact must be made of copper, particularly vertical tubes and lateral fins. During the war Ford tried using steel fins because of copper scarcity, but it did not work well and he went back to copper as soon as it became available. He also tried steel hub caps in which approximately one pound of copper is used for each set of four caps, but steel does not take nickel plating efficiently and that plan was abandoned. This re-established consumption of 1,000,000 pounds annually. The same is true of headlight and spotlight reflector backs where copper must be used to hold secure the silver plating.

Japanese steel industry is said to be in such condition that none of the iron and steel manufacturers are conducting business with any prospect of making a profit as the present market price is barely sufficient to cover the cost of material and wages. The potential obstacles that hamper the successful conduct of iron industry in this country are the high wages and high cost of coal.


STEEL TUBING
CLOSE Joints and Welded Steel Tubing for Bedsteads, Trolley Arms, Agricultural Implements, and all other manufacturing purposes, reliable quality, uniform in size, 14 to 20 gauge, 3-8 inch to 2 inch outside diameter.
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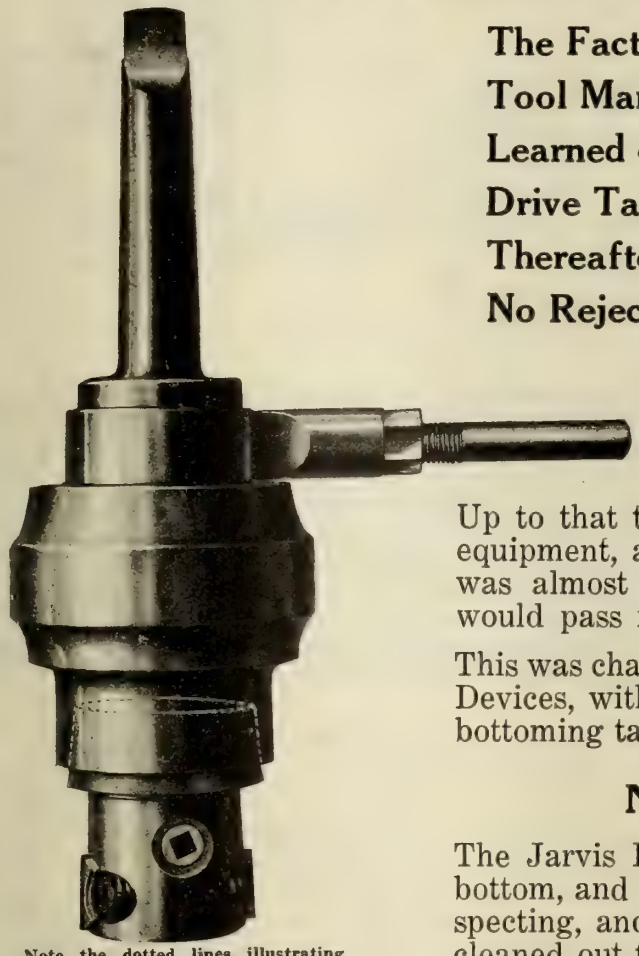

Note the dotted lines illustrating position and size of Friction Cone.

The Factory Manager of a Large Tool Manufacturing Concern Learned of the Jarvis Friction Drive Tapping Device, and Thereafter There Were No Rejections.

Up to that time they had been using regular standard equipment, and the bottoming taps did not bottom. It was almost impossible to tap the holes so that they would pass inspection.

This was changed like magic when the 20 Jarvis Tapping Devices, with Cone Friction Drive, took the place of 90 bottoming taps.

No Inspection Needed

The Jarvis Friction Tapping Device taps the holes to bottom, and then runs in a second time to do its own inspecting, and when it finishes, every hole is thoroughly cleaned out to bottom.

Very little pressure is needed to drive the device.

The drive is controlled by pressure on the machine spindle.

Stripped threads are unknown.

Holes tapped in toughest metal with little tap breakage.

Standard Chuck.

No special taps required.

The Taps freely started and stopped while rotating.

Adaptable to Drilling Machine or Speed Lathe.

Ask us about the Jarvis High Speed Tapping Devices, which act without clinching or binding.

And the Jarvis Quick Change Chucks and Collets, for Drilling, Counterboring, Tapping and Stud Setting.

We are sole distributors.

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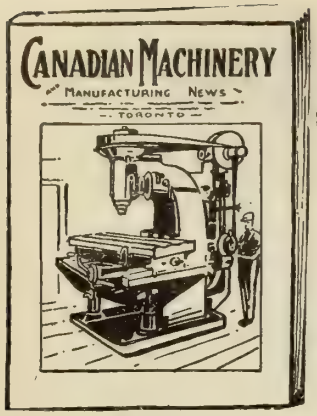

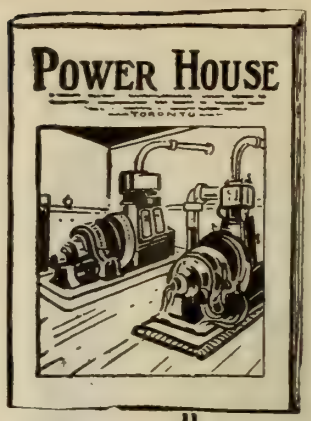

DO YOU Manufacture Industrial Equipment?

Are you a manufacturer of twist drills, hack saws, mechanics' tools, wire guards, bolts, rivets, paints—do you manufacture lines of any description that can be used in machine shops, metal-working plants, power plants or foundries? If you do the publications you see illustrated here (Canadian Machinery, Canadian Foundryman, and Power House) can build a bigger demand for your products.

This group of technical newspapers is read by the men who are prospective buyers of your lines. You can bring to the attention of these men the reason why they should demand your goods when purchasing from their dealers. You can effectively do this by placing a message in the paper which serves the field in which your products are sold.

CANADIAN MACHINERY AND MANUFACTURING NEWS is published weekly and covers the machinery, iron and steel and general metal-working industries of Canada.

POWER HOUSE is published semi-monthly; it serves steam, electrical, water and gas power plants, and the power houses of all general manufacturing plants.

CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS is published monthly; it serves the grey iron, steel and non-ferrous foundries.

Each one of these publications reach proprietors, managers, purchasing agents, foremen—the men who direct the purchasing of goods. A message to these men in any of the MacLean Technical Newspapers is certain to have a strong influence.

Write for complete Data.

MACLEAN TECHNICAL NEWSPAPERS

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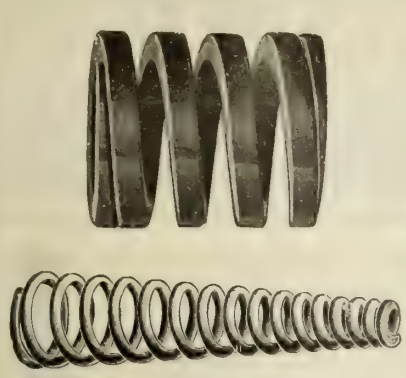

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PRECISION SPRINGS
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ENGINES, VALVES, DIES,
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ALSO SPECIAL DESIGNS
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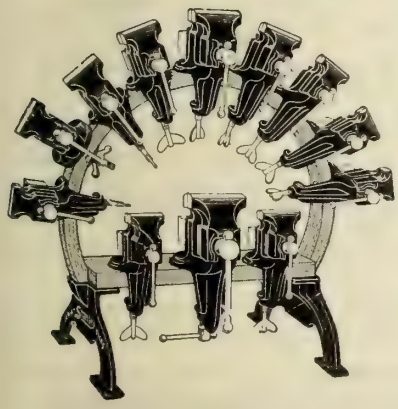
'RICE LEWIS' NEWS



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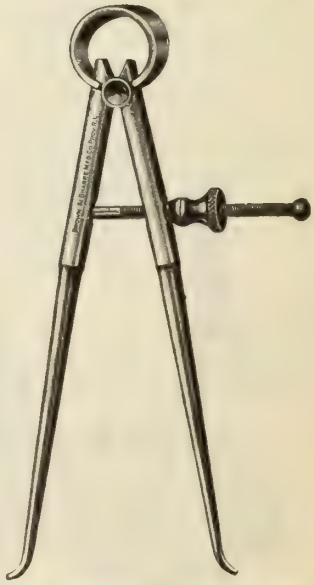
Your Plant?

This is the best time of the year to do it. Are you properly equipped for the purpose? We can furnish everything you require in

SMALL TOOLS

You may need Vises, Wrenches, Calipers, Stocks and Dies and other tools. We have them. Write for description and prices.



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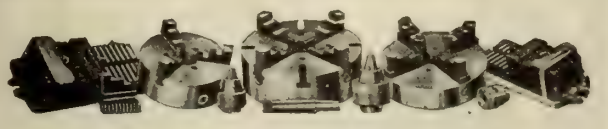

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Many interesting applications of the continuous method to the field of industrial heating are shown in **Bulletin 234-T.** Write for copy.

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LOWER COST

Rotary Automatic Furnaces in series for a three-operation heat-treatment—normalizing, hardening and drawing.

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-A Small Heavy Duty Lathe
-With 32 Thread Changes

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ROCKFORD
"ECONOMY"

This double back geared, quick change engine lathe brings many advantages to the tool room. High grade, accurate, small in size but extremely powerful.

All gears are cut steel and covered to safe-guard the operator. A lead screw is used only for chasing. Sizes 12", 14", 18" and 22" swing. Write for circular.

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For Hardness Testing

in shop and laboratory use the
Standard Scleroscope
Universally adopted; direct reading; inexpensive, and the only instrument that agrees with others of its kind in all parts of the world, thus solving problems of ordering materials to specification.

BOOKLET FREE.

Heat Indication
by optical means is fast becoming the correct thing. The PYROSCOPE has solved the problem.

THE PYROSCOPE
Perfect constancy, inexpensive, no electricity used. Built to stand rough usage, and upon common-sense lines. Used by the Government and best firms.

THE SCLEROSCOPE (Set)

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Flexible shaft equipments for grinding, polishing, drilling, reaming, scraping, scratch brushing, power screw driving and nut setting.
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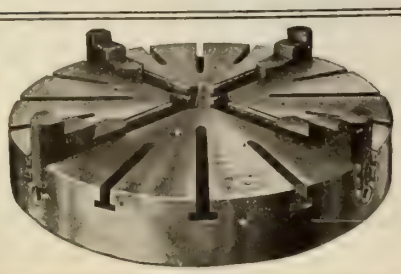

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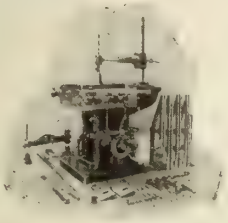

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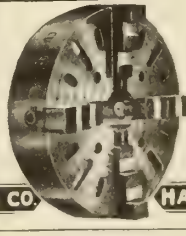

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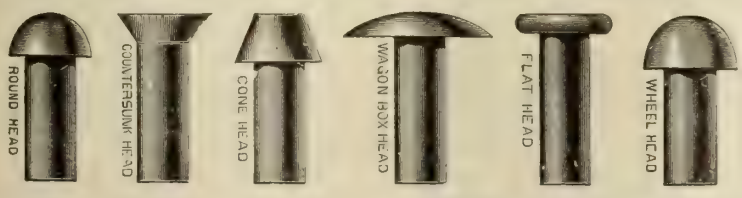

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143-153 University Avenue
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Die Castings.

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Brass, Bronze, Copper and Aluminum.

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Grey Iron.

Galt Malleable Iron Co., Ltd.
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John T. Hepburn, Limited
TORONTO, ONT.
Grey Iron.

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GALT, ONT.
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William Kennedy & Sons, Ltd.
OWEN SOUND, ONT.
Steel, Malleable and Heavy Grey Iron.
See Advertisement Page 7

Machinery & Foundries, Ltd.
BROCKVILLE, ONT.
Light and Medium Grey Iron.

A. F. McCulloch
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Brass, Alum. Castings—Wood, Metal Patterns.

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Maxwells, Limited
ST. MARYS, ONT.
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WOODSTOCK, ONT.
Specialty Light Grey Iron.

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Victoria Avenue. LINDSAY, ONT.
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Canadian Machinery & Mfg. News
153 University Ave., Toronto.

Canadian Machinery BUYERS DIRECTORY

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ABRASIVE DISCS
Lion Grinding Wheels, Limited, Montreal, Que.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John, London, S.E., Eng.

ABRASIVE MATERIALS
Lion Grinding Wheels, Limited, Montreal, Que.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John, London, S.E., Eng.

ACETYLENE, DISSOLVED
Dominion Oxygen Co., Toronto.
Liquide Air Company, Toronto.

ANCHOR BELTS
Steel Co. of Can. Ltd., Hamilton, Ont

ANGLE BARS
Steel Co. of Can. Ltd., Hamilton, Ont.

ANVILS
Aikins & Co., Inc., E.C., Indianapolis, I.

ANCHOR BOLTS
Steel Co. of Can., Ltd., Hamilton, Ont.

ARBORS
Atkins & Co., Inc., E. C., Indianapolis,
Brown & Sharpe Mfg.Co., Providence,R.I.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.

BELLS, BRASS, BRONZE and STEEL
Canada Foundries & Forgings Co., Welland, Ont.
Canadian SKF Co., Toronto, Ont.

BARS, BORING
Armstrong Bros. Tool Co., Chicago, Ill.
Bertram & Son Co., td., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

BARS, BORING, PORTABLE
Underwood Corp., H. B., Philadelphia.

BARS, STEEL
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
British Empire Steel Corporation, Montreal, Que.

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Canadian SKF Co., Toronto, Ont.

BEARINGS, ROLLER
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

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D. K. McLaren, Limited, Montreal,
McLaren Belting Co., J. C., Montreal, Que.

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D. K. McLaren, Limited, Montreal,

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D. K. McLaren, Limited, Montreal,
McLaren Belting Co., J.C., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

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D. K. McLaren, Limited, Montreal,
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Bristol Company, Waterbury, Conn.

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D. K. McLaren, Limited, Montreal,
McLaren Belting Co., J. C., Montreal, Que.

BELTING, CHAIN
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Fittings, Limited, Oshawa, Ont.
Jones & Glassco, Montreal, Que.
real, Que.
Renold (Hans) of Canada, Ltd., Mont-

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Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Dom. Belting Co., Ltd., Hamilton, Ont.
D. K. McLaren, Limited, Montreal,
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Can. Fairbanks-Morse Ltd., Montreal, Q.
D. K. McLaren, Limited, Montreal,
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BENDING MACHINES, POWER
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bertrams Ltd., Edinburgh, Scotland.
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BLOCKS
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Armstrong Bros. Tool Co., Chicago, Ill.
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BUFFERS
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U. S Electrical Tool Co., Cincinnati, O.

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S. F. Bowser & Co., Ltd., Toronto, Ont

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Starrett Co., L. S., Athol, Mass.

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Can. Fairbanks-Morse Co., Ltd., Montreal,
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Skinner Chuck Co., New Britain, Conn.
Union Mfg., New Britain, Conn.

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Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Cushman Chuck Co., Hartford, Conn.
Geometric Tool Co., New Haven, Conn.
Gisholt Machine Co., Madison, Wis.
Herbert, Limited, Alfred, Toronto, Ont.
Ker & Goodwin Machine Co., Brantford, Ont.
Pryibil Machine Co., New York, N.Y.
Skinner Chuck Co., New Britain, Conn
Union Mfg. Co., New Britain, Conn.

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CHUCKS, PLANER
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Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

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CHUCKS, VERTICAL BORING MILL
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Gisholt Machine Co., Madison, Wis.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

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Starrett Co., L. S., Athol, Mass.

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Hardinge Bros., Limited, Toronto, Ont.

CLOCKS, TIME
Gisholt Machine Co., Madison, Wis.

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Chicago Watchman's Clock Co., Chicago, Ill.
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Johnson Machine Co., Carlyle, Manchester, Conn.

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Can.-Link Belt Co., Toronto, Ont.
Roelofson Elevator Works, Galt, Ont.

COAL-STORAGE SYSTEMS
Can. Link-Belt Co., Toronto, Ont.

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Canada Foundries & Forgings Co., Welland, Ont.
Can Link-Belt Co., Toronto, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

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Butterfield & Co., Inc., Rock Island, Que.
Geometric Tool Co., New Haven, Conn.
Hardinge Bros., Inc., Chicago, Ill.
Hendley Machine Co., Torrington Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

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Oakley Chemical Co., New York, N.Y.

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Wright Mfg. Co., Lisbon, Ohio.

BLOCKS, DIE
Canada Foundries & Forgings Co., Welland, Ont.

BLOCKS, PILLOW
Can. Link-Belt Co., Toronto, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

BLOWERS
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Flexible Shaft Co., Ltd., Toronto, Ont.

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Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Montreal, Que.

BOLT AND NUT MACHINERY, Automatic
National Acme Co., Cleveland, Ohio.

BOLTS AND NUTS
British Empire Steel Corporation, Montreal, Que.
National Acme Co., Montreal, Que.

BOLT THREADING DIE HEADS
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BOLTS, TRACK
Steel Co. of Canada, Ltd., Hamilton, Ont.

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Bertram & Sons Co., Ltd., The John Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

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Can. Fairbanks-Morse Co., Ltd., Montreal,
Gisholt Machine Co., Madison, Wis.
Herbert, Limited, Alfred, Toronto, Ont.
Landis Tool Co., Waynesboro, Pa.
Vertical
Can. Fairbanks-Morse Co., Ltd. Montreal, Que.

CAMS
Canada Foundries & Forgings Co., Welland, Ont.

CAN-MAKING MACHINERY
(See Sheet Metal Working Machinery)
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Bliss Co., E. W., Brooklyn, N. Y.
Smooth Mfg. Co., Jersey City, N. J.

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Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.

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Reynold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

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D. K McLaren, Limited, Montreal,

CASTINGS, ALUMINUM, BRASS, BRONZE, COPPER, DIE-MOLDED, FERRO-ALLOY, IRON, SEMI-STEEL, STEEL.
See "Where to buy your castings" Section Page number may be found by turning to Advertisers' Index.

CHAINS, DRIVING
Can Link-Belt Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont
Jones & Glassco, Montreal, Que.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

CHASERS
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CHUCKING MACHINES
Acme Machine Tool Co., Cincinnati, O
Brown & Sharpe Mfg. Co., Providence, R. I.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

BUYERS' DIRECTORY

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Oakley Chemical Co., New York, N.Y.

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Can. Fairbanks-Morse Co., Ltd., Montreal.

CONES, FRICTION
Norton Co., of Can. Ltd., Hamilton, Ont.

CONNECTING RODS AND STRAPS
Canada Foundries & Forgings Co., Welland, Ont.

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Dominion Engineering Works, Limited, Montreal, Que.
Victoria Foundry Co., Ltd., Ottawa, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

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Jones & Glassco, Montreal, Que.

COTTERS
Steel Co. of Canada, Ltd., Hamilton, Ont.

COUNTERBORES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

COUNTERS, REVOLUTION
Starrett Co., L. S., Athol, Mass.

COUNTERSHAFTS
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Johnson Machine Co., Carlyle, Man.
Kempsmith Mfg. Co., Milwaukee, Wis.

COUNTERSINKS
Butterfield & Co., Inc., Rock Island, Que.
Pratt &Whitney Co., of Canada, Ltd., Dundas, Ont.

COUPLERS, CAR AND LOCOMOTIVE
Can. Steel Foundries, Montreal, Que.

COUPLINGS
Steel Co. of Canada, Ltd., Hamilton, Ont.

COUPLINGS, SHAFT
Can. Link-Belt Co., Toronto, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

CRANES, ELECTRIC
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can.-Link-Belt Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Northern Crane Works, Walkerville, Ont.
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.

CRANES, LOCOMOTIVE
Can. Link-Belt Co., Toronto, Ont.

Bertram & Son Co., td., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Northern Crane Works, Walkerville, Ont.

CRANK PIN TURNING MACHINE
Underwood Corp., H.B., Philadelphia, Pa.

CUTTERS, GEAR
Brown & Sharpe Mfg. Co., Providence, R. I.

Butterfield & Co., Inc., Rock Island, Q. Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CUTTERS, HIGH SPEED
Atkins & Co., Inc., E. C., Indianapolis.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CUTTERS, MILLING
Brown & Sharpe Mfg. Co., Providence, R. I.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.

CUTTERS, STAY BOLT
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.

CUTTING-OFF MACHINE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Starrett Co., L. S., Athol, Mass.

CUTTING OFF MACHINES, PIPE (SEE PIPE-CUTTING AND THREADING MACHINES)
Landis Machine Co., Inc., Waynesboro, Pa.

CUTTING-OFF TOOLS
Armstrong Bros. Tool Co., Chicago, Ill.

CUTTING OIL FILTERS (SEE OIL FILTERING SYSTEMS.
Bowser, S. F. & Co., Ltd., Toronto.

CUTTING, OXY-HYDROGEN
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

DETACHABLE CHAIN
International Malleable Iron Co., Guelph, Ont.

DIAMONDS, BLACK AND ROUGH
Can. Desmond-Stephan Mfg Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

DIAMOND TOOLS
Can. Desmond-Stephan Co., Hamilton,
Wheel Trueing Tool Co., Windsor, Ont.

DIAMOND CROSSINGS
Can. Steel Foundries, Montreal, Que.

DIAMONDS, IMPORTERS
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Co., Windsor, Ont.

DIES, SCREW AND THREAD CUTTING
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.

DIES, SHEET-METAL AND SUB-PRESS (See Tool Work)
Brown, Boggs & Co., Ltd., Hamilton, Ont.

DIES, FORGING
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

DIES, SCREW AND THREAD CUTTING
Morse Twist Drill & Machine Co., New Bedford, Mass.

DIES, SELF-OPENING, ADJUSTABLE
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Landis Machine Co., Inc., Waynesboro,
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DIES, THREADING-OPENING
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont

DIVIDING HEADS
Burke Machine Tool Co., Conneaut, Ohio.
Hendey Machine Co., Torrington, Conn.
Kearney & Treacker Co., Milwaukee, Wis.

DOGS, LATHE AND MILLING MACHINE
Armstrong Bros. Tool Co., Chicago, Ill.

DRAFTING MATERIALS
American Lead Pencil Co., New York City, N.Y.

DRESSERS, GRINDING WHEEL
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ont.
Norton Co., of Can., Ltd., Hamilton.
Wheel Trueing Co., Windsor, Ont.

DRESSING TOOLS
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Co., Windsor, Ont.

DRILL HOLDERS
Armstrong Bros. Tool Co., Chicago, Ill.

DRILLING MACHINES, BENCH
Burke Machine Tool Co., Conneaut, Ohio.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Hardinge Bros., Inc., Chicago, Ill.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, ELECTRIC AND HAND
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, GANG
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

DRILLING MACHINES, HEAVY DUTY
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
Herbert, Limited, Alfred, Toronto, Ont.

BORING, DRILLING AND MILLING MACHINES, (HORIZONTAL.)
Gisholt Machine Co., Madison, Wis.
Herbert, Limited, Alfred, Toronto, Ont.

DRILLING MACHINES, Multiple Spindle
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
National Acme Co., Cleveland, Ohio.

DRILLING MACHINES, Pneumatic
Cleveland Pneumatic Tool Co., Toronto. Ont.

DRILLING MACHINES, PORTABLE
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, RADIAL
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Herbert, Limited, Alfred, Toronto, Ont.
Williams Machinery Co., A. R., Toronto,

DRILLING MACHINES, SENSITIVE
Burke Machine Tool Co., Conneaut, O.
Herbert, Limited, Alfred, Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Williams Machinery Co., A. R., Toronto.
Wisconsin Electric Co., Racine, Wis

DRILLING MACHINES, TURRET
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wisconsin
Williams Machinery Co., A. R., Toronto.

DRILLING MACHINES, VERTICAL
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Herbert, Limited, Alfred, Toronto, Ont.

DRILLS, CENTRE
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DRILLS, ELECTRIC
U. S. Electrical Tool Co., Cincinnati, Ohio
Black & Decker Mfg. Co., Ltd., Montreal, Que.

DRILLS, HIGH SPEED TWIST
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Cleveland Twist Drill Co., Cleveland, O.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DRILLS, RATCHET
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

DRILLS, TWIST AND FLAT
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.

DROP FORGINGS
Steel Co. of Canada, Ltd., Hamilton.

DUMB WAITERS
Roelofson Elevator Works, Galt, Ont.

DUST HANDLING EQUIPMENT
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

ELECTRIC DRILLS AND GRINDERS
Black & Decker Mfg. Co., Ltd., Montreal, Que.
U. S. Electrical Tool Co., Cincinnati, Ohio.

ELECTRIC STEAM GENERATORS
Dominion Engineering Works, Limited, Montreal, Que.

ELECTRICAL INSTRUMENTS
Bristol Co., Waterbury, Conn.

ELECTRICAL SUPPLIES
Atkins & Co., Inc., E. C., Indianapolis.
Diamond State Fibre Co., Toronto, Ont.

ELECTRIC TOOLS
U. S. Electrical Tool Co., Cincinnati, Ohio.

ELEVATORS AND CONVEYORS
Can. Link-Belt C., Toronto, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.

ELEVATORS, FREIGHT AND PASSENGER
Roelofson Elevator Works, Galt, Ont.

EQUIPMENT, ELEVATOR SAFETY
Jones & Glassco, Montreal, Que.

EMERY WHEELS (See Grinding Wheels)
Lion Grinding Wheels, Limited, Montreal, Que.
Atkins & Co., E. C., Indianapolis, I.
Norton Co., of Canada., Ltd., Hamilton.

ENGINES, CAPSTAN
Kennedy & Sons, Wm., Owen Sound, Ont.

ENGINEERS, MECHANICAL
Dominion Engineering Works, Limited, Montreal, Que.
Gisholt Machine Co., Madison, Wis.
Hamilton Gear & Machine Co., Toronto,

EXPANDERS, TUBE
Jardine & Co., A. B., Hespeler, Ont.

FANS, ELECTRIC
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

FANS, EXHAUST
Can. Blower & Forge Co., Ltd., Kitchner, Ont.

FANS, VENTILATING
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

FIBRE
Diamond State Fibre Co., of Can. Ltd., Toronto, Ont.

FILES AND RASPS
Nicholson File Co., Port Hope, Ont.
Simmons Canada Saw Co., Montreal, Que.

FILLER, IRON (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J.

FIRE ESCAPES
Roelofson Elevator Co., Galt, Ont.

FITTINGS, PIPE
International Malleable Iron Co., Guelph.
Fittings, Limited, Oshawa, Ont.

FLEXIBLE SHAFTS
Flexible Shaft Co., Ltd., Toronto, Ont.
Strand & Co., N. A., Chicago, Ill

FLUXES, WELDING
Dominion Oxygen Co., Ltd, Toronto
Liquide Air Company, Toronto, Ont.

FORGES
Flexible Shaft Co., Ltd., Toronto, Ont.

FORGING MACHINERY
Acme Machinery Co., Cleveland, Ohio
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown Boggs & Co., Ltd., Montreal.
National Machinery Co., Tiffin, Ohio.
Steel Co. of Canada, Ltd., Hamilton.

FORGINGS, DROP
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Ltd., Toronto, Ont.

FORGINGS, HAMMER
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Hepburn Ltd., John T., Toronto, Ont.

FOUNDRY EQUIPMENT
Rice Lewis & Son, Ltd., Toronto, Ont.

FOUNDRY SUPPLIES
Rice Lewis & Son, Ltd., Toronto, Ont.

FROGS, SPRING OR RIGID
Can. Steel Foundries, Montreal, Que.

FURNACES, ELECTRIC
Rockwell Co., W. S. New York City.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

FURNACES, HEAT TREATING COAL
Rockwell Co., W. S., New York City.

FURNACES, HEAT TREATING OIL AND GAS
Bellevue Industrial Furnace Co., Detroit, Michigan.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Flexible Shaft Co., Ltd., Toronto, Ont.
Rockwell Co. W. S., New York, N. Y.

FURNACES TEMPERING AND ANNEALING
Bellevue Industrial Furnace Co., Detriot, Mich.
Brown & Sharpe Mfg., Co., Providence R. I.
Flexible Shaft Co., Ltd., Toronto, Ont.
Rockwell Co., W. S., New York City.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

FURNACES AND OVENS, ELECTRIC
Rockwell Co. W. S., New York, N. Y.
Starrett Co., L. S., Athol, Mass.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

BUYERS' DIRECTORY

GAGES, MEASURING (See Tool Work)
Brown & Sharpe Mfg. Co., Providence, R. I.
Greenfield Tap & Die Corp., Galt, Ont.
Lufkin Rule Co., Windsor, Ont.
Starrett Co., L. S., Athol, Mass.

GAGES, RECORDING
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GAGES, SPECIAL MEASURING
(See Tool Work)
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GAGES, THREAD
Brown & Sharpe Mfg. Co., Providence R. I.
Herbert, Limited, Alfred, Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

GALVANIZING
Fittings, Limited, Oshawa, Ont.

GAS, COAL COMPRESSED
L'Air Liquid Society, Toronto, Ont.

GAS, COMPRESSED
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

GASKETS
Diamond State Fibre Co. of Ca., Ltd., Toronto, Ont.
Smooth Mfg. Co., Jersey City, N. J.

GAUGES VACUUM AND PRESSURE
Taylor Instrument Co. Toronto, Ont.

GEAR BLANKS
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.
Dominion Engineering Works, Limited, Montreal, Que.

GEAR COUNTERS
Hart Mfg. Co., R. A., Battle Creek, Michigan.

REAP CUTTING MACHINES
Bertram & Sons Co., Ltd., The John, Dundas, Ont.

Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Fellows Gear Shaper Co., Springfield, Vt.
Whiton Machine Co., D. E., New London, Conn.

GEAR TESTING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.

GEARS, CAST
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Hull Iron & Steel Foundries, Hull, Que.
Dominion Engineering Works, Limited, Montreal, Que.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

GEARS, CUT
Brown & Sharpe Mfg. Co., Providence, R. I.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Gardner & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto, Ont.
Hepburn Ltd., John T. Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

GEARS, DRESSED
Kennedy & Sons, Wm., Owen Sound, Ontario.

GEARS, FORGED
Canada Foundries & Forgings Co., Welland, Ont.

GEARS, HERRINGBONE
Hamilton Gear & Machine Co., Toronto, Ont.

GEARS, RAWHIDE (See Gears, Cut)
Hamilton Gear & Machine Co., Toronto.

GEAR, SILENT CHAIN
Gardner & Son, Robt., Montreal, Que.
Can. Link-Belt Co., Ltd., Toronto, Can.
Hans Renold of Canada, Ltd., Montreal, Quebec.

GEARS, WORM
Hamilton Gear & Machine Co., Toronto.

GENERATORS ACETYLENE
L'Air Liquide Society, Toronto, Ont.

GOGGLES, SAFETY
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company. Toronto.

GRAB BUCKETS
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Cleveland Twist Drill Co., Cleveland, O.

GREASE CUPS, PRESSED STEEL AND BRASS
Can. Winkley Co., Ltd., Windsor, Ont.

GREASES, LUBRICATING
Canadian SKF Co., Toronto, Ont

GRINDERS, ELECTRIC
Black & Decker Mfg. Co., Ltd., Montreal, Que.
U. S. Electrical Tool Co., Cincinnati, Ohio.

GRINDERS TOOL POST
U. S. Electrical Tool Co., Cincinnati, Ohio.

GRINDING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Norton Co., of Canada, Ltd., Hamilton

GRINDING MACHINES, ABRASIVE BELT
Norton Co. of Can. Ltd., Hamilton, Ont.

GRINDING MACHINES, AUTOMATIC
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, BENCH
Blount Co., J. G., Everett, Mass.
Geometric Tool Co., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co of Canada, Ltd., Hamilton, Ont.
Pratt & Whitney Co of Canada, Ltd.,

GRINDING MACHINES, CENTER
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES, CUTTER AND REAMER
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, CYLINDRICAL
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.
Norton Co., of Canada, Ltd., Hamilton.

GRINDING MACHINES, DIE
Geometric Tool Co., New Haven, Conn.
National Acme Co., Cleveland, O.
National Machinery Co., Tiffin, Ohio.

GRINDING MACHINES, DRILL
Bellevue Industrial Furnace Co., Detroit, Mich.
Bertram & Son Co., Ltd., The John, Dundas, Ont.

GRINDING MACHINES, ELECTRIC
Strand & Co., N. A., Chicago, Ill.

GRINDING MACHINES, FLOOR AND TOOL
Blount Co., J. G., Everett, Mass.
Herbert, Limited, Alfred, Toronto, Ont
National Acme Co., Cleveland, Ohio.
Norton Co. of Canada, Ltd., Hamilton, Ontario.
Greenfield Tap & Die Corp., Galt, Ont
U. S. Electrical Tool Co., Cincinnati, Ohio.

GRINDING MACHINES, INTERNAL
Garlock Machinery Ltd., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Cleveland Pneumatic Tool Co., Toronto Ont.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES PORTABLE
Strand & Co., N. A., Chicago, Ill.

GRINDING MACHINES, SNAGGING
Blount Co., J. G., Everett, Mass.
Norton Co., of Can. Ltd., Hamilton, Ont
U. S. Electrical Tool Co., Cincinnati, Ohio

GRINDING MACHINES, SURFACE
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, THREAD
Pratt & Whitney Co., of Canada, Ltd., Sound, Ont.

GRINDING MACHINERY, TOOL POST
Gisholt Machine Co., Madison, Wis.
Grenfield Tap & Die Corp., Galt, Ont.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES, UNIVERSAL
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Herbert, Limited, Alfred, Toronto, Ont.
Landis Tool Co. Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co., of Canada, Ltd., Hamilton Ontario.

GRINDING WHEELS
Lion Grinding Wheels, Limited, Montreal, Que.
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Norton Co. of Can., Ltd., Hamilton, Ont.

GUN-BARREL MACHINERY
Steinle Turret Machine Co., Madison, Wisconsin.

HACK SAWS, POWER
Atkins & Co., Inc., E.C., Indianapolis, Indiana.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L S., Athol, Mass.

HAMMERS, CHIPPING
Cleveland Pneumatic Tool Co., Toronto, Ont.
High Speed Hammer Co., Rochester.

HAMMERS, DROP
Bertram & Son Co., Ltd., The John Dundas, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

HAMMERS, ELECTRIC
Brown, Boggs & Co., Ltd., Hamilton, Ont.

HAMMERS, PNEUMATIC
Can. Steel Foundries, Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto Ont.

HANGERS, SHAFTING
Canadian SKF Co., Toronto, Ont.
Brown & Sharpe Mfg Co., Providence, R I.
Hamilton Gear & Machine Co Toronto
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

HOBBING MACHINES
Shore Instrument Co., Jamaica, N Y

HARDENING, CASE-HARDENING AND TEMPERING
Barnes Company, Wallace, Hamilton
Gisholt Machine Co., Madison, Wis.
Cleveland Pneumatic Tool Co., Toronto Ont.

HAMMERS, POWER
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Jardine & Co., A. B., Hespeler, Ont.

HOBS
Brown & Sharpe Mfg. Co., Providence, R I.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

HOISTS, ELECTRIC
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Northern Crane Works, Walkerville, Ont.
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.

HOISTS, HAND
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

HOISTS, PNEUMATIC
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont

HOLDERS-ON, PNEUMATIC
Cleveland Pneumatic Tool Co., Toronto Ont.

HYDRAULIC MACHINERY
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Kennedy & Sons, Ltd., Wm., Owen

IGNITERS, GAS ENGINE
Canada Foundries & Forgings Co., Welland, Ont.
Burke Machine Tool Co., Conneaut, O

INDICATORS, SPEED AND TEST
Brown & Sharpe Mfg. Co., Providence, R.I.

INSULATION
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.

IRON BARS
Steel Co. of Canada, Ltd., Hamilton, Ont.

JACKS, HYDRAULIC
Norton, A. O., Boston, Mass.

JACKS, PLANER
Armstrong Bros. Tool Co., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

JAPANNING AND VARNISHING OVENS
Brantford Oven & Rack Co., Brantford, Ont.

JIGS AND FIXTURES (SEE TOOL WORK)
Fisher Motor Co., Ltd., Orillia, Ont.
Gisholt Machine Co., Madison, Wis.

KEYSEATING MACHINES
Morton Mfg. Co., Muskegon, Mich
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

KEYS, MACHINE
Can. Drawn Steel Co., Hamilton, Ont.
Morton Mfg. Co., Muskegon, Mich.

KNIVES, MACHINE
Atkins & Co., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

KNURL HOLDERS
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

LATHE ATTACHMENTS
Hendey Machine Co., Torrington, Conn.

LATHE TOOLS
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

LATHES, AUTOMATIC AND SEMI-AUTOMATIC
Gisholt Machine Co., Madison, Wis.
Herbert, Limited, Alfred, Toronto, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, BENCH
Hardinge Bros., Inc., Chicago, Ill.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

LATHES, BORING
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, CHUCKING (SEE LATHES, HORIZONTAL TURRET, AND LATHES, VERTICAL TURRET)
Acme Machine Tool Co., Cincinnati, O.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis
Herbert, Limited, Alfred, Toronto, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, ENGINE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hendey Machine Co., Torrington, Conn.
Herbert, Limited, Alfred, Toronto, Ont.

LATHES, EXTENSION AND GAP
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison Wis.
Herbert, Limited, Alfred, Toronto, Ont.
National Acme Co., Cleveland, O.
Steinle Turret Machine Co., Madison, Wis.

LATHES, PRECISION
Hardinge Bros., Chicago.

LATHES, RELIEVING
Hendey Machine Co., Torrington, Conn.

BUYERS' DIRECTORY

LATHE, UNIVERSAL HAND
Brown & Sharpe Mfg. Co., Providence, Rhode Island.

LATHE, SPEED AND HAND
Blount Co., J. G., Everett, Mass.

LATHES, SPINNING
Pryibil Machine Co., Torrington, Conn.

LATHES, VERTICAL TURRET
Bertram & Son, Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

LATHES, WOOD TURNING
Blount, Co., J. G., Everett, Mass.
Can. Fairbanks-Morse Co., Ltd., Montreal.

LEAD PIPE
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

LEATHER FILLET
D. K. McLaren, Limited, Montreal,

LINOLEUM MILL MACHINERY
Bertrams, Ltd., Edinburgh, Scotland.

LIQUID AIR PLANTS
L'Air Liquide Society, Toronto, Ont.

LOCKERS, CLOTHES
Dennis Wire and Iron Works, London, Ont.

LUBRICANTS
Oakley Chemical Co., New York, N.Y.

LUBRICATING SYSTEMS
Bowser, S. F., & Co., Ltd., Toronto, Canada.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Ltd., Welland, Ont.
Ker & Goodwin Machine Co., Brantford, Ont
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R. Toronto Ont.

MANGANESE STEEL
Can. Steel Foundries, Montreal, Que.

MANDRELS, EXPANDING
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont.

MANDRELS, SOLID
Greenfield Tap & Die Corp., Galt, Ont.
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Pratt & Whitney Co., of Canada. Ltd., Dundas, Ont.

MEASURING MACHINES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MECHANICS' FINE TOOLS
Lufkin Rule Co., Windsor, Ont.

METALS, ALLOY
Canada Metal Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.

METAL WORKERS
Parker Co., Charles, Meriden, Conn.

MICROMETER CALIPERS
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Rice Lewis & Son, Ltd., Toronto, Ont.

MILLING ATTACHMENTS
Burke Machine Tool Co., Conneaut, O.
Hendey Machine Co., Torrington, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.

MILLING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Burke Machine Tool Co., Conneaut, O

MILLING MACHINES, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence, R. I.
Hardinge Bros., Inc., Chicago, Ill.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

MILLING MACHINES, BENCH
Burke Machine Tool Co., Conneaut. O.
Hardinge Bros., Inc., Chicago, Ill.

MILLING MACHINES, HAND
Brown & Sharpe Mfg. Co., Providence
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MILLING MACHINES, HORIZONTAL PLANER TYPE.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Kearney & Trecker Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto.

MILLING MACHINES, PLAIN
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, O.
Hendey Machine Co., Torrington, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.

MILLING MACHINES, THREAD
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MILLING MACHINES, UNIVERSAL
Brown & Sharpe Mfg. Co., Providence,
Hendey Machine Co., Torrington, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.

MILLING MACHINES, VERTICAL
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, O.
Herbert, Limited, Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto.

MILLING TOOLS, ADJUSTABLE HOLLOW
Geometric Tool Co., New Haven, Conn.

MOTORS, ELECTRIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Roelofson Elevator Co., Galt, Ont.
Williams Machinery Co., A. R., Toronto,
Wisconsin Electric Co., Racine Wis.

NAILS AND STAPLES
Canada Metal Co., Ltd., Toronto, Ont.

NIPPLES
Canada Metal Co., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton.

NITROGEN
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

NUT TAPPERS
(See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
National Acme Co., Cleveland, Ohio.

NUTS, FINISHED and SEMI-FINISHED
Galt Macine Screw Co., Galt, Ont.
National Acme Co., Montreal, ue.

NUTS (Up to 4-in.)
Steel Co. of Canada, Ltd., Hamilton.

NUTS, S.A.E., PLAIN AND CASTELLATED
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

OIL FILTERING AND STORAGE SYSTEMS
Bowser, S. F., & Co., Ltd., Toronto,

OIL STORAGE ENGINEERS
Bowser, S. F., & Co., Ltd., Toronto,

OIL HOLE COVERS
Can. Whitney Co., Ltd., Windsor, Ont.

OILS, SOLUABLE
Brantford Oven & Rack Co., Brantford, Ontario.

ORNAMENTAL IRON AND WIRE WORKS
Roelofson Elevator Works, Galt, Ont.

OXYGEN
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

OXY-ACETYLENE APPARATUS
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Atlas Press Co., Kalamazoo, Mich.

PAPER MILL CONVEYORS
Bertram Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd., Montreal, Que.

PAPER MILL MACHINERY
Dominion Engineering Works, Limited, Montreal, Que.

PATTERNS, WOOD AND METAL
Fittings, Limited, Oshawa, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.
Victoria Foundry Co., Ltd., Ottawa.

PHOSPHOR TIN
Canada Metal Co., Ltd., Toronto, Ont.

PHOTOGRAPHIC DUPLICATING MACHINES
Photostat Corp., Providence, R. I.

PIPE BENDING MACHINES
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Underwood Corp., H. R., Philadelphia, Pa.
Williams Machinery Co., A. R., Toronto.

PIPE CUTTING AND THREADING MACHINES
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.

PIPE
Canada Metal Co., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.

PIPE FITTINGS
Canada Metal Co., Toronto, Ont.
International Malleable Iron Co., Guelph Ont.

PIPE AND NIPPLE THREADING MACHINES
Landis Machine Co., Inc., Waynesboro, Pa.

PIPE FITTERS' TOOLS
Rice Lewis & Son, Ltd., Toronto. Ont.

PIPE THREADING DIE HEADS
Landis Machine Co., Inc., Waynesboro, Pa.

PISTON-RING MACHINES
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

PLANING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Williams Machinery Co., A. R., Toronto.

PLANING MACHINES, ROTARY
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Herbert, Limited, Alfred, Toronto, Ont.

PLATE ROLLS
Bertram & Son Co., Ltd., The John, Dundas, Ont.

PNEUMATIC TOOLS
Cleveland Pneumatic Tool Co., Toronto.

POLISHING AND BUFFING MACHINES
Lion Grinding Wheels, Limited, Montreal, Que
Blount Co., J. G. Everett, Mass.
Brown & Sharpe Mfg. Co., Providence.
Pryibil Machine Co., New York, N.Y.

PRESSED STEEL PARTS
American Pulley Co., Philadelphia, Pa.

PRESSES, ARBOR
Atlas Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

PRESSES, DROP AND FORGING
Brown, Boggs & Co., Ltd., Hamilton.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

PRESSES, FOOT AND HAND
Brown, Boggs & Co., Ltd., Hamilton

PRESSES, HYDRAULIC
Bertram & Son Co., Ltd., The John Dunidas, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Perrin Ltd., W. R., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

PRESSES, POWER
Bliss Co., E. W., Prooklyn, N. Y.
Brown, Boggs, & Co., Ltd., Hamilton.
Hepburn Ltd., John T., Toronto, Ont.
Stoll Co., Inc., D. H., Buffalo, N.Y.

PRESSES, SCREW
Brown, Boggs & Co., Ltd., Hamilton.

PROFILING MACHINES
Prtt & Whitney Co., of Canada, Ltd., Dundas, Ont.

PROTRACTORS
Brown & Sharpe Mfg. Co., Providence.
Lufkin Rule Co., Windsor, Ont.

PROPELLERS
Kennedy & Sons, Wm., Owen Sound Ontario.

PULLEYS, CORK INSERT
American Pulley Co., Philadelphia, Pa.

PULLEYS, METAL AND FIBRE
American Pulley Co., Philadelphia, Pa.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.
D. K. McLaren Co., Limited Montreal, Que.

PULP AND PAPER MILL EQUIPMENT
Dominion Engineering Works, Ltd., Montreal, Que.

PUMPS, HYDRAULIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Dominion Engineering Works, Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont

PUMPS, LUBRICANT AND OIL
Bowser, S. F., & Co., Ltd., Toronto.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Hepburn Ltd., John T., Toronto, Ont.

PUMPS, POWER
Bowser, S. F., & Co., Ltd., Toronto.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hepburn Ltd., John T., Toronto, Ont.

PUNCHES, CENTER
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

PUNCHES, HAND
Brown Boggs & Co., Ltd., Hamilton.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Jardine & Co., A. B., Hespeler, Ont.

PUNCHES, POWER
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

PUNCHING MACHINES, HORIZONTAL
Bertrams Ltd., Edinburgh, Scotland.

PYROMETERS, ELECTRIC
Bristol Co., Waterbury, Conn.
Flexible Shaft Co., Ltd., Toronto, Ont.
Taylor Instrument Co., Toronto, Ont.
Hiram Walker & Sons Metal Products Co., Walkerville, Ont.

RACKS, CUT
Hamilton Gear & Machine Co., Toronto.

RACKS, STORAGE
(See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ontario.

REAMER HOLDERS
Simonds Canada Saw Co., Montreal, Q.

REAMERS, ELECTRIC
U. S. Electrical Tool Co., Cincinnati, Ohio.

REAMERS, EXPANDING
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

REAMERS, SOLID
Butterfield & Co., Inc., Rock Island, Q.
Morse Twist Drill & Machine Co., New Bedford, Mass.

REAMERS, TAPER
Brown & Sharpe Mfg. Co., Providence, R. I.
Butterfield & Co., Inc., Rock Island, Q.
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canad, Ltd., Dundas, Ont.

RECORDERS, TEMPERATURE
Taylor Instrument Co., Rochester, N. Y.

RECORDERS, TIME
Gisholt Machine Co., Rochester, N. Y.
Taylor Instrument Co., Toronto, Ont.

REGULATORS, TEMPERATURE
Taylor Instrument Co., Toronto, Ont.

RIVETS AND BURRS
Parmenter & Bulloch Co., Gananoque, Ont.
Steel Co., of Canada, Ltd., Hamilton.

RIVET-MAKING MACHINERY
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

BUYERS' DIRECTORY

RIVETING MACHINES
Can. Fairbanks-Morse Ltd., Montreal Q.
High Speed Hammer Co., Rochester, N.Y.
Parmenter & Bulloch Co., Gananoque Ont.

RUDDER FRAMES, STEEL
Can. Steel Foundries, Montreal, Que.

RUBBER MILL MACHINERY
Bertram Ltd., Edinburgh, Scotland.

RULES, STEEL AND WOOD
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Windsor, Ont.

RUST PREVENTATIVES
Oakley Chemical Co., New York, N. Y.

SAND EQUIPMENT
Can. Link-Belt Co., Toronto, Ont.

SAND RAMMERS, PNEUMATIC
Cleveland Pneumatic Tool Co., Toronto.

SAW FRAMES AND BLADES, HACK
Atkins & Co., Inc., E. C., Indianapolis.
Diamond Saw & Stamping Works, Buffalo, N. Y.
Rice Lewis & Sons, Ltd., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWING MACHINES, POWER HACK
Atkins & Co., Inc., E. C., Indianapolis.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

SAW SHARPENING MACHINES
Atkins & Co., Inc., E. C., Indianapolis.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

SAWS, CIRCULAR METAL
Atkins & Co., Inc., E. C., Indianapolis.
Pryibil Machine Co., New York, N. Y.
Gisholt Machine Co., Madison, Wis.

SAWS, HAND
Atkins & Co., Inc., E. C., Indianapolis
Simonds Canada Saw Co., Montreal, Q.

SAWS, HOT AND COLD
Atkins & Co., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Q.

SAWS, HIGH SPEED STEEL
Atkins & Co., Inc., E.C., Indianapolis, I.
Butterfield & Co. Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWS, METAL BAND
Atkins & Co., E. C., Indianapolis, I.

SAWS, METAL CUTTING
Brown & Sharpe Mfg. Co., Providence.
Butterfield & Co., Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.
Starrett Co., L. S., Athol, Mass.

SAWS, SCREW SLOTTING
Atkins & Co., Inc., E., C., Indianapolis.
Butterfield & Co., Inc., Rock Island, Q.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canda, Ltd., Dundas, Ont.

SAWS, SCREW SLOTTING
Atkins & Co., Inc., E. C., Indianapolis.
Butterfield & Co., Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWS, WOOD
E. C. Atkins & Co., Indianapolis, Ind.

SCALES
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Lufkin Rule Co., Windsor, Ont.

SCREENS
Dominion Engineering Works, Ltd., Montreal, Que.

SCREW DRIVERS, OPTICAL, JEWELRY AND NOVELTY
Strand & Co., N. A., Chicago, Ill.

SCREW MACHINE WORK
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Montreal, Que.

SCREW MACHINERY, WOOD AND LAG
Cook Co., Asa S., Hartford, Conn.

SCREW MACHINES
Brown & Sharpe Mfg. Co., Providence, Rhode Island.

SCREW MACHINES, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.

SCREW MACHINE PRODUCTS
National Acme Co., Montreal, Que.

SCREW PLATES
Butterfield & Co., Inc., Rock Island, Que.
Jardine & Co., A. B., Hespeler, Ont.

SCREWS, CAP AND SET
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

SCREWS, SAFETY, SET
Galt Machine Screw Co., Galt, Ont.

SECOND-HAND MACHINERY
See last page of directory.

SEPARATORS, MOISTURE AND OIL
Bowser, S. F., & Co., Ltd., Toronto, Canada.

SEPARATORS, OIL AND WASTE
Bowser, S. F., & Co., Ltd., Toronto.

SHAFTS, FLEXIBLE
Strand & Co., N. A., Chicago, Ill.

SHAFTING
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
Williams Machinery Co., A. R., Toronto.

SHAPES, COLD-DRAWN SPECIAL STEEL
Union Drawn Steel Co., Hamilton, Ont.

SHAPING MACHINES
Hendey Machine Co., Torrington, Conn.
Morton Mfg. Co., Muskegon, Mich.
Williams Machinery Co., A. R. Toronto.

SHEARS HAND
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

SHEARS, POWER
Bliss Co., E. W., Brooklyn, N. Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Stoll Co., Inc., D. H., Buffalo, N. Y.
Williams Machinery Co., A. R., Toronto, Ont.

SHEARING MACHINES, ANGLE, IRON BAR AND GATE
Bertrams Ltd., Edinburgh, Scotland.

SHEET LEAD
Canada Metal Co., Ltd., Toronto, Ont.

SHEET METAL WORKING MACHINERY
Bliss Co., E. W., Brooklyn, N. Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Stoll Co., Inc., D. H, Buffalo, N.Y.

SHEETS, NICKEL, MONEL AND FIBRE
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.

SHEETS, O.P.C.R. & B. A. AND BLUE ANNEALED
Steel Co., of Canada, Ltd., Hamilton, Ont.

SIDE FRAMES, LOCOMOTIVE
Can. Steel Foundries, Montreal, Que.

SLOTTING ATTACHMENTS
Brown & Sharpe Mfg. Co., Providence, R.I.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

SLOTTING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.

SOLDERS
Canada Metal Co., Ltd., Toronto, Ont.

SPECIAL MACHINERY AND TOOLS
Brown Engineering Corp., Ltd., Toronto.
Gisholt Machine Co., Madison, Wis.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.
National Acme Co., Cleveland, O.

SPIKES, RAILWAY AND PRESSED
Steel Co of Canada, Ltd., Hamilton, Ont.

SPINNING LATHES
Prybil Machine Co., P., New York City.

SPRING, MILLED
Barnes & Co., Wallace, Hamilton, Ont.

SPRINGS, SMALL SPIRAL HELICAL, COMPRESSION, EXTENSION, TORSION AND SPECIAL
Barnes Company, Wallace, Hamilton.

SPRINGS
Barnes Company, Wallace, Hamilton.
Cleveland Wire Spring Co., Clevleand, O.
Steele Ltd., James, Guelph, Ont.

SPRINGS, FLAT STEEL, BRUSH HOLDER, CLOCK, SMALL FLAT SPRINGS
Barnes Company, Wallace, Hamilton.

SPROCKETS AND CHAINS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Renold Hanson of Canada, Ltd., Montreal, Que.

SQUARES
Brown & Sharpe Mfg. Co., Providence, R.I.
Lufkin Rule Co., Windsor, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

STAMPING, METAL
American Pulley Co., Philadelphia, Pa.
Barnes Company, Wallace, Hamilton.
Diamond Saw & Stamping Works, Buffalo, N. Y.
Parmenter & Bulloch Co., Gananoque, Ont.

STAMPS, STEEL
Diamond Saw & Stamping Works, Buffalo, N. Y.

STEEL CONCRETE REINFORCEMENT
Steel Co. of Canada, Ltd., Hamilton.

STEEL PLATE
British Empire Steel Co., Montreal, Que.

STEEL AND IRON BARS
Steel Co. of Canada, Ltd., Hamilton.

STEELS TOOL
British Empire Steel Co. Montreal Q.

STEEL, COLD-ROLLED STRIP
British Empire Steel Co., Montreal, Q.
Barnes Company, Wallace, Hamilton.

STEEL, CRUCIBLE, SPRING
Barnes, Company, Wallace, Hamilton.
British Empire Steel Co., Montreal, Q.

SHEETS, OPEN HEARTH STEEL
Steel Co., of Canada, Ltd., Hamilton.

STEEL, SHAFTING AND FREE CUTTING SCREW
Union Drawn Steel Co., Hamilton, Ont.

STEEL, SHEET
British Empire Steel Co., Montreal, Q.
Rice Lewis & Son, Ltd., Toronto, Ont.

STEEL, STAINLESS
Steel Co., of Can. Ltd., Hamilton, Ont.

STEEL STAIRS
Roelofson Elevator Works, Galt, Ont.

STEELS, ALLOY AND CARBON
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Can. Steel Foundries, Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton, Ont.

STEELS, HIGH-SPEED
Armstrong Bros. Tool Co., Chicago, Ill.
Atkins & Co., Ltd., Wm., Sheffield, England.
British Empire Steel Co., Montreal, Q.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton.

STEEL TUBING, CLOSE JOINT AND WELDED
Standard Tube & Fence Co., Ltd., Woodstock, Ont.

STERN FRAMES, CAST STEEL
Can. Steel Foundries, Montreal, Que.

STRAIGHTENING MACHINERY
Bertram Ltd., Edinburgh, Scotland.
Williams & Co., Ltd., J. H., Brooklyn, N.Y.

STUDS
Galt Machine Screw Co., Galt, Ont.

STUD SETTERS, SELF OPENING
Geometric Tool Co., New Haven, Conn.

SWAGING MACHINES
Atkins & Co., Inc., E. C., Indianapolis, Indiana.

SWITCHES, RAILWAY
Can. Steel Foundries, Montreal, Que.

TACHOMETERS
Bristol Co., Waterbury, Conn.

TANKS AND PUMPS, OIL
Bowser, S. F., & Co., Ltd., Toronto.

TAP HOLDERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
William L. Procunier, Chicago, Ill.

TAPER PINS
Galt Machine Screw Co., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

TAPES, MEASURING
Starrett Co., L. S., Athol, Mass.
Lufkin, Rule Co., Windsor, Ont.

TAPPING MACHINES AND ATTACHMENTS
Burke Machine Tool Co., Canneaut, O.
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.
Wm. L. Procunier, Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

TAPS AND DIES
Butterfield & Co., Inc., Rock Island, Q.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Herbert, Limited, Alfred, Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

TAPS, COLLAPSING
Geometric Tool Co., New Haven, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.

TEETH, DREDGE BUCKET
Kennedy & Sons, W., Owen Sound, Ont.

THERMOMETERS
Bristol Co., Waterbury, Conn.
Flexible Shaft Co., Ltd., Toronto, Ont.
Taylor Instrument Co., Toronto, Ont.
Greenfield Tap and Die Corp., Galt, Ontario.

THREAD-CUTTING TOOLS
Butterfield & Co., Inc., Rock Island, Q.
Greenfield Tap and Die Corp., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

THREAD CUTTING MACHINES
Landis Machine Co., Inc., Waynesboro, Pa.

THREADING MACHINES
Acme Machinery Co., Cleveland, Ohio.
Geometric Tool Co., New Haven, Conn.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Williams Tool Corp., of Can. Ltd., Brantford, Ont.

THREAD LEAD TESTING MACHINES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

THREAD-ROLLING MACHINES
Bliss Co., E. W., Brooklyn, N. Y.

TIE PLATES
Steel Co. of Canada, Ltd., Hamilton.

TIME RECORDERS
International Business Machine Co., Ltd., Toronto, Ont.

TONGS
Hepburn Ltd., John T., Toronto, Ont.

TOOL CASES
Rice Lewis & Son, Ltd., Toronto, Ont.

TOOL HOLDERS
Armstrong Bros., Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Bertrams Ltd., Edinburgh, Scotland.

TOOL POSTS, LATHE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Williams & Co., Ltd., J. H., Brooklyn, N.Y.

TOOLS, SMALL
(See Machinists' Small Tools)
Armstrong Bros. Tool Co., Chicago, Ill.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Lufkin Rule Co., Windsor, Ont.
National Machine Tool Co., Racine, Wis.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S. Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A.R., Toronto,

TOOL WORK
Brown Engineering Corp., Ltd., Toronto, Ontario.

TORCHES, BLOW
Rice Lewis & Son, Ltd., Toronto, Ont.

TRACKWORK, RAILWAY
Can. Steel Foundries, Montreal, Que.

TRACKWORK, MANGANESE STEEL
Can. Steel Foundries, Montreal, Que.

TRANSMISSION MACHINERY
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound.
Renold, (Hans) of Canada, Ltd., Montreal, Que.

TROLLEYS AND TRAMWAYS
Can. Link-Belt Co., Toronto, Ont.
Northern Crane Works, Walkerville, Ont.
Wright Mfg. Co., Lisbon, Ohio.

TROLLEY WHEELS
Langley & Austin, Galt, Ont.

TROWELS, PLASTERING
E. C. Atkins & Co., Indianapolis, Ind.

WRENCHES, MACHINISTS'
Armstrong Bros. Tool Co., Chicago, Ill.

TRUCKS
Can. Fairbanks-Morse Ltd., Montreal, Q.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.

BUYERS' DIRECTORY

TUBING, SEAMLESS STEEL, BRASS AND COPPER AND FIBRE
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.

TURRET HEADS
Bertram & Son Co., Ltd., The John Dundas, Ont.

TURRET MACHINES
(See Lathes, Horizontal Turret)
Acme Machine Tool Co., Cincinnati, O.
Cook Co., Asa S., Hartford, Conn.
Gisholt Machine Co. Madison Wis.
Herbert, Limited, Alfred, Toronto, Ont.
National Acme Co. Cleveland O.
Pratt & Whitney Co. of Canada Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin

TURRETS, TOOL POST
Gisholt Machine Co. Madison, Wis.

UNIONS, PIPE
Fittings, Limited, Oshawa, Ont.

VALVES
Canada Metal Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

VISES, DRILLING MACHINE
Burke Machine Tool Co., Conneaut, Ohio.
Charles Parker Co., Meriden, Conn.
Cleveland Pneumatic Tool Co., Toronto, Ontario.
Kempsmith Mfg Co., Milwaukee, Wis.

VISES, PIPE
Charles Parker Co., Meriden, Conn.

VISES, PLANER AND SHAPER
Bertram & Son Co., Ltd., The John Dundas, Ont.
Philip Gies Foundry, Kitchener, Ont.
Hendley Machine Co., Torrington, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.

VISES, WOOD WORKERS'
Charles Parker Co., Meriden, Conn.
Parmenter & Bulloch Co., Gananoque, Ontario.

VOLTMETERS
Bristol Co., Waterbury, Conn.

WAGON LEADERS
Can. Link-Belt Co., Toronto, Ont.

WASHERS, LOCK, SPLIT AND SPRING
Barnes Company, Wallace, Hamilton.

WATER POWER PLANTS
Dominion Engineering Works, Limited, Montreal, Que.

WELDING APPARATUS, OXY-ACETYLENE
L'Air Liquide Society, Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto, Ont.

WELDING APPARATUS
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.

WELDING, ELECTRIC, ARC, SPOT AND BUTT
International Malleable Iron Co., Guelph, Ont.

WELDING MACHINES, OXY-ACETYLENE
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.

WELDING, ELECTRIC
McLaren Belting Co., J. C., Montreal, Que.
Steel Co. of Canada, Ltd., Hamilton.

WELDING ROD, TOBIN, MANGANESE, BRONZE AND ALUMINUM
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto, Ont.

WELDING SUPPLIES
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.

WHEELS, INDUSTRIAL
American Pulley Co., Philadelphia, Pa.
Hull Iron & Steel Foundries, Hull, Que.
Kennedy & Sons, Wm., Owen Sound, Ontario.

WINCHES, HEADGATE
Kennedy & Sons, Wm. Owen Sound, Ontario.

WINCHES, STOPLOG
Kennedy & Sons, Wm., Owen Sound, Ontario.

WIPING PRODUCTS
Sanitary Wiping Products Co., Toronto, Ont.

WIRE
Barnes Company, Wallace, Hamilton.
Canada Metal Co., Ltd., Toronto, Ont
Dennis Wire & Iron Works, London, Ontario.
Greening Wire Co., B., Hamilton, Ont.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

WIRE, BLACK TEMPERED, MUSIC PHOSPHOR BRONZE AND PREMIER
Barnes Company, Wallace, Hamilton

WIRE, COPPER AND BRASS, FINE AND HEAVY
Steel Co., of Canada, Ltd., Hamilton, Ontario.

WIRE STRAIGHTENING AND CUTTING MACHINERY
Brown, Boggs & Co., Ltd., Hamilton, Ontario.

WIRE, WELDING
L'Air Liquide Society, Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.

WIRES, SPECIAL
Dennis Wire & Iron Works, London, Ontario.
Greening Wire Co., B., Hamilton, Ont

WOODWORKING MACHINERY
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Williams Machinery Co., A. R., Toronto, Ontario.

WRENCHES, DROP FORGED
Armstrong Bros. Tool Co., Chicago, Ill
Canada Foundries & Forgings Co., Welland, Ont.

Buying made easy

By grouping together these manufacturers of Special Machinery, Gears, Gauges, Dies, etc., we are making buying easy for you. Here you have a directory of the firms who can fill your requirements on any of these lines. When you are in need of any of the above, consult the firms listed here

CANADIAN MACHINERY

Buyers' Directory

143 University Ave. - - Toronto

$5 May Save You $500 or $5,000!

You work hard for the dollars you save. Properly invested they can be made to work hard for you. But they must be properly invested.

If you feel the need of a guide to show you how to invest your money to bring you the biggest return consistent with safety; to show you how to avoid the pitfalls of investment; you need THE FINANCIAL POST.

It will give you a personalized investment service. Its articles every week will tell you what you want to know about investing. Its discussion of current business and national problems will give you a new angle on economic and political questions. You will have too all the privileges of the Investors Inquiries Department. You may ask as many questions as you like about your own investment and financial problems—the standing of your broker, and the analysis of particular securities, insurance problems, etc. This service is free to all readers.

Stop losing money on bad investments. Invest $5 now where it may save you $500 or $5,000. Pin a $5 bill to this ad. (or your letterhead), write your name and address and we will send you THE POST for one year (52 issues).

THE FINANCIAL POST 143 University Ave. Toronto

DIRECTORY OF DEALERS

THE Buyers' Directory of CANADIAN MACHINERY was originally intended to contain information regarding lines actually manufactured by our advertisers. We now carry the advertising of leading machinery dealers, some of whom represent scores of manufacturers in addition to being manufacturers themselves in some cases. We recommend, therefore, if our subscribers cannot find what they want in our Directory that they communicate with the dealers whose names appear herewith.

MACHINE TOOLS, ETC.

Bertram & Sons, Ltd., John, Dundas, Ont.
The Canadian Fairbanks-Morse Co., Montreal, Que.
Garlock Machinery Ltd., Toronto.
Herbert Ltd., Alfred, Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

SHOP and FACTORY SUPPLIES

The Canadian Fairbanks-Morse Co., Montreal, Que.

Garlock Machinery Ltd., Toronto.
Herbert Ltd., Alfred, Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

POWER EQUIPMENT, ETC.

The Canadian Fairbanks-Morse Co., Montreal, Que.
Herbert Ltd., Alfred, Toronto, Ont.

WOODWORKING MACHINERY

The Canadian Fairbanks-Morse Co., Montreal, Que.

Garlock Machinery Ltd., Toronto.
Herbert Ltd., Alfred, Toronto, Ont.

A. R. Williams Machinery Co, Toronto, Ont.

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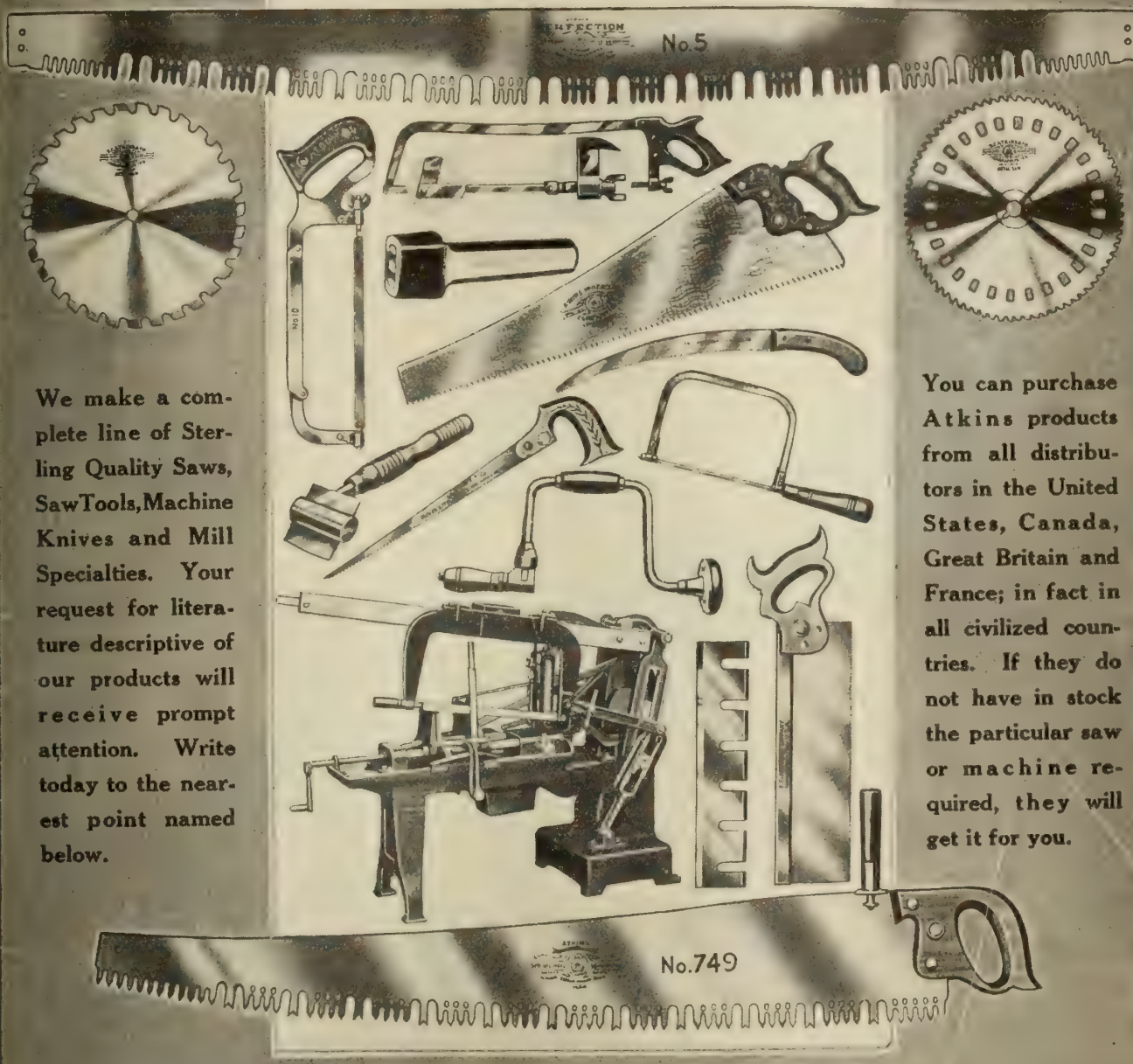
STERLING QUALITY SAWS and TOOLS

A Perfect Saw for every Purpose

"Finest on Earth"

"Finest on Earth"



We make a complete line of Sterling Quality Saws, SawTools, Machine Knives and Mill Specialties. Your request for literature descriptive of our products will receive prompt attention. Write today to the nearest point named below.

You can purchase Atkins products from all distributors in the United States, Canada, Great Britain and France; in fact in all civilized countries. If they do not have in stock the particular saw or machine required, they will get it for you.

If you have difficulty in obtaining Atkins Saws and other products through your regular service, write

E. C. Atkins & Company

Established 1857

Canadian Factory: HAMILTON, ONTARIO

Branch: VANCOUVER, B. C.

NAMCO

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STANDARD

S.A.E., U.S.S. & "V" Cap Screws, "V" and U.S.S. Set Screws, S.A.E. Plain and Castellated Nuts, U.S.S. and "V" Semi-Finished Nuts and Studs.

SPECIAL

Screw Machine Product up to $2\frac{1}{4}$" diameter to sample or blueprint made up promptly.

Hardened and ground product to specifications.

THE

NATIONAL ACME COMPANY

MONTREAL, P.Q.

CANADIAN MACHINERY
AND MANUFACTURING NEWS

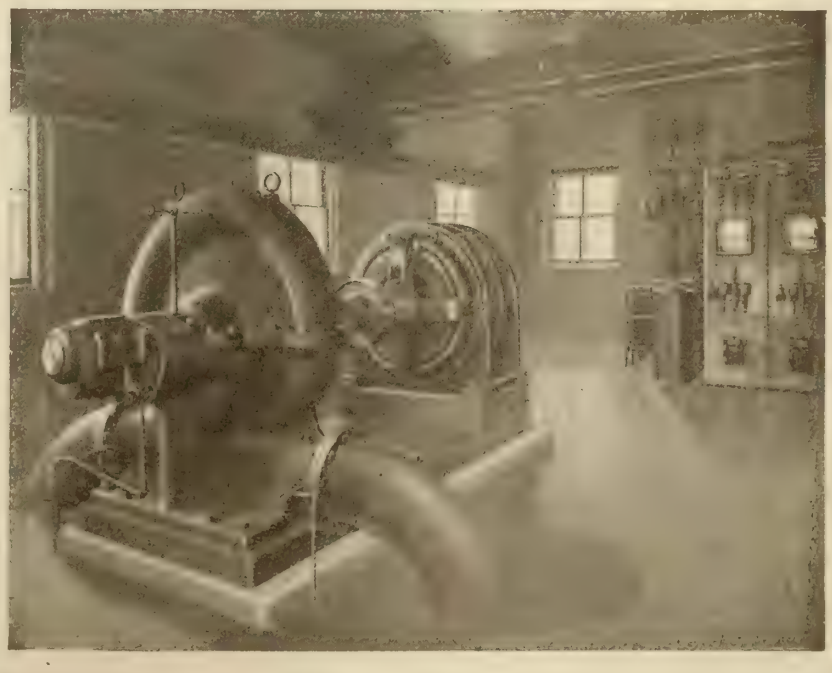
Vol. XXVIII. No. 23 | Published Weekly by the MacLean Publishing Company, Limited, Toronto, Ont. | Dec. 7, 1922 | $4.00 a Year Subscription Price

READ AND PASS TO	Check	See Page	READ AND PASS TO	Check	See Page

BAWDEN

Manufacturers of the Following Lines

Bawden Steam Pumps
Bawden Centrifugal Pumps
Bawden Vacuum Pumps
Bawden Air Compressors
Rubber Mill Machinery
Rubber Tire Moulds
Special Automatic Machinery
Special Brass Work
Gear Cutting of all kinds
Also makers of
Brass, Bronze, Aluminum and
Grey Iron Castings.



Bawden Installation at Riverdale Pumping Station, city of Toronto

Bawden Machine Co., Limited
Sterling Road, Toronto, Ont.

No Shoulders
No Necks or Bellies

Just the tough back portions of hides, specially selected by experts, are used in the making of

D. K. McLAREN'S BELTING

These, in turn, are subjected to a process of tanning that not only adds to the original toughness of the hides but imparts a flexibility possible to attain only by this

Genuine British Oak Tanning Process

It is to this long-time and expensive tanning process that D. K. McLaren's Leather Belting owes its reputation for "gripping power" and "trouble-free" service on the pulley, even under adverse conditions.

The **Oak Leaf** is stamped upon all D. K. McLaren's Leather Belting as a sign of this efficiency—**Look for it.**

D·K McLAREN
LIMITED

Head Office and Factory:

351 St. James St., Montreal, P.Q.

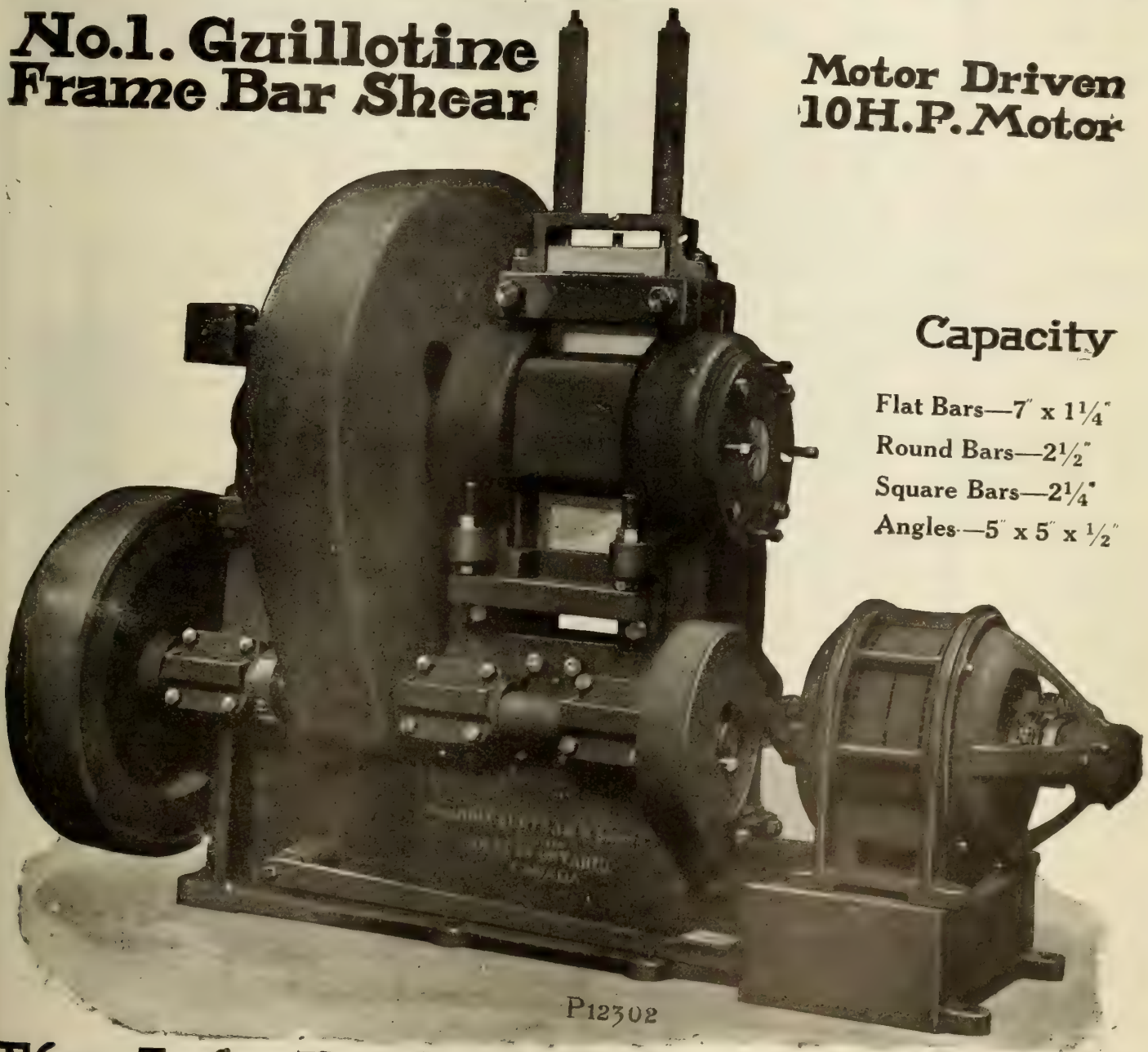
Toronto, Ont. 194 King St. West.
St. John, N. B. 90 Germain St.
Calgary, Alta. Gormans, Limited.
Edmonton, Alta. Gormans, Limited
Vancouver, B. C. Gormans, Limited, 1158 Homer St.

The BERTRAM Page

MACHINE TOOLS

No. 1. Guillotine Frame Bar Shear

Motor Driven
10 H.P. Motor



Capacity

Flat Bars—7″ x 1¼″
Round Bars—2½″
Square Bars—2¼″
Angles—5″ x 5″ x ½″

The John Bertram & Sons Co., Limited

DUNDAS. ONTARIO. CANADA.

MONTREAL 723 Drummond Bldg. | TORONTO 32 Front St. W. | VANCOUVER 609 Bank of Ottawa Bldg. | WALKERVILLE 103½ Sandwich St. | WINNIPEG 1205 McArthur Bldg. | HALIFAX Roy Bldg.

If what you need is not advertised, consult our Buyers' Directory and write advertisers, listed under proper heading

A Short Story About Long Faces

"Boss, ain't you sorry you's baldheaded?"

"Why, no, Sam; I haven't any hair to comb now."

"Dat's so, boss; but you suttinly has a long face to wash."—Boston Transcript.

YOU don't have to be bald to have a long face. Keen disappointment will give you a long face. Chagrin will stretch a man's countenance perpendicularly. If a man finds he has been outmanoeuvred, or if he finds himself a victim of his own lack of judgment you will find his face elongated.

For instance, on the first of January when our "*Annual Review and Reference Number*" goes into circulation a few manufacturers may pull long faces when they see the advertisements of their wise competitors. All other things being equal a strong advertisement in our "*Annual Review and Reference Number*" will give one manufacturer a long lead over his competitor who neglects to take a similar step.

Supposing Mr. Brown, sales manager for Jones & Co., was attending a huge gathering of the leading buyers in the metal-working field. He was asked to give a short talk on his line. He gets on his feet and to his audience he says: "Gentlemen, I have nothing to say." What would the inference be?

Mr. Smith, sales manager for Messrs. Black & Co., attending the same gathering, is asked to tell about his line. In a short, snappy, well-directed talk of five minutes he drives home his message. Which man would create the most favorable impression?

In our "*Annual Review and Reference Number*" you have the opportunity to address not only one but many clients—leading buyers in the metal-working industry of this country. Because of its size and interesting contents, both editorial and advertising, it is kept for months for reference purposes, and not only does it circulate in Canada, but it will be on file in the office of all the trade commissioners and copies are being sent to a selected list of importers in the various foreign countries with which Canada can do business to-day.

Don't start the year with a long face. A good strong sales message in our "*Annual Review and Reference Number*" will make you pleased with yourself and with the world in general. The outlook for business is better than it has been for a long time. This does not mean, however, that you will not have to look out for business.

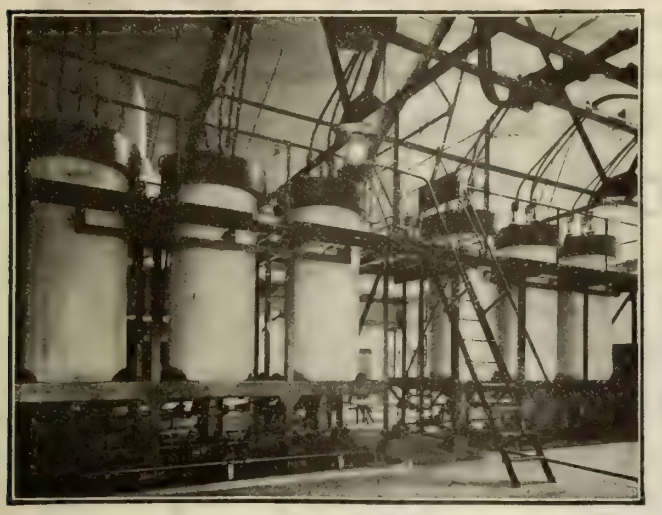
Start the new year right—write us for particulars regarding space in our "Annual Review and Reference Number" while there still is time.

Canadian Machinery and Manufacturing News

153 University Avenue

TORONTO

If interested, tear out this page and place with letters to be answered



Two 3 phase Kaelin Electric Steam Generator Units for 6600 volts, designed and built by us for the Laurentide Co., Limited. Capacity of units shown, 7000 boiler horsepower, all controlled by a single operator on each shift.

"Can our idle power be made to conserve our coal pile?"

It's worth finding out and we have the answer.

A number of plants producing or purchasing power but not using it fully at week-ends or other periods are turning this surplus energy into heat by means of

The Kaelin Electric Steam Generator

(Patents applied for)

The generator shown at the left is typical of sizes from 75 to 400 boiler horsepower for 3-phase power. Note its compactness and convenience.

thus securing remarkable reductions in their bills for coal or other fuel.

The saving in labor is also quite important. Altogether, the generator often pays for itself within a short time.

We build these generators in sizes from 5 to 3,500 boiler horsepower, for pressures up to 200 lbs.; also in sizes from 5 to 75 boiler horsepower for low pressure steam heating.

When desired, any of these generators may be equipped with automatic pressure or surplus power control.

Write for Quotations.

Hydraulic Department:

I. P. Morris Hydraulic Turbines and Centrifugal Pumps. The Larner-Johnson Hydraulic Valve in sizes up to 20 ft. diameter. Large Gate and Pivot Valves.

Paper Machinery Department:

Fourdrinier Machines for Fine Papers, High-Speed Machines for Newsprint or Kraft, Cylinder and Wet Machines, Millspaugh Suction Rolls, etc.

Dominion Engineering Works, Limited

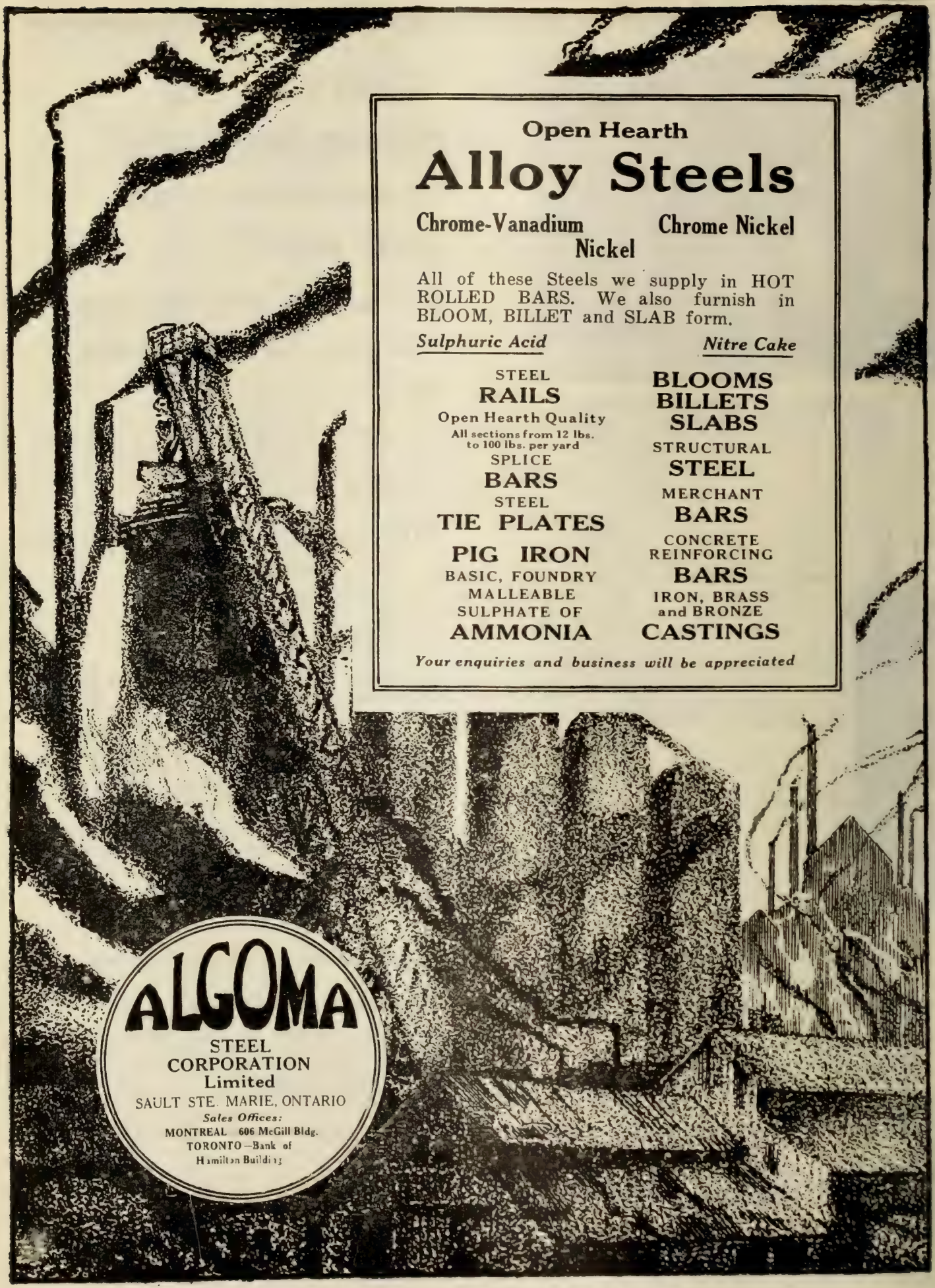
Telephone: Melrose 700

Montreal, Canada

Cable Address: "Domworks, Montreal"

Western Representative: R. F. MATHER, London Building, Vancouver, B.C.

(M-74)



Open Hearth

Alloy Steels

Chrome-Vanadium Chrome Nickel
Nickel

All of these Steels we supply in HOT ROLLED BARS. We also furnish in BLOOM, BILLET and SLAB form.

Sulphuric Acid *Nitre Cake*

STEEL
RAILS
Open Hearth Quality
All sections from 12 lbs. to 100 lbs. per yard
SPLICE
BARS
STEEL
TIE PLATES
PIG IRON
BASIC, FOUNDRY
MALLEABLE
SULPHATE OF
AMMONIA

BLOOMS
BILLETS
SLABS
STRUCTURAL
STEEL
MERCHANT
BARS
CONCRETE
REINFORCING
BARS
IRON, BRASS
and BRONZE
CASTINGS

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CORPORATION
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TORONTO—Bank of
Hamilton Building

If interested tear out this page and place with letters to be answered.

No User of Oxygen or Dissolved Acetylene Should Make Arrangements for the Year's Supply Without First Securing Our Prices

THE Dominion Oxygen Company's policy of maintaining a definite schedule of prices based on consumption works to your advantage.

Prices are now appreciably lower than a year ago due to the price reductions as the volume of sales increased.

If you are not familiar with the Dominion Oxygen policy which provides for a liberal contract, prompt shipments, modern cylinders, friendly relations with customers, and the lowest prices obtainable, we will be glad to tell you about it.

DOMINION OXYGEN COMPANY, Limited

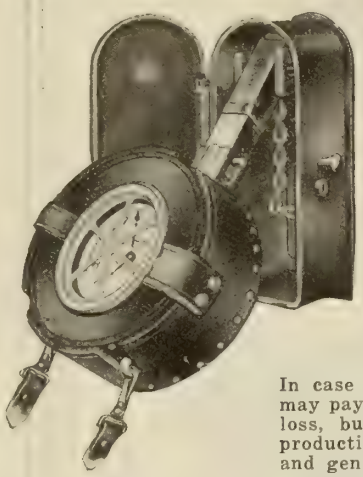
Operating the Welding and Cutting Gas Division of
PREST-O-LITE COMPANY OF CANADA, LIMITED

General Offices: 80 Adelaide St. East, TORONTO.

Hamilton Merritton Welland Montreal Oshawa Windsor Quebec Shawinigan Falls Winnipeg Toronto

D31

Why Take Chances?



The HARDINGE SYSTEM Protects You

In case of fire, full insurance may pay you for your property loss, but what about loss of production — the laid-off men and general disorganization?

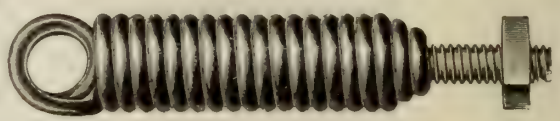
The thing to do is to **prevent** loss and that is just what the Hardinge Watchman's Clock does. It keeps your watchman "on the job" whatever his inclination. With the Hardinge System installed you can rest easy knowing you are taking no chances. It's an **assurance against** fire or robbery and **insurance for** your steady income and production.

Write for our free trial offer.

Hardinge Bros. of Canada, Ltd.
47 Wellington St. E. TORONTO 50 Front St. E.

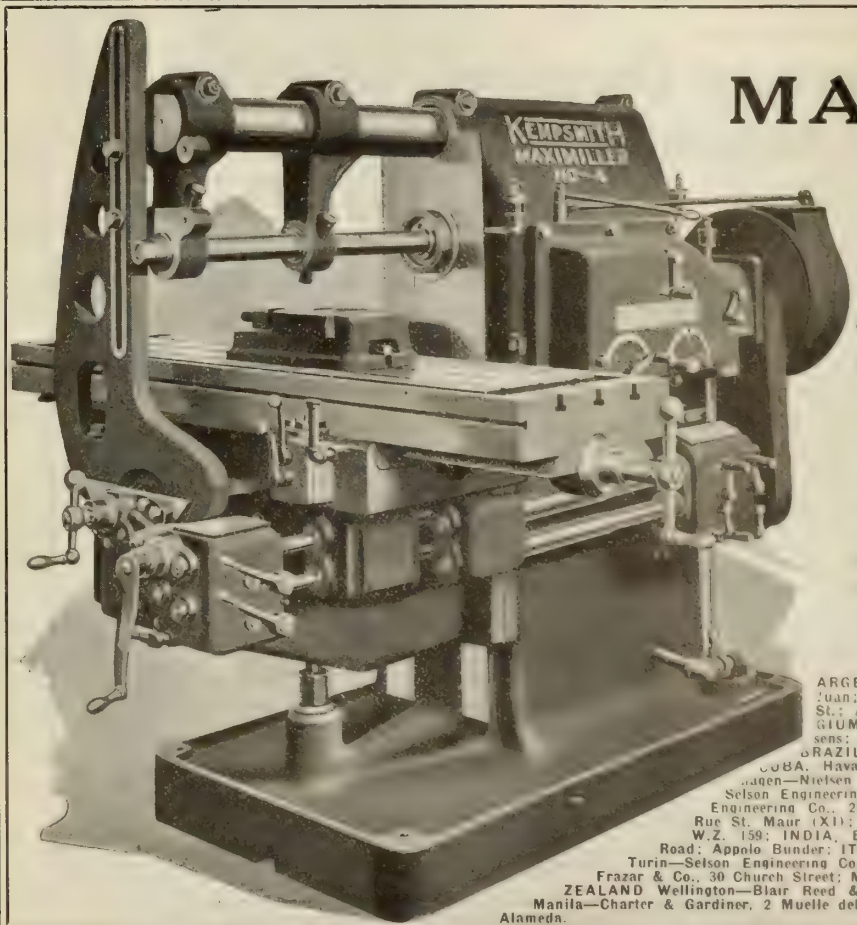
RELIABLE SPRINGS by RELIABLE MAKERS

We have a competent Staff
Let us solve your problems



Write for Catalogue

Raymond Mfg. Co., Ltd.
Corry, Pa., U.S.A.



THE MAXIMILLER

FOR

PERMANENT PRODUCTION PROFITS

BECAUSE:—
RIGID CONSTRUCTION, AMPLE POWER! POWER RAPID TRAVERSE! (In all directions)
CENTRALIZED CONTROL! GEARS RUN IN OIL!

Built By

KEMPSMITH

MANUFACTURING CO.

Milwaukee U.S.A.

Builders of Cone Type, Constant Speed and Production Milling Machines.

Send for Circular.

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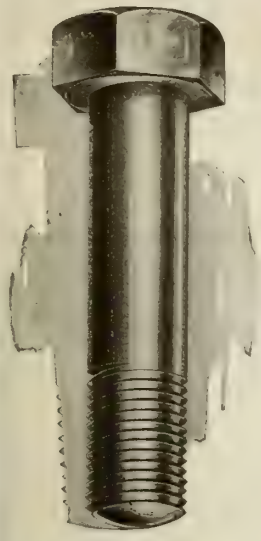
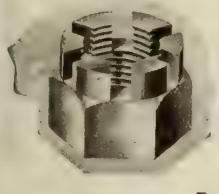


ACCURACY

Just now all jobbers should have a complete stock of SAE Cap Screws, Plain and Castellated Nuts and Taper Pins to meet the automobile repair trade requirements.

Your rush orders filled promptly by



The Galt Machine Screw Co., Limited

GALT, ONTARIO

Eastern Representatives:
Messrs. F. BACON & COMPANY
131 St. Paul Street West, Montreal, Que.
Western Representative:
Mr. D. PHILIP
138 Portage Avenue, Winnipeg, Man.

KENNEDY

WATER POWER PLANT MACHINERY

STOPLOG WINCHES

The unusual ability of Kennedy Stoplog Winches may be gathered from the fact that on one occasion the mass of ice, snow and logs, when lifted by this 27-ton motor driven winch was estimated to weigh 90 tons!

The Wm. Kennedy & Sons, Limited

OWEN SOUND ONTARIO.

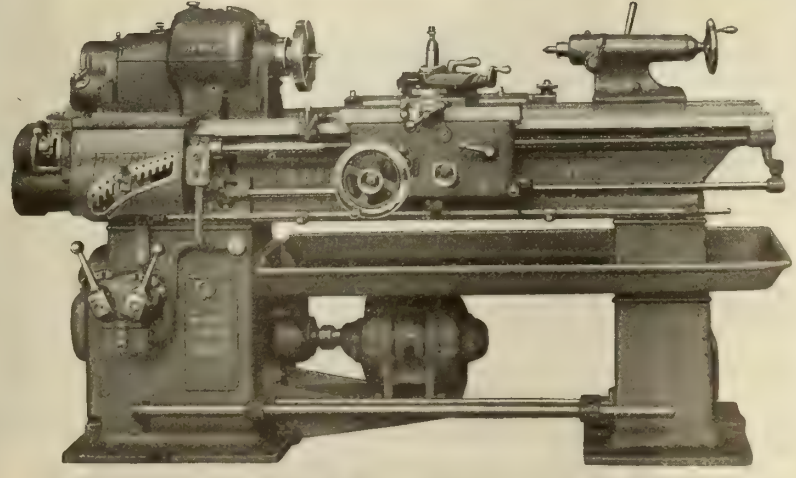
District Representatives:

M. B. SAUNDERS, 8 Silver St., Cobalt, Phone: Cobalt, 153.

L. A. MITCHELL, 1091A Bathurst St., Toronto; Phone: Hillcrest 2014

H. C. KENNEDY, 232 St. James St., Montreal; Phone Main 394.

HENDEY



HENDEY 1922 Design (Enclosed Belt to Spindle). Motor Driven Engine Lathe.

SOME FEATURES OF 1922 DESIGN MOTOR DRIVEN LATHE

Power applied to spindle through enclosed belt.

Belt pull on spindle downward.

Belt tension under variable control.

Pulley runs on long sleeve, not on spindle direct.

Nine speed changes to belt, obtained through nine alloy steel hardened gears, sliding on hardened and ground shafts, all running in an oil-tight box.

Lathe head is back-geared, giving a total of 18 spindle speeds.

This lathe develops exceptional power at spindle, and with its ease of handling is capable of a high rate of production.

THE HENDEY MACHINE CO.

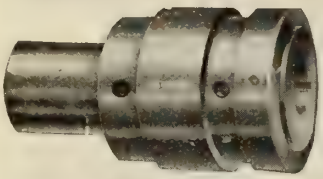
Torrington **Connecticut**

Canadian Agents: A. R. Williams Machinery Co., Ltd., Toronto, St. John, Halifax, Winnipeg and Vancouver; Williams & Wilson, Ltd., Montreal, Quebec.

THE JOHNSON FRICTION CLUTCH

AS USED ON THE

"NEW" COLBURN HEAVY DUTY BORING MILL

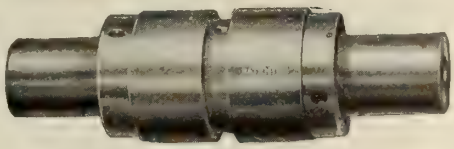


Single Clutch.

One No. 2 Special Single Clutch is placed in the feed case on each side of this machine. Two Single Clutches on each machine.

IN ADDITION TO THE ABOVE

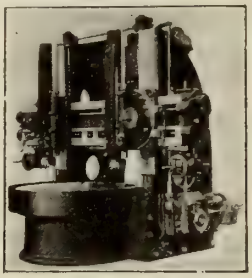
There are two No. 4 special short double clutches on each side of this machine to control the vertical and horizontal feeds.



Double Clutch.

Total of six Johnson Friction Clutches on each machine

Johnson Clutches are used on their 42 in., 48 in., 54 in. 62 in., and 72 in. mills.



Colburn machine tool plant engineers know that "The proof of the Johnson Clutch is in its use."

WRITE FOR YELLOW CATALOG.

Courtesy: Colburn Mach. Tool Plant, Cleveland, Ohio.

THE CARLYLE JOHNSON MACHINE CO. MANCHESTER CONN

GISHOLT

LABOR SAVING EQUIPMENT

TURRET LATHES
Hand Operated
For Chucking and Bar Work
AUTOMATIC TURRET LATHES
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VERTICAL BORING and TURNING MILLS
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REAMERS, "SOLID ADJUSTABLE"
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BORING BARS
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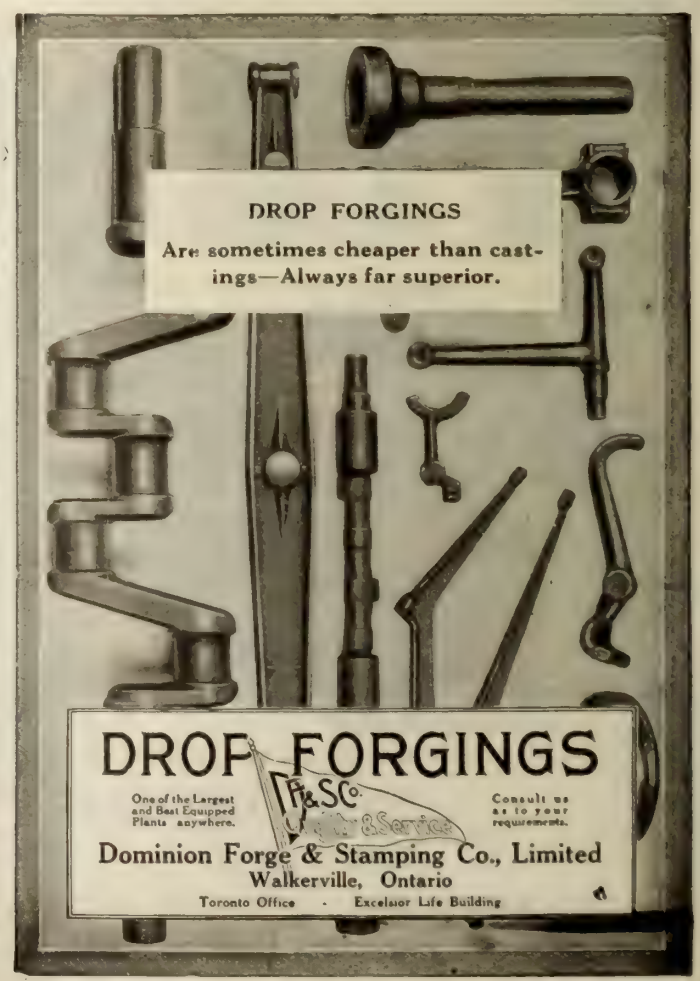
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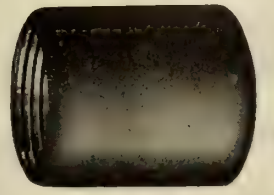
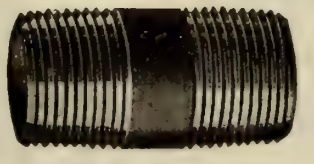
COUPLINGS and NIPPLES





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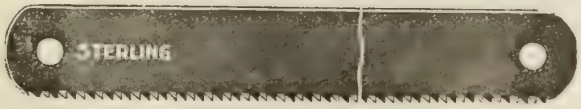

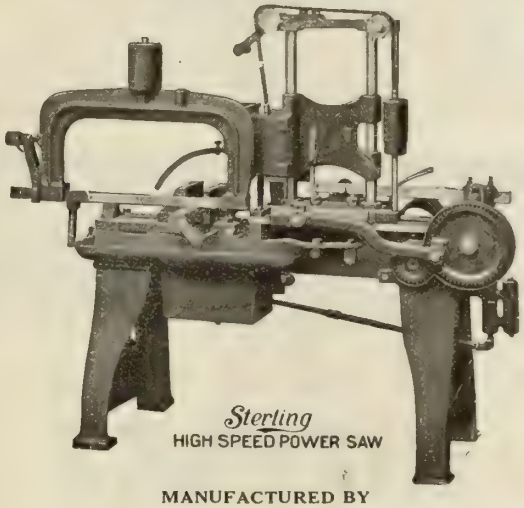

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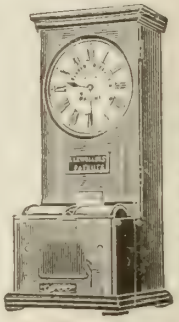

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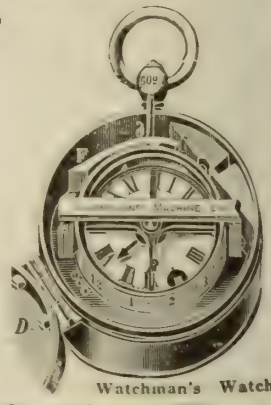

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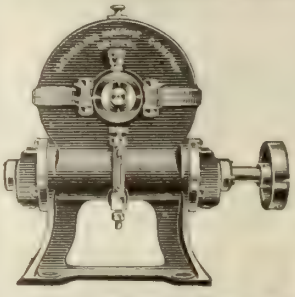

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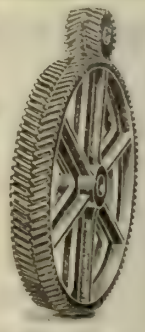

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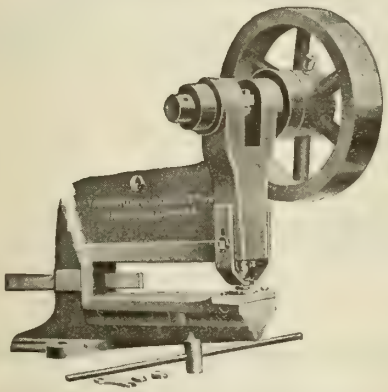

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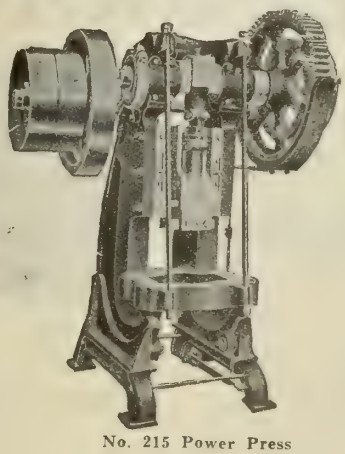
Quality that is **"built in"** on a machine is bound to assert itself in the long run.

For nearly half-a-century "B-B" Tools have been the choice of practical men who believe that dependable tools are a first consideration.



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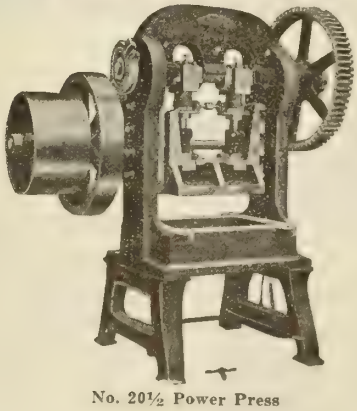
The "B-B" line includes Shears and Presses of all kinds, Tinsmiths' and Sheet Metal Machines, etc.



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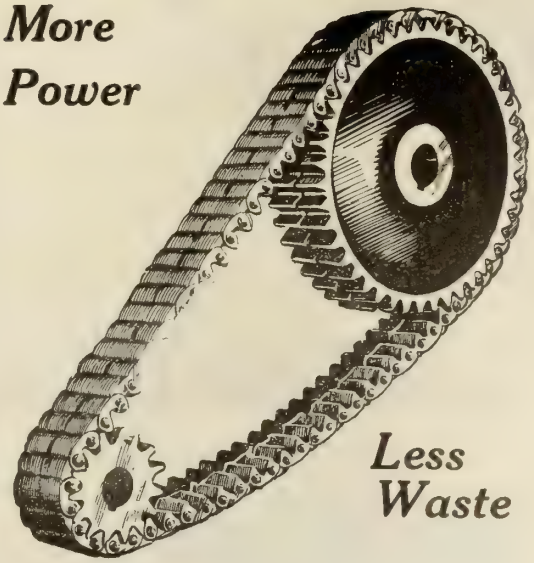

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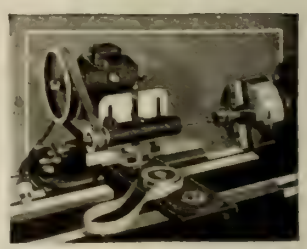

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TYPE HLLU

This precision grinder for external and internal grinding has a wider range than any other portable machine.
It can be used on 10" or larger lathes and will grind within 2" of the maximum lathe swing.
Standard equipment includes three pulleys for speeds of 30,000, 16,500, 9,500, and 5,500 R.P.M.

Catalogue 20L mailed upon request.

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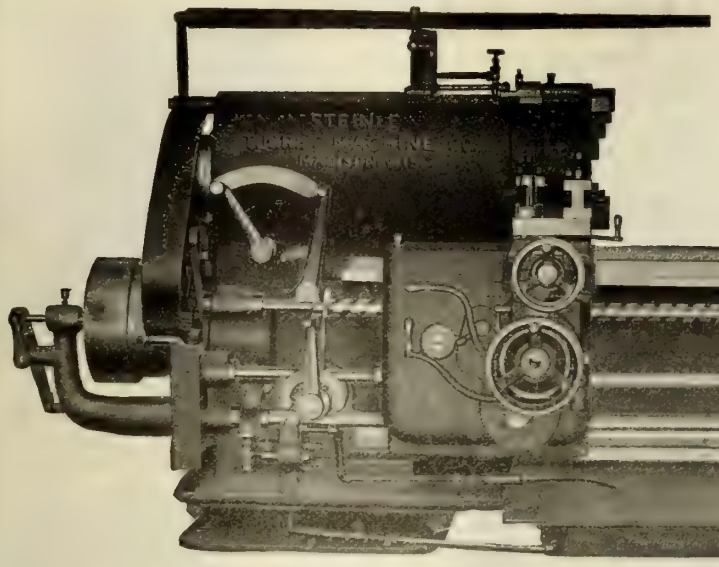

Standard Belt driven 24 inch Lathe, Furnished either with 4 inch or 6 1-4 inch spindle bore and with standard or special tooling equipment.

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Send us drawings of your work so that our Engineering Department can estimate STEINLE production, or ask to have a qualified representative call upon you to determine what work can be produced to advantage on our machines.

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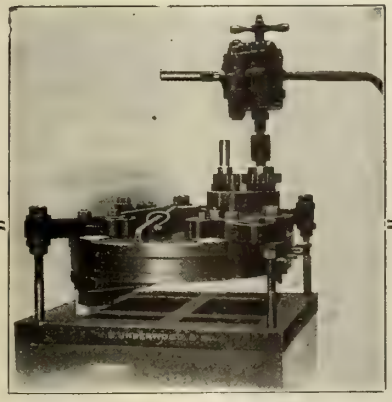

This New Heavy Type Valve Seat Rotary Planer

Is the latest development of our line of Portable Valve Seat Planers and was constructed to meet the demand for a machine that would face off deeply worn seats at **once cut.** This new type will face seats up to 30 inches across corners and is giving a satisfaction best endorsed by the many repeat orders we are receiving.

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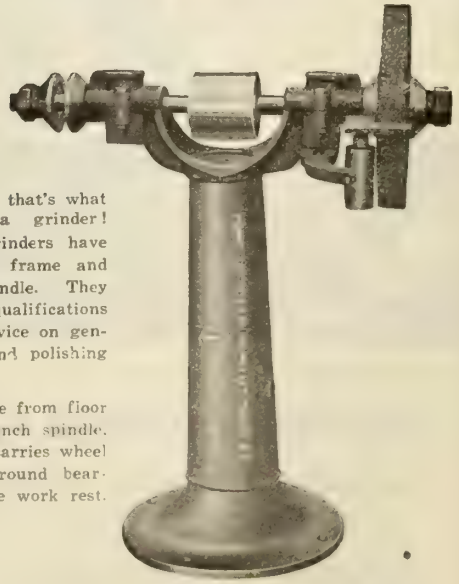
They Have the Strength!



STRENGTH — that's what counts in a grinder! "Jardine" Grinders have a strong, rigid frame and heavy steel spindle. They have all the qualifications for years of service on general grinding and polishing work.

Height of spindle from floor 30 inches. 1⅜-inch spindle, 29 inches long, carries wheel at each end. Ground bearings. Adjustable work rest. Weight 150 lbs.

A "Jardine" is the low-priced answer to a costly question. Ask for catalogue No. 18

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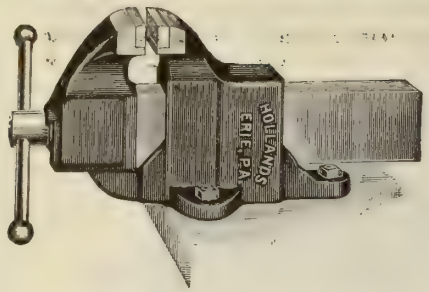

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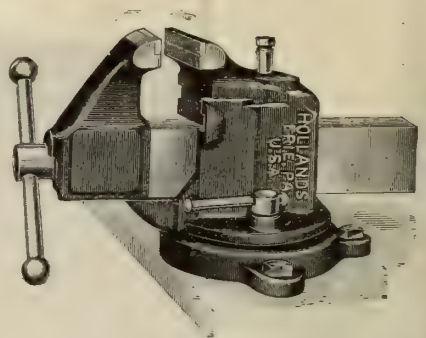

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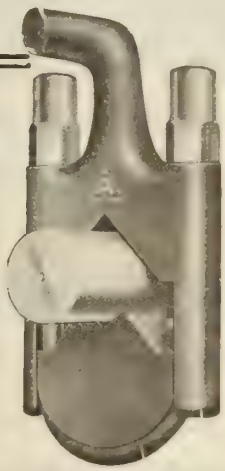

THIS Dog is so constructed as to combine a wide range of adjustment with the convenient features of the Clamp Dog and the Simplicity and Strength of the ordinary Lathe Dog.

It is specially adapted for use on finished work which would be liable to be damaged by the set screw of a common Lathe Dog.

A distinct advantage of this Dog is that it can be applied without removing work from centres.

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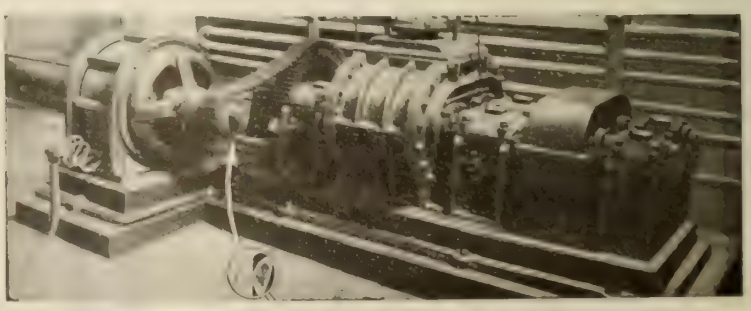

25 H.P. Morse Silent Chain to Positive Blower

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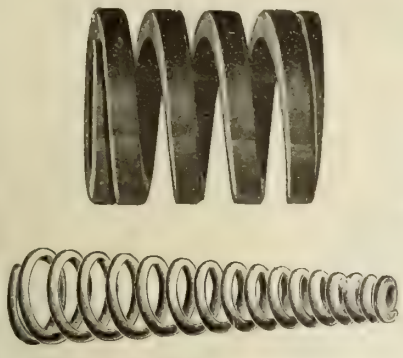

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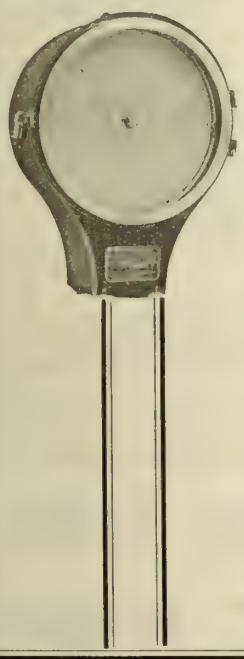

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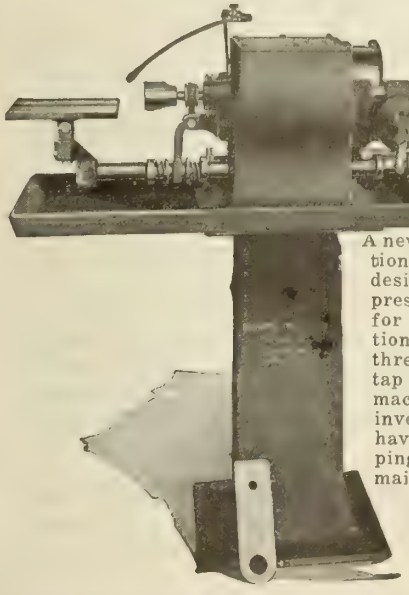
BURKE



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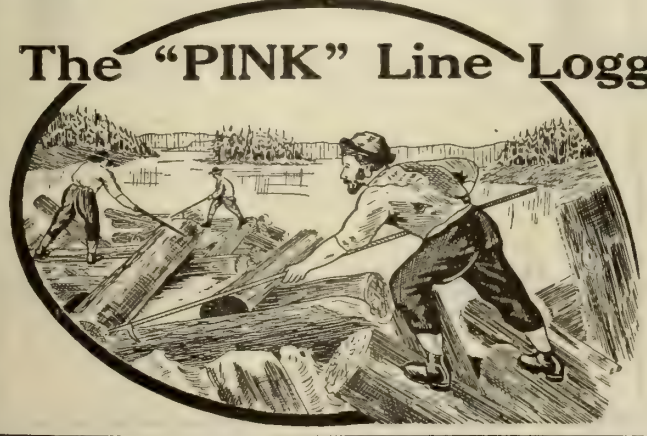

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Thomas Pink Co., Limited
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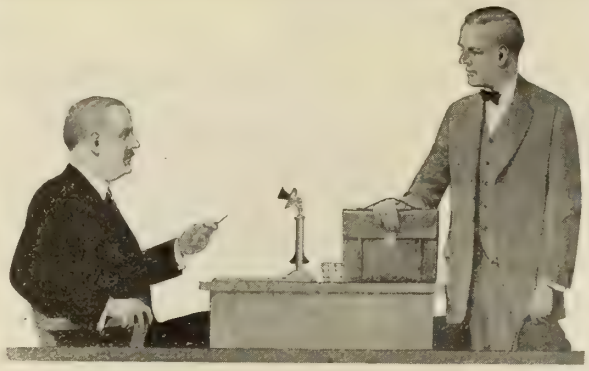

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A range of sizes from 15 to 60-inch swing. Illustration is 22-inch Ball Bearing Lathe with 6-inch Oval Chuck and Compound Rest.

P. Pryibil Machine Company

New York City

Established 1859

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THE "RED RIBBON" BELT
TORONTO, CANADA

For the Good of Your Plant
Install "P M S" Belting

Your plant is the essence of your success. Whatever is good for the plant is good for your business and for you.

Every test that we can bring to bear proves to us that "P M S" Belting is superior; in adhesion to the pulley, even pliability, strength and resistance to the effects of heat, cold and moisture. Our confidence in "P M S" Belting convinces us that it will prove good for your plant by increasing production and revenue.

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BELLEVUE
FURNACES
for every industrial use

The Solution

to your annealing and heat treating problems lies in the use of efficient economical Bellevue Furnaces.

The flame is easily controlled—attains complete combustion—heats the entire furnace quickly and uniformly—but does not come in contact with the material.

Sturdily built and reinforced, also properly lined with the highest grade heat resisting bricks—Bellevue Furnaces give excellent results.

Are you contemplating furnace installations—gas or oil burning?

We will gladly give you full information

Bellevue Industrial Furnace Co.
2977 Bellevue Ave.
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Representatives in Canada
CHAS. A. STRELINGER COMPANY, WINDSOR
GARLOCK MACHINERY LTD. Toronto, Montreal, Winnipeg

SEAMLESS STEEL TUBING AT BARGAIN PRICES

Being anxious to clear out our stock of steel tubing, we offer the material shown at less than mill cost. This is an exceptional opportunity. Secure the best sizes NOW.

Material in Stock

1000 ft. 3-16" O.D. x 20 Ga.
800 ft. 1" O.D. x 10 Ga.
300 ft 1½" O.D. x 18 Ga.
250 ft. 1½" O.D. x 7 Ga.
25 ft. 1⅝" O.D. ¾" wall.
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Subject To Prior Sale

5c *per lb.*

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We have some welded steel tubing at very low prices, so that if you do not see what you require in this list, write us for complete information.

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The Handle STAYS Where You Leave It

One of the "70"

The set screw and tension spring at which the arrow points prevent the handle from sliding down its full length every time the mechanic lets go of it; a feature that saves a good deal of time in the course of a day. This is one of *seven Special Features* that make Parker Vises unusually serviceable. For eighty years they have been standard tooling equipment in the biggest shops of the United States and Canada.

Send for Catalog No. 57-C.

The Charles Parker Co. (*Master Vise Makers*)
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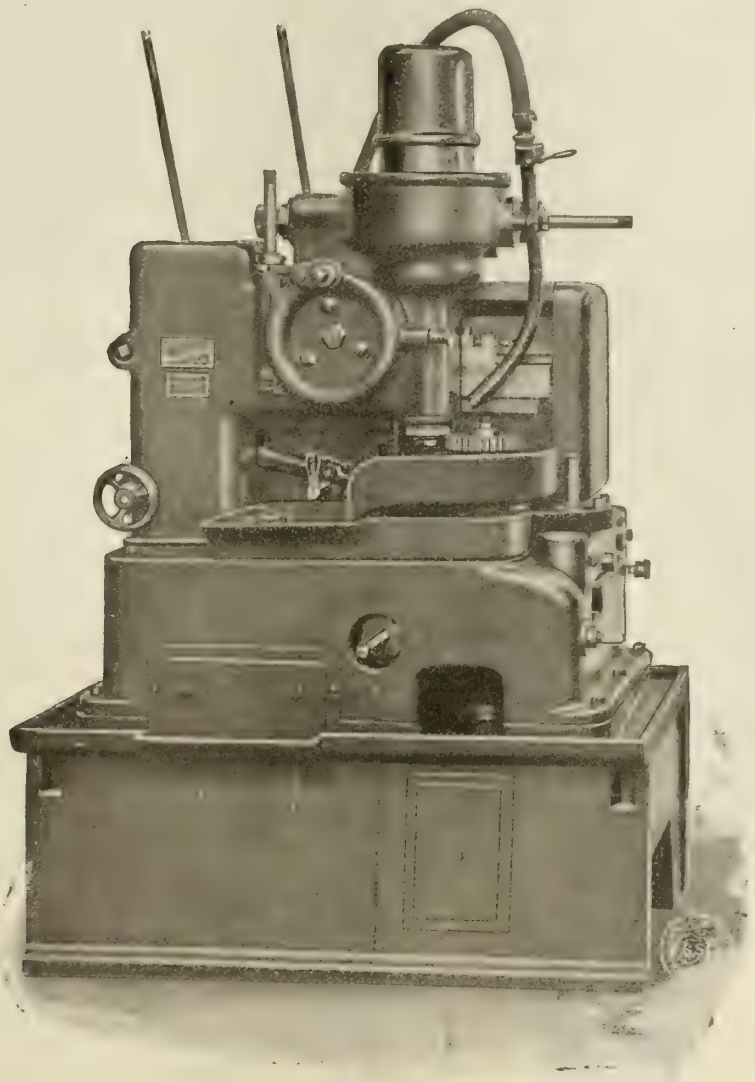
PARKER VISES

Grip Like a Grizzly

CUT GEAR COSTS
WITH THE
New Production Gear Shaper



The new production Gear Shaper, illustrated, has been designed to cut gear costs. It incorporates every feature necessary in a gear cutting machine to obtain this result, and still one of the outstanding features of the Gear Shaper principle—accuracy—has been maintained.
It is designed to cut one gear at a time and at a speed which eclipses all other methods.
All operating levers are at the front of the machine, permitting a number to be bolted together and operated as a unit, one 6 H.P. motor furnishing ample power for 10 machines
It incorporates to the fullest extent the three principal requirements of production—high speed, accuracy and simplicity of operation.
See illustrated article in all technical magazines
Send for our booklet, "A New Development in Gear Cutting," which has been prepared for the benefit of Engineers and Production Managers interested in the best gear cutting equipment available.

Write for your copy now.

THE FELLOWS GEAR SHAPER COMPANY,
SPRINGFIELD, VERMONT, U.S.A.

Foreign Agents:—Alfred Herbert, Ltd., Coventry, England; Societe Anonyme Alfred Herbert, Paris, France; Societa Anonima Italiana Alfred Herbert, Milan, Italy; Alfred Herbert, Ltd., Yokohama, Japan; Societe Anonyme Alfred Herbert, Barcelona, Spain; Societe Anonyme Belge Alfred Herbert, Brussels, Belgium; Alfred Herbert (India) Ltd., Head Office, Calcutta, India.

If Your Work

calls for

SPEED

as well as

PRECISION

Morse

High

Speed

Drills

will meet

the need

Their reputation is built on years of ACTUAL PERFORMANCE

Morse Twist Drill & Machine Co.

New Bedford, Mass., U. S. A.

Gasoline Quickly Available

Gasoline carried around the shop in open measures is dangerous. Moreover, this practice is wasteful, for much of the gasoline is lost by evaporation and spilling.

The Bowser Portable Wheel Tank is evaporation proof. No fumes can escape, so, the fire hazard is eliminated. The outfit is easily moved to the point of most convenient service.

The Bowser piston-type pump accurately measures the exact quantity needed. Workmen's time and steps are saved. Booklet C-13 tells how hundreds of other plants have cut down overhead and increased plant efficiency with Bowser Equipment. Write for it to-day.

Bowser Equipment is MADE IN CANADA by

S. F. BOWSER & CO., Inc.
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ACCURATE MEASURING PUMPS

Bowser Products

For Handling Gasoline and Oils Wherever Sold or Used

- Filling Station Pumps and Tanks for Gasoline.
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- Storage and Measuring Outfits for Paint Oils, Kerosene and Lubricating Oils.
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- Carload Oil Storage Tanks.
- Dry Cleaners' Underground Naphtha Clarifying Systems.
- Richardson-Phoenix Oil Circulating and Filtering Systems and Force Feed Lubricators.

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AT THE LOUVIERE (BELGIUM) BOLT CO. WORKS---TEN LANDIS SINGLE HEAD THREADING MACHINES IN THIS ROW

In addition to these ten 1½″ Landis Single Head Threading Machines the Louviere Bolt Company has two more machines of the same size and one 2″ Double Head Machine, in another department. All of these machines are used for threading bolts; all are highly efficient and profitable; that they are entirely satisfactory to their owner is evident by the size of the installation.

If yours is a problem of cutting thread we'll be glad to put our engineering department at your command—no matter where you may be. Write us.

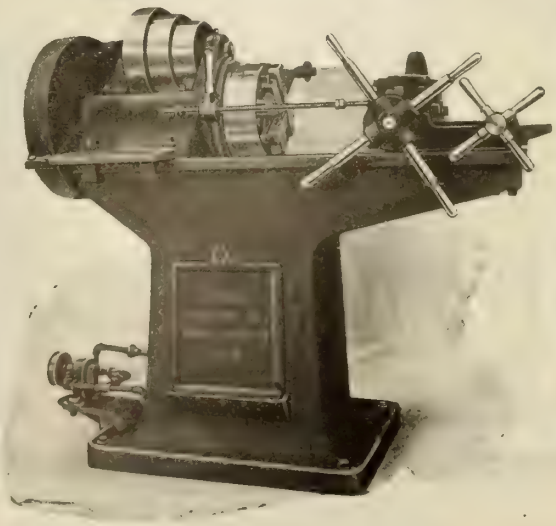
LANDIS MACHINE CO., Inc.
Waynesboro, Pa., U.S.A.

LANDIS

DOMESTIC AGENTS: Marshall & Huschart Machinery Co., Chicago, Ill.; Marshall & Huschart Machinery Co. of Indiana, Indianapolis, Ind.; Colcord-Wright Machinery & Supply Co., St. Louis, Mo.; R. B. Whitacre & Co., St. Paul, Minn.; Hamilton Machinery Co., Chattanooga, Tenn.; Seeger Machine Tool Co., Atlanta, Ga.; Young & Vann Supply Co., Birmingham, Ala.; Woodward, Wight & Co., New Orleans, La.; Jos. T. Ryerson & Son, Houston, Texas; Hendrie & Bolthoff Mfg. & Supply Co., Denver, Colo.; Salt Lake Hardware Co., Salt Lake City, Utah; Eccles & Smith Co., San Francisco, Calif.; Los Angeles, Calif.; Portland, Ore.; Hallidie Machy. Co., Seattle, Wash.; Hallidie Co., Spokane, Wash. CANADIAN AGENTS: Canadian Fairbanks-Morse Co., Toronto and Montreal. FOREIGN AGENTS: Alfred Herbert Ltd., Coventry, Eng.; Calcutta, India; and Yokohama, Japan; Allied Machinery Co., Barcelona, Spain; Turin, Italy; Zurich, Switzerland and Tientsin, China, R. S. Stokvis & Zonen, Rotterdam, Holland; and Dutch East Indies; D. Drury & Co., Johannesburg, South Africa; Benson Brothers, Sydney, Australia.

The Famous Landis Chaser

Landis Single Head Threading Machine



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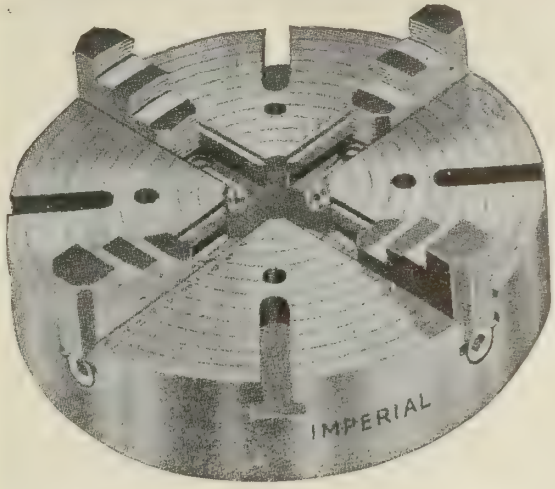
Highly Endorsed by Canada's Best Manufacturers

Sturdy long-wearing "Made-in-Canada" Chucks that are making good everywhere.
Specify them in your next order.



Ker & Goodwin Machinery Co.
BRANTFORD, Ont. LIMITED

Buried in the Work and Broke!

Next time a tap breaks below the surface of a large casting, don't let some make-shift method of removing it injure the thread and waste half an hour of valuable production time. Instead—

Walton it Out in a Jiffy

And save the casting.

Special analysis steel fingers of the Walton Extractor drop into the flutes of the broken tap—and grip. Then a few turns of a wrench applied to the squared end of the Extractor backs out the buried tap.

Sixty-day trial offer proves the Walton Extractor pays for itself. Write.

The Walton Co.
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PIG IRON IRON ORE COAL

M·A HANNA & Co.

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HEAT-RESISTING CASTINGS

UNUSUAL SHAPES OUR SPECIALTY

Made in Canada

Hiram Walker & Sons Metal Products
WALKERVILLE, ONTARIO. Limited

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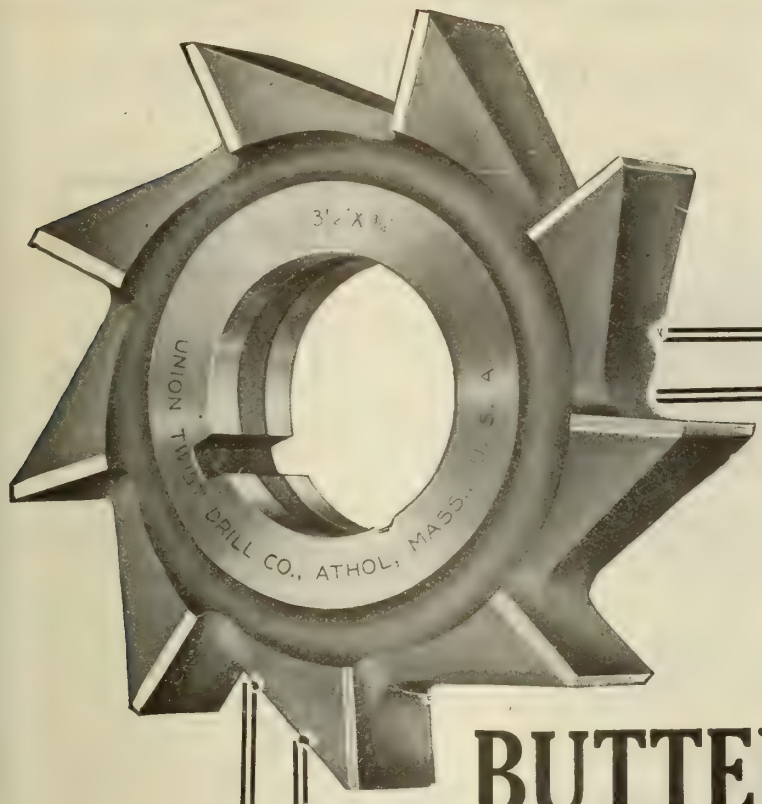


Leaders In Their Field

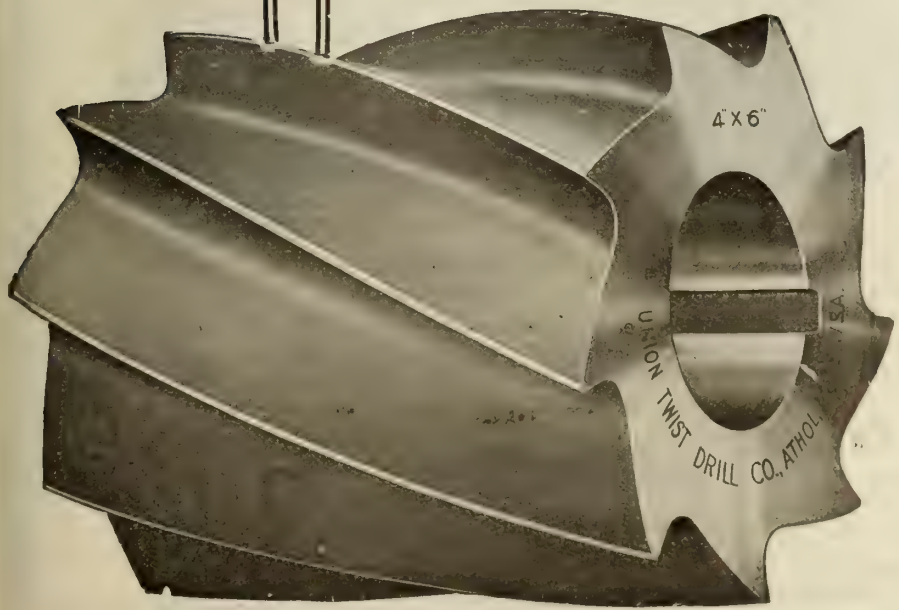
BUTTERFIELD TOOLS

The hardware merchant who handles Butterfield Tools has a marked advantage over his competitors.

The popularity and prestige of these tools makes their sale comparatively easy.

Wherever speed, accuracy and reliability are required in tools, Butterfield's products are known and used.

It will pay you to get in touch with the purchasing agents of the large factories near you.



Butterfield & Co. Division

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ROCK ISLAND, QUEBEC

STORES: 220 King St. West, Toronto; 131 St. Paul St. West, Montreal.

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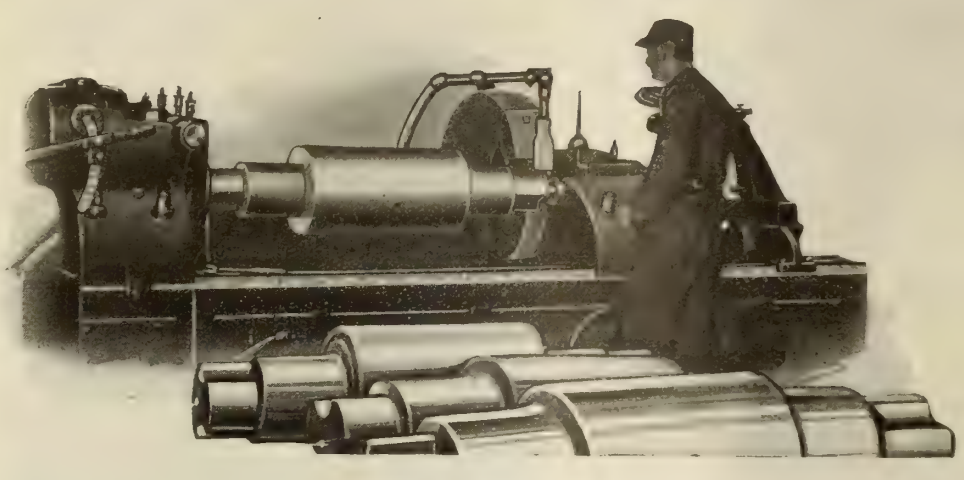
Whether the Work is Large or Small—There's a



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To Handle the Job

Grinding Necks of Rolls with a LANDIS Roll Grinding Machine.

To meet the requirements of progressive manufacturers, who found that grinding machines permitted greater accuracy, LANDIS Grinders have been developed along various lines to meet the many exacting demands for greater accuracy and production.

Here are a few of the LANDIS types: plain, roll, camshaft, crank pin, piston, universal, internal, ball race and cylinder grinding machines.

Let us send you a catalog.

Landis Tool Co., Waynesboro, Pa., U.S.A.

CANADIAN AGENTS: A. R. Williams Machinery Co., Halifax, St. John, Winnipeg, Vancouver; Williams and Wilson, Montreal; F. F. Barber Machinery Co., Ltd., Toronto.

MADE IN CANADA
FOR THIRTY YEARS

MUST Earn Its Full Cost

LEVIATHAN AND ANACONDA
ELEVATING TRANSMITTING CONVEYING BELTING

FOR more than thirty years we have accepted the responsibility imposed by our definite guarantee to the effect that our responsibility for every Leviathan and every Anaconda continues **after** the belt is placed in service **until** it has earned its **full cost** as compared with the service under the same or similar conditions of any belt of any kind.

The widely varying kinds of service which belts must encounter in modern industry is only overcome by **individually made belting** —belting scientifically made to meet both usual and unusual conditions. Leviathan and Anaconda Belting cover all classes of work —the former is used generally for **usual** conditions, the latter for **special** ones.

We shall be pleased to co-operate with you in overcoming your belting problems—may we?

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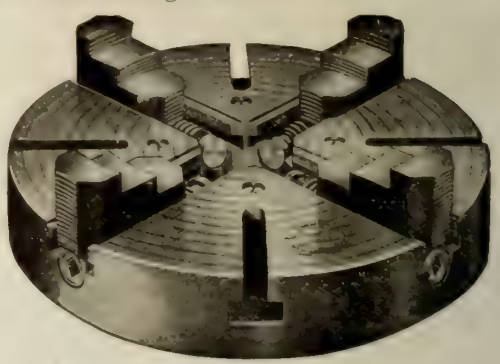
ALL STEEL

INDEPENDENT CHUCKS

are not an experiment—they have come to stay. They are a necessity with the modern machinery and high-speed steel cutting tools.



THE UNION STEEL BODY CHUCKS

are well designed and have all the elements of strength and durability for which they are designed. We make other types in steel also, including the Geared Scroll Chucks and the Geared Scroll Combination—all designed for heavy work and hard usage.

Union Manufacturing Company

New Britain, Conn.

New York Office: 26 Cortlandt Street

Makers of a complete line of chucks

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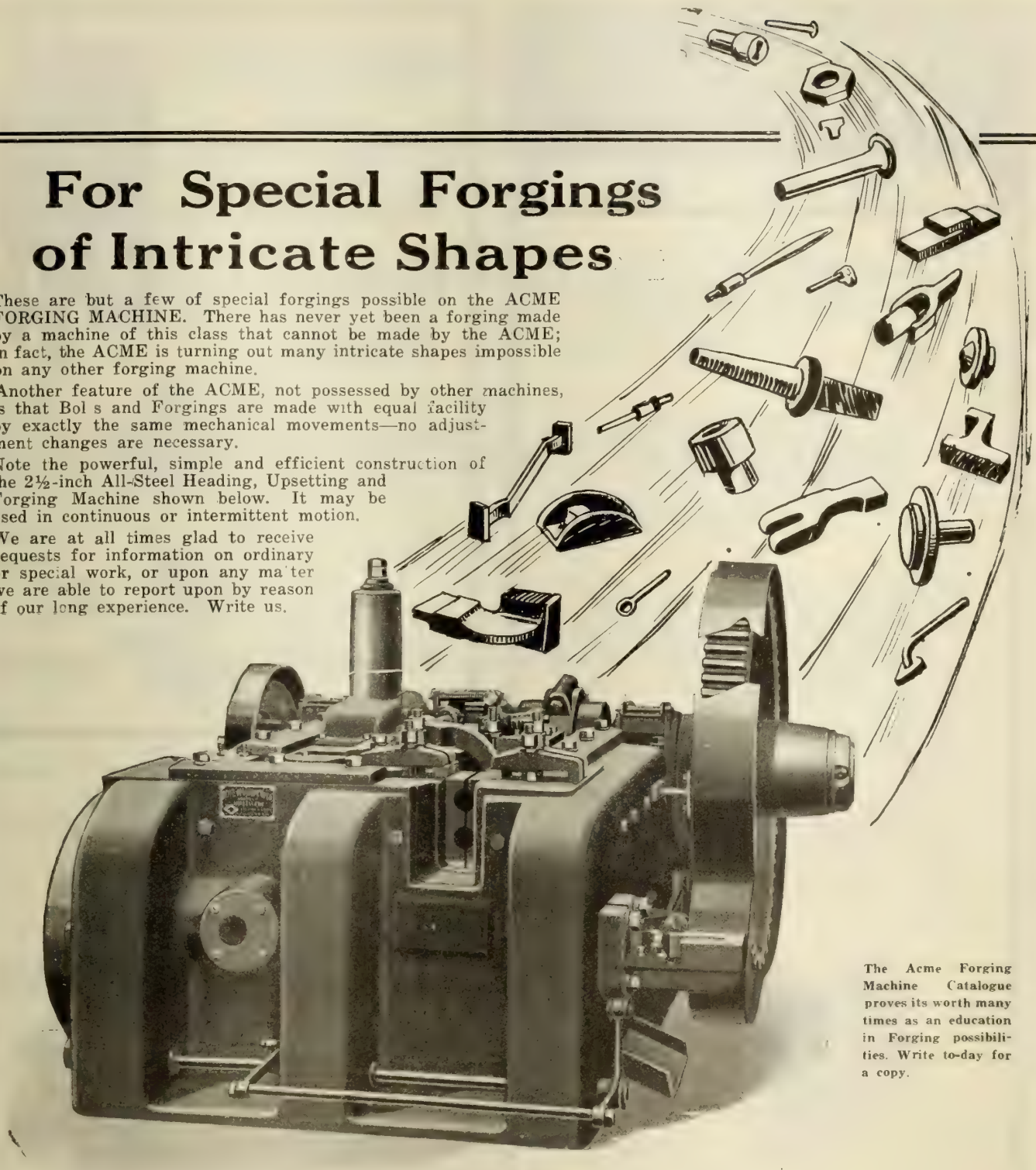
For Special Forgings of Intricate Shapes

These are but a few of special forgings possible on the ACME FORGING MACHINE. There has never yet been a forging made by a machine of this class that cannot be made by the ACME; in fact, the ACME is turning out many intricate shapes impossible on any other forging machine.

Another feature of the ACME, not possessed by other machines, is that Bol s and Forgings are made with equal facility by exactly the same mechanical movements—no adjustment changes are necessary.

Note the powerful, simple and efficient construction of the 2½-inch All-Steel Heading, Upsetting and Forging Machine shown below. It may be used in continuous or intermittent motion.

We are at all times glad to receive requests for information on ordinary or special work, or upon any ma ter we are able to report upon by reason of our long experience. Write us.



The Acme Forging Machine Catalogue proves its worth many times as an education in Forging possibilities. Write to-day for a copy.

The Acme Machinery Company

4530 St. Clair Avenue - - - Cleveland, Ohio

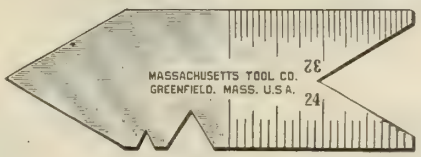
Canadian Agents:

The John Bertram & Sons Co., Limited, Dundas, Ont.

GOODELL-PRATT

1500 GOOD TOOLS

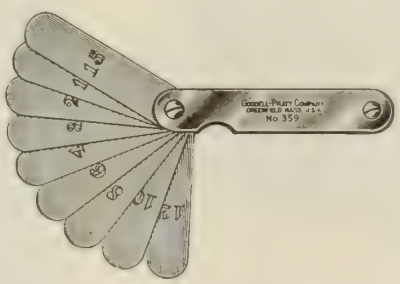
If you can find More Accurate Tools Buy Them



We say this because we don't believe you can find any machinists' tools of greater accuracy. But we don't want you to take our word for it; we prefer to have you subject Goodell-Pratt precision tools to the most exacting tests in comparison with any other standard brands.

Take Center Gauges, for instance: Every Goodell-Pratt Center Gauge is made of spring tempered crucible steel accurately ground and graduated. Each Center Gauge is lapped in the V's and tested to make sure that it is a light tight fit.

Look at Goodell-Pratt Feeder Gauges: no oversize, undersize or uneven leaves are included.



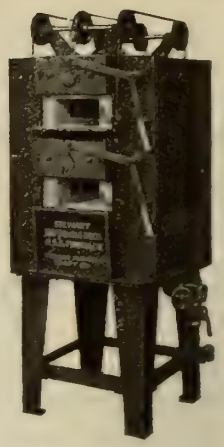
"Tools for the Toolmaker" shows all these good tools. Write for it.

Goodell-Pratt Company

Toolsmiths

Greenfield - Mass., U.S.A.

Stewart Double Deck High Speed Steel Furnace



The upper chamber of this furnace is used for pre-heating, heated by waste gases from lower chamber. Thus you have fuel economy to an unusual degree.

The lower chamber, for high speed steel hardening, is fitted with carbofrax floor and supports, and will stand heats up to over 4,000 deg. F. Long life of lining is assured.

Furnace can also be used for carbon steel hardening. Burns gas or oil fuel. Made in five standard sizes—special sizes built to specification.

There's a Stewart Furnace for every heat-treating operation in practically every industry

Made in Canada by

Flexible Shaft Co., Limited

353 Carlaw Ave., Toronto.

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FOUNDRY TRADES EXHIBITION
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an authoritative description of the leading exhibits at the above Exhibition.

The equipment of the foundry with modern plant and appliances is becoming more and more recognized by engineers as a matter of great importance in economical production.

Those situated in various parts of the world who are interested in, but unable to visit the Exhibition, will find these issues of great value in giving information regarding the latest developments in foundry practice.

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WELDING AND CUTTING

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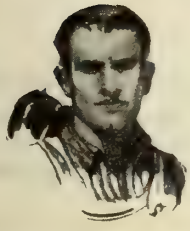

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Write for Catalog No. 22'3'and the Supplement describing the new Starrett Tools.

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The World's Greatest Toolmakers
Manufacturers of Hacksaws Unexcelled
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Starrett Tools

Carbons for Electric Arc Welding

THE electric welding industry has been tremendously advanced by the high development of arc carbons for specific purposes. We manufacture the following grades, named in the order of their current carrying capacities:—

Plain Welding Carbon:
A hard carbon for Ordinary service.

Columbia Welding Carbon:
Very hard. It can also be furnished copper coated, making it suitable for use as a cutting electrode as well as for heavy welding work.

Special Graphite Welding Carbon:
Rather soft and graphitic. High conductivity. Used where a high amperage is required. Used with excellent results on general work.

CANADIAN NATIONAL CARBON CO. LIMITED
TORONTO - CANADA

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TEMPERATURE INSTRUMENTS
INDICATING - RECORDING - CONTROLLING

are investments to insure uniformity of your products. If temperature is a factor in your plant then no matter what the product or the process a *TYCOS* Temperature Instrument will get desired results.

Our General Industrial Catalog should be in your reference library. Send for one.

Taylor Instrument Companies
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There's a Tycos or Taylor Temperature Instrument for Every Purpose
850

Wood Screw Making Machinery

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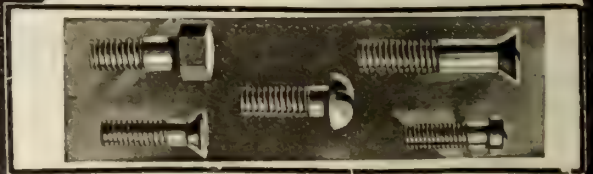

For sixty years we have constantly manufactured machinery for making screws, always studying to improve and refine our product.

Write or Wire us.

Cable address: "Cook," Hartford, U.S.A.
Codes: Liebers
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Asa S. Cook Co.
Hartford, Conn.

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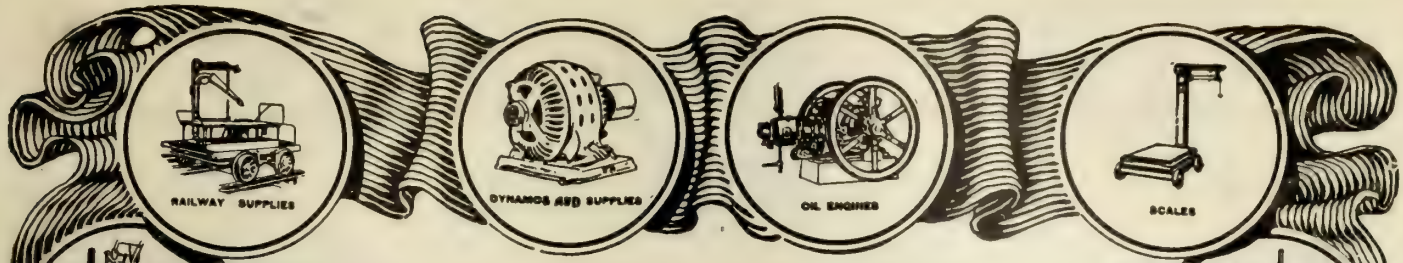
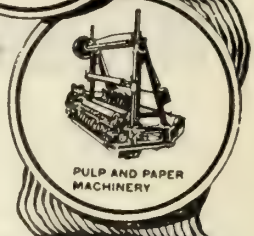
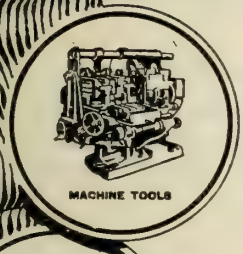


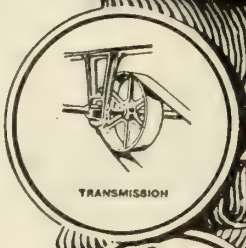


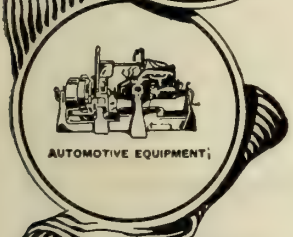
Representing the Leading Manufacturers

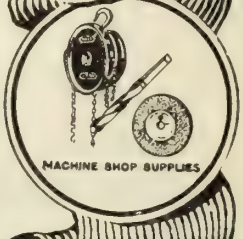
In addition to manufacturing and distributing Fairbanks-Morse products, The Canadian Fairbanks-Morse Co., Limited, represents the leading manufacturers of mechanical goods.

When ordering from our nearest branch, you are ordering from the manufacturer whose product has proved itself the acknowledged leader in its particular field. Here are some of the well known lines we handle:—









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McDougall Lathes
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Landis Threaders
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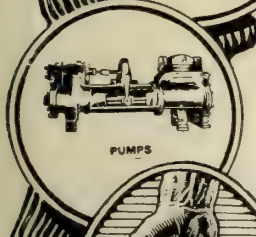
Each department is in charge of men who can give you valuable help in the solution of your problems.



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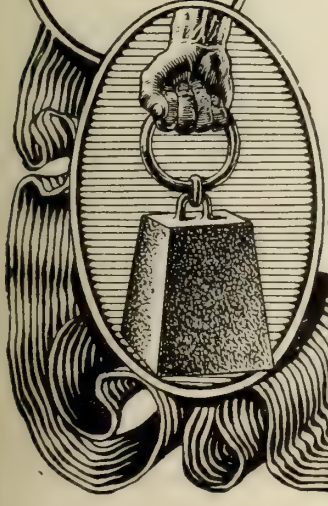

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CANADIAN MACHINERY AND MANUFACTURING NEWS

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Proper Chucking Ensures Added Production

Several Methods of Gripping Work—Interior And Exterior Locating Mediums—Holding Peculiar Shaped Parts With Special Jaws—Use of Auxiliary Clamps—Where Overhang is Permissible

By J. H. MOORE

IN ENTERING the subject of "how to secure added production by means of proper chucking," it brings to our mind a rather striking incident which occurred several years ago when everyone was striving, day and night, for still greater production. A certain superintendent had managed to boost his production figures on a particular part, and in relating the methods used, said, "Do you know, we actually increased our production rate over 100 per cent. without new tools or machines. All we changed was the form of chuck jaws." He seemed actually surprised at the result, whereas, he should, in the first place, have considered carefully his chucking methods.

Quite frequently too much attention is paid to the tooling and not enough to the style of chuck used. This is a serious mistake, because anything that tends to reduce the time between actual cutting should be carefully considered. When selecting a chuck for general purpose work, one should keep in mind that versatility is an important asset. Select a style that is universal in character, and adaptable to many classes of work. This will often save the cost of special holding fixtures. Special jaws for holding parts of irregular shape can be made at small cost, whereas a special holding fixture usually means greater overhang as well as greater expense, both of which are objectionable.

Consider the chuck in its proper light. It is a very important lathe accessory, an indispensable link which connects the work to the source of power, and the efficiency of an otherwise costly and productive machine can be stultified by the choice of a poor chuck. The requirements of a good chuck could well be summarized as follows—Gripping power, strength, durability and adaptability.

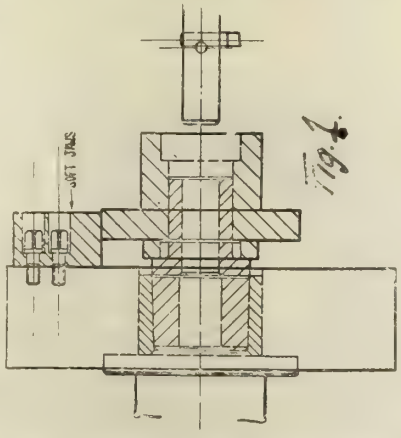

Fig. 1—Showing method of using central locating plug.

It is not the intention of this article to go into the question of design, but rather to show actual cases where good chucking methods have been successfully adopted, leaving readers to study the illustrations at their leisure, perhaps applying some of the same ideas to their own particular product.

When a high degree of concentricity is required between first and second operation work, it is not wise practice to rely entirely upon the soft chuck jaws. If at all possible, the work should be located from the center hole, finished in the first operation. This may be done by means of a true plug fitting in the chuck liner, whilst the outside diameter, finished also at the first operation, can be gripped in the soft jaws. Fig. 1 is a good illustration of this method of chucking.

Should you wish to locate second operation work from an external diameter,

Photographs show actual applications of the Coventry Chuck, and are reproduced through courtesy of Alfred Herbert Ltd.

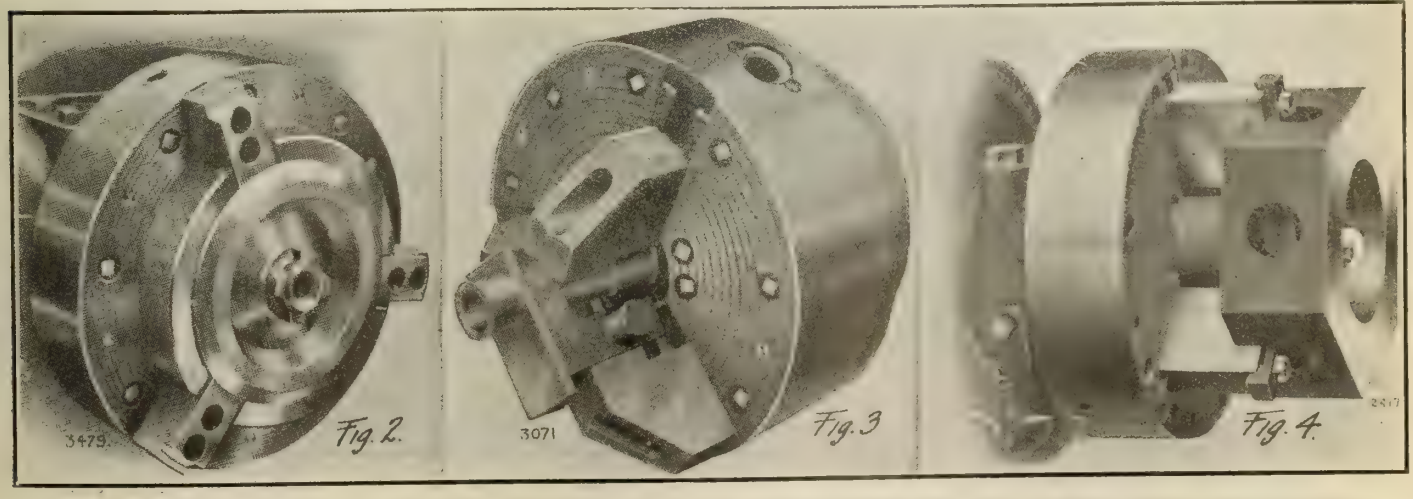

Fig. 2—Use of exterior locating ring. Fig. 3—Peculiar shaped stamping held by special jaws. Fig. 4—Holding hexagon turret by means of jaws and auxiliary clamps.

finished at the first operation, you can adopt the method shown at Fig. 2. In this case the part, a motor-cycle flywheel, is located in an adapter plate bolted to the regular chuck face. Note that the adapter plate has three slots cut in it, these admitting the soft chuck jaws. Thus, true concentricity is secured, for the jaws merely do the gripping, the adapter plate assuring proper location.

Fig. 3 shows a peculiar shaped stamping held by means of special jaws on the regular chuck. Two of these grip on the round boss, while the other is flattened to grip on the offset lug. Ask some men to hold such a piece in the chuck and they would say, "It can't be done," and yet the solution is very simple, as the illustration shows.

In Fig. 4, we have a combination of ideas. The hexagon turret being held has to be bored and faced, and the jaws are designed to grip on the boss, but in addition, clamps are provided, which draw back the work securely against the jaws, thus making the holding all the more accurate and secure.

Contrary to popular opinion, it is not necessary to use a four jaw chuck to grip square objects such as shown at Fig. 5. Here we see a special set of jaws holding a pipe flange quickly and accurately. Note that one standard style jaw grips on a corner of the flange, while other two jaws having straight faces, complete the set.

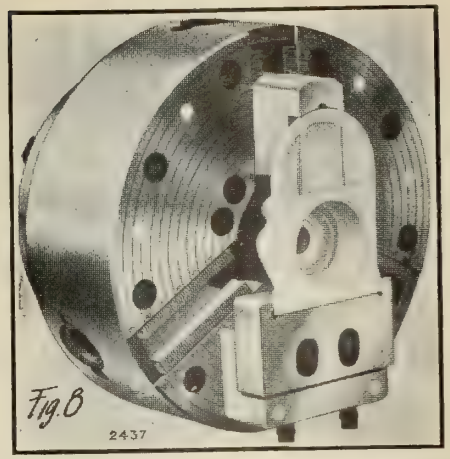

Fig. 8—Using the one-jaw method of holding.

The next example, Fig. 6, shows the holding of a bevel gear, in which the teeth are cast. During the boring and facing operations it is necessary to grip on the cast teeth in order that they may eventually be true with the bore. To ensure this, soft jaw blanks were suitably formed to suit the gear, and then case hardened.

Irregular Work

Fig. 7 shows how the standard reversible jaws on the chuck we are speaking of can be applied to irregular shaped work. The part depicted is a gas engine cam, this being gripped as quickly and easily as any circular object after the jaws have once been set carefully.

Fig. 8 shows a peculiar chucking application but one which has been very successful. This is known as the one-jaw method, and the part, a magnet end shield, is clamped by a single jaw against an adjustable locating block bolted to the face of the chuck, the two ordinary jaws being removed. In numerous cases this method of holding is more satisfactory than the usual two-jaw system.

Another good example of the one-jaw method is shown at Fig. 9. The part is an aero engine carburetor body made from an aluminum casting. In the operation shown, the jaw grips over the solid metal at the bottom of the hole, thus avoiding distortion, yet getting ideal gripping power.

Fig. 10 shows a drop forging of a roller steady box tool. The machinery operations consist of drilling and boring the boss for the overhead bar. Note that one jaw grips the boss, while the second, which is of vee block form, engages the corner below the back carrier. The third jaw grips the part behind the vertical adjusting screw boss.

While it is not good practice to have the chuck jaws overhang too much, the application shown at Fig. 11 is quite permissible because the machinery operation in this case is not very heavy. The special jaws shown were designed to

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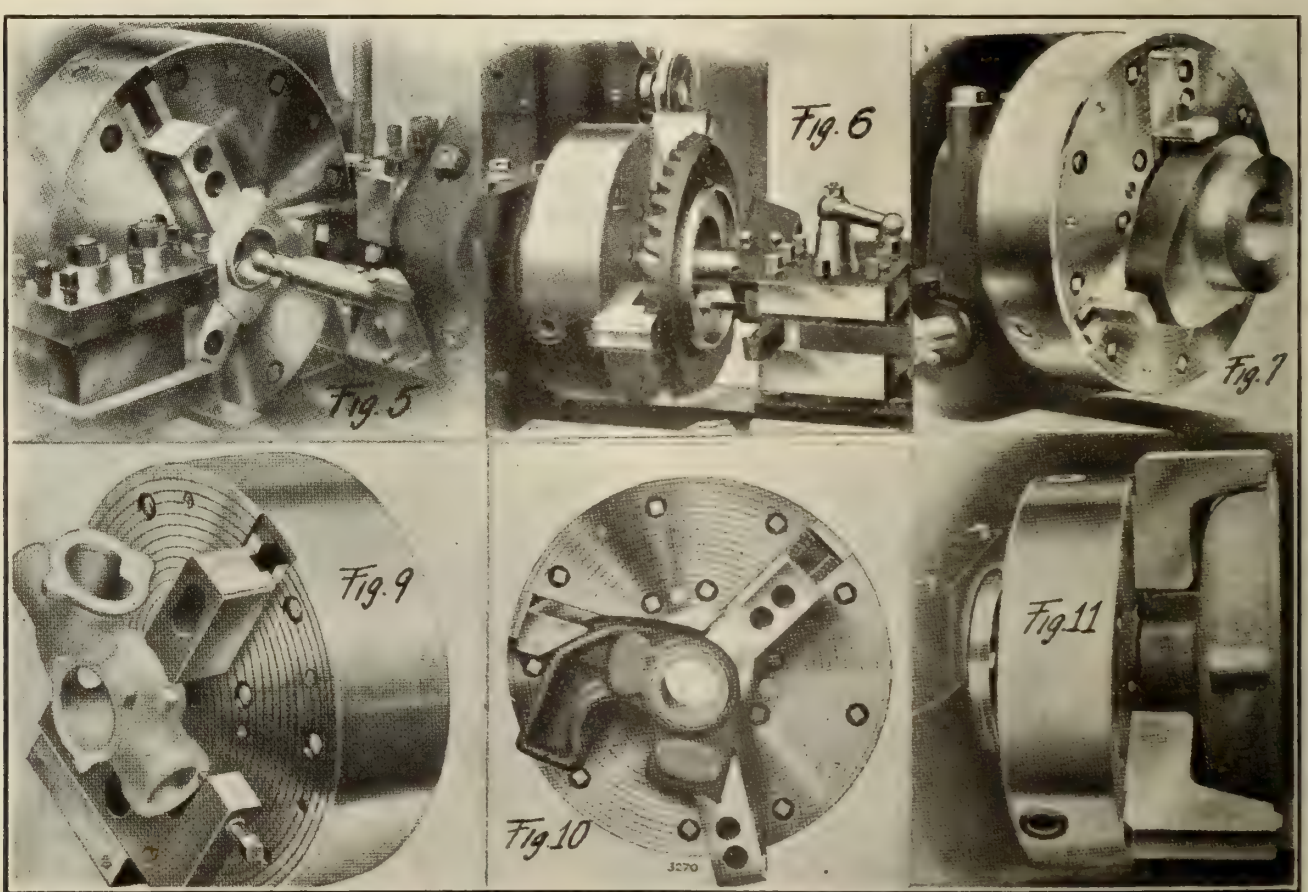

Fig. 5—Holding four-sided parts with three jaws. Fig. 6—Method of holding cast-tooth bevel gears. Fig. 7—Gripping gas engine cams in regular chuck. Fig. 9—One jaw holding arrangement. Fig. 10—Peculiar shaped drop forging held by special jaws. Fig. 11—A case where overhang is worth-while.

Rust Imposes Severe Tax on Steel Products

How Ferrous Base Metals Affect Galvanized Coatings—Value of Commercially Pure Iron—It Resists Corrosive Influences—Results of Seven Test Conditions—No Deterioration

By D. M. STRICKLAND

THE preservation of iron and steel installations is a most important economic problem. Every time the material of longest life is chosen for actual service requirements, such action is a step toward the conservation of our national resources.

The rust tax is a severe tax and extensive users of iron and steel products realize that bare, uncoated ferrous metal sheets should never be exposed to conditions of service when it is possible to prolong the service life of these sheets by the external application of a protective coating.

One of the most efficient of the protective coatings in use to-day is spelter. It is not to be expected, however, that it is possible to render poor grade sheets serviceable by simply covering up the manufacturing blemishes with a spelter coating. Such a procedure would indeed be far from conservation practices. The base metal must be chosen with exacting care. It should be thoroughly deoxidized and degasified, and be of the highest possible quality in every detail.

A base metal which has proved most satisfactory in these essential requirements is commercially pure iron. There are several reasons for this which will immediately appeal to the research investigators. In the first place, considering mechanical advantages, the commercially pure iron sheet (uniform in density and softness) is admirably qualified to take on a tight adhering zinc coating, one which does not peel, a coating which we have found withstands corrugating, culvert forming and sheet working in general. This is true when the spelter is present up to as high as three ounces per square foot.

Again, the purer the iron, the purer the coating. This is due to the fact that pure iron has less alloying tendency toward zinc than has steel. This point is clearly demonstrated by tests described by W. T. Flanders in Galvanizing and Tinning. Mr. Flanders shows that impure iron and steel dissolve in molten zinc much faster (from three to seven times) than does commercially pure iron, and he furthermore recommends that commercially pure iron be used as equipment for hot-dip galvanizing plants.

Further substantiating evidence can be obtained by determining the iron content carried by the coating after application. Many spelter coating analyses as determined during the past eight years have been averaged with the following results, averages being compiled from results obtained from over 500 different galvanized specimens:

Material	Percentage of iron in Coating
Commercially pure iron	3.92
Impure coppered iron	4.89
Common steel	5.91
Coppered steel	4.55

These figures show that the iron content of the galvanized coating in grades other than commercially pure iron is from 16 to 50 per cent. higher than for the purer coating. Such averages, covering as they do so long a period of time, clearly substantiate the foregoing statement that the purer the iron, the purer the coating.

The purer coating has a decided advantage over the impure galvanizing from the standpoint of electrolytic corrosion. The difference in potential between commercially pure iron and its coating is less than the electro-potential difference between spelter coating and a base metal of impure iron or steel. This is true because coppered steels are more electro-negative to zinc than is commercially pure iron, the coppered metals themselves being electro-negative to the iron. Interesting results are obtained when a galvanized specimen of commercially pure iron has its coating stripped from two-thirds of its exposed surface and the entire sample is immersed in a 3½ per cent. solution of sea salt. The unprotected iron surface will remain bright and uncorroded. The zincked portion of the sample (although only one-third of the total surfaced area) protects the exposed iron and continues to do so while the zinc withstands the corrosive action of the salt solution. Galvanized coppered-steel specimens of equal size and carrying approximately the same weight of coating when subjected to identical test conditions showed that the unprotected steel remained bright 61 per cent. as long as the commercially pure iron.

The tabulations herewith typify the results that are obtained when tests are conducted for the purpose of determin-

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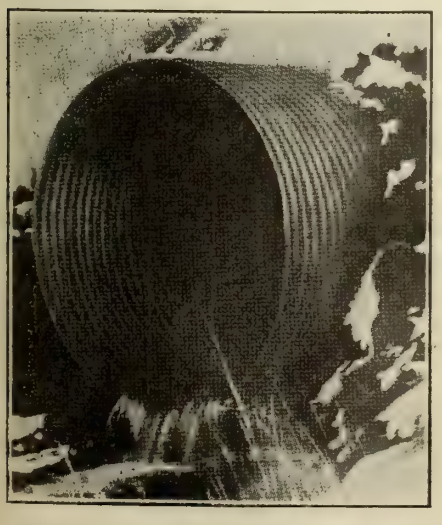
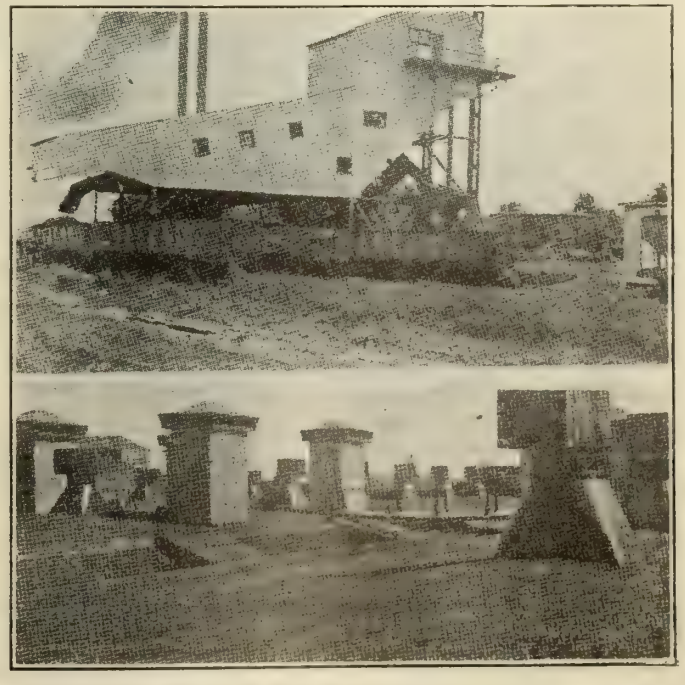


Galvanized iron culvert in as good condition as when first installed ten years ago.



Pure iron used in coal chutes and ventilators in use for 13 years, reveal no evidences of corrosion.

Keeping Track of Costs in the Small Shop

Successful System for Light Manufacturing—Recording Work of Skilled and Unskilled Labour—Planning the Details—Following the Product Through the Plant—Simple Card System

By G. BLAKE

THIS subject of cost-keeping is one which has interested the writer very much, especially in its application to the small shop. A system may prove very effective in large establishments employing from 500 to 10,000, but it may not be at all applicable to the small shop. Yet it must not be inferred that, because a system which has been successful in a large shop does not work, the smaller shop can do without a manufacturing system; it is as necessary for the shop with a pay-roll of 25 and upwards as it is for the larger establishments. Of course, the author has taken it for granted that the small factory has a specialty of some description; it may be lathes, bakery machinery, electrical apparatus, or motor car accessories; at any rate, it will be assumed that the small shop in this particular case does manufacture a specialty. Take, for example, electric control gear, which is made up largely of brass, copper and cast iron. Other materials are used, but not to the same extent as the three named. A great deal of both the machining and assembling is performed by specialized labor, either male or female; skilled labor is not required except in the tool room, inspection, final assembly and testing departments. It is generally accepted that, in using specialized labor, a greater degree of attention is required from the charge hand or foreman, both in the training and supervision of such labor. Where instructions have to be given great care must be exercised in the giving of details which, to a skilled mechanic, would not be necessary.

Effective System

In a small factory the following manufacturing system was introduced with very successful results. Prior to its inauguration every one in the works did his best individually, but without any systematic effort. For instance, the setting of processes and piece-work rates was in the hands of the foreman who, though an excellent fellow, had not much idea of running a small shop for the economic production of the firm's specialty; things just ran along haphazard. If the bench hands required any parts from the machine shop (there being no finished stores) they simply came across to the machine engaged on the parts they needed, took away with them enough to last for a day or more and, if the parts did not fit, they altered something to suit. This, of course, led to all sorts of trouble, especially when asked to supply spare parts after the apparatus had been in use some time.

Organizing the Works

An engineer was engaged to organize the works and install modern methods. The first change brought about was in the planning of the work; manufacturing processes and times were fixed, jigs, tools and gauges were designed, and works instruction sheets were made out as Fig. 1. As will be noted from the sheet shown, all tools, jigs, fixtures and gauges were specified and tabulated under their letter and number. For example, all jigs and fixtures were put under J with numbers from 1 to 1,000, all tools were under T, and gauges under G. The machine shop charge hand was notified by the shop superintendent that there was an order for same, 500 machines, comprising 150 parts machine. He would then go to the shop clerk and ask him for an order form (Fig. 2 illustrates the type used). On the front side A of the order card all particulars relating to the job were entered by the shop clerk, such as S/o No., Part No., Drg. No., description, quantity required and material, with the space at the bottom for a date when the order was issued and one for the date when the order was completed.

The reverse side B of the card was arranged as a progress card for the job, and by looking over the cards the shop clerk would readily furnish the production engineer with information as to the position of any component, number of components, or finished units or machines. For example, taking the sample card shown, and supposing that there were 150 parts in a complete machine, an order card would be made out by the shop clerk for each part and given out to the machine shop as required. In connection with the assembly and sub-assemblies, a card would be made out to cover each, one for sub-assemblies of contacts, oil dash pots, etc., and another for final assembly. When a part or complete machine was finished the card was returned to the shop clerk duly signed.

Returning to the machining of components, the work was inspected after each operation. The inspector would enter in the space provided the quantity passed and initial the card for that particular operation. It would then be ready for the next operation, the quantity after

WORKS INSTRUCTION SHEET. N° 213.

Description	Contact Bracket For Automatic Starter	Type AP/2	Part No. S43	Order No. 6-1927	Mat'l C.M.
Operation			Std. Time	Jigs	Tools	Gauges
N°1	Mill bottom face Hold bracket in fixture 10 at one setting		2/60	391		310 311
N°2	Drill 4-⅝" holes for locking bolts and spot face		2/60	324	62	
N°3	Mill contact faces Locating from bottom face and bolt holes		2/60	327		312
N°4	Assemble on Panel		2/60			
Total Time Per Piece In Minutes 9						

Remarks.
The sequence of these operations must be adhered to. Any alteration or new arrangement must be given in writing and the exact nature of alteration or modification.
Fig 1
Date 6-2-21

Works instruction sheet.

PRODUCTION ORDER

Part N°
Description
S/o N°
Drg N°
Quantity
Material
Remarks
Date Issued
Date Completed

A

Date	Quant Passed	V.R. Sig.	Date	Quant Passed	V.R. Sig.

B

Fig. 2—Front and back view of order form card.

each operation being easily seen and noted.

Obtaining Material

Again, returning to the commencement of a job, after the charge hand had obtained the order card he would next obtain the blue print and works instruction sheet, then he would present the order card at the rough stores so that the material could be obtained. No materials were given out unless an order card was presented. A sample store stock card is shown in Fig. 3. This card was double-sided so that both sides could be utilized. Then, the charge hand would apply at the tool store for the tools, jigs, gauges, etc., as specified on the works instruction sheet, it being so arranged that where possible all jigs and tools, etc., belonging to the job were kept together in a small box or bin with a sample piece so that the charge hand could set up the job on the machine, and then test the work from the sample before putting the operator on the job.

Grinding Tools

In connection with the grinding of twist drills, etc., it was arranged that an experienced driller was put in charge of the boys on the drilling machines, and he was responsible for all the grinding of twist drills. During the rest of his time he would personally do all the important drilling. By this means the drill bill was reduced very considerably as, previous to this, the boys ground their own drills, entailing a great loss of time (boys will talk round the emery wheel) as they could not appreciate the difference between grinding a drill for steel and one for cast iron or brass; consequently, drills did not last long, as they were not properly ground and in addition the drilling times were high. The same applied to the capstan department. No operator was permitted to grind his own tools; the charge hand had to see to the tool grinding.

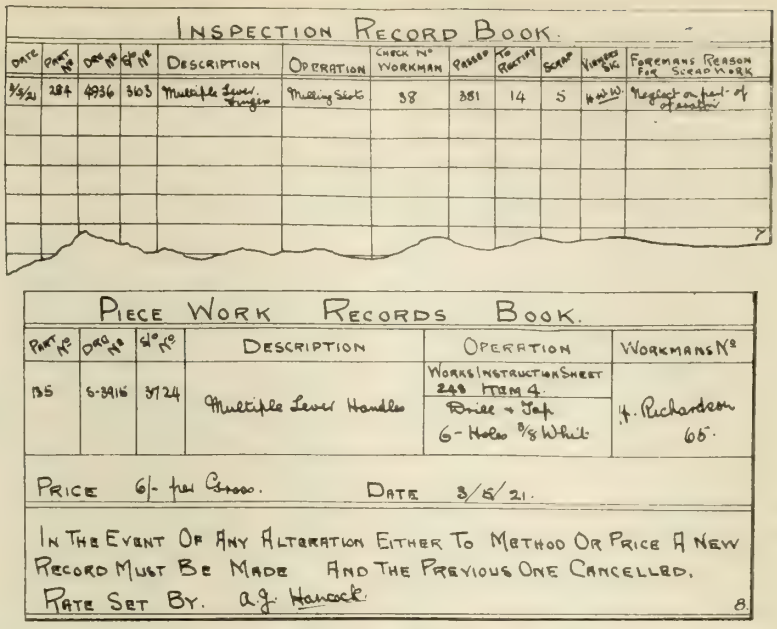
In connection with the inspection of the work, a smart bench hand was trained to undertake this duty, and all work was inspected before being forwarded to the finished parts stores. A section of the main store was portioned off for this purpose. Bench hands, etc., requiring parts for their job had to have a requisition note (Fig. 4) from their charge hand calling for a quantity of the components. By this method no work was allowed to be taken away from the machines by the bench hands or any other individuals.

In the tool room a tool fitter was appointed to perodically inspect and adjust all working and inspection gauges, the tool store being incorporated in the tool room. All new jigs, fixtures, tools and gauges were personally inspected and tried out by the writer before being put in the tool store. Standardization in the tool room was carried out as far as possible; gap gauges were made in blanks from case-hardened mild steel, and when a gauge was required the order to the tool room simply specified blank No. 1, 2 or 3, whichever size was nearest to the finished dimensions of the gauge. Regarding the heat treatment of tools, etc., many carbon steel tools had been ruined previously through overheating. A piece of ½ in. dia. cast steel was magnetized at one end and was made sufficiently long to be held by the hand and to go in the furnace to test whether the tool in the fire was at its correct hardening temperature. As is well known, carbon steel when at the correct hardening temperature has no affinity for the magnet. The tool fitters were instructed in this method for gauging the hardening temperature, with very good results.

Responsible Tool Fitters

A word about the tool fitters; they were smart bench hands taken from the assembly bench, and by careful training these men in time became quite proficient tool fitters, and results amply justified the time taken in special instruction and training. Two of the most promising apprentices were selected for the tool room; each had a year in the production engineer's office on jig and tool drawing. As the boys selected were very keen and had a good technical education, they both proved good draughtsmen and worked out all jigs, tools, fixtures, gauges, etc., from freehand sketches. It not only created desire on the part of the boys themselves, but it acted as an incentive to all the rest of the boys in the works to qualify for jig and tool drawing and tool room work. No expensive jig and tool designers were required, as the production engineer designed all the jigs, tools, etc., and the boy in the office did the drawings to scale in detail. This procedure could be profitable adopted in most small shops.

A jig, tool and gauge record book, as illustrated in Fig. 5, was kept in the



INSPECTION RECORD BOOK.

Date	Part No.	Drg. No.	Op. No.	Description	Operation	Check No. Workman	Passed	No. Rejected	Scrap	Number Sig.	Foremans Reason For Scrap Work
3/5/21	284	4936	3103	Multiple Lever Bracket	Milling Slots	38	381	14	5	H.W.	Neglect on part of operator

PIECE WORK RECORDS BOOK.

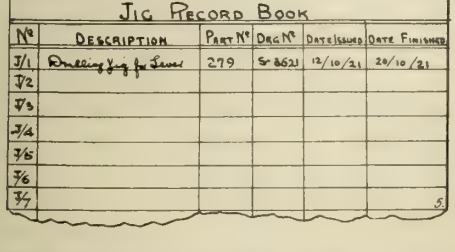
Part No.	Drg. No.	Op. No.	Description	Operation	Workmans No.
135	6-3916	3124	Multiple Lever Handles	Works Instruction Sheet 249 Item 4. Drill + Jig 6-Holes 5/8 Whit.	J. Richardson 65.

Price 6/- per Gross. Date 3/5/21.

In The Event Of Any Alteration Either To Method Or Price A New Record Must Be Made And The Previous One Cancelled.

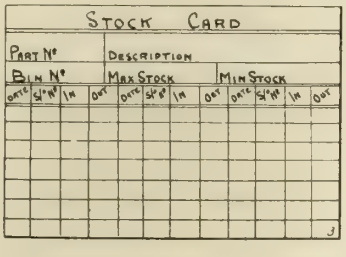
Rate Set By. A.J. Hancock.

Fig. 7—Top: sample from inspection record book.
Fig. 8—Lower: sample from piece work record book.



JIG RECORD BOOK

No.	Description	Part No.	Drg. No.	Date Issued	Date Finished
J/1	Drilling Jig for Lever	279	S-8621	12/10/21	20/10/21
J/2					
J/3					
J/4					
J/5					
J/6					
J/7					

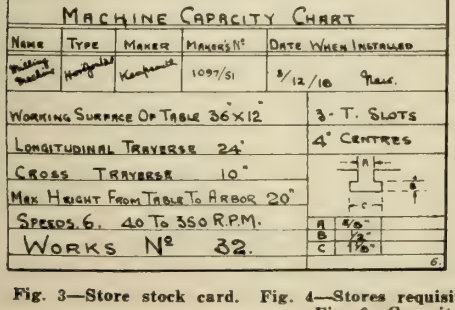


STOCK CARD

Part No. Description

Bin No. Max Stock Min Stock

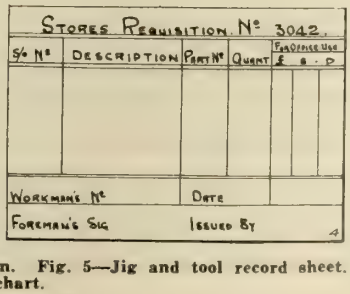
Date	S/No.	In	Out	Date	S/No.	In	Out	Date	S/No.	In	Out



MACHINE CAPACITY CHART

Name	Type	Maker	Makers No.	Date When Installed
Milling Machine	Horizontal	Kempsmith	1097/51	8/12/18 New.

Working Surface Of Table 36"×12"	3-T. Slots 4" Centres
Longitudinal Traverse 24"	
Cross Traverse 10"	
Max Height From Table To Arbor 20"	
Speeds 6. 40 To 350 R.P.M.	A 5/8" B 1/2" C 1/16"
Works No. 32.	



STORES REQUISITION No. 3042.

S/L No.	Description	Part No.	Quant.	For Office Use £ s. d.

Workmans No. Date

Foreman's Sig. Issued By

Fig. 3—Store stock card. Fig. 4—Stores requisition. Fig. 5—Jig and tool record sheet. Fig. 6—Capacity chart.

production engineer's office, and all tools, jigs, fixtures and gauges were recorded under their respective letters, i.e., T, 1 to 1,000 for tools; J, 1 to 1,000 for jigs and fixtures; G, 1 to 1,000 for gauges. This book was kept for reference purposes. As shown in the sample page, all particulars regarding the tool or jig, etc., were recorded. A card index system would answer equally well. A plan of the whole works was made, showing the position of each machine, bench, etc. A small flag attached to a pin with the worker's name written thereon and stuck on the plan (which was mounted on a board and hung up in the office) indicated at a glance the position of each employee in the works. When running a night shift the flags were duplicated in the case of a machine or bench being double-shifted, the day worker's name in black ink and the night worker's name in red ink. Capacity charts for every machine were got out, so that it was not necessary to measure up any machine to see if the job could be accommodated on it. All this information was tabulated and put away for future reference in connection with work planning. On these charts or machine capacity cards the name of the machine, type, maker's inspection number, number of machine in works, together with the date on which it was bought, and whether new or secondhand. Fig. 6 illustrates the chart.

An inspection record book (Fig. 7) was kept by the inspector in which were entered all parts inspected and passed, together with the S/o No., Drg. No., Part No., operation, etc. (sample page shown). It will be noted that there is a column for scrap work. This proved very useful to the production engineer, as it showed the amount of scrap in every job from day to day, and enabled him to take up the matter with the charge hand concerned.

Setting Piece-work Rates

In connection with the setting of piece-work rates, all piece-work rates were fixed before a job was sent into the works by the production engineer. A book with pages in duplicate was used for keeping piece-work records. Fig. 8 shows the type of book. One of the pages was kept by the production engineer for future reference and the other page was forwarded to the office for costing purposes.

IDENTIFICATION CHART

MATERIAL	COLOUR	RACK Nº
CAST STEEL ·9% CARBON	RED	51
CAST STEEL 1·25% CARBON	ORANGE	52
HIGH SPEED STEEL 14% TUNGSTEN	GREEN	53
HIGH SPEED STEEL 18% TUNGSTEN	WHITE	54
MILD STEEL BRIGHT DRAWN	BLUE	55
MILD STEEL BLACK BAR	RED AND WHITE	56
MILD STEEL CASEHARDENING	RED AND GREEN	57
NICKEL CHROME STEEL	RED AND ORANGE	58
BRASS ROD DRAWN	BLUE AND WHITE	59
GUN METAL	BLUE AND ORANGE	60
PHOSPHOR BRONZE	BLUE AND RED	61
COPPER HARD DRAWN	GREEN AND ORANGE	62
DELTA METAL	GREEN AND WHITE	63
ALUMINIUM	PINK	64
NICKEL	PINK AND BLUE	65

3

Material identification card.

Identification Card

Fig. 9 illustrates an identification card used in the rough stores, so that all materials could be easily identified. A master card measuring 24 in. by 15 in. was got out and hung in the stores near the raw material so that the storekeeper's assistant could classify all materials. The bars and rods were painted their respective colors, so that it was impossible for any one to make a mistake. Where no color scheme is in operation it not infrequently happens that a whole batch of work is ruined in the heat treatment department owing to the hardener treating the steel wrongly, as high-speed steel had been specified and the stores, without knowing it, had given out cast steel. This card is very effective in, say, a motor car factory where there are so many kinds of steel used. The same remarks apply to the various kinds of non-ferrous metals.

The system depicted in the foregoing article is not only applicable to the small shop, but can be applied to larger. Its chief advantages are its simplicity, economy and efficiency.

RUST IMPOSES SEVERE TAX

(Continued from page 33)

ing the comparative resistiveness of pure and impure coatings. The object of this test was to observe the action of dilute acids on galvanized samples.

Different grades of galvanized materials were used in the investigation. Samples, 16-gauge, 2x2 in., after cleaning and weighing were vertically placed in separate tumblers and completely immersed, using 300 cc of very weak acid (N/100) for each specimen. The acids used were sulphuric, nitric, acetic, tannic and hydrochloric. The test was run in duplicate at 100 deg. C.

In order to guard against exhaustion of solution strength, each test piece was removed from the acid at the end of 24 hours and immersed in 300 cc of fresh acid. At the end of 45 days the test was discontinued and weight losses recorded.

The test was amplified by conducting at the same time a similar test at room temperature.

These results verify the claims that the purer coating is more resistant to corrosive influences and has a longer service life than coatings contaminated with higher iron percentages.

Other Tests Bear Out Conclusions

The foregoing is but one of a large number of investigations. The influence of the base metal on the galvanized coating was investigated by observing tests where different grades of full-size sheets, fence wires, culverts, gutter and drain pipes, shingles, tanks, laboratory specimens, etc., were subjected to a large number of test conditions, such as atmospheric, soil, river waters, drainage, still water laboratory tests, aerated immersion tests, coal mine installations, etc. In fact, many and diversified corrosion tests have been conducted using commercially pure iron in comparison with galvanized samples of impure iron and steel, and the results obtained show without exception that the purer coating on this material is always found to be the most lasting.

The following is a tabulation of the analyses of the base metals followed by a report of the results obtained:

Material	Sul.	Ph.	os.	Carb.	Mang.	Cop.
Commercially pure iron	.020	.006	.010	.018	.020	
Coppered iron	.062	.023	.014	.021	.230	
Coppered steel	.074	.091	.110	.410	.200	

PERCENTAGE LOSS OF GALVANIZED COATING

Material	Sulphuric Acid		Nitric Acid		Acetic Acid	
	Boil. Temp.	Room Temp.	Boil. Temp.	Room Temp.	Boil. Temp.	Room Temp.
	%	%	%	%	%	%
Com. pure iron	85	73	23	21	79	51
Coppered iron	95	90	36	26	100	82
Coppered steel	100	93	38	25	100	82

Material	Tannic Acid		Hydrochloric Acid	
	Boiling Temp.	Room Temp	Boiling Temp	Room Temp
	Per Ct.	Per Ct.	Per Ct	Per Ct
Com. pure iron	10	5	78	54
Coppered iron	15	11	100	88
Coppered steel	12	10	100	84

In addition to the valuable laboratory tests showing, as they do, the greater resistivity of the pure spelter coating, hundreds of actual service installations have been under observation which yield data of a most convincing character.

Conclusions which are drawn from the normal service life of galvanized ferrous metals when subjected to every-day commercial requirements are the final criteria to be considered when establishing the value of the commercially pure iron base metal.

Individual service records of the thousands of installations during the past 14 years, taken in part or whole, show the value of commercially pure iron as the base metal for galvanized sheet metal requirements. The results of so large and varied a number of laboratory tests simulating so many conditions of actual service; the valuable information from commercial installation; the purity of the zinc coating and the protection it affords even when part of the base metal is exposed; the superior corrosion resistance of galvanized specimens when the electro-potential between the base metal and coating is at a minimum; smoothness, purity, deoxidation — all these points, singly or as a whole, would seem to give an undoubted advantage to commercially pure iron as a satisfactory base metal for galvanized installations.

It is not good practice to use wire lacing in a belt that is to be shifted by hand.

?? Questions and Answers ??

CLEANING CASTINGS

Question:—We would be pleased to have you advise us what pickling process would be best for removing sand and cleaning grey iron castings.—W. H. C., Montreal.

Answer:—One of the most common methods of removing sand from castings is to soak them over night in a solution of one part sulphuric acid (oil of vitriol) and 4 parts water. This is to be kept in a wooden vat, painted on the inside with white lead. If the solution is kept boiling by having steam pipes running through it, several batches can be pickled during a day. This solution is only good where the scale is soft enough to be penetrated by the acid, which attacks the surface of the iron, leaving the scale loose so that it can be washed or brushed off.

If the sand is burned right into the metal there is only one acid which will remove it. Hydrofluoric acid will eat sand, and if kept in a glass retainer, will dissolve the glass, but it will not attack iron, neither will it affect wood, so a wooden vat constitutes the entire equipment. If the castings are immersed for two or three hours in one part of hydrofluoric acid and ten parts of water, the metal will be freed from sand as well as the hard magnetic oxide (scale). This solution is equally as effective on forgings, and is by all means the best method known.

CARRYING MINING SUPPLIES

Question.—Can you inform me as to the advisability of establishing a stock warehouse in the north country in order to serve the gold and silver mines with necessary supplies or equipment? What would you consider the initial step in establishing a contact with that field?—C. J. E., Belleville.

Answer.—There is, undoubtedly, a definite market in the north for all kinds of material entering into mining processes. Whether it would be advisable to establish a warehouse at Cobalt or other northern centre, rather than at Toronto or Montreal, would depend upon a personal trip of observation to learn what the actual requirements are. This, too, would be one of the first steps necessary in establishing contact with the market. It is estimated that the value of material and equipment used by the mines of the north runs well over 30 millions. It seems to be a field worth cultivating. Foundries have already found it to be a profitable market for heavy castings, steel crusher balls and repairs. There is an increasing demand for ball and tube mills, crushers, stamp batteries, grinding machinery, electrical equipment, high-speed steel, rock drills, pumps, fittings and high pressure pumps. Hoisting equipment, so largely used, calls for wire rope or cable, steam shovels for surface work and trenching, steel rails from 12 to 33 lbs., and other railroad accessories together with switches, turntables, cars, etc. Good business is being done in pumps, pumping equipment such as reducing and globe valves, steam boilers and engines and many other accessories and materials used in extraction of precious metals by chlorination or cyanide processes.

Canadian Machinery and Manufacturing News would have its readers feel that its resources for gathering special information, such as they may require, are freely at their service. Their questions will receive immediate consideration. On the other hand, should they feel that they are in a position to add to the information given in these columns upon any subject, their co-operation will be greatly appreciated. Desired information is first sent by mail to enquirers. Names will be supplied upon request.

C. I. F. CONTRACTS

Question.—Will you please tell me what is generally included in the terms C. I. F. as applied to a shipping order or a contract? Does it embody all charges to point of final delivery?—Exporter, Toronto.

Answer.—This term, broadly speaking generally signifies charges, insurance, freight paid. Responsibility of each party to the contract is recently described by a writer in the trade supplement of the London Times. The seller is required to:—

1. Put the goods free on board (F. O. B.) and pay all transportation to the agreed destination.

2. Be responsible for all loss and for damage until delivery of the goods into the custody of the shipowner:

3. Take out and pay for all necessary marine insurance.

4. Deliver to the buyer or his agent a clean bill of lading to the agreed destination and a marine insurance policy or negotiable insurance certificate.

The buyer on his part is expected especially to:—

1. Be responsible for loss and for damage thereafter and to make all claims to which he is entitled under insurance.

2. Take delivery and pay costs of discharge, lighterage and landing at port of discharge in accordance with the bill of lading clauses.

3. Pay all import duties, customs and wharfage charges, if any.

Above terms generally apply to sales made on C. I. F. basis, but the terms are sometimes modified by special clauses in contracts of sale.

THREADING DIES

Question:—Is there any rule for finding the approximate weight of square and round steel bars when the side or diameter and length are known—without resorting to weighing?

Answer:—It is possible to figure quite closely by calculating the volume of the bar in cubic feet and multiplying the result by 489.6, the weight of one cubic foot of steel. Another method is by figuring direct by dividing the product of the square of four times the diameter by 6, for round bars, and by 4.7 for square bars. This gives the weight per foot of running length. Suppose we have a round bar 7 in. dia. and 10 ft., long, the weight would be:—

$$\frac{(4D)^2}{6} \times 10 = \frac{28 \times 28}{6} \times 10 = 1306.6 \text{ lbs.}$$

For a square bar 7 in. on a side, the weight would be for the same length:—

$$\frac{(4D)^2}{4.7} \times 10 = \frac{28 \times 28}{4.7} \times 10 = 1668 \text{ lbs.}$$

WEIGHT OF STEEL BARS

Question:—We have a set of collapsing dies which appear to be in first-class condition but frequently we are troubled with flats at the root of the thread. What would cause this condition? E. J.

Answer:—While it would be difficult to give a definite remedy for this trouble without knowing the kind of metal on which the threads are cut, it would seem that the dies are not properly ground. The flattening at the root of the thread is likely caused by some of the dies cutting in advance or later than the others. Assuming that the dies are of the milled type, we would suggest testing the dies on a trial piece of stock, stopping them in the process of cutting and closely examining the various dies for accuracy of position and chamfer. All the cutting should be done on the chamfer, and not back on the full thread. If the dies do show cutting on front or back side of the teeth, they should be stoned slightly on the edge that is doing the shaving. Should this trouble continue it would be well to take the matter up with the makers of the dies, giving all detail particulars.

Effective Method of Carburizing Local Areas

Numerous Ways of Protecting Metal From Exposure to Carbon Carrying Gases—Drying the Parts Before Packing—Preventing Carburizing Action by Copper Plating—Removing Grease

THE ABILITY to carburize only those areas which are to be increased in carbon content and are desired hard, leaving the remainder soft, is one of the most valuable assets of the user of the carburizing process. Such methods are invaluable for ball bearings where a deep backing of soft metal is desired for strength and toughness while the race itself is extremely hard; for carburizing delicate parts where production methods preclude separate handling in the hardening operation; to keep from heating and quenching the shanks; for delicate tools or gauges where the thin metal would carburize clear through and be brittle; for work which distorts in hardening and for the reshaping of which machining or bending is necessary, such as arbors, shafts, gears, cam shafts, etc.

Sections of parts carburized which are to be kept free from an increase in carbon may be covered with fire clay mixed with water to the consistency of putty, dried by moderately slow heat and packed in the pots with carburizer in the ordinary manner. Drying before packing is usually necessary as the water in the fire clay when exposed to the high heat of the carburizing furnace will cause the fire clay to crack. The carburizing gases will enter the fissures thus made and cause partial carburization. Salt is often mixed with the fire clay to lower its fusing temperature and act as a binder. After carburizing in the usual manner, the clay would be knocked off, and the work treated as any carburized work in the hardening operation. This method is successful for the small shops where the demand for local carburizing is not great.

Protecting Sleeve

The metal protecting sleeve is especially practical where the form of the work permits its use. The method here is to have a sleeve or collar that can be slipped over the part required to be left unhardened. This sleeve is either a push fit or, if loose, can be wired in place. Too much looseness between the sleeve and the work will allow the carburizing gases to enter. This may be avoided by daubing a thin mixture of fire clay on the inside of the sleeve before putting it in place. After carburizing, the work may be hardened in the regular way with either the sleeve left on or removed. Leaving the sleeve on insures softness of the part covered, but if the sleeve fits too tightly trouble may be experienced in its subsequent removal. The sleeve can be made of iron or steel. It can be made in sections, for ease of applying, in which case the sections may be wired together with fire clay at the joints. Asbestos paper is often used as a wrapping for the section desired free from an increase in carbon.

Other Methods

Sand can also be used as a mask by placing it at the bottom of the pot and imbedding the section of the work desired free from an increase in carbon in it, the section to be carburized extending above it and surrounded with carburizing material in the regular way. This method is usually not to be desired, as the sand becomes mired with the carburizing material, and with the iron scale which accumulates from the pots, will eventually form glass or silicate deposits on the work. A thin paste of water glass (sodium silicate) and Kaolin (a fine grade of clay which can be purchased at any drug house) is oftentimes painted on sections of the work desired free from an increase in carbon. The mixture is dried on the work in the air and is packed in the pots in the regular way.

The above methods are more efficient for light than deep carburization. The skill of the operator in applying them affects the final results. For greater depths, the long heat eventually breaks them down and penetration of carbon will be experienced. The use of the sand method is probably the only exception, but, as explained, it has other objections. By leaving sufficient extra metal on sections desired to be soft after hardening, and, after carburizing, machining off this excess metal, these sections are with certainty prevented from hardening on the quench. It is evident that, while this is a very sure method, there will be more time used and considerable cost, which however, may often be more than offset by its advantages.

Copper Plating Method

The most satisfactory method so far found, where the volume of work warrants it, is the copper plating method. As everyone knows, it is impossible to harden copper by heat treatment. Carbon is the chief hardening element in metals and there is no affinity between copper and iron nor copper and carbon. The copper plating process referred to is

This shows the various conditions of case and core under different heat treatments. Beginning at the top left is the original steel. No. 2 is carburized at 1650 deg. F., quenched from the pot in oil. No. 3 is re-heated at 1650 deg. F. and quenched in oil. No. 4 is carburized at 1650 deg. F., quenched from the pot in oil, re-heated to 1425 deg. F. and quenched in water. No. 5 is carburized at 1650 deg. F., cooled in the pot. No. 6 is carburized at 1610 deg. F., cooled in the pot, re-heated at 1650 deg. F., quenched in oil, re-heated at 1425 deg. F. and quenched in water. No. 7 is carburized at 1650 deg. F., cooled in the pot, re-heated at 1425 deg. F. and quenched in water.

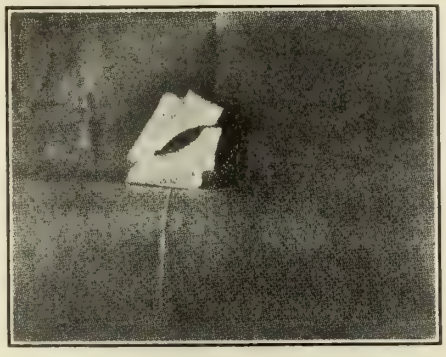
As recommended by the American Gear Manufacturers Association.

the electro-plating process. Simply applying copper sulphate, etc., is not satisfactory inasmuch as there is no bond between the steel and the copper coating. This coating will peel off under certain conditions, which may be a too heavy copper coating, lack of density, or difference of expansion. The copper electroplating process consists in chemically cleaning the work, copper electroplating it and removing mechanically the copper at the parts desired to be increased in carbon. This method of mechanically removing the copper calls also for removing some of the steel so that it is necessary to have a sufficient allowance of metal to be removed. This mechanical removing of copper is done by grinding or by machining. The former is in no way satisfactory as minute particles of copper are rubbed in and imbedded in the surface desired hard, by the wheel giving to the hardened finished surface a semi-softness that is often puzzling as well as serious, and sometimes the carburizer is unfairly blamed. In order to avoid mechanically removing the copper, japanning of the surface desired to be carburized is resorted to before copper-plating. After baking the japan the whole is plated. The japan burns off in the carburizing process and the steel formerly covered by the japan is carburized. The following method is practised by one of the largest concerns doing local carburizing and protecting their work by electro-copper plating .

Cleaning the Surface

The grease is first removed from the work by cleaning in sal soda or gasoline, according to the amount of grease present. The work is then thoroughly cleaned, before japanning, by washing successively in potash, hydrochloric acid pickle, cold water, potash, cyanide solution, cold water and hot water. The work is japanned with two coats, being baked at 400 deg. F. after each coat. The same routine of washing is gone through as before but omitting the hot water. Then the work is plated in the cyanide copper solution for 10 to 15 seconds, or until a copper color is barely obtained. This solution should only be lukewarm and used at 5 volts. Formula is 50 gallons of water, 25 pounds copper carbonate and 50 pounds cyanide of potassium (or enough to bring carbonate into solution). This solution should be kept 8 to 10 deg. Baume gravity. Next the work is thoroughly rinsed in cold water and transferred to a nickel plate bath, run with about 3 volts and scant anode surface. Bath should not be too hot. Plate 10 to 15 minutes to give good foundation. Rinse work thoroughly in cold water and transfer to acid copper solution, cold at 5 volts. Plate 20 to 30 minutes. Formula is 50 gallons water, add copper sulphate to give 18 deg. Be. solution, and then sulphuric acid to 20-22 deg. Be. Keep acidity and gravity correct. Wash in cold and then hot water and dry.

The ability of the plate to resist action of carburizing materials depends not upon thickness, .001 in.-.0015 in. is sufficient for any purpose, but on foundation and density. The cleaning before and after japanning, keeping the solution cool enough, and the density of the plate, are the important factors. The nickel plate might be omitted in some cases, but it eliminates a long time in the cyanide-copper solution and the consequent action of the same on the japan and steel. It also gives a good foundation which is resistant to the action of



Carburized ball-bearing. This shows that only the raceways have been carburized. The carbon has been kept out of other portions by copper plating. This is a 50-hour heat. For such deep carburizing, care must be used in selecting the carburized material.

the acid copper solution. It is found that, as a regular proposition, the nickel foundation is most satisfactory. The method of plating described is used for work requiring deep penetration of carbon and is very satisfactory even for over a hundred hours of carburizing.

It is understood that with certain carburizers with active chemical energizers the copper plate has a tendency to break down. For gear work, however, any of the commercial carburizers are satisfactory, as break-down of copper in pinhead spots is of no consequence. If, however, occasion demands absolute freedom from copper break-down, charred bone, charred bone and charcoal, or hydro-carborated bone black carburizers are recommended. For gear work, japanning is not always necessary as the copper plate may be applied before the teeth are shaped. The removing of the metal will then lay bare just the part that is desired to carburize.

Protective Coating

Recent developments in France in selective case-hardening employ a protective coating applied with a brush in a paste or semi-liquid form. This mixture is composed principally of powdered copper with an inner material and a binder. The formula recommended is powdered copper two parts by weight, powdered emery one part by weight, commercial solution of silicate of soda in sufficient quantity to give a thick paint. This formula was arrived at after long experimenting and many tests. Aluminum in powdered form and many other materials were tried with little or no success. The coating obtained with the above mixture is very adherent before heating and is easily removed from the steel after case-hardening. The best method of preparing paint is to mix the powdered copper and emery before use, and just before applying to the steel add the necessary amount of silicate of soda to give the desired consistency. The silicate is added little by little so as to make first a thick paste and then is brought to the necessary fluidity to flow freely from the brush.

The previous removal of grease from the steel is important. Experience has shown that the paste will only protect properly if the parts are perfectly free from grease. Removing grease with a bath of hot potash solution is altogether insufficient, the mineral oils being only partially or not at all emulsified. The simplest and most efficient method of removing grease seems to be to heat the work in a furnace to about 900 deg. F., avoiding in all cases red heat. A coating is required of about one-half or equal the thickness of the case against which it is to protect the steel. Drying takes about fifteen minutes and the pieces may be packed in the boxes one hour later.

CATALOGUE

The Canadian Ingersoll-Rand Co., Sherbrooke, Que., have just issued a new bulletin, K-3111, illustrating and describing their new class "ER"-1 single-stage, straight-line, belt-drive, air or gas compressors. These new machines are produced in their entirety at the Sherbrooke plant and embody all of the latest developments in compressor engineering. These include "Ingersoll-Rand" plate inlet and discharge valves; enclosed construction with automatic combined flood and splash lubrication at all speeds; forged-steel connecting rod and crankshaft; removable die-cast bearing shells, etc. The plate valve adopted for these machines is a modified form of the valve used for several years on their largest compressors. An outstanding advantage of the valve is that it requires no lubrication or mechanical valve gear and is supported throughout its entire operation in perfect alignment without any form of wearing guide. Regulation of the class ER-1 compressor is accomplished either by an automatic inlet unloader or by a "free air unloader" operating directly on the inlet valves. Bulletin K-311 presents an interesting comparison of the various types of compressor drives and contains other information of value to compressor users. The class ER-1 compressor is as nearly automatic as any machine of this kind can be and is particularly adapted to small mines, quarries, foundries, machine shops, textile or paper mills and industrial plants generally. Copy may be secured on request.

Brightening Up Interiors of Industrial Plants

Workmen Influenced by Shop Conditions—Well Lighted Factory Raises Morale of Employee—Effective Reflection of Available Light—White Painted Walls a Means of Protection

MANUFACTURERS are rapidly realizing the economic value attached to the practical solution of the artificial lighting of factory interiors. There are so many factors involved in the problem of present-day production that no executive can afford to overlook even the smallest one if he desires to meet the competition that makes it necessary to consider every phase of plant operation while endeavoring to produce on a paying basis. Workmen are engaged to perform certain duties and anything that detracts from the efficient accomplishment of these duties, naturally utilizes a certain percentage of energy that might well be applied to a more useful purpose.

Proper Diffusion of Light

Economic illumination is not so much a question of providing sufficient candle-power but rather the scientific distribution of the light available. This includes both the natural daylight and artificial lighting facilities. To utilize fully the daylight coming into a factory through the windows and skylight, or the illumination transmitted from electric lights—no matter how systematically these units may be situated—the question of proper reflection is of vital importance. This problem of light diffusion is best solved by coating walls, pillars, and other reflecting surfaces with a paint having the necessary qualities. It has been found that by finishing the interior walls of a plant in white, with a special line of paint developed for this purpose, that not only the lighting bill has been reduced, but fewer accidents resulted, and that the morale of the workers was greatly increased; also that cleanliness and sanitation were greatly promoted. In addition to this, production was much larger, due to the decrease in the number of spoilt jobs.

It is generally admitted that clean, white walls are an aid to industrial efficiency and an economic necessity. They eliminate the dark corners and minimize the shadows, thus reducing the possibility of accident, and increasing the confidence and goodwill of the workmen. In dark and dingy factories production is invariably below the possible capacity of its equipment and operators. Much of this loss through inefficiency is directly chargeable to poor lighting. Shop atmosphere has much to do with human temperament. Clean, well-lighted sanitary factories have an appeal to that type of worker who is a special asset to any organization.

Influence on the Worker

Factory executives are more or less agreed on the beneficial results arising from a well-lighted and sanitary workshop. The collective efficiency of any body of men may be said to be directly proportionate to the conditions under which they work. A dark, disorderly and unsanitary factory will naturally develop a spirit of depression in the mental and physical attitude of nearly every employee. Much of their energy is required in guarding themselves against the risks and dangers that invariably lurk in shops where inadequate lighting creates extreme shadows, and where particular care must be exercised by passing employees to avoid the hazard that is generally associated in places of this nature.

Poor Lighting Causes Eyestrain

One of the most objectionable features in connection with poorly lighted plants, especially during the winter months when the hours of natural utilization of daylight are comparatively few, is the detrimental effect upon the eyesight. In plants where proper attention to effective lighting has been overlooked the tendency has too often been to provide excessive illumination at points where it was deemed most necessary. This condition, which in the past may have been considered good practice, would now be classed as inefficient and uneconomical. For instance, suppose a strong light is located over a machine and directed on the spot where the work is actually being performed. Should the general lighting arrangements be such as to leave the rest of the machine and adjoining floor space in comparative darkness, the strain on the worker's eyesight when turning from the strong light to surrounding shadows would eventually develop fatigue and affect his ability to maintain effective production after a definite period, depending on his constitution and experience.

Specific Instance

The writer has in mind an instance where he was employed in a large engineering plant in the States some years ago, working on the night shift. Each individual machine was supplied one or

(Continued on page 42)

Illustrations reproduced through the courtesy of the Flint Varnish and Color Co.

General view of factory before painting.

Same factory after coating with mill white.

News From the Welding Field

Safe Practice in Handling Acetylene Generators

Best Housing Methods Under Different Conditions—Fire Hazard Requires Special Attention—Natural and Artificial Lighting of Buildings—Pressure in Pipe Line Important

THERE is one of three things to do with the acetylene generator—it can be housed in a separate building away from other buildings; it can be housed in a lean-to building or shed adjoining your plant; or it can be installed inside one of your plant buildings. A separate isolated gas house is the ideal method, especially so if you go to the expense of having a substantial structure with floors at truck floor level, and divide the building into three or four compartments, using one section for housing the acetylene generator, one or two sections for the housing of calcium carbide and acetylene cylinders, and another section for the storage of oxygen cylinders. The isolated generator, carbide and gas storage warehouse need not necessarily be of fireproof construction, although such construction is preferable. In the case where it is decided to house the acetylene generator in a building which is a lean-to to your main plant, it should be separated from such plant building by an unpierced fire wall.

Where it is decided to house the generator inside one of the plant buildings, as said before, it is important to be sure that your insurance companies do not object, and also to see that you are not breaking some local ordinances. However, if such is not the case and you are housing the generator inside, a special compartment or room must be constructed, and such compartment be built of non-combustible materials. The door to such a compartment should preferably open to the outside, but if it does open into the main building or shop, the door should be of the fire, self-closing type. You will readily appreciate however, that it is far more desirable to have the door open to the outside; then if there is any leak of gas there is no chance for the gas to escape through the door into the main building or shop, with the possibility of being ignited by some heat or spark-emitting device.

In the opinion of the writer the acetylene generators should not be installed inside buildings where the building is more than one story in height, except in the case of a special generator house provided with two floors, when the second floor is sometimes used for the storage of a supply of carbide and for charging the generator. Be sure to see that the generator stands on a substantial and firm foundation. We know of cases where generators were put up on a flimsy foundation, which were later undermined by the water discharged from the generator, and as a result, the generator canted over and broke off certain piping connections, causing serious trouble.

The recommendations here set forth are made in the hope of serving the manufacturer and user of acetylene and help him to steer clear of accidents which need not occur. Remember that safe practice does not end with the proper operation of your welding equipment. Welding must only be used for work where welding can be considered good and safe practice for construction or repair. Some users become over-enthusiastic and attempt to employ welding on certain work where it should never be attempted and, consequently, fall down badly, with the result that it tends to give welding a bad name and creates a feeling of insecurity about the process in the minds of those who are considering its use.

A generator room must be protected from freezing. This is most important. Freezing up of acetylene generators is the cause of fifty per cent of the accidents that have happened with them. One should never attempt to lower the freezing point of the water by using calcium chloride in an attempt to do away with the necessity of heating, for the reason that the calcium chloride not only tends to corrode the generator itself, but will gradually permeate the whole piping system and cause serious trouble.

Generator houses should be provided with plenty of daylight illumination, and plenty of head room. It must necessarily be well ventilated, and also be provided with good and sufficient artificial illumination. This must necessarily be of the incandescent electric type, with globes properly protected and with switches outside the building. Certain existing rules call for acetylene generators to be charged during daylight hours only, but such rules are to-day obsolete and cannot be complied with for the reason that many generators are in constant use, and during the winter months it is necessary to charge in other than daylight hours. For this reason it is essential that the artificial illumination be good.

One would think to-day that any workman who could get a job would be educated sufficiently to know that you can't bring a naked flame in contact with a combustible gas without getting ignition or explosion—yet a considerable percentage of the accidents that have occurred with acetylene generators have been caused by this very thing. For this reason it is strongly recommended that good natural and artificial illumination be provided in the generator house, so that there will be no possible inducement for the thoughtless workman to strike a match or use a lantern when examining the generator. The instructions furnished by the manufacturers of acetylene generators for the installation of their machines should be followed closely, and it is advisable, when at all possible, to have the manufacturer install the machine and put it in operation.

It is quite unnecessary to say anything about the installation of acetylene gas piping, beyond stating that it should be of ample size to meet the estimated maximum demand and should be installed according to the requirements of the National Board of Underwriters. We venture to suggest that if any who have acetylene installations would secure a copy of the National Board of Fire Underwriters' rules, and would peruse these rules and observe whether the installations comply with them or not, quite a number would find that the National Fire Underwriters' rules were not followed when the installations were made. It should be appreciated that National Board rules are recommended and drawn up by the National Fire Protection Association, a body that has always made a point of consulting with the industry when preparing rules. Possibly it can be said that National Board rules are the rules recommended by the acetylene industry. You will find amongst the National Board installation rules, those calling for escape and relief pipes to be carried outside of buildings. Personal inspection has shown numerous installations where no atten-

As recommended by the National Safety Council.

tion was paid to this rule, and safety devices, if they were called upon to operate, discharged their gas inside of the buildings. This was asking for trouble.

A considerable number of the acetylene generators in use to-day for supplying gas to shop piping systems deliver the gas to the piping system at pressures up to 15 lbs. per square inch. It is therefore necessary to have the piping systems tested after installation at a good deal higher pressure than is commonly employed for testing out city gas piping systems. Let us now deal with the installation of the oxygen supply.

In the majority of cases, oxygen is used direct from a standard oxygen cylinder, a separate cylinder being used for each welding station or blowpipe in use. In some instances, however, a number of oxygen cylinders are manifolded together, the gas being supplied to the shops through a system of piping. In rare cases oxygen is manufactured on the premises, the gas being first collected in a gas holder and then compressed in a receiver to a pressure of a few hundred pounds, after which it is passed through a regulator and supplied to the welding stations through a system of shop piping.

In those systems where it is desired to manifold a number of oxygen cylinders and supply gas to welding stations, it is extremely desirable that the necessary manifolds be purchased from a responsible apparatus manufacturer or be made up to their specifications. Every care possible must be taken with the installation of the oxygen piping system. It should be appreciated that oxygen, when supplied in cylinders, is under a pressure of approximately 2,000 pounds per square inch, and consequently oxygen manifolds must be sufficiently strong to withstand this pressure. It must be borne in mind also, that no combustible material should be employed in making up the manifolds, for the reason that oxygen under pressure is liable to cause a spontaneous combustion of such material.

When assembling the manifolds and the piping system, great care must be taken to see that fittings, etc., are handled with clean hands. Crease on a joint or in the interior of the piping might cause serious trouble. The interior of the piping must be clear of all scale and rust, and should be thoroughly washed out with caustic soda before being put into service. It is needless to talk about the actual setting up of welding apparatus, beyond saying that the manufacturer's instructions must be followed to the letter. In those installations where both gases, oxygen and acetylene are supplied from a single cylinder of each gas, the cylinders should be so located that they cannot be knocked over or struck by passing traffic. In most cases, where the individual cylinders are employed, it is the best practice to have both cylinders mounted on a truck, so that they can be conveniently transported from point to point.

Now a few words about the operation and manipulation of the generators and other equipment. When starting up an acetylene generator the first time, the instructions of the manufacturer must be followed in detail. Where possible it is extremely desirable that the acetylene generator manufacturer should not only install the machine, but should put it in operation. After the generator is charged with water and carbide, a connection should be made at the extreme end of the piping system, so that the gas can be discharged from that point to the open air. It is most important, before starting to use the gas for welding, to make sure that all air has been purged from the generator and the piping system. Some common sense has to be used to judge when this has been accomplished, but in the average installation, the decomposition of 10 to 15 pounds of carbide will have generated sufficient gas to expel all air from the generator and pipe lines. You may possibly wonder why this is so important, and we will therefore endeavor to explain more clearly.

Under normal and proper working conditions, the pressure of the acetylene gas in your pipe lines and generator will never exceed 15 pounds per square inch. Pure acetylene gas (that is, acetylene without any air mixture) at any pressure below 15 pounds per square inch is non-explosive. It is possible to fill any empty cylinder with pure acetylene at a pressure of 15 pounds per square inch, fit the cylinder with a spark plug and make a spark, and there will be absolutely no ignition of the acetylene, but if there is a small percentage of air present, there will be a violent explosion. If the same cylinder were filled with acetylene at 30 pounds pressure, and there was no air present and the spark plug was sparked, there would be a violent explosion. The action of acetylene under pressure between 15 and 30 pounds per square inch is somewhat uncertain, but all the best authorities have definitely decided that acetylene should never be used in a free state at a pressure in excess of 15 pounds per square inch.

Now, let us assume that you failed to purge your pipe lines of air or mixtures of air and acetylene, and were to light a blowpipe that is supplied with gas from the pipe line, and then suppose that the blowpipe backfired—it would be possible for the backfire to propagate right through the piping system up to the flashback or hydraulic seal which is necessarily attached to the discharge outlet of all generators. This backfire along the piping system might be of sufficient violence to split the pipe or loosen the joints. Cases are known where, while the generator was being purged, a cap at the end of the piping system has been removed and a match applied, under the idea that as soon as the discharge from the pipe would ignite, it would show that all air had been driven out of the pipe. In such cases, of course, an accident has generally occurred, the mixture of gas and air discharging from the pipe having ignited, and owing to the orifice being large and the velocity of the gas and air comparatively low, ignition has propagated throughout the piping system.

BRIGHTENING UP INTERIORS

(Continued from page 40)

more small electric lights and along the shop fifty feet above the floor and over the crane runway were a number of large arc lights that were often almost entirely obscured by the dust coming in from the adjacent foundry, running parallel to the machine shop. As long as a man could stay at his machine all went well, but when a visit to the tool room was necessary, or when duty required a hunt for material on the floor or bench nearby it was like taking a trip into the wilderness blindfolded. On one occasion the writer nearly broke his arm on one of his frequent trips through the poorly lighted factory.

It might be stated that about a year after the time above mentioned, systematic investigations was made regarding the problem of more efficient illumination, with the result that an entirely new system of lighting was installed with due consideration being given to the effective diffusion of the artificial lighting by means of coating the walls with mill white paint. Under the new system of illumination the expense of lighting the plant, figured on a year's basis, was less than 50 per cent. of that of the year previous, and the production, based on actual figures, was increased upwards of 20 per cent., with less labor turnover. Workmen were better contented and changes were less frequent.

An unusual use of mill white paint was brought to our attention recently which emphasized the wide range of purposes for which a finish of this nature can be utilized. A manufacturer of black powder finished the walls of his plant with a high gloss white, in order to make the powder dust that settled on the walls visible, so that it could be brushed down readily. The high gloss surface eliminated any pockets where the powder might collect.

Fire hazard is an ever-present source of anxiety to every plant owner. This danger is exaggerated when conditions invite the accumulation of inflammable rubbish. The secretive nature of all humans seems to associate evil with darkness and when the average workman has a piece of waste, paper, or other seemingly useless material to throw away it seems second nature to discard it in the first dark corner he comes across. This surely is inviting trouble. The danger is additionally emphasized when smoking is secretly practised by some of the men, and the fear of detection causes them to throw a cigarette butt or partly burned match behind a pile of castings, radiator, or other secluded spot where darkness is the sole "redeeming" feature.

Practical Ideas From Practical Men

CALCULATING THE STIFFNESS OF SHAFTS

By W. F. Schaphorst

Referring to the article under the above title in the October 12th number of Canadian Machinery, page 24, there are some statements contained therein that are either not clear to me or typographical errors have been made. For instance, Mr. Livermore says that K may be obtained from the following expression:

$$K = \sqrt{\frac{1}{D}}$$

According to this, when D is equal to one degree we would have:

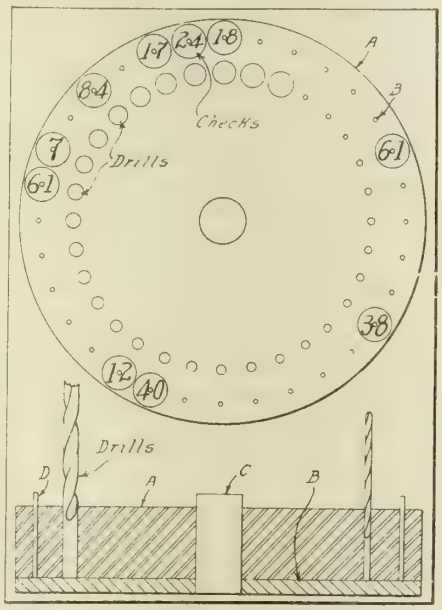
$$K = \sqrt{\frac{1}{1}} = 1$$

In the article, however, a table is given listing the values of D, varying from .25 to 10 degrees, and in this table the value of K corresponding with D when D is equal to 1 is K equals 0.0835, whereas the above formula gives the value as 1. If a typographical error has been made in the formula for K, it probably would have assisted readers like myself had Mr. Livermore given an example so that it would have been possible to have checked back. The value of K corresponding with D equals 4.50 is certainly a typographical error if the balance of the table is correct, as it evidently should be 0.0574 instead of 0.574.

TOOL CRIB DRILL STAND

By Harry Moore

Most tool cribs issue tools on the check system, that is, a system where each man is given a number of checks at starting, each check stamped with a number to identify the holder. When a tool is required, one of these brass checks is handed to the storeman in exchange, and when the tool is returned the check is handed back to complete the transaction. The trouble with the majority of these systems is, they don't work, and one of the main reasons for this is the mixing up of the checks in the tool crib itself. Mistakes are easily made at the best of times but the chances are greatly multiplied when the storeman endeavors to satisfy the demands of half a dozen impatient piece workers. Twist drills are perhaps the most frequently moved tools and the drawing accompanying this article shows a tool crib drill stand with a few special features of its own. Two stands were tried out before this one was developed. One was made from a square block, with the drills held closely together, this feature necessitating the use of hooks in line with the drill rows for the purpose of locating the checks. If two or more drills were taken out of one row, a single hook had to take care of all the checks on that line; which naturally led to confusion. Stand number two was a long narrow block holding a single line of drills spaced far enough apart to permit a check to be placed in front of each one if necessary. When this was adopted all checks were drilled with a small hole in the center to allow them to be placed over a pin driven in place on the drill stand. The objectionable part about this type of stand is the amount of space required to mount it properly, and for this reason we brought out the circular drill stand shown. It is made from an old flange casting, drilled in a circle for the drills and outside this circle for the pins that locate the checks opposite the drill they have been exchanged for. The flange A rests on a thinner flange B both swivelling on a stud C inserted in the bench. It will be readily noticed that this kind of drill stand makes for orderly arrangement in this particular department of the tool crib by lessening the chances of mixed checks; indeed, it would be a pretty careless toolman that was incapable of dropping the check over one of the pins D as the drill was being removed.



Tool room drill stand.

THREADING PLUMBERS' NIPPLES IN THE SHOP

By D. A. Hampson

The average plumbing shop boasts a pipe machine that will thread up to 4-in. or 6-in. pipe. When the occasional jobs come along that make use of larger sizes the plumber goes to the machine shop to get the pipe cut off and threaded. Every machine shop doing job work should have "pipe centres" to fit one or more lathes of 20-in. swing or larger. The reason they should be fitted to a lathe of this size is because the steady rest has to be used frequently on this kind of work and the rests supplied with lathes of 16-in. swing are seldom large enough to take in even 6-in. pipe.

The pipe centre is a tailstock centre. Two "heads" will do the average range of work better than one—one to take all sizes up to and including 6-in. pipe and the other from 6-in. to 12-in. Each of these heads are cones made of cast iron, faced on their outside surface to an included angle of 60 to 80 deg., and having a hub bored and faced to turn on a stem that is placed in the tailstock sleeve in the taper hole that ordinarily holds the centre. The change from ordinary centre to one of the pipe centres does not take five minutes. The head of the pipe centre has more bearing in the pipe than on its stem, consequently it rotates with the pipe—the stem must be lubricated, and often a thrust bearing is employed as a refinement. At the driving end, a good four-jaw chuck is better than trying to use a live pipe centre—the former serves to drive and to true the pipe.

Invariably, the conditions are as follows. A plumber or steam fitter brings in a length of pipe. It already has a thread on one end, maybe on two. He wants so many nipples made out of this pipe and threaded. Usually he brings in a fitting to go by in making up, though often he says "make the threads same as the old ones." Quite often the pipe is much longer than the lathe. Long pipe must be steady-rested. Short pieces are held between chuck and pipe centre.

Shop foremen do not look with pleasure on the pipe jobs that come in. They are apt to cost more than can be reasonably charged for them. If a machinist does not break a thread tool or a cut-off tool before he gets done, the foreman heaves a sigh of relief. Added to this (which cannot be charged up) there is a good deal of wear on steady rest jaws, more or less time spent clearing up which does not seem to get in on the bill, and miscellaneous time of a man "to give a lift" here and there. But the big expense is for tools. Here is how to avoid this tool expense.

Wrought iron pipe is "tough goods." The material is stringy to begin with. Then there is a mean scale on the outside, which is made worse because the pipe is not round, and so the tool skates over this scale for several revolutions before it gets under all the surface; by

that time it has a dulled edge which cannot help pinching and sticking as it penetrates further. Quite often the pipe has seen long use and the exterior has a coating of rust or concrete. Any formed tool, such as a cut-off or a threading tool, has a hard time working against such odds.

The only proper method is to use an ordinary turning tool to cut the surface down to clean metal. Do this first and one great source of trouble is eliminated. And on what is to be a threaded end, turn the taper portion too—don't leave it to be slowly cut down with the thread tool. The great gain in using a turning tool instead of the formed tool lies in the fact that it is a natural roughing tool, shaped for hard work and usually made of tougher material than both the thread and cut-off tools. And when a piece of pipe is merely to be cut off—not threaded in the shop—the turning tool is of assistance. Here, the tool is made to cut a section about double the width of the cut-off tool, getting well under the scale. Then it is fed in at the centre, working it sidewise a bit so that it does not hog in, and its rounded point removes a good volume of metal that the cut-off blade would have to otherwise.

Too many men cannot seem to make head way on a pipe job. Assume that a piece of 8-in. pipe a foot long with threads on both ends is brought in with instructions to cut it in two and make two threaded nipples of the halves. What does the average man do? He puts on chuck and pipe centre. Then he gets a cutting-off tool and feeds it straight in; the unevenness of the surface and the scale take the edge off before the cut is one-quarter made and then the tool begins to dig and sputter. In an attempt to remedy this the man spills lard oil on by the pint, but it doesn't help and pretty soon—Bang! The blade snaps off, and there goes all the profit on the job.

Some delay (and advice by the boys) and he gets another tool to start afresh. Finally the piece is severed. After recentering, he goes at the thread with a nice sharp thread tool on the uneven, scaly surface. In some cases he does get another tool and chamfer the corner first. He proceeds to cut a full thread with the V-shaped tool but, unless he has made several sharpenings to put back the edge lost on the scale, his thread is all torn and bears little resemblance to the smoothly-formed one needed to make a nice pipe job. Not only does he cut a full thread, but he has to make the thread tapered, which means reducing the diameter about one-sixteenth at the end—doing this the slowest and hardest way, by using the thread tool.

The job has taken over three hours. The foreman knows that two hours and a half is more than it is worth, but he takes the chance of a kick and puts it down that way; there is no way of recovering the loss of the threading tool. An impartial, unofficial observer would remark what the foreman also knows in his heart—that that kind of job might better not be taken.

Now, if this same job were undertaken by a man who followed the method outlined above, what would be his procedure? After chucking and centering as before, this man puts in his faithful round-nosed or diamond-point tool. He had the belt on the slowest "open" speed for truing up and he leaves it there, for his turning tool will stand such a speed without serious results. As there was no fitting sent in with the job, calipers have to be used; these he sets to the root diameter or less and, marking the centre with a piece of chalk, he scoops out a spot there that the calipers will pass over easily. The work of the cut-off tool is then more than half done.

Next a section about 2-in. long is turned on each side of the groove, turning off the black. Reversing the feed, any skilled man can "back cut" and feed in his tool to give a good enough taper for threading; or the taper attachment can be used, though it is hardly necessary after a little practice. The thread tool is next set in the post. It will last for several threads without grinding because it has clean metal only to cut. If a narrow-pointed diamond point has been used for rough turning, this same tool can be used to rough the thread and in so doing it will relieve the thread tool that much more—the only precaution is not to go so deep that there is not metal enough to finish with the V tool. Rough threading with the diamond point can be done on belt speed, then the gears are thrown in for finish threading and finish cutting off. The saving in time on this faster speed is considerable.

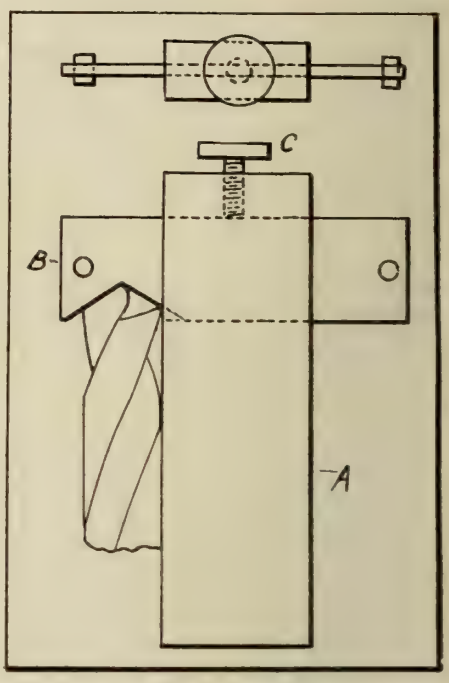
If there is a taper attachment on the lathe, it is set for the thread angle, or taper. But most lathes in job shops on this class of work do not have attachments. Therefore the machinist must depend upon measurement and his eye. By having the O.D. turned to approximate taper, it is easily possible to cut a thread of very fair taper fit.

The man who has used this method has his job finished in an hour and a half and the lathe straightened up. He has no broken tools. He has not created excitement for the boys. Everything went off smoothly and the shop makes a profit. Thread jobs on pipe are of too frequent occurrence and cause too much loss for executives to lose sight of a simple method of turning this loss into a nice business.

TWIST DRILL GRINDING GAUGE

By H. T. Osborn

In grinding twist drills by hand, considerable trouble is often experienced in getting both lips at the same angle, as all who have ever done it know. Unless the point or scraping edge is quite central and cutting edges at the same angle as each other and, consequently, of equal length, the drill will cut a larger hole than intended. Often this does not matter much but, anyhow, the drill works smoother and at a heavier feed when ground correctly. Even machine-ground drills are not necessarily exact. Feeling the need of some kind of a gauge that would bring these errors into visibility, I recently made up the little tool shown in the sketch. It consists simply of a



Twist drill grinding gauge.

stock A having a blade B which slides in a slot through A and can be locked by the screw C. In use the drill is placed as shown and the blade adjusted to suit the size of drill, bringing drill to lay along the stock A. When held up to the light in this way the slightest errors become glaringly apparent. To test the centre, the drill is tried in this way and then given a half turn and tried again, as will be readily understood. We have found this device quite successful and it doesn't cost much to make, being a piece of cold-rolled steel bar and a piece of hack-saw blade.

In the operation of machine tools, especially those working frequently on cast iron, where considerable dust is nearly always present, it is a good plan to wash out the bearings periodically with gasoline, to thoroughly clean them of dirt and grit.

The flash point of an oil is an approximate measure of the temperature at which inflammable vapors begin to pass off. It is, consequently, an indication of the fire hazard. A minimum value is generally specified by law, which for fuel oil is usually 150 deg. F. by the Pensky-Martens closed tester. As the flash point depends somewhat on how determined, the type of instrument used should be specified.

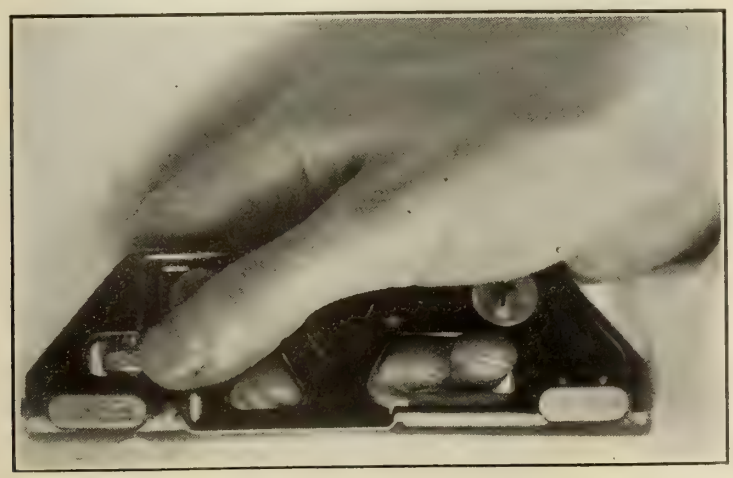
New Things in Shop Equipment

MULTI-DIAMETER TOOL

A multi-diameter counterbore, fitted with separate blades for different diameters, has recently been developed and placed on the market. The device is primarily intended for machining core holes on automatic engines, and for machining spark plug holes, but may be adapted to a variety of uses within its range. The tool can be made to finish as many as six diameters by means of one cutter. Small diameter blades extend full length and are placed between others that cut the larger diameters. It is claimed that the tool has a long life. On the double diameter tools it is possible to grind both the diameters the full length of the blades. These multi-diameter tools are made by the Eclipse Interchangeable Counterbore Co., Detroit, Mich., and are interchangeable with other tools manufactured by the concern.

ADJUSTABLE LIMIT LINE GAUGES

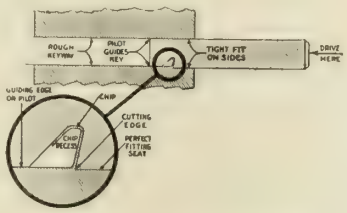
A "go" and "no go" type of internal measuring gauge, which is entirely new in principle and design, has been developed and added to the already extensive line of precision instruments. Two spherical-ended hardened-steel pins are carried in a cast-iron frame, similar in construction to the P. & W. "trusform" gauges. Built like a bridge truss, it combines strength with lightness and successfully resists the tendency to distort or warp. One pin is adjusted to any size within its range by means of opposed set screws which lock the pin firmly in position when tightened. The opposite pin works between two stops, one of which is adjustable to give any desired limits from .001 to .025 in. This pin is instantly moved by a simple motion of the thumb and finger inward to the "go" position or outward to the adjustable stop for the "no go" size. All adjustments may be readily sealed to prevent tampering with the measurements. It is a simple matter to test the setting at any time or change it to compensate for wear. Four removable brass discs provide ample space for working. These instruments are the product of the Pratt and Whitney Co., New York.



Adjustable limit internal gauge.

KEYTITE SELF-FITTING KEYS

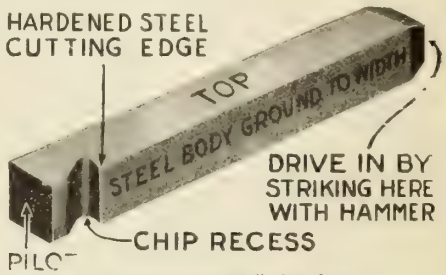
In almost every industry keys are used to make the driving connection between shafts and couplings, gears, sprockets, pulleys, etc. It is usual to mill or slot



Showing method of application.

the key in the shaft and to slot the keyway in the external member. But both of these keyway sizes will vary slightly and to obtain the desired tightness between the key and keyways it has been necessary to carefully fit the parts together. This has usually been done by hand, either by filing the key to fit the keyways or by filing or scraping the keyways to fit the key. It usually takes a good mechanic three or four hours to fit an ordinary 1½-in. x 1½-in. key. A key slightly smaller, say 1 in. x 1 in., may require only two hours and in exceptional cases may be fitted well enough in an hour. But the mechanic needs to be experienced and the key and keyways need to be almost the right size to start with in order to obtain even these results. Such hand fitting generally is quite expensive work and the results are not always satisfactory.

In the new keytite self-fitting keys, a tough chisel stock is used and this is ground to a size very slightly larger than the nominal keyway width. A cutting edge and chip recess are provided near the front end of the key. Ahead of these is a pilot slightly smaller than the nominal keyway width. To install one of these keys, the pilot is entered first with the cutting edge at the side. Then the key is driven home with an ordinary machinist's hammer or with a sledge, de-

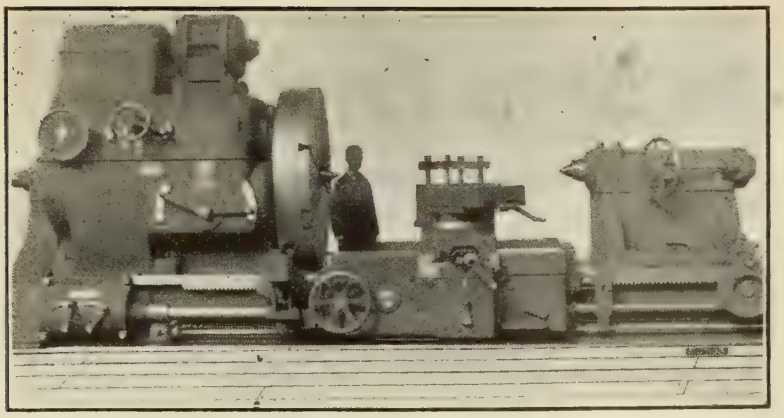


Features of self-fitting key.

pending upon the size of the key. The cutting edge sizes the keyways and, it is claimed, makes a tight fit between the body of the key and the keyways. In the larger sizes cutting edges are sometimes provided on both sides. When it is desired to fit top and bottom as well as on the sides, a cutting edge is also provided at the top. Gib keys and other modifications can be furnished as required, all with this self-fitting advantage which saves the cost of hand fitting and which always provides that the key will be a tight fit in the keyways. These keys are being placed on the market by Smith and Serrell, Newark, N. J.

HEAVY TYPE ENGINE LATHE

The machine here illustrated is a heavy-duty, 60-in. swing lathe which has been placed on the market recently. It is fitted with a constant-speed motor of 40 h.p., and has 24 faceplate speeds obtained by speed-change gears operated by levers conveniently located on the headstock. The motor may be started and stopped by a handle mounted on the carriage, for either alternating or direct-current motor drives and, in addition to this, when the lathe is driven by a direct-current motor any faceplate speed within the range of the motor may be obtained by the same handle. A push button on the headstock may be used for "jogging" the driving motor to allow quick and easy shifting of the speed-change gears. The headstock is of heavy and substantial design and is entirely enclosed, preventing injury to the operator or the gearing. This also allows all



Heavy-duty 60-in. swing engine lathe

bearings and gears to be continuously oiled by means of a pump supplying filtered oil to a large reservoir in the upper part of the head, from which it is distributed by pipes into a settling tank in the base of the head from which it is pumped through a filter back to the reservoir.

The faceplate spindle bearings are exceptionally large. On account of their slower speed they are fitted with oil-distributing rings and large oil wells in addition to the continuous oil supply. The faceplate has four pairs of parallel slots at right angles to permit attachment of heavy steel faceplate jaws. The tool steel centres are hardened and ground and fitted with large spanner nuts for easy extraction. The tail spindle is of ample diameter for stiffness when run out and is carried in a substantial tailstock having increased diameter near the centre. The tail spindle adjustment is by gearing and a hand wheel located on the side in a position convenient for the operator when placing work on the centres. The tail spindle has double clamping bolts for securing in position when set. The upper portion of the tailstock has a cross adjustment by a screw for use in turning slight tapers and is clamped to the lower section by heavy bolts independent of the bolts which clamp the tailstock to the bed. The adjustment of the tail spindle is not changed when moving the tailstock on the bed.

In addition to the large bolts which clamp the tailstock to the bed, there is a tail brace pawl provided engaging a ratchet in the bed, absolutely preventing any slipping of the tailstock under heavy end thrust. The pawl may be lifted out of the ratchet by a handle on the front of the tailstock. This ratchet is in sections, readily removable to allow cleaning out chips which may accumulate in the bed. The tool carriage has lateral, cross and angular power and hand feeds and also a rapid traverse along the bed by a 5 h.p. motor and drum switch with spring return to off position mounted on the carriage. The control of the driving motor is also obtained through a handle on the carriage. The tool slide is of the full width of the bridge and has clamping bolts and straps for securing the cutting tools. Large micrometer collars are fitted on the crossfeed screws.

The carriage apron is of one-piece type enclosing the gearing. All shafts have bearings at each end and the gears and bearings are oiled from one reservoir which is filled from the top of the carriage. The direction of any feed may be changed and started or stopped at the carriage. The operating levers are conveniently located and interlocked so that neither two feeds nor a feed and thread cutting can be engaged at the same time. The thread of the leadscrew is used only for thread cutting, the feeds being obtained from a spline in the leadscrew. The feeds or threads are obtained through a quick-change gear box giving four feeds or threads without removing gears. This covers the ordinary range of work and any other feeds or threads may be obtained by change-gears provided at the end of the headstock. All of the gears and bearings in the feed box are oiled from a tank providing an ample supply. On lathes with long beds, the leadscrew and the controller shaft are supported at intervals by bearings which are automatically spaced by the carriage. There is a steady rest included which has five jaws with screw adjustment and large wearing surfaces. These lathes are manufactured by Niles Bement-Pond Co., New York.

RAILWAY WHEEL GAUGE

An interesting and serviceable gauge for use on railroads for accurately determining the amount of metal to be removed from a worn wheel in order to restore the proper contour, has recently been developed and placed on the market. The gauge gives a direct reading of the amount of service metal on a steel or steel-tired wheel as the basis for billing foreign roads for wheel replacements according to Interchange Rules. It indicates whether or not a worn wheel is worth turning to restore the standard contour, and the thickness of service metal which will remain after turning. This measurement can be made either before or after machining. The gauge can be set to the wheel in a dark place, if necessary, and then taken to the light for reading, thus avoiding errors and guesswork. When applying the gauge the side pointer is swung clear and the gauge placed over the wheel with the face bearing on the inside, with the centre pointer bearing on the worn contour. The limit of wear pointer is then placed in the limit of wear groove and all other pointers allowed to come in contact with different parts of the face of wheel. The gauge is then removed and front plate moved downward until the lower edge coincides with the lowest of the four sliding pointers. The reading on the plate scale indicates the amount of metal to be removed to restore standard shape, while the reading on the pointer scale shows the amount of service metal remaining after the turning operation. The gauges are manufactured by the Pratt and Whitney Co., New York.

Montreal.—Canadian Castings, Limited, incorporated with $20,000 capital, will conduct a general foundry and machine shop business.

Railway wheel contour gauge.

CANADIAN MACHINERY
AND MANUFACTURING NEWS

Published in the Interests of the Machinery, Manufacturing, Iron, Steel, and Metal Working Industries.

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No Easy Re-Adjustment Plan

CANADIAN correspondents to English publications picture the Canadian West as having a fit of the blues, as despondent, as having been victimized by boomsters and speculators from the East.

While much of what is said is not without a degree of truth, it does not appear that the West has any more reason for despondency than have a good many industries in other parts of Canada. Whatever conditions have caused despondency, they have not deprived the West of the means toward a great future. All industries have been confronted with painful duties involved in readjustment. One of the most prominent Canadian financial men expressed a doubt recently as to whether the West was willing enough to adjust itself as a whole to the problems of readjustment. He referred, as an instance, to the heads of two large establishments who, although considerably in debt, could afford to spend the winter in California. He doubted that the West was adapting itself fully to the necessity of sacrifices to the same general extent as the manufacturer of the East. Yet the Canadian West was far and away ahead of the Western States in the early days, as regards prosperity and possibilities. He doubted not that readjustments would be most painless where they met with most willing disposition to make them so.

Manufacturers attempting to make collections in the West have been sadly handicapped by legislative enactments giving individuals too great a measure of relief from financial responsibility. This, it is claimed, may in time seriously affect that spirit of independence for which the West has long been noted and through which, after all, comes proper recognition of the inter-dependence of all sections of the country. Manufacturers in the East had no such assistance, and many have been operating for some time "in the red" or at a loss.

Mining Regions Offer Market

IT HAS BEEN pointed out frequently in these columns that an exceptional market for steel, electrical equipment, drills, pumps, rails, steam shovels, labor-saving machinery for lifting and dumping, is developing in the mining regions of the North.

Although Canadian manufacturers have by no means neglected this field, it may be questioned whether the importance of the prospect has been fully recognized. While it is difficult, at times, to separate the wheat from the chaff in respect to gold mines, or to ascertain which has a future or which has not, this is hardly as important as it might seem. A great amount of development work is being done, much of it on property of positive merit. Sufficient has been accomplished in connection with gold or silver factories, as they are called, to warrant consideration of this business as likely to take rank with any of those departments of the market that have established earlier claims to importance.

To outside enterprise, also, the field has an increasing appeal and it would not be surprising to see new industries encouraged to locate stocks or branch factories here to better serve this market. Dealers and manufacturers who are already in contact, say it is entitled to the broadest vision. A recent instance might be quoted, in a recent report of F. W. Field, British Trade Commissioner, Toronto, who recently paid a visit to the Ontario gold fields. He pointed out that "there is a good demand in Northern Ontario for the following mining machinery and supplies, estimated at a value of 20 to 30 million dollars." He further observes that the opinion was frequently expressed that manufacturers in the United Kingdom should warehouse fairly substantial supplies at Montreal or Toronto for that market. A stock of standard sizes of wire rope and finished machines in sizes likely to be of service, he said, should be carried.

To Please Through Service

EARLY interviews with Sir Henry Thornton, new head of the Canadian National Railways, seem to establish as correct first impressions that he is the kind of man not likely to be swayed by the feeling that offence might result, in any quarter, from decisions otherwise calculated to be in the best interests of the system. His observations as reported credit him with a sense of responsibility and of the feeling that the avenue to success is not the one that is lined with good-natured intentions to please everybody.

Questioned as to location of the head offices of the system, he replied that they would be wherever practical wisdom dictated they should be. He added that somebody was going to be peeved, whatever the choice. As a business proposition, the future of the people's road could not be bound up with matters of petty preferences. These did not enter into its duties to serve Canadian transportation needs efficiently.

Machine tool men, and manufacturers of other equipment look for some activity in buying, now that a directing executive head has arrived. Whatever move is made, it will be based on thorough investigation of the system's requirements, and to familiarize himself with these, Sir Henry seems to have made an early start.

Editorials in Brief

Index price of eleven commodities in iron and steel for October shows a decline of two points from last year's price and of 86 points from October 1918. Conservative buyers must consider that for the past two years prices have maintained a fairly stable level and that temporary influences do not indicate marked movements in either direction.

Steel Men Report Encouraging Year-End Business

Weather Favorable to Prolonged Building Operations—Hoops, Rods, Sheets in Demand—Pittsburgh Reports Continued High Production—Prospect of Firmer Prices Early in New Year

SENSITIVE INDEX IN IRON-STEEL OUTPUT

THAT present price movements in pig iron parallel, in an interesting way, those of the past hundred years, is the observation of a Pittsburgh statistician. Commenting on the fact that the rate of production was higher in November than in October, and that the 40,000,000-ton rate is higher by more than 15 per cent. than that of the six months prior to Oct. 1, he points out that, as the world progresses, there have been permanent output advances. This result follows in spite of very material increases or decreases from time to time and prices, likewise, find adjustment. In 1815 the average price of pig iron was $53.75; in 1850 it was $20.87; 1872 average, $48.87; 1878 average, $17.62; 1897 average $9.50; July, 1917, average, $55.56; September, 1920, average, $48.50; March, 1922, $19.38; September, 1922, $33.50.

Twice in the past ten years pig iron has sold at about $50 while present prices are close to those of 1803, when the average was $29.25. It is pointed out that any future estimate as to the steel industry must keep in mind this ever-changing character. Its basic relationship to industry generally brings it within the influence of almost every factor making for fluctuation. That is the great reason why iron and steel are regarded as a sensitive barometer of industrial conditions.

Canadian markets are running according to form. The present year has been characteristic. January price on pig iron was $29; February saw a reduction of $2 per ton. Due to strike influence there was a gradual advance through the summer months and in September it registered $39.30. There have been gradual reductions since that time until today the price of pig iron of 2.25 to 2.75 silicon is $32.30. The last reduction of one dollar per ton became effective during the past week. This price is a little better than Buffalo quotation, $26.50, plus $2.80 duty; $3.30 freight and 40 cents sales tax. The tendency of the Canadian producers is to meet the Buffalo price, if at all feasible. It is estimated that absolute rock bottom is but a few notches distant, and that the market is showing little evidence of strong demand.

There is pronounced optimism in the Canada steel market as the year end approaches. Mild weather has brought out business that would otherwise be lacking. Demand for sheets continues strong. Building operations have not been as seriously interfered with as is usual at this time of the year, and contracts are being hurried to completion. No price changes of note have occurred, but there is a growing feeling that the New Year will see advances in certain lines. Large producers in the Pittsburgh district have made no change for the first quarter. Independent operators assert that there is no profit at present figures. Buying is inclined to be conservative so far as advance requirements are concerned. There is very strong demand, however, for tubular goods, and there is urgent call for deliveries.

Toronto

December 6.

DEMAND for building materials continues strong as weather favors completion of contracts before heavy frost sets in. There is a good market for sheets, bars, hoops and metal lath. Improvements in shipments will enable much work to be done that would otherwise be held over.

Iron and Steel. Dealers report that the year will close with a very satisfactory record. Although no announcement has been made as to the new year, it is felt in some quarters that advances are due in certain lines. Frequent assertions that competition has reduced profits almost to the fading point are heard, and it is predicted that U. S. markets must soon show the result of increasing production costs. One large dealer states that he is taking steps immediately to cover requirements in bars and sheets at present levels. His opinion is that the market is on the verge of an upward movement. Local prices:—

Iron bars	3 25	3 40
Steel bars	3 25	3 40
Reinforcing bars	3 15	3 25
Steel hoops		4 15
Tire Steel		3 50
Spring steel	7 00	14 00
Band steel, No. 10 gauge and 3-16 in base		3 90
Small shapes		3 50
Sheets, black, No. 28		4 60
Sheets, blue, ann., No. 10		4 25
Canada plates, dull, 52 sheets		4 90
Canada plates, all bright		5 40
Galvanized Sheets, No. 28		6 00

Old Materials. Asked for an opinion as to the report that prices on old material were due for a decline, a large dealer stated that, on the contrary, it would not surprise him to see an advance in certain lines. While coppers were easy, there was great scarcity in better classes of iron scrap. Though the demand was not urgent, one condition offset the other to such an extent as to discourage any idea of decline. Buffalo reports indicate that stocks of heavy melting steel are very low. Dealers, it is said, are building up their stocks of material in anticipation of big business early in 1923. Recently buying has developed on a large scale. Dealers' average buying prices:—

Copper, light	9 00
Copper, crucible	11 25
Copper, heavy	11 00
Copper wire	11 00
No. 1 composition	9 00
New brass cuttings	7 00
Red brass turnings	7 00
Yellow brass turnings	5 25
Light brass	4 50
Medium brass	6 00
Scrap zinc	3 50
Heavy lead	4 50
Tea lead	3 00
Aluminum	11 00
Boiler plate, per gross ton	9 00
Heavy melting steel	10 00
Axles (wrought iron)	20 00
Rails (scrap)	11 00
Malleable	10 00
No. 1 machine cast iron	18 00
Pipe, wrought	7 00

Non-Ferrous Metals. Canadian demand continues along conservative lines. It seems to be a matter of supply houses carrying, for the time being, the requirements of the trade so far as the small foundry or buyer is concerned.

London reports a firm undertone in the tin market, with some improvement in American demand.

Copper trading continues comparatively light and prices have undergone no change for the first quarter 1923.

Although zinc has shown a disposition to sag in London, the New York market is firm. Supplies are not any too heavy and some producers are behind in deliveries. Current prices follow:—

Lake copper	17 25
Electrolytic copper	17 00
Castings, Copper	16 50
Tin	41 00
Lead	7 50
Spelter	9 50
Antimony	8 50
Aluminum	22 00

Montreal

December 6

THE outstanding feature of interest here this week is the forthcoming banquet to be tendered by the Board of Trade to the new president of the Canadian National Railways, Sir Henry Thornton. It is expected that he will give an indication of his policy in regard to the co-ordination of the different groups of government-owned railways and the business section is intensely interested in knowing if this is likely to shape out and also what plans may be devised for the enlargement of their equipment, both locomotives and freight cars, and nothing would be of greater interest to the Canadian manufacturers than to receive an indication that the near future is likely to see large orders for new equipment placed on the market.

Iron and Steel. No price changes have been announced in general steel com-

modities this week and the level which has been maintained for the past few weeks still continues to be quoted and will probably continue for some time. Supplies in warehouses on the whole are not over-abundant, due to the continued difficulties existing in transportation conditions from the American sources of supply and if the local demand was greater than it is there would be a general all-round increase in prices. It is only the quietness in the trade here which keeps prices steady.

Iron bars, base	3 15 to 3 25
Steel bars, base	3 15 to 3 25
Reinforcing bars, base	3 15 to 3 25
Steel hoops	4 00
Tire steel	3 25 to 3 40
Spring steel	7 00
Band steel, No. 10 gauge and 3-16" base	3 65 3 75
Small shapes	3 40
Sheets, black, No. 28	4 75
Shets, blue, ann., No. 10	4 10
Canada plates, dull sheets	6 50
Canada Plates, all bright	7 00
Galvanized Sheets, No. 28	6 50

Pig Iron. Commenting on the decline in pig iron prices, a large dealer states: "A further reduction of $1 per ton in the price of Canadian-made pig iron was necessitated by the keen competition from the United States, particularly the Buffalo district. Demand for pig iron is showing slight improvement, but little or nothing is being bought for delivery beyond the present month, consumers apparently preferring to feel their way in the hope of being successful in making purchases at the low point of the market. According to up-to-date reports from the United States, it would seem as if there is a growing feeling that prices are now at almost, if not quite, the low point and that there shortly will be an improvement in buying which will result in some up-turn in prices.

Algoma, No. 1, car lots on Tracks, nominal quotation	35 15	
Summerlee, 30-ton lots, dock	35 00	....
Carron, 30 ton lots	35 00	....
Do., 5 ton lots, ex. warehouse	40 50	....

Non-Ferrous Metals. Markets continue somewhat inactive and reflect, to a certain extent, a feeling that prices have an uncertain trend. English and American markets are, in fact, suggestive of this and do not seem favorable to active buying movements. Local prices:

Lake Copper	17 50
Electrolytic Copper	17 25
Castings, Copper	17 00
Tin	42 75
Lead	7 75
Spelter	9 50
Antimony	7 50
Aluminum	22 00

Pittsburgh

December 6.

FROM the safe and sane viewpoint, the outstanding feature of the steel situation is the way in which production holds up. The rate of production has been about **40,000,000 tons a year, or** more, since October 1, and, in advance of the regular monthly report, the appearance is that the rate was somewhat higher in November than in October. The 40,000,000-ton rate would be more than 15 per cent. above the average rate in the six-months' period prior to October 1.

In the six months referred to, consumption did not exceed production, as the period did not start with any stocks to draw from. It would not be natural for consumption to increase at this time of the year, nor is there evidence that it has increased in many quarters, while in some directions there are no doubt decreases. Necessarily, when production increases at one time it must decrease at another, although over periods of years there are permanent increases as the world advances. Prices, likewise, must come down after advances, and vice versa. Thus the average price of pig iron was $29.25 in 1803, $53.75 in 1815, $20.87 in 1850, $36.87 in 1854, $20.25 in 1861, $48.87 in 1872, $17.62 in 1878, $28.50 in 1880, $9.50 in 1897, $55.56 in July, 1917; $27.95, April to October, 1921; $48.50 in September, 1920; $19.39 in March, 1922, and $33.50 in September, 1922. The figures through 1880 refer to foundry iron at Philadelphia, the later figures referring to Bessemer iron at valley furnaces. The market now is close to that of 1803, while more than 30 years ago it frequently sold at $20 or less and twice in the past ten years it has sold at about $50. Nevertheless, the typical market report, curiously enough, refers to price advances as being natural and normal and passes over declines as if they were unnatural and unusual.

As to fluctuations in production, there was a record rate of pig iron production in October, 1907, while two months later, in December, the rate was only 44 per cent. as great. In steel ingot production, there was a high rate of production in October, 1920, while in the following July the rate was approximately one-fourth as great, having decreased nearly 75 per cent.

The steel industry has been likened to a kaleidoscope, and judgment as to the future is very likely to be wrong if this fact is not borne in mind. If the trade is stagnant, one must not assume it will continue so and vice versa. The fact that from April 1 to October 1 steel mills were unable, from physical reasons, to make as much steel as their order books provided for does not prove that they will be under similar pressure to produce in the next six months. They may be or they may not be.

Coal and Coke

Coal markets continue soft, on the whole, as they have been for two or three weeks past. In the last few days steam coal has been a shade easier in price. Domestic lump has stiffened, with some mines obtaining advanced prices, up to $5.25 or $5.50. Gas and by-product show a considerable range according to quality and it is not easy to say whether or not they have declined. Pittsburgh district steam coal is $2.50 to $2.75, with gas at $3.00 to $3.75, chiefly at $3.25. Connellsville steam coal is $2.25 to $2.50, with good-grade by-product at $3.25 to $3.75.

Connellsville furnace coke is a trifle easier, say 25 cents, at $7.00 to $7.25. Production increases continuously while consumption grows in jerks, as one idle furnace or another comes in. As most of the furnaces are contracted to the end of the year, spot coke does not sell very readily. For regular shipment over December $8.00 or higher is quoted. On tentative inquiries for first quarter some operators have quoted $8.00 and none seem disposed to go below this figure at present, while furnaces are not at all interested, feeling that pig iron conditions are and will remain such that much cheaper coke is necessary.

Pig Iron Is Easier

Valley pig iron is down $3 on Bessemer to $28, $1.50 on basic to $25.50 and $1 on foundry to $26.50, though in foundry it must be noted that single carloads of particularly desired brands have been going chiefly at $27.50. Prices are f.o.b. valley furnaces, freight to Pittsburgh being $1.77. In the case of Bessemer and basic the quotations given are practically asking prices, there having been no late transactions to test the market properly.

Predictions As To 1923

Sheet bars show no regular market. Contracts for the current quarter were chiefly at $38 Pittsburgh or Youngstown. It is plain that prompt lots could be bought at $37, and they might possibly be secured at less. Some of the fourth-quarter tonnage will probably have to hold over, mills not being able to specify as fully as expected. A fair guess is that the ordinary price for first-quarter will be not under $33 or over $35. Billets show no activity and are usually considered quotable at the same level as sheet bars.

Finished Steel

Bars, shapes and plates continue to be regarded as being at a general market level of 2.00c, but right along there have been concessions on particularly desirable orders, and such concessions are increasing. It is commonly expected that prices will be lower, the chief question being whether there will be much readjustment in the next few weeks. As no very large tonnage has been sold at 2.00c or the higher prices ruling between one and three months ago, for early deliveries, while some deliveries are still being made on old orders at around 1.50c, a decline in the open market to 1.75c or 1.80c would not really be especially important.

Claim No Profit

Some of the independent tin plate mills have not yet recovered from their disappointment that the Steel Corporation, in making its price for first half on November 23, did not advance from $4.75. Independents claim there is no profit at this figure. The sheet mills had been expecting an advance but as the market had weakened by the time the 3.35c price was reaffirmed they were not surprised. Sheet buyers are very conservative, making commitments only

for material needed very shortly, and the market is hardly more than steady, at 2.50c for blue annealed, 3.35c for common black and 4.35c for galvanized. In automobile sheets there is some uncertainty. When, on November 23, the Steel Corporation continued its 4.70c price, the independents had a firm market of 5.00c, and they are indisposed to go down to 4.70c if they can avoid doing so.

Tubular goods continue to be by far the strongest item in the finished steel list. Pressure upon the mills for deliveries is heavy, particularly in the smaller sizes of merchant pipe, while there is not a little new buying. Prices are very firmly held.

Wire products are firm, with a fairly good demand, under the leadership of nails, plain wire being 2.45c and nails $2.70. There is no thought in the trade that these prices will come down within the discernible future, and an advance is not an impossibility.

BETHLEHEM EXTENDING LINES

In the light of recent reports that Bethlehem Steel Corporation are negotiating for purchase of a Canadian tin-plate mill, it is interesting to note that the Corporation is pursuing a somewhat aggressive policy in extending their lines. Following their absorption of the Lackawanna Steel Co., at Buffalo, they have now purchased most of the properties of the Midvale Steel and Ordnance Company and its subsidiary, the Cambria Steel Company. The consolidated companies will have a capitalization of $456,000,000. Eugene G. Grace, president of the Bethlehem Steel Corporation makes the following statement in connection with the purchase:—

"The acquisition of the Midvale and Cambria properties will give to Bethlehem important lines of steel products which it does not now manufacture, such as wire rods, wire and wire products, steel freight and mine cars, steel wheels, boiler tubes, agricultural implement parts, etc.; in fact, it will place Bethlehem in position to produce all the so-called commercial steel products with the exception of pipe and seamless tubes. For these Bethlehem is planning to build plants at one of its existing properties.

"Bethlehem's present annual ingot capacity of 4,890,000 tons will be increased to 7,600,000 tons by the Midvale-Cambria purchase.

"The combined investment in property and plant, less depreciation and depletion will be about $465,500,000 and the aggregate net quick assets will be about $133,700,000.

"The stockholders' meetings and the other proceedings will require sixty to ninety days before the transaction can be concluded. In the meantime, the Bethlehem management will be acquainting themselves with operating conditions at the Midvale and Cambria properties so as to facilitate the taking over of the active management when the transaction shall have been ratified by the stockholders of the respective companies."

Should Test Value of Cost System

THE value of a cost accounting system as an aid to management can be measured by the promptness with which costs are compiled and presented, and this demand for prompt presentation has brought about the use of standard or predetermined overhead rates. With such rates as a basis, production costs can be obtained immediately on the completion of the manufacturing operations without the delay involved in holding up their compilation until the close of an accounting period, when the overhead expenses would be distributed and the actual rates obtained. These actual rates, however, should be used to check the accuracy of the pre-determined rates which have been in force and to indicate to what extent they can be relied on.

Dangerous Practice

Innumerable cases are to be found where arbitrary rates have been in use for a long time without any attempt having been made to prove periodically their correctness or reliability. This practice is a very dangerous one, as it gives results which are based purely on guesswork, whereas a very slight amount of additional clerical work in summarizing the overhead applied on the basis of the rates in current use would immediately indicate the accuracy with which overhead was being applied.

One of the difficulties—and a very serious one—that has been met with during the past year or two is that, during periods of low production, overhead rates which are sufficiently high to absorb all the factory expenses result in excessive production costs as compared with costs obtained when plants are being operated at full or normal capacity. This is particularly annoying when the prices to be obtained for manufactured goods are in general lower than in times of high production, and it is now becoming generally accepted that the most satisfactory way to overcome this difficulty, from the point of view of price-fixing and cost determination, is to charge to the product only the proportion of the total overhead that the current production bears to the production when the factory is operating at normal capacity.

Distributing Expenses

To illustrate this idea more clearly let us think of a business consisting of two separate factories, A and B. Normally the products of Factory A would be charged with overhead sufficient to absorb the total expenses of that factory, and the same conditions would apply to Factory B. In view of general business depression, however, it is found necessary to close down Factory B, and to carry on manufacturing in Factory A only. Although Factory B has still to carry insurance, taxes, depreciation, rental and other expenses, these charges have nothing to do with the cost of production in Factory A and would not ordinarily be included in the overhead applied to the products of that factory, but would probably be written off direct to profit and loss account. In the same way, the carrying expenses of unused capacity in a single plant should not be charged to current production, but should be charged to an account which might be called "unabsorbed overhead account" and closed out at the end of an accounting period direct to profit and loss.

Unabsorbed Overhead

A consideration of overhead along these lines involves, therefore, the preparation of departmental rates on the basis of normal plant capacity, and the modification of these rates when production is below normal rates. Unabsorbed overhead is charged to the account of that name, but it is not advisable to carry over balances in this account from one year to another. The amount of such balances charged direct to profit and loss account will be an indication of the expense of unused plant capacity, and this information should be very valuable from a managerial standpoint. At the same time, the overhead charged to the product will give truer costs, and in periods of varying production will result in more reliable figures of comparative costs.

In establishing pre-determined rates these will be more accurate if calculated on the basis of actual expenses over as long a period as possible and when production is more or less normal, as the effect of minor fluctuations will then be eliminated. As explained in a previous article the factory is first of all divided into production centres or other suitable divisions depending on the nature of the manufacturing processes and the machinery and equipment in use. There will be normally both direct and indirect departments, or as they are sometimes called, productive and non-productive departments. Direct or productive departments are those in which material is subjected to actual operations forming a part of the process of manufacture. By indirect or non-productive departments are meant such sections as the power-house, tool-room, pattern shop, stores, etc., where no direct operations on the raw material of manufacture are performed.

Strike Equitable Basis

Actual expenses as obtained from the various factory expense accounts are then distributed to the direct and indi-

(Continued on page 581)

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Toronto price:—

Silicon, 2.25% to 2.75%	$32 80
Algoma, No. 1, Montreal	35 15
Summerlee, Scotch, Montreal dock	35 00
Summerlee, Warehouse, 5-ton	40 50
Carron, Montreal docks	35 00
Grey forge, Pittsburgh	28 77
Lake Superior, charcoal. Chicago	36 15
Standard low phos., Philadelphia	38 00
Bessemer, Pittsburgh	32 77
Basic, valley furnace	26 50 to 27 00

METALS

	Montreal	Toronto
Lake copper	$17 50	$17 25
Electrolytic copper	17 25	17 00
Castings, copper	17 00	17 00
Tin	42 75	41 00
Spelter	9 50	9 50
Lead	7 75	7 50
Antimony	7 50	9 00
Aluminum	22 00	22 00

Prices per 100 lbs.

BILLETS

F. O. B. Pittsburgh

	Per gross ton
Bessemer billets, 4 in. x 4 in. and larger	$37 00
Open hearth billets	37 00
O. H. sheet bars	37 00
Forging billets	45 00
Bessemer rods	46 50

IRON AND STEEL

Per 100 lbs. to large buyers

Iron bars, base, Toronto	$3 25	3 40
Steel bars, base, Toronto	3 25	3 40
Small shapes, base		3 50
Iron bars, base, Montreal	3 15	3 25
Steel bars, base, Montreal	3 15	3 [illegible]
Reinforcing bars, base	3 15	3 40
Steel hoops		4 50
Tire steel, base		3 50
Spring steel	7 00	14 00
Band steel, No. 10 gauge and 3-16 in. base		3 90
Chequered floor plate ¼" and heavier	6 25	7 00
Chequered plates ¼-in. and heavier, sunken diamond		5 40
Bessemer rails heavy at mill		2 35

PITTSBURGH MILL

Steel bars	2 00
Tank plates	2 00
Structural shapes	2 00
Steel hoops	2 75 to 2 90

F. O. B. Chicago Warehouse

Steel bars	2 80
Structural shapes	2 90
Plates	2 90
Small shapes under 3-in.	2 75 to 2 90

PLATES

Plates 3-16 in.	$3.85	$3 60
Plates, ¼ up	3 50	3 40

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$ 4 60	$5 10
Sheets, blue ann., No. 10	3 85	4 25
Canada plates, dull, 52 sheets	5 25	4 90
Can. plates, a'l bright	6 50	6 00
Galvanized sheets. No. 28	6 75	6 25
Queen's Head, 28 B.W.G.	7 25	
Fleur de Lis, 28 B.W.G.	7 00	
Gorbal's best, No. 28, U. S. G.	6 10	
Colborne's Crown, No. 28		
Premier 28	6 10	6 35
Premier 10¾ oz.	6 80	6 75
Zinc sheets	10 25	11 50 11 00

FREIGHT RATES

Pittsburgh to Following Points	Per 100 lbs. C.L.	L.C.L.
Montreal	52	65½
St. John, N. B.	76	96
Halifax	77½	97
Toronto	34	48½
Guelph	34	48½
London	34	48½
Windsor	31½	45½
Kingston	48½	61

OLD MATERIAL

Dealers' Average Buying Prices

	Montreal Per Ton	Toronto Gross
Boiler plate	$ 9 00	$ 9 00
Heavy Melting Steel	10 00	11 00
Axles (wrought iron)	20 00	16 00
Rails (scrap)	11 00	11 00
Malleable scrap	10 00	11 00
No. 1 Machine cast iron	22 00	18 00
Pipe, wrought	7 00	6 00
Car wheel	17 00	16 00
Steel axles	15 00	15 00
Mach. shop turnings	6 00	6 00
Stove plate	16 00	14 00
Cast boring	6 00	6 00
Copper, light	9 00	9 00
Copper, crucible	11 50	11 25
Copper heavy	11 25	11 00
Copper, wire	11 25	11 00
No. 1 machine composition	9 00	9 00
New brass cuttings	7 00	7 00
Red brass turnings	7 25	7 00
Yellow brass turnings	5 25	4 85
Light brass	4 50	3 50
Medium brass	6 00	4 50
Scrap zinc	4 50	4 00
Heavy lead	4 50	4 50
Tea lead	3 00	3 00
Aluminum	11 00	11 00

COLD ROLLED STEEL

(At Warehouse)

Rounds and squares	$4 75 base
Hexagon and flats	$5 75 base
Cumberland ground shafting base	$6 00 base

COPPER PRODUCTS

Prices per lb.

	Montreal	Toronto
Copper bars, 1¼ to 2 in.	28-31	.2
Plain sheets. 16 oz. in. 30 x 72 hot rolled	31-34	.29
Copper sheet, tinned, 16 oz.	39-43	.26
Copper sheet, planished, 16 oz. base	40 00	.46
Braziers', in sheets, 6 x 4 base	30	.29
Copper tubing, seamless		.33

LEAD SHEETS

Roll Lot Prices

	Montreal	Toronto
Sheets, 3 lbs., sq. ft.	$10 35	$10 50
Sheets, 3½ lbs., sq. ft.	10 25	10 50
Sheets 4 to 6 lbs. sq. ft.	10 10	9 50

Cut sheets, ¼c. per lb. extra

Cut sheets to size, 1c. per lb. extra

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in.	22
Brass sheets, 24 gauge and heavier base	23
Brass tubing, seamless	30

STANDARD BUTTWELD PIPE S/C

Per 100 feet.

Price List No. 57. November 2, 1922.

	Steel Blk.	Steel Galv.	Gen. Wrot. Iron Blk.	Gen. Wrot. Iron Galv.
⅛ in.	6 00	8 00	....	....
¼ in.	3 96	6 00	7 20	9 30
⅜ in.	3 96	6 00	7 20	9 30
½ in.	5 02	6 55	7 31	8 93
¾ in.	6 10	7 82	8 86	10 70
1 in.	8 67	11 22	12 75	15 47
1¼ in.	11 73	15 18	17 25	20 93
1½ in.	14 03	18 15	20 63	25 03
2 in.	18 87	24 42	27 75	33 67
2½ in.	29 84	38 61	....	....
3 in.	39 02	50 49	....	....
3½ in.	50 60	64 10	....	....
4 in.	59 95	76 30	....	....

STANDARD LAPWELD PIPE

Per 100 feet.

Below dividing line—price per foot.

	Steel Blk.	Steel Galv.	Gen. Wrot. Iron Blk.	Gen. Wrot. Iron Galv.
2	22 20	27 75	31 08	37 00
2½	32 76	41 54	46 80	56 16
3	42 84	54 32	61 20	73 44
3½	51 52	65 32	73 60	88 32
4	61 04	77 39	87 20	104 64
4½	71 12	90 17	1 07	1 27
5	82 88	105 08	1 24	1 48
6	1 08	1 36	1 61	1 92
7	1 40	1 79	2 07	2 50
8L	1 48	1 88	2 18	2 63
8	1 70	2 16	2 51	3 02
9	2 07	2 62	....	....
10L	1 92	2 43	2 82	3 63
10	2 47	3 13	3 63	4 37

Prices—Ontario, Quebec and Maritime Provinces.
Terms—2% Cash discount if paid within 30 days.

Provinces

WROUGHT NIPPLES

4-in. and under, close and short, 55 per cent.

4½-in. and larger, close and short, 45 per cent.

4-in. and under running thread, 35%.

Standard couplings 4-in. and under 25%.

Do., 4½-in. and larger 5 per cent.

MALLEABLE FITTING LIST

1 in. elbow	.32	.53
2 in. elbow	1.05	1.70
1 in. tee	.43	.70
2 in. tee	1.45	2.40
1 in. coupling R. & L.	.33	.53
1 in locknut R. & L.	.15	.23

Discount to dealers—70 per cent.

BOILER TUBES

Sizes	Seamless Toronto	Lapw'ld Toronto	Seaml's Montreal	Lapw'ld Montreal
1 in.	20.00	....	23.80	....
1¼ in.	22.00	....	23.80	....
1½ in.	24.00	....	23.80	....
1¾ in.	24.00	....	24.50	24.00
2 in.	22.00	19.00	21.00	19.75
2¼ in.	24.00	21.50	24.00	22.25
2½ in.	25.00	23.50	27.00	23.25
3 in.	34.00	28.50	34.00	29.50
3½ in.	36.00	....	36.00	....
3½ in.	38.00	33.00	38.00	34.25
4 in.	50.00	42.00	49.00	43.50

Prices per 100 ft., Montreal and Toronto

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, 7-16 and up	30
Carriage bolts, ⅜ in. and smaller 6 in. and shorter	40
Coach and lag screws	45
Stove bolts	72½
Wrought Washers	60
Do., coach head	60
Machine bolts, 7-16 and over	35
Machine bolts, ⅜-in. and less	35
Blank bolts	35
Bolt ends	35
Machine screws, fl. and rd. hd., steel cut thread	37½ & 10
Machine screws, o. and fil. hd., steel cut thread	30
Machine screws, o, and fil. hd., brass cut thread	15
Standard couplings, 4-in. and under, brass cut thread	30% 30
Nuts, square, blank off net list	$1.00
Nuts, square, tapped off net list	50c.
Nuts, hex., blank off net list	50c.
Nuts, hex., tapped net list	
Copper rivets and burrs, list less	32c.
Burrs only, list plus	10%
Iron rivets and burrs	47%
Boiler rivets, base ¾ in and larger	$5.75
Structural rivets, as above	5 65
Wood screws, O. & R., bright	80
Wood screws, flat, bright	82½
Wood screws, flat brass	77½
Wood screws, O. & R., brass	75
Wood screws, flat, bronze	72½
Wood screws, O. & R., bronze	70

NAILS AND SPIKES

Wire nails, base	$3 65
Cut nails, base	4 35
Miscellaneous wire nails	72½%

MILLED PRODUCTS

(Prices on unbroken packages)

Set screws	65
Square and hexagon head cap screws	60
Round head cap screws	20
Fillister head cap screws	35
Flat head screws	25
Button head cap screws	20
Studs	45
Semi-finished nuts up to and including 9/16 in.	70
Semi-finished nuts ⅝ to 1¼ in.	65
Semi-finished nuts 1⅜ to 2 in	35
Coupling bolts	35
Taper pins, up to and including No. 5	65
Taper pin No. 6 and over	55
Planer bolts without fillet	10
Planer bolts with fillet	Net
Patch bolts	Plus 10%
Hollow set screws	20
Thumb screws	50
Thumb nuts	70

CARBON DRILLS AND REAMERS

	Discount.
S. S. drills, wire size	60
Can. carbon cutters	plus 10
Standard drills, all sizes	60
3-fluted drills, plus	10
Jobbers and letter sizes	60
Bit stock	50
Ratchet drills	25
S. S. drills for wood	10
Wood boring brace drills	50
Electricians' bits	30
Sockets	50
Sleeves	30
Taper pin reamers	20
Drills and countersinks	20
Bridge reamers, carbon	30
Centre reamers	Net
Taps, machine screw	55 to 60
Taps, hand, ¼ in. to ⅜ in	40 to 45
7/16 in. to. ⅝ in.	40 to 50
11/16 in. to 1 in.	35 to 45
Chucking reamers	20 off
Hand reamers	20
High speed drills, list	40
Can. high speed cutters	plus 10
American	plus 40

FILES AND RASPS

Globe	60/5
Vulcan	50
P. H. and Imperial	60
Nicholson	35/5
Black Diamond	35/5
Heller	40
Jowitts	net
J. Barton Smith, Eagle	55
McClelland, Globe	50
Delta Files	20
Disston	40
Disston	50
Great Western-American	50
Kearney & Foote, Arcade	60/5

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

PROOF COIL CHAIN
B. B. B. CHAIN

⅜ in., $16.45; 7-16 in., $14.00; ½ in., $12.95; 5-8 in., $13.15; ¾ in., $12.75; ⅞ in., $12.25; 1 in., $11.85; 1⅛ and 1¼ in., $10.55. Fire weld chain same sizes respectively are $14.00; $11.50; $10.40; $10.55; $10.15; $9.75; $9.35; and $8.25.

ELECTRIC WELD COIL CHAIN B.B.B.

⅛ in. $20.00; 3-16 in. $16.50; ¼ in. $15.50; 5-16 in. $12.70.

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	30%
Standard	30 and 10%
Cut leather lacing, No. 1	1.60
Leather in side, (Lacing)	1.50

RUBBER BELTING

Standard 36 ....28% Best grades 28%

TAPES

Chesterman Metallic, 50 ft.	$5 00
Lufkin Metallic, 603, 50 ft.	3 17
Admiral Steel Tape, 50 ft.	3 00
Admiral Steel Tape, 100 ft.	4 50
Major Jun. Steel Tape, 50 ft.	3 75
Rival Steel Tape, 50 ft.	4 40
Rival Steel Tape, 100 ft.	8 75
Reliable Jun. Steel Tape, 50 ft.	5 25

PLUMBING SUPPLIES

Plumbers' oakum, per cwt.	6 40
Navy oakum, cwt.	13 00
Solder, strictly	0 25
Solder, guaranteed	0 26½
Soldering coppers, lb.	0 62½
White lead, pure, cwt	13 20
Red dry lead, 100-lb. kegs, per cwt.	9 75
Wood alcohol, per gal.	1 75
Whiting, plain, per 100 lbs.	3 00

ROPE AND PACKING

Packing, square braided	0 38
Packing, No. 1 Italian	0 31
Packing, No. 2 Italian	0 24
Pure Manila rope ¾ and larger, base	0 20
British Manila rope	18
New Zealand hemp	0 18
Jute packing, fine	15c
Jute packing, coarse	11c

OILS AND COMPOUNDS

Castor Machine Oil, per lb.	34½
Royalite, per gal. bulk	21
Machine oil, per gal.	39
Black oil, per gal. (Summer)	19
Cylinder oil, Capital	69½
Turp., single bbls., gal.	2 20
Linseed oil, raw, single bbls.	1 05
Premier gasoline	29 00
Fuel oil, bbls., gal.	10 80

WASTE

XXX Extra ..... 17 Atlas 18
Peerless ..... 21 X Empire 13½
XX Grand ..... 16 Ideal 18
Superior ..... 20 X Press .. 12
X L C R 15

Colored

Lion .....12½ Fancy .. 14
Standard .....11 Popular ... 9½
No. 1 ..... 13 Keen 8

Wool Packing

Arrow .....24 Anvil 16
Axle 20

Washed Wipers

Select White ...18 Dark colored. 13
Mixed Colored ..14

This list subject to trade discount

PLATING SUPPLIES

Polishing wheels, felt	$3 25
Polishing wheels, bull-neck	1 60
Emerey in kegs, Turkish	7½
Pumice, ground	3 to 4½
Emery glue	18
Tripoli composition	6 to 8
Crocus composition	12
Emery composition	11
Rouge, silver powder	60
Rouge, powder, nickel	35

Prices per lb.

ANODES

Nickel	40 to .45
Copper	22to 24
Zinc	14 to 14½

PLATING CHEMICALS

Acid boracic	.20
Acid, hydrochloric	.03¾
Acid, nitric	.10¼
Acid, sulphuric	.03¾
Ammonia, aqua	.20
Ammonium, Carbonate	.15
Ammonium, chloride	.13
Ammonium, hydrosulphuret	.75
Ammonium, sulphate	.10
Arsenic, white	.18
Copper carbonate, anhy.	.26
Copper, sulphate	8 to 10
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.14
Nickel carbonate	.32
Nickel sulphate	.14
Potassium sulphide (substitute)	.40
Silver chloride (per oz.)	.85
Silver nitrate (per oz.)	.70
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium evanide, 127-130%	.31
Sodium hyposulphite	.08
Sodium phosphate	.10
Tin chloride	.50
Zinc chloride, C. P.	.30
Zinc sulphate	.06

Prices per lb. unless otherwise stated

Is Your Name on our Mailing List?
The Williams Monthly Machinery List (mailed free of charge) contains some unusual and timely bargains in both new and remanufactured Machinery and supplies. Every Williams remanufactured machine is guaranteed to be as good as new for all practical purposes. Your orders will receive prompt and intelligent attention.
Send us your name and address for our next issue, it may contain just the machine you need.
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If its Machinery—Write "Williams"

PROPER CHUCKING ENSURES ADDED PRODUCTION

(Continued from page 32)

hold the end shields for electric motors, and in this case, the overhang is 5¾ inches from the chuck face. The chuck itself is 15 inch size, so all things considered, this was an ideal way of getting over the holding of a peculiar shaped part.

Having shown several applications of good chucking practice, we will summarize several facts which should be remembered.

When gripping work of a frail character, do not attempt to put all the gripping power on the casting itself. Use the jaw chucks as a means of centralizing the part, but have some form of a pull back arrangement to grip the face of the work, thus avoiding distortion.

When parts extend a long way out from the chuck it is often advantageous to bolt a bell chuck to the face of regular chuck. In this way the work can be supported and gripped at three or four more additional points.

In chucking square objects, remember that the application shown at Fig. 5 is often better than using a four-jaw chuck.

Central Location Plugs

That a high degree of concentricity can be obtained by means of central location plugs, or external rings, depending upon the nature of the piece to be machined.

That irregular shaped parts can be successfully held by means of special jaws, and that this method is usually less expensive than the making of special holding fixtures.

Last, but not least, that the chuck is a vital aid or hindrance to production, depending upon how it is used, and it is therefore worthy of close attention and consideration.

SHOULD TEST VALUE OF COST SYSTEM

(Continued from page 50)

rect departments on as equitable a basis as it is possible to determine. For instance, depreciation, insurance and taxes might be distributed on the basis of the investment in equipment in each department; power-house expense on the average horse-power used; repairs on the basis of actual cost to departments; and miscellaneous and general factory expense in proportion to the number of employees in each department, or to the direct-labor hours or direct-labor cost, or again in the proportion that all other expenses have been distributed to departments. The expenses of indirect departments are then distributed to direct departments in the ratio of the services rendered to each of the latter, and from the records of departmental labor costs, labor hours, or machine hours, it is a straightforward calculation to obtain departmental overhead rates for each of the direct or productive departments.

Toronto.—Lillibridge Oil Burners, Limited, Toronto, are incorporated with $100,000 capital to manufacture and deal in furnaces, stoves, ranges, boilers, and sanitary equipment.

Birmingham Motors, Limited, Peterborough, it is announced in Canadian Gazette, have been adjudged bankrupt. This enterprise was promoted largely in Peterborough and vicinity and received the support of local capital.

One firm is said to have exported five full ships of lumber in the last few days, and several others are taking cargo before the severe weather sets in. It is reported that Price Bros. will double the capacity of its mills in the Lake St. John district. The work will start early next spring.

Montreal.—Assurance of French official support for the exhibition train of Canadian products which is to tour France next spring, has been obtained by Senator Charles Beaubien, of Montreal, from President Millerand, according to a despatch received here from London. The French railways are to give free passage to the train, and a stationary exhibition will be arranged in Paris after the tour.

News From the Industrial Field

Parker Motor Car Co., Montreal, has taken over the Montreal Vehicle Motor Co. W. H. Parker, vice-president and engineer, says the company will build and deliver 2,000 cars for 1923.

Construction work on the new city hall building at Kitchener, Ont., will be in the hands of P. H. Secord & Sons Construction Co., of Brantford. The estimated cost of the structure will be about $253,000.

Steel work on the new office addition to be built on the the Montreal Tramways building on Craig St., Montreal, has been awarded to the Dominion Bridge Co. The structure will cost about $125,000.

The total cost of the bridge to be constructed at Ile Perrot, Que., for the dominion and provincial governments will be approximately $260,000. Work on the superstructure will be carried out by the Dominion Bridge Co. at a cost of about $125,000, the remainder of the work being awarded to the Dufresne Construction Co.

Sault Ste. Marie.—Although the Algoma Steel Corporation have only one blast furnace in operation at present, the fact that men are at work relining other blast units is taken as an indication that there is to be an early resumption of activities at the plant. There are good supplies of coal, of which there was a recent shortage.

Sarnia.—Indians of Sarnia reserve are being enriched by the payment of $200,000 by the Dominion Alloy Steel Corporation, Limited, for their site, on reserve property, upon which they propose to erect their steel plant. About $100,000 is being retained in trust for the Indians by the Department of Indian Affairs at Ottawa. The next step towards the development of the plans of the Dominion Alloy Steel Corporation, now that the transfer of the reserve land is completed, will be to survey and clear the river front property.

Vancouver, B. C.—What is supposed to be the first automatic electric railway substation in Canada will be installed here by the B. C. Electric Railway Co., to cost $65,000. The action of automatic substations is described as being almost human. Whenever the voltage on the trolley wire drops as a result of a heavy load, such as occurs when a large number of street cars begin to climb a grade, the substation automatically starts into operation. When the voltage is restored to normal, the machine returns to rest.

Milton Foundry, Machine & Tool Co., Milton, Ont., reports good business at present. They are working on the iron and steel work for a large brick dryer for Milton Pressed Brick plant at Streetsville.

Milton, Ont.—P. L. Robertson Screw Co., are adding a new wing to their present factory to be used as office and warehouse. Their heating system will be changed to fuel oil. The office will be heated electrically.

Milton, Ont.—Milton Shoe Co.'s factory, closed for two years, has been bought by the Milton Worsted Yarn Spinning Co. They are now busy making alterations to suit the new industry, as they have outgrown present premises.

William Cowan, Sr., founder of the Cowan Co. of Galt, manufacturers of wood-working machinery, and for many years president and directing head of the company, died early this week at his home in Galt, at the age of 82 years. He had only been ill for a short time. Mr. Cowan was born at Blochmhor Farm Waterloo Township, not far from Galt, and has been a resident of that place all his life. He graduated from college in Toronto as a veterinary surgeon and practised this profession for several years. On retiring from this business many years ago he took an active part in organizing the company that now bears his name. He was actively associated in politics and different phases of social and business life, and up to the last was an active member of the Galt Board of Trade.

Speaking of machine tool prospects, a Montreal dealer states:—"Demand for machine tools for the past three or four months shows considerable improvement over any similar period within the last two years. As to railroad buying, the G. T. R. has purchased considerable equipment for Battle Creek Shops, and the C. N. R. have made purchases for various shops."

Montreal.—P. Ackerman, electrical engineer of the Shawinigan Water & Power Co., has perfected an invention that has to do with relay protection making long-distance transmission of high electric power safer and more effective. Much interference with service was caused by lightning, wind or sleet storms. By the new method, a faulty section is disconnected automatically. Long distance transmission has been made safer and more effective.

Milton, Ont.—Second floor of the Dominion Express building will be fitted up as a hosiery mill by a Toronto firm, who will occupy it by the New Year.

Fort William.—Twenty-five carloads of machinery are being installed in the plant of the Fort William Paper Co. This equipment is from Dominion Engineering Works, Montreal. The wood mill turns out 120 tons of ground wood pulp a day, while the paper mill turns out 800 feet of paper a minute. It will operate shortly with a capacity of 160 tons a day.

Sault Ste. Marie.—That an old established English firm, using steel in its articles of manufacture, is in prospect for this city, was recently announced at a meeting of the Board of Trade. Another proposed industry was American and used the products of pulp mills. There is some prospect of the Government coming to an immediate decision to extend a railroad into the Mississauga forest reserve.

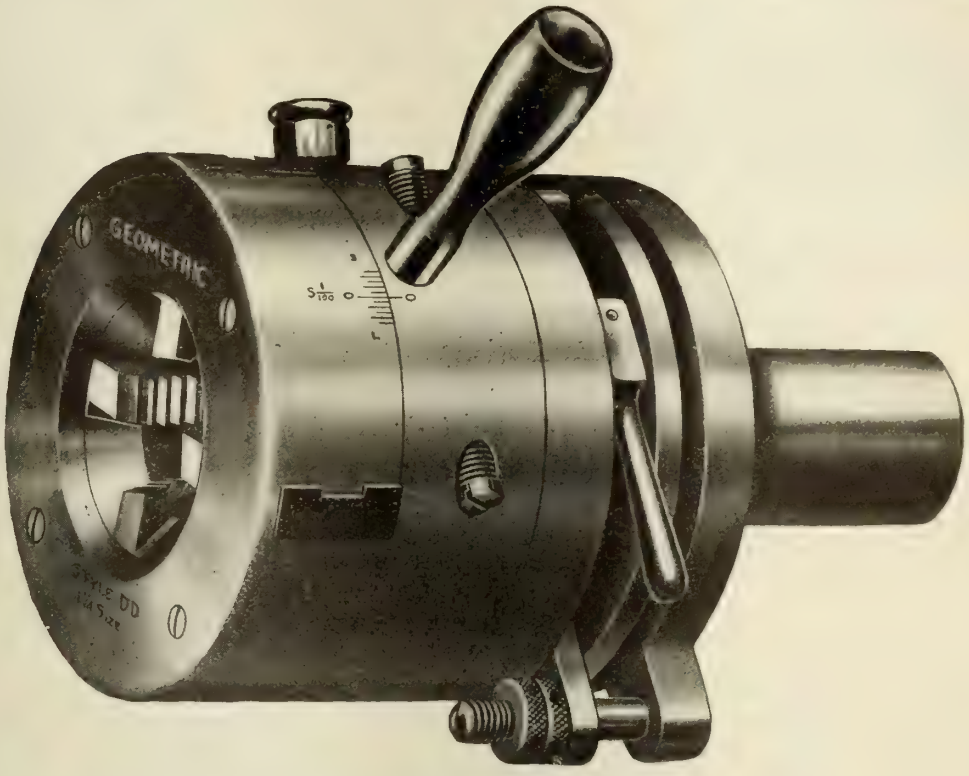
Something new in equipment for handling coal at a pit head is being built by a British firm for a colliery in that country. The plant is operated by hydraulic power and it includes specially designed cages for loading and unloading the tubs in which the coal is conveyed. The action of charging and emptying the cages is done automatically by hydraulic machinery. The special feature of this equipment is that the whole of the operations are controlled from a central point. All the pumps, rams, accumulator castings, steel structures, and other parts of the equipment are being designed and produced at one factory.

Windsor.—Michigan Steel Corporation will build a modern six-mill sheet steel plant on a 35-acre site along the river Rauge, opposite the property of the Canadian Steel Corporation at Ojibway. Detroit is the largest market in the United States for steel used in the production of motor cars and it is proposed that the new plant will largely take care of this demand. The directors of the new corporation are:—B. Lovejoy, New York, of the firm of Wheelock & Lovejoy, chairman of the board of directors; George R. Fink, formerly with the West Penn Steel Company of Pittsburgh, president and treasurer; Frank H. Jones, New York, of the Worthington Pump and Machinery Corporation, vice-president, and W. H. Steel, Detroit, formerly with the Newton Steel Company, Newton Falls, Ohio, vice-president.

A WELL-BALANCED DIE HEAD

Geometric Style DD
For Hand Operated Turrets

Yields to Adjustment
Resists Inaccuracy



Faulty Turret adjustment is common and causes serious trouble in cutting Screw Threads. The Geometric Style DD Die Head for Hand-operated Turrets, with its compensating spring mechanism, not only functions perfectly itself, but overcomes any inaccuracies of adjustment of the Turret.

The Die Head yields as it comes in contact with the work, allowing the Chasers to start the thread properly.

In perfecting a Die Head for certain Automatic Screw Machines, features were developed that made the Die Head quite as desirable for Hand-Operated Turrets, and as a result the Style DD for Hand Operated Turrets has been added to the Geometric Die Heads that have just the right features for the varied requirements of machine and work.

Latest improved equipment is telling the story of production in busy shops.

Geometric Screw Cutting Tools Have a Story to Tell You. Have You Heard It?

THE GEOMETRIC TOOL COMPANY
NEW HAVEN **CONNECTICUT**

Canadian Agents:

Williams & Wilson, Ltd., Montreal. **The A. R. Williams Machinery Co., Ltd., Toronto.**
St. John, N. B. **Halifax, N. S.** **Vancouver, B. C.**

Quebec:—Extraordinary activity is reported in lumber this year in Northern Quebec, exportation making a record.

Sault Ste. Marie.—The Robert Johnson Motor Co. Limited, have secured a charter, with $100,000 capital, to manufacture and deal in engines, boilers, power plant and hydraulic equipment of all kinds.

Toronto.—The Radio Valve Co., Limited, have been incorporated with $150,000 capital to produce and market thermionic valves of every kind and electrical radio, mechanical and automotive apparatus.

Montreal.—Boiler Equipment Company, Limited, are incorporated with $50,000 capital, to manufacture and market steam boilers, tanks and internal combustion engines, as well as contractors' equipment.

Discussing the passing year's business in farm implements, a manufacturer states:—"Sales during the year just closing have been greatly curtailed by the limited buying power of the farmer, but we are hopeful that this condition will gradually improve and the demand for our product will be correspondingly increased."

Fredericton, N. B.—Receipts from license fees under the Motor Vehicle Act in New Brunswick during the fiscal year which closed on October 31 last, amounted to $302,200. This is the largest in the history of the province, and compares with $276,000 collected last year. While complete figures had not been tabulated as yet, it is said there were approximately 16,000 automobiles and trucks registered in the province last year.

Fort William.—Several thousand bushmen will be required by the lumber manufacturers of Ontario west of the Great Lakes this winter, according to the Employment Service of Canada. Several hundred men are being sent to these camps each week and the demand is becoming more and more insistent. Depletion of stocks during the past summer, owing to heavy building demands in Eastern Canada and the United States, is responsible for the camps being put back on full strength.

J. J. Riley, general manager of the Flint Varnish and Color Works, Toronto, states that November was the best month in the history of their business in Canada, both from a production and sales standpoint. This was largely due to development which had taken place in their plant on lacquers and enamels, which, heretofore, had to be imported from other countries. Considerable research and experimental work had been carried on for some time, and they are reaping the benefit of this work. They are erecting an addition to their plant.

RECORD CAR LOADING

Reports from the carriers of car service division of the American Railway Association show that for the week ended November 18, for loading of all commodities totaled 969,094 cars, the heaviest in the history of the American Railroads for this time of the year. This is an increase of 178,731 cars, or about 23 per cent., over the corresponding week last year and an increase of 79,956 cars over the corresponding week in 1920. This also was an increase of 15,185 cars over the week before, when, however, car loadings declined owing to the observance of Armistice Day as well as Election Day.

Coal loading for the first time since April 1, when the miners' strike began, exceeded 200,000 cars in one week, the total for the week of November being 205,024 cars. This was an increase of 16,712 cars over the week before, and an increase of 36,586 cars above the same week last year, but 11,298 cars below the same week in 1920.

Coke loading totaled 12,431 cars, 158 in excess of the week before. While this was an increase of 5,967 cars over last year, it was a decrease of 1,194 under two years ago.

Ore loading totaled 32,780 cars, 6,603 below the preceding week, but 24,445 cars above the same week last year. Compared with the corresponding week in 1920, this was a decrease of 4,894 cars.

Magnetic chucks are very efficient for holding small pieces for grinding, as the entire face of the chuck can be covered with such parts, thereby supporting each other firmly, so that a large number can be machined at one time, resulting in a much larger production than would be possible by handling the pieces separately.

An important adaptation of the air atomizer and one which is attracting increasing attention, is the oil burner for heating residences. Several burners have been placed on the market recently, some using kerosene, others capable of burning oil as heavy as 20 deg. Be. without preheating. They usually operate with electricity, a motor driving a pump and fan. The pump takes the oil from the storage tank and forces it under moderate pressure through the burner. The fan supplies the air for atomization.

Ford Co. to Use Direct Motor Drive

REPLYING to a request for confirmation of certain reports relative to the proposed addition to the Canadian Ford plant at Ford, Ont., and to the motorizing of their machinery, W. R. Campbell, vice-pres. and treasurer of the company, writes as follows to Canadian Machinery:—

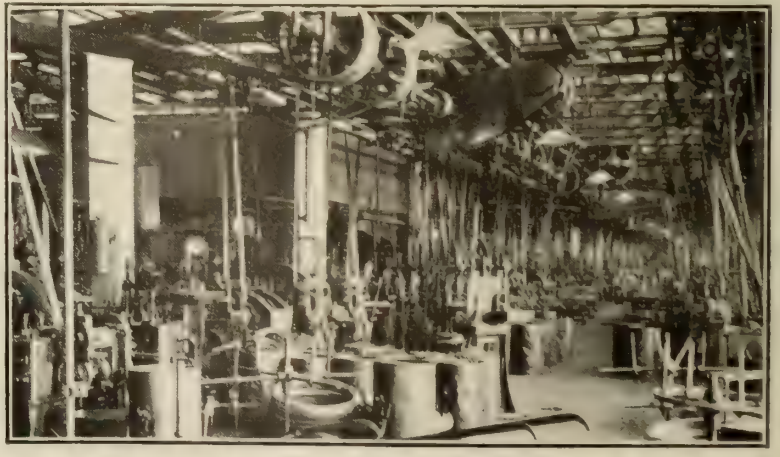
"You have been correctly informed regarding the policy adopted by this company of eliminating overhead transmission and adopting direct motor drive.

"In this connection you are possibly aware of the fact that we have just let a contract for a new factory with floor space of approximately 625,000 square feet, of one-story steel construction.

"We have for some time past, been considering the direct motor drive and have now definitely adopted this policy, due to the fact that the steel structure of the building can be greatly simplified and cheapened by eliminating the necessary load for overhead transmission.

"It will take us some months to complete the operation of motorizing our plant; at the present time we are not in a position to furnish details. An order has been given to the Westinghouse Company of Canada, however, for necessary D. C. motors of a type similar to those used by the Ford Motor Company, Detroit, for similar purposes.

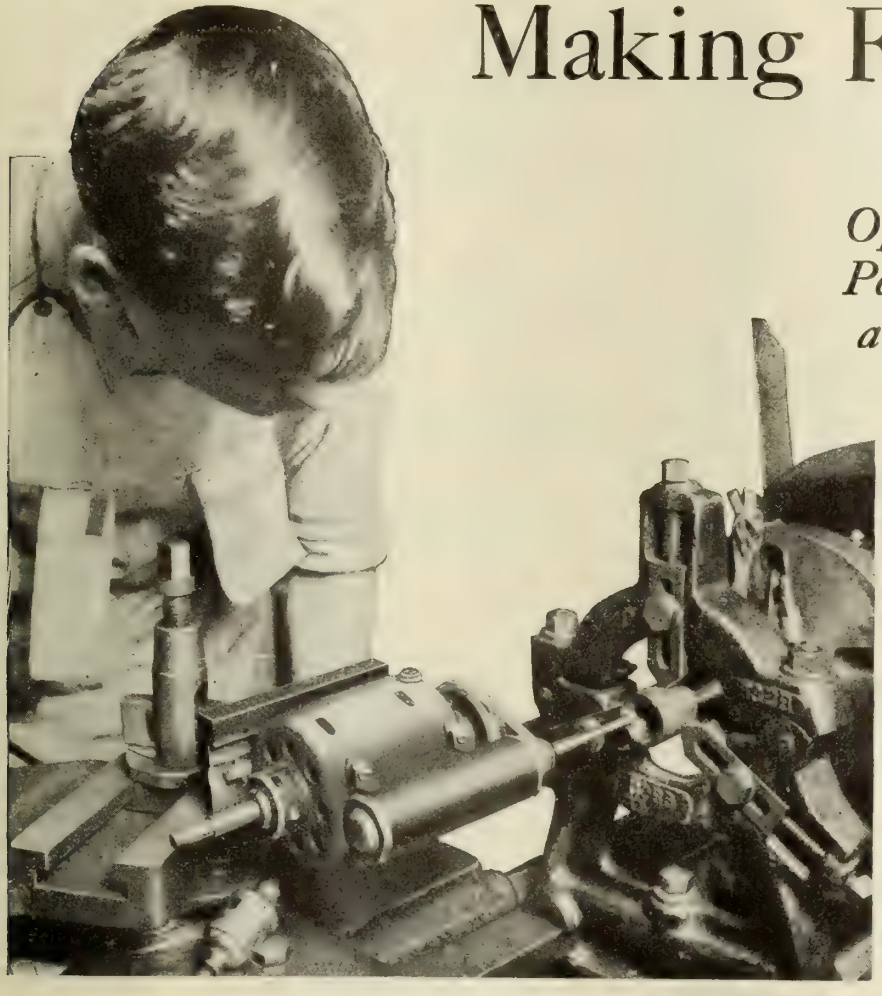
"There are a great many reasons for taking the step which we have, and which, of course, must be quite obvious. The plant which we are about to erect we hope will be in operation by May or June of next year."



Section of machine shop of the Ford Motor Co., of Canada, Walkerville. Motor drive, similar to that in the Detroit Ford plant, is now being introduced.

Making Fine Tools

An Interesting Operation, Economically Performed by Means of a DUMORE Grinder



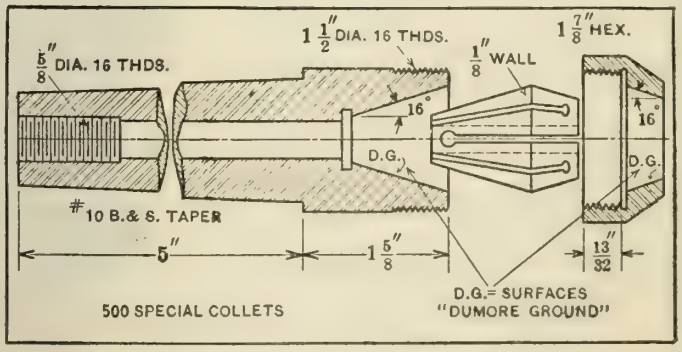
This photograph — taken at the City Engineering Company's (Dayton, Ohio) plant shows a Dumore Grinder finishing the main shank and head of a special draw-in collet. There were 500 put through in this special lot and the time for the operation shown averaged 8 minutes per piece.

The second operation; grinding the internal face of the collet nut, was also performed by this convenient precision tool.

Dumore Grinders are popular here as in every plant where fine tools are made. Their accuracy makes them useful for the finest finishing work; their simplicity and convenience make them practical for many difficult, almost inaccessible jobs.

Dumore Grinders transform any lathe into a precision grinder; they make fine finishing possible in every machine shop.

May we tell you more about them?



WISCONSIN ELECTRIC COMPANY

2952 SIXTEENTH STREET - - RACINE, WISCONSIN, U.S.A.

DUMORE HIGH SPEED GRINDERS

Inserted Tooth Metal Saws

Greater production and economy are reasons why Machine Shops are equipping their metal cutting machines with Simonds Inserted Tooth Saws. Fitted with High Speed Steel Teeth in an especially fine steel plate, these saws cut rapidly without dulling easily.

The Simonds "00" style Inserted Tooth metal saw cuts only 3/16 inch kerf.

Write for prices and catalog.

Simonds
Canada Saw Co., Ltd.
"The Saw Makers"

MONTREAL, QUE.
ST. JOHN, N.B.
VANCOUVER, B.C.

QUEBEC SCRAP TO AMERICAN POINTS

QUEBEC.—Altogether, ten cargoes of scrap iron were shipped during the month of September and October from the port of Quebec. Each of these cargoes, of approximately 1,500 tons, were gathered on the east and north shores of the St. Lawrence by men engaged in the business. Two cargoes were loaded from the Levis side of the river and the other eight from the Louise docks on the Quebec side.

Vessels engaged to handle the scrap were chiefly lake steamers. They took their cargoes to Buffalo, Niagara, Cleveland and other United States lakeports. The material varied greatly in quality, size and species. Part of it was acquired from the railway shops and Quebec foundries, and quite a tonnage consisted of discarded rails from the lines of the different railways.

One steamer from Quebec, during the latter part of November, was loaded with approximately 2,000 tons of railway steel rails and cleared at the customs house for Cuba. Inquiries elicited the fact that the scrap dealers who had purchased and shipped the cargo, had sold out, in advance, these rails to Cuban planters whose plantations were distant from the centre of population, and who were building railways to connect with shipping centres.

Shippers of the scrap iron were non-communicative as to the prices they paid for and the profit they expected to make on the scrap. It may be that they had not cleaned up all the scrap available and preferred to be cautious, fearing competition.

The Eastern Canada Steel and Iron Co., Quebec, has just been awarded the contract to furnish the fabricated steel for improvements to be made to the Louise docks by the Quebec Harbor Commission. Plans mean a change in the accommodation and landing of passengers arriving by the C. P. R. Empresses and others of the company's ocean liners at the opening of navigation next spring. In future, the Canadian Pacific liners, instead of docking in line with the Louise docks breakwater pier as has been the custom, will come into the St. Charles river and dock in line with the north embankment pier. The change will call for extensions to shed 28 and the building of overhead bridges for which the Eastern Canada Steel and Iron Co. have been awarded the contract.

Numerous fires which have included the destruction of churches and colleges in this province are destined to create a boom in fireproof building in which steel and concrete will form component parts. Heretofore, all buildings were built of wood, brick and granite, with the interiors all finished in wood. When fire broke out, buildings were either totally destroyed, or so badly damaged that rebuilding was out of the question. Losses have been such that the authorities have decided to have wood replaced by steel and concrete. The example, without doubt, will be followed by many investors in new buildings. This will eventually mean lower rates of insurance than have generally obtained in this city and vicinity.

No. 4 Press
10 to 12
tons

Write for complete information on Atlas Arbor Presses. All sizes for all purposes.

ATLAS PRESS CO
330 N. Park St.
Kalamazoo, Mich., U.S.A.
Canadian Representatives:
Chas. A. Strelinger Windsor, Ont.

GLUE SPREADER AND MIXER

Corbett Foundry and Machine Co., Ltd., Owen Sound, have designed and built an improved vegetable glue spreader and mixer to meet the requirements of the Canadian furniture and woodworking industry. The spreader is belt-driven through machine-cut gearing, and it is claimed, is practically noiseless, and proof against leakages. The rolls are steel corrugated for the proper and uniform spreading of the glue. The desired thickness of glue to be spread is controlled by the use of roll scrapers, which revolve intermittently while the machine is running. All necessary adjustments can be made while the machine is in motion. All the parts are accessible, gearing is guarded and the machine has a maximum capacity for two-inch material. It is made in width from thirty-one inches to eighty-four inches.

The glue mixer and cooker is of the double agitator type, that is, two sets of paddles in the inner kettle, running in opposite directions, thereby ensuring a perfect and uniform mix. Made in capacities from thirty-seven to seventy-five Imperial gallons. Each mixer is fitted with water gauge glass and steam safety valve.

YOU MUST HAVE-- BABBITT METAL

that can be depended on.

Because—

our products bear this reputation they are being used extensively from coast to coast.

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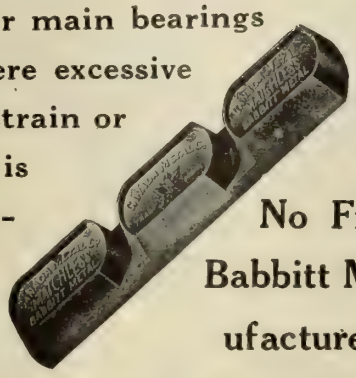
The BABBITT METAL—

unequalled for all General Service and of such high quality that it can be employed in many cases where a Genuine Babbitt has been used

without a fault

IMPERIAL GENUINE

For your main bearings and where excessive shock, strain or friction is encountered.



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Clean Filing

Clean filing cannot be done with dull files.

To keep a dull file in use is to waste time and effort.

As soon as a file begins to get dull, replace it with a new file.

Replace it with one of these standard brands, and you can be sure of maximum service before your new file in turn becomes dull.

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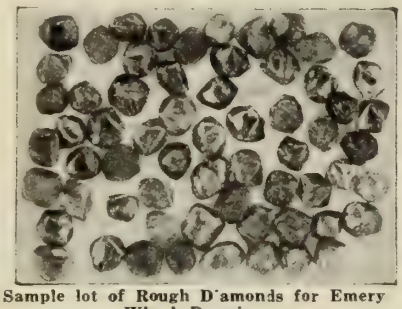

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We stock diamonds and dressing tools for all services and sizes of abrasive wheels.

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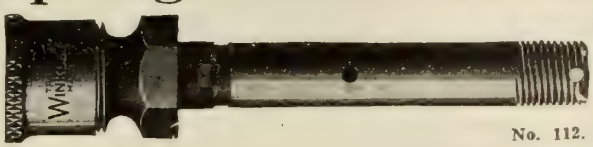

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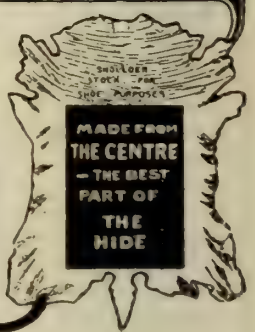

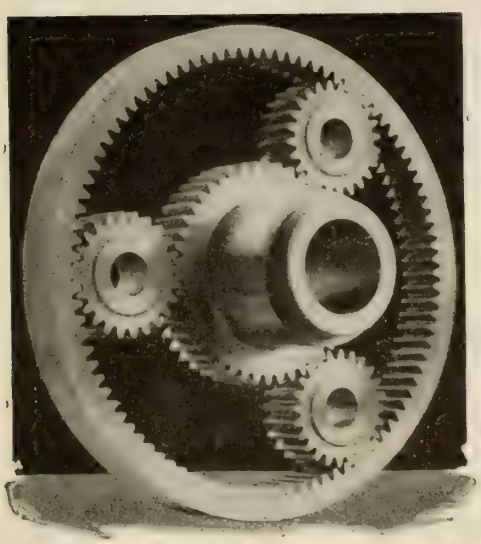

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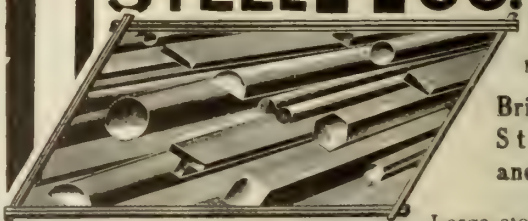

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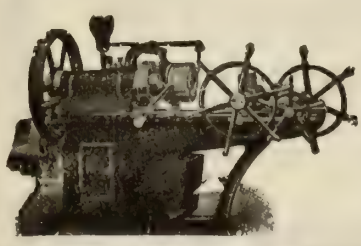

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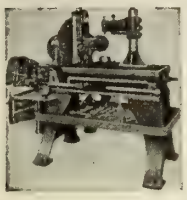

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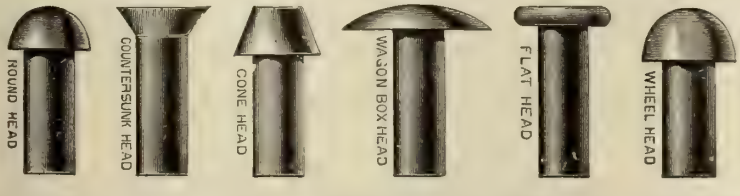

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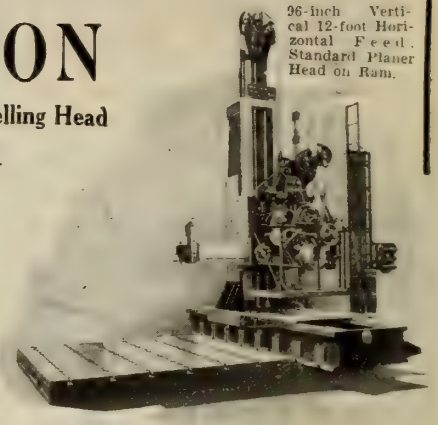

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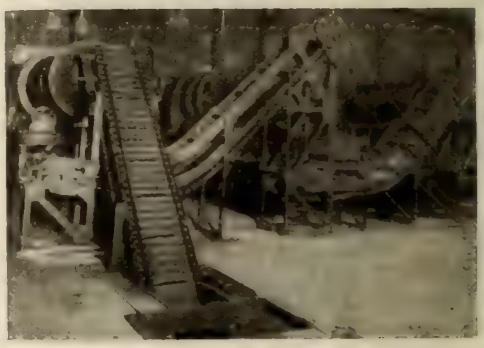

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POWERFUL-STURDY-DEPENDABLE-ACCURATE

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For production, where exceptional gripping power is required, where heavy cuts are often necessary and large pieces are held, this type of chuck will render most satisfactory service.

Although the Skinner Steel Body Chuck has been in use for years, we have never known of one breaking in service. It is the heaviest, strongest Independent Chuck made.

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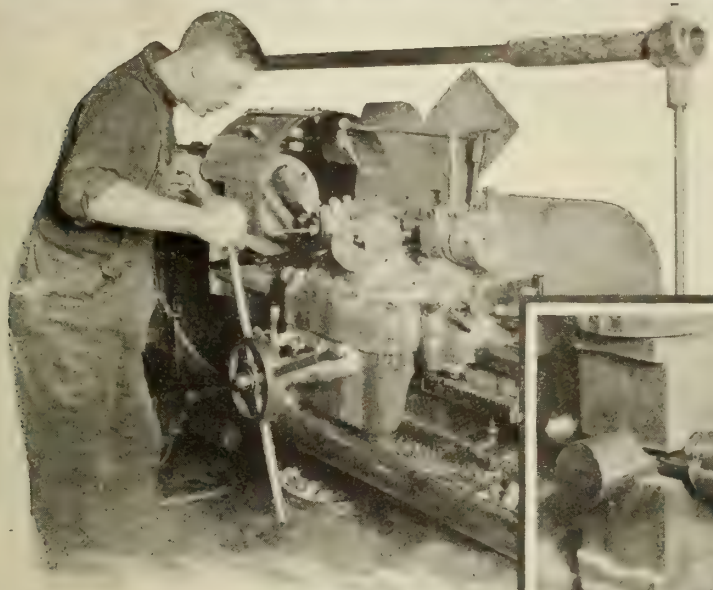
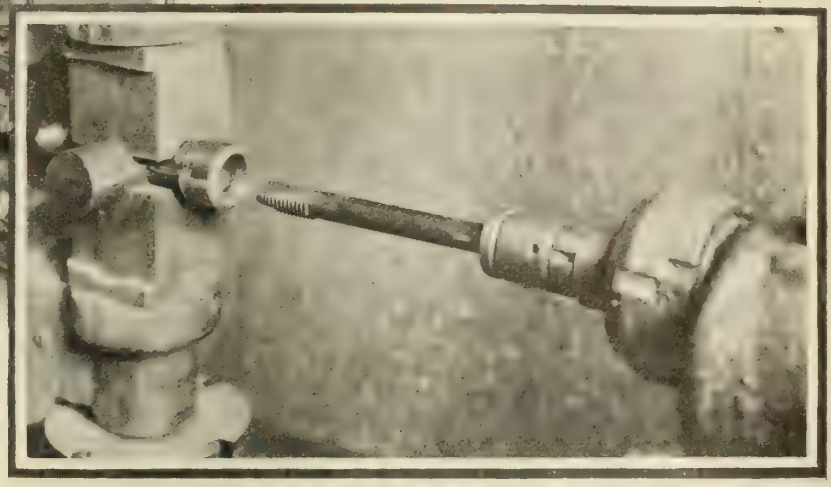


Will a "Gun" Tap Stand Punishment?



Steel Forgings 5 Seconds per hole 500 Holes per Grinding!

They say that "in the dark all coons look alike," and doubtless in a catalog or showcase it's hard to see the difference between the *original* spiral-pointed tap (the GTD "GUN" Tap) and an ordinary spiral-pointed tap which copies the *appearance* of a "GUN" Tap.

But out on the job—against the cold light of production demands—"GUN" Taps stand out by the way they stand "punishment." On the J & L pictured above, a "GUN" Tap is used to tap a 5/8 in. hole 1 1/8 in. deep (eleven threads) in a forged steel compressor drum. This tap, working under severe strain (5 seconds per hole), was selected after many ordinary taps had failed, and for four years has justified the confidence of a well-known New Jersey concern (name on request).

The "GUN" Tap, famous for its easy, shearing cut, freedom from clogging and breakage, and its sustained accuracy, will surprise you by outlasting several ordinary taps. On this job, 500 holes are tapped before regrinding—and it's good for an indefinite number of grindings.

Remember the "GUN" is the *original spiral-pointed tap*. Its superiority is characteristic of GTD small tool service all along the line.

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OF CANADA, LIMITED GALT, ONTARIO

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This is possible if you use ONLY "Maple Leaf" stitched cotton duck belting. It has a positive gripping surface which hugs the pulley. Costs less than leather, rubber or balata.
Once you use "Maple Leaf" belting you specify it always for it is the NO TROUBLE belting which helps production. Write us for samples.

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BRANTFORD PATTERN WORKS ARE PREpared to make up patterns of any kind—including marine works—to sketches, blue prints or sample castings. Prompt, efficient service. Bell 'Phone 631; Machine 'Phone 733. Brantford Pattern Works, 49 George St., Brantford, Ont. (ctfm)

POSITION WANTED

PRACTICAL AND VIGOROUS FACTORY EXecutive desires a change. Is now employed as manager in charge of office and mechanical ends. Highest references, character and ability. Apply Box 820, Canadian Machinery. (C.22M).

WANTED

WANTED—ONE SECOND-HAND ELECTRIC blue printing outfit. John T. Hepburn, Ltd., 18 Van Horne St., Toronto, Ont.

WANTED—200 to 300 H.P 3 phase, 25 cycle, 550 volt, belt driven Generator set, used equipment preferred: must be in good working order. Box 821, Canadian Machinery.

WANTED—ENERGETIC YOUNG MAN, assistant to Production Superintendent, General Engineering Plant. Certain mechanical knowledge required. Energy and ability to work principal features. Box 819, Canadian Machinery (C.23.M.)

MODERN FOUNDRY FOR RENT
Reasonable rent to responsible party. For further particulars write Box No. 818.

If you want something unusual

and it isn't advertised here, the logical thing would be to advertise for it. You'll find that a small ad. in the Classified Advertising Section will save you a great deal of time in locating men or machinery. Look over these pages and if you don't see what you want, send us your copy to-day for next week's issue.

CANADIAN MACHINERY
Classified Advertising Section
143-153 University Avenue
TORONTO

If interested, tear out this page and place with letters to be answered

The Brown-Boggs Co., Limited
HAMILTON, ONT.
Grey Iron.

Fisher Motor Co., Limited.
ORILLIA, ONT.
Die Castings.

Sully Brass Foundry, Limited
618 Brock Ave., TORONTO, ONT.
Brass, Bronze, Copper and Aluminum.

Canadian Rumley Co., Limited
Queen West and Abell Streets,
TORONTO, ONT.
Grey Iron.

Galt Malleable Iron Co., Ltd.
GALT, ONT.
Malleable.

S. Vessot & Company
JOLIETTE, QUE.,
Grey Iron, Brass and Aluminum.

Miller Bros. & Sons, Limited,
120 Dalhousie St., MONTREAL.
Grey Iron, Semi-Steel Castings up to 10 tons.

Can. Mead-Morrison Co., Ltd.,
MONTREAL, P.Q. WELLAND, ONT.
Grey Iron Machinery Castings up to six tons.

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Grey Iron, Patterns, Etc.

Hull Iron & Steel Foundries Ltd.
HULL, CANADA.
Steel, Manganese, Chrome.

John T. Hepburn, Limited
TORONTO, ONT.
Grey Iron.

Can. Hanson & VanWinkle Co.
LIMITED
TORONTO, ONT.
Monel, Aluminum, Brass, Bronze, Grey Iron.

Tallman Brass & Metal, Ltd.
HAMILTON, CANADA
Brass, Bronze, Manganese Bronze, Aluminum.

Dom. Foundries & Steel, Ltd.
HAMILTON, CANADA.
Steel Castings all sizes.

Manitoba Steel Foundries, Ltd.
Office Winnipeg. Works Selkirk, Man.
Steel Castings up to 5,000 lbs.

Brantford Brass Foundry Co.
BRANTFORD, ONT.
Aluminum, Brass, Bronze, Specialty.

The Katie Foundry
GALT, ONT.
Grey Iron, Semi-Steel, Brass, Aluminum.

William Kennedy & Sons, Ltd.
OWEN SOUND, ONT.
Steel, Malleable and Heavy Grey Iron.
See Advertisement Page 7

Machinery & Foundries, Ltd.
BROCKVILLE, ONT.
Light and Medium Grey Iron.

A. F. McCulloch
OSHAWA, ONT.
Brass, Alum. Castings—Wood, Metal Patterns.

Corbet Foundry & Machine Co. Ltd.
OWEN SOUND, ONT.
Grey Iron, Brass.

Fittings Limited,
OSHAWA, ONT.
Malleable, Grey Iron, Brass, Aluminum.

W. W. Wells
370 Victoria Street, TORONTO, ONT.
Nickel and Monel Metal.

The Robert Mitchell Co., Ltd.
64 Belair Ave., MONTREAL.
Light Grey Iron.

Canadian Steel Foundries, Ltd.
MONTREAL, QUE.
Steel and Ferro-Alloy.

Langley & Austin,
GALT, ONT.
Copper, Bronze, Brass and Aluminum.

Maxwells, Limited
ST. MARYS, ONT.
Light Grey Iron, Tinning same a specialty.

The Eureka Planter Co., Ltd.,
WOODSTOCK, ONT.
Specialty Light Grey Iron.

Lindsay Foundry and Pattern Works, Limited
Victoria Avenue, LINDSAY, ONT.
Grey Iron and Semi-Steel

Dominion Engineering Works, Limited
MONTREAL, QUE.
Grey Iron and Semi-Steel to 75 tons.

Smith's Falls Malleable Castings, Limited
SMITH'S FALLS, ONT.
Malleable.

Imperial Foundry Company
2167 St. Clair Ave., TORONTO, ONT.
Grey Iron Castings. Phone Junction 7935.

International Malleable Iron Company, Limited
GUELPH, ONT.
Malleable.

YOU ARE INVITED

The foundries represented on this page are well equipped, progressive, and their product is of known high quality. If you are a foundry owner and you can say the same of your service and product, we shall be glad to list you in this department. Write us for particulars.

Canadian Machinery & Mfg. News
153 University Ave., Toronto.

Canadian Machinery BUYERS DIRECTORY

If what you want is not here, write us, and we will tell you where to get it. Let us suggest that you consult also the advertisers' index— last page of book, after having secured advertisers' names from this directory. The information you desire may be found in the advertising pages. This department is maintained for the benefit and convenience of our readers. The insertion of our advertisers' names undr proper headings is gladly undertaken, but does not become part of an advertising contract.

ABRASIVE DISCS
Lion Grinding Wheels, Limited, Montreal, Que.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John, London, S.E., Eng.

ABRASIVE MATERIALS
Lion Grinding Wheels, Limited, Montreal, Que.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John, London, S.E., Eng.

ACETYLENE, DISSOLVED
Dominion Oxygen Co., Toronto.
Liquide Air Company, Toronto.

ANCHOR BELTS
Steel Co. of Can. Ltd., Hamilton, Ont

ANGLE BARS
Steel Co. of Can. Ltd., Hamilton, Ont.

ANVILS
Atkins & Co., Inc., E.C., Indianapolis, I.

ANCHOR BOLTS
Steel Co. of Can., Ltd., Hamilton, Ont.

ARBORS
Atkins & Co., Inc., E. C., Indianapolis,
Brown & Sharpe Mfg.Co., Providence,R.I.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.

BELLS, BRASS, BRONZE and STEEL
Canada Foundries & Forgings Co., Welland, Ont.
Canadian SKF Co., Toronto, Ont.

BARS, BORING
Armstrong Bros. Tool Co., Chicago, Ill.
Bertram & Son Co., td., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

BARS, BORING, PORTABLE
Underwood Corp., H. B., Philadelphia.

BARS, STEEL
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
British Empire Steel Corporation, Montreal, Que.

BEARINGS, BALL
Canadian SKF Co., Toronto, Ont.

BEARINGS, ROLLER
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

BELT CEMENT
D. K. McLaren, Limited, Montreal.
McLaren Belting Co., J. C., Montreal, Que.

BELT DRESSINGS AND FILLERS
Dom. Belting Co., Ltd., Hamilton, Ont.
D K. McLaren, Limited, Montreal,

BELT FASTENERS
Bristol Company, Waterbury, Conn.
D K McLaren, Limited, Montreal,
McLaren Belting Co., J.C., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

BELT HOOKS
Bristol Co., Waterbury, Conn.
D K McLaren, Limited, Montreal,

BELT LACING
Bristol Company, Waterbury, Conn.
D K. McLaren, Limited, Montreal,
McLaren Belting Co., J. C., Montreal,

BELT LACING, STEEL
Bristol Company, Waterbury, Conn.

BELT LACING MACHINES
D K. McLaren, Limited, Montreal,
McLaren Belting Co., J. C., Montreal, Que.

BELTING, CHAIN
Can. Link-Belt Co., Toronto, Ont.
Fittings, Limited, Oshawa, Ont.
Jones & Glassco, Montreal, Que.
real, Que.
Renold (Hans) of Canada, Ltd., Montreal, Que.

BELTING, FABRIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Dom. Belting Co., Ltd., Hamilton, Ont
D. K. McLaren, Limited, Montreal,
McLaren Belting Co., J. C., Montreal, Que.

BELTING, LEATHER
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Can. Fairbanks-Morse Ltd., Montreal, Q.
D. K. McLaren, Limited, Montreal,
McLaren Belting Co., J. C., Montreal, Que.

BELTS, ABRASIVE
Oakey & Sons, Ltd., John, London, S.E., Eng.

BENDING MACHINES, POWER
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bertrams Ltd., Edinburgh, Scotland.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

BILLETS, BLOOMS and SLABS
Steel Co., of Can. Ltd., Hamilton, Ont.

BLAST GATES
Rockwell Co. W. S., New York, N. Y

BLOCKS
Wright Mfg. Co., Lisbon, Ohio.

BORING TOOLS
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.

BUCKET CARRIERS, Pivoted
Can. Link-Belt Co., Toronto, Ont.

BUFFERS
Pryibil Machine Co., New York, N Y

BUFFING OR POLISHING MACHINES
(See Polishing and Buffing Machines)
Blount Co., J. G., Everett, Mass
Herbert, Limited, Alfred, Toronto Ont
Pryibil Machine Co., New York, N Y
U. S. Electrical Tool Co., Cincinnati, O.

BUILDING MATERIALS
Bertram & Son Co., Ltd., The John Dundas, Ont.

BURNERS, OIL AND GAS
Rockwell Co., W.S., New York City

BURRS
Steel Co of Can. Ltd., Hamilton Ont

CABINETS, OIL
S. F. Bowser & Co., Ltd., Toronto, Ont

CALIPERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Starrett Co., L. S., Athol, Mass.

For list of Dealers see the last page of This Buyers Directory

BLOCKS, CHAIN (See Hoists, Hand)
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

BLOCKS, DIE
Canada Foundries & Forgings Co., Welland, Ont.

BLOCKS, PILLOW
Can. Link-Belt Co., Toronto, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

BLOWERS
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Flexible Shaft Co,. Ltd., Toronto, Ont.

BOLT AND NUT MACHINERY
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Montreal, Que.

BOLT AND NUT MACHINERY, Automatic
National Acme Co., Cleveland, Ohio

BOLTS AND NUTS
British Empire Steel Corporation, Montreal, Que.
National Acme Co., Montreal, Que

BOLT THREADING DIE HEADS
Landis Machine Co., Inc., Waynesboro, Pa.

BOLTS, TRACK
Steel Co. of Canada, Ltd., Hamilton, Ont.

BORING and TURNING MILLS, Vertical
Bertram & Sons Co., Ltd., The John Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

BORING, DRILLING and MILLING MACHINES, Horizontal.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
Herbert, Limited, Alfred, Toronto, Ont.
Landis Tool Co., Waynesboro, Pa
Vertical
Can. Fairbanks-Morse Co., Ltd. Montreal, Que.

CAMS
Canada Foundries & Forgings Co., Welland, Ont.

CAN-MAKING MACHINERY
(See Sheet Metal Working Machinery)
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Bliss Co., E. W., Brooklyn, N. Y.
Smooth Mfg. Co., Jersey City, N. J.

CEMENTS, IRON
CENTERING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gariock Machinery, Ltd., Toronto, Ont.

CHAINS (See Sprockets and Chains)
Reynold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio

CARD CLOTHING
D K McLaren, Limited, Montreal

CASTINGS, ALUMINUM, BRASS, BRONZE, COPPER, DIE-MOLDED, FERRO-ALLOY, IRON, SEMI-STEEL, STEEL.
See "Where to buy your castings" Section Page number may be found by turning to Advertisers' Index

CHAINS, DRIVING
Can Link-Belt Co., Toronto, Ont
Greenfield Tap & Die Corp., Galt, Ont
Jones & Glassco, Montreal, Que
Renold (Hans) of Canada, Ltd Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio

CHASERS
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, a.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CHUCKING MACHINES
Acme Machine Tool Co., Cincinnati, O
Brown & Sharpe Mfg. Co., Providence, R. I.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

CHUCKS, DRILL AND TAP
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canadian SKF Co., Toronto, Ont.
Cushman Chuck Co., Hartford, Conn
Geometric Tool Co., New Haven, Conn.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn
Union Mfg., New Britain, Conn.

CHUCKS, LATHE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Cushman Chuck Co., Hartford, Conn.
Geometric Tool Co., New Haven, Conn.
Gisholt Machine Co., Madison, Wis.
Herbert, Limited, Alfred, Toronto, Ont.
Ker & Goodwin Machine Co., Brantford Ont.
Pryibil Machine Co., New York, N.Y.
Skinner Chuck Co., New Britain, Conn
Union Mfg. Co., New Britain, Conn.

CHUCKS, MAGNETIC
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

CHUCKS, PLANER
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cushman Chuck Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn
Union Mfg. Co., New Britain, Conn.

CHUCKS, TAPPING
William L. Procunier, Chicago, Ill.

CHUCKS, VERTICAL BORING MILL
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis
Skinner Chuck Co., New Britain, Conn
Union Mfg. Co., New Britain, Conn.

CLAMPS, MACHINISTS'
Brown & Sharpe Mfg. Co., Providence.
Starrett Co., L. S., Athol, Mass.

CLEANERS, METAL, WASTE, GENERAL
Oakley Chemical Co., New York, N. Y

CLOCKS
Chicago Watchman's Clock Co., Chicago
Hardinge Bros., Limited, Toronto, Ont.

CLOCKS, TIME
Gisholt Machine Co., Madison, Wis.

CLOCKS, WATCHMEN'S
Chicago Watchman's Clock Co., Chicago Ill.
Hardinge Bros., Limited, Toronto, Ont.

CLUTCHES, FRICTION
Can.-Link-Belt Co., Toronto, Ont
Johnson Machine Co., Carlyle, Manchester, Conn.

COAL AND ASH HANDLING MACHINERY
Can.-Link Belt Co., Toronto Ont
Rocklesss Elevator Works, Galt Ont

COAL-STORAGE SYSTEMS
Can. Link-Belt Co., Toronto, Ont.

COLLARS, SHAFT OR SET
Canada Foundries & Forgings Co., Welland, Ont
Can. Link-Belt Co., Toronto, Ont
Kennedy & Sons, Ltd., Wm., Owen Sound Ont

COLLETS
Butterfield & Co., Inc., Rock Island Que.
Geometric Tool Co. New Haven Conn
Hardinge Bros., Inc., Chicago, Ill.
Hendley Machine Co., Torrington Conn
Kearney & Trecker Co. Milwaukee, Wis
Pratt & Whitney Co., of Canada Ltd Dundas, Ont.

COMPOUNDS, CLEANING
Oakley Chemical Co. New York, N Y

BUYERS' DIRECTORY

COMPOUNDS—CUTTING, DRILLING, GRINDING, SCREW CUTTING
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Oakley Chemical Co., New York, N.Y.

COMPRESSORS, AIR AND GAS
Can. Fairbanks-Morse Co., Ltd., Montreal.

CONES, FRICTION
Norton Co., of Can. Ltd., Hamilton, Ont.

CONNECTING RODS AND STRAPS
Canada Foundries & Forgings Co., Welland, Ont.

CONTRACT WORK
Dominion Engineering Works, Limited, Montreal, Que.
Victoria Foundry Co., Ltd., Ottawa, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

CONVEYORS AND ELEVATORS (SEE ELEVATORS)
Jones & Glassco, Montreal, Que.

COTTERS
Steel Co. of Canada, Ltd., Hamilton, Ont.

COUNTERBORES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

COUNTERS, REVOLUTION
Starrett Co., L. S., Athol, Mass

COUNTERSHAFTS
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Johnson Machine Co., Carlyle, Man.
Kempsmith Mfg. Co., Milwaukee, Wis.

COUNTERSINKS
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

COUPLERS, CAR AND LOCOMOTIVE
Can. Steel Foundries, Montreal, Que.

COUPLINGS
Steel Co. of Canada, Ltd., Hamilton, Ont.

COUPLINGS, SHAFT
Can. Link-Belt Co., Toronto, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

CRANES, ELECTRIC
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can.-Link-Belt Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Northern Crane Works, Walkerville, Ont.
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.

CRANES, LOCOMOTIVE
Can. Link-Belt Co., Toronto, Ont.

Bertram & Son Co., td., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Northern Crane Works, Walkerville, Ont.

CRANK PIN TURNING MACHINE
Underwood Corp., H.B., Philadelphia, Pa.

CUTTERS, GEAR
Brown & Sharpe Mfg. Co., Providence, R. I.

Butterfield & Co., Inc., Rock Island, Q. Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CUTTERS, HIGH SPEED
Atkins & Co., Inc., E. C., Indianapolis.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CUTTERS, MILLING
Brown & Sharpe Mfg. Co., Providence, R. I.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.

CUTTERS, STAY BOLT
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.

CUTTING-OFF MACHINE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Starrett Co., L. S., Athol, Mass.

CUTTING OFF MACHINES, PIPE (SEE PIPE-CUTTING AND THREADING MACHINES)
Landis Machine Co., Inc., Waynesboro, Pa.

CUTTING-OFF TOOLS
Armstrong Bros. Tool Co., Chicago, Ill.

CUTTING OIL FILTERS (SEE OIL FILTERING SYSTEMS
Bowser, S. F. & Co., Ltd., Toronto.

CUTTING, OXY-HYDROGEN
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

DETACHABLE CHAIN
International Malleable Iron Co., Guelph, Ont.

DIAMONDS, BLACK AND ROUGH
Can. Desmond-Stephan Mfg Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

DIAMOND TOOLS
Can. Desmond-Stephan Co., **Hamilton,**
Wheel Trueing Tool Co., Windsor, Ont.

DIAMOND CROSSINGS
Can. Steel Foundries, Montreal, Que.

DIAMONDS, IMPORTERS
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Co., Windsor, Ont.

DIES, SCREW AND THREAD CUTTING
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.

DIES, SHEET-METAL AND SUB-PRESS (See Tool Work)
Brown, Boggs & Co., Ltd., Hamilton, Ont.

DIES, FORGING
Brown, Boggs & Co., Ltd., **Hamilton, Ont.**
Canada Foundries & Forgings Co., Welland, Ont.

DIES, SCREW AND THREAD CUTTING
Morse Twist Drill & Machine Co., New Bedford, Mass.

DIES, SELF-OPENING, ADJUSTABLE
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DIES, THREADING-OPENING
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DIVIDING HEADS
Burke Machine Tool Co., Conneaut, Ohio.
Hendey Machine Co., Torrington, Conn.
Kearney & Treacker Co., Milwaukee, Wis.

DOGS, LATHE AND MILLING MACHINE
Armstrong Bros. Tool Co., Chicago, Ill.

DRAFTING MATERIALS
American Lead Pencil Co., New York City, N.Y.

DRESSERS, GRINDING WHEEL
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ont.
Norton Co., of Can., Ltd., Hamilton.
Wheel Trueing Co., Windsor, Ont

DRESSING TOOLS
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Co., Windsor, Ont.

DRILL HOLDERS
Armstrong Bros. Tool Co., Chicago, Ill

DRILLING MACHINES, BENCH
Burke Machine Tool Co., Conneaut, Ohio.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Hardinge Bros., Inc., Chicago, Ill.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, ELECTRIC AND HAND
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, GANG
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

DRILLING MACHINES, HEAVY DUTY
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
Herbert, Limited, Alfred, Toronto, Ont.

BORING, DRILLING AND MILLING MACHINES, (HORIZONTAL.)
Gisholt Machine Co., Madison, Wis
Herbert, Limited, Alfred, Toronto, Ont.

DRILLING MACHINES, Multiple Spindle
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
National Acme Co., Cleveland, Ohio.

DRILLING MACHINES, Pneumatic
Cleveland Pneumatic Tool Co., Toronto. Ont.

DRILLING MACHINES, PORTABLE
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, RADIAL
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal. Que.
Herbert, Limited, Alfred, Toronto, Ont.
Williams Machinery Co., A. R., Toronto.

DRILLING MACHINES, SENSITIVE
Burke Machine Tool Co., Conneaut, O
Herbert, Limited, Alfred, Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Williams Machinery Co., A. R., Toronto
Wisconsin Electric Co., Racine, Wis

DRILLING MACHINES, TURRET
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wisconsin
Williams Machinery Co., A. R., Toronto.

DRILLING MACHINES, VERTICAL
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Herbert, Limited, Alfred, Toronto, Ont.

DRILLS, CENTRE
Butterfield & Co., Inc., Rock Island, Que
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont

DRILLS, ELECTRIC
U. S. Electrical Tool Co., Cincinnati, Ohio
Black & Decker Mfg. Co., Ltd., Montreal, Que.

DRILLS, HIGH SPEED TWIST
Butterfield & Co., Inc., Rock Island, Que
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Cleveland Twist Drill Co., Cleveland, O.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DRILLS, RATCHET
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont
Morse Twist Drill & Machine Co., New Bedford, Mass.

DRILLS, TWIST AND FLAT
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont

DROP FORGINGS
Steel Co of Canada, Ltd., Hamilton

DUMB WAITERS
Roelofson Elevator Works, Galt, Ont.

DUST HANDLING EQUIPMENT
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

ELECTRIC DRILLS AND GRINDERS
Black & Decker Mfg. Co., Ltd., Montreal, Que.
U. S. Electrical Tool Co., Cincinnati, Ohio

ELECTRIC STEAM GENERATORS
Dominion Engineering Works, Limited, Montreal, Que.

ELECTRICAL INSTRUMENTS
Bristol Co., Waterbury, Conn.

ELECTRICAL SUPPLIES
Atkins & Co., Inc., E. C., Indianapolis
Diamond State Fibre Co., Toronto, Ont.

ELECTRIC TOOLS
U. S. Electrical Tool Co., Cincinnati, Ohio.

ELEVATORS AND CONVEYORS
Can. Link-Belt C., Toronto, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q

ELEVATORS, FREIGHT AND PASSENGER
Roelofson Elevator Works, Galt, Ont.
EQUIPMENT, ELEVATOR SAFETY
Jones & Glassco, Montreal, Que.

EMERY WHEELS (See Grinding Wheels)
Lion Grinding Wheels, Limited, Montreal, Que.
Atkins & Co., E. C., Indianapolis, I
Norton Co., of Canada., Ltd., Hamilton

ENGINES, CAPSTAN
Kennedy & Sons, Wm., Owen Sound Ont.

ENGINEERS, MECHANICAL
Dominion Engineering Works, Limited Montreal, Que.
Gisholt Machine Co., Madison, Wis
Hamilton Gear & Machine Co., Toronto

EXPANDERS, TUBE
Jardine & Co., A. B., Hespeler, Ont

FANS, ELECTRIC
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

FANS, EXHAUST
Can. Blower & Forge Co., Ltd., Kitchner, Ont.

FANS, VENTILATING
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

FIBRE
Diamond State Fibre Co., of Can Ltd Toronto, Ont.

FILES AND RASPS
Nicholson File Co., Port Hope, Ont
Simmons Canada Saw Co., Montreal. Que.

FILLER, IRON (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J.

FIRE ESCAPES
Roelofson Elevator Co., Galt, Ont.

FITTINGS, PIPE
International Malleable Iron Co., Guelph
Fittings, Limited, Oshawa, Ont.

FLEXIBLE SHAFTS
Flexible Shaft Co., Ltd., Toronto, Ont
Strand & Co., N. A., Chicago, Ill

FLUXES, WELDING
Dominion Oxygen Co., Ltd, Toronto
Liquide Air Company, Toronto, Ont.

FORGES
Flexible Shaft Co., Ltd., Toronto, Ont.

FORGING MACHINERY
Acme Machinery Co., Cleveland, Ohio
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown Boggs & Co., Ltd., Montreal.
National Machinery Co., Tiffin, Ohio.
Steel Co of Canada, Ltd., Hamilton

FORGINGS, DROP
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Ltd., Toronto, Ont.

FORGINGS, HAMMER
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Hepburn Ltd., John T., Toronto, Ont.

FOUNDRY EQUIPMENT
Rice Lewis & Son, Ltd., Toronto, Ont

FOUNDRY SUPPLIES
Rice Lewis & Son, Ltd., Toronto, Ont

FROGS, SPRING OR RIGID
Can. Steel Foundries, Montreal, Que.

FURNACES, ELECTRIC
Rockwell Co., W. S. New York City.
Hiram Walker & Sons Metal Products Ltd., Walkerville, Ont.

FURNACES, HEAT TREATING COAL
Rockwell Co., W. S., New York City.

FURNACES, HEAT TREATING OIL OR GAS
Bellevue Industrial Furnace Co., Detroit, Michigan.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Flexible Shaft Co., Ltd., Toronto, On
Rockwell Co. W. S., New York, N. Y.

FURNACES TEMPERING AND ANNEALING
Bellevue Industrial Furnace Co., Detriot, Mich.
Brown & Sharpe Mfg., Co., Providence R. I.
Flexible Shaft Co., Ltd., Toronto, Ont
Rockwell Co., W. S., New York City.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

FURNACES AND OVENS, ELECTRIC
Rockwell Co. W. S., New York, N. Y.
Starrett Co., L. S., Athol, Mass.
Hiram Walker & Sons Metal Products Ltd., Walkerville, Ont.

BUYERS' DIRECTORY

GAGES, MEASURING (See Tool Work)
Brown & Sharpe Mfg. Co., Providence, R. I.
Greenfield Tap & Die Corp., Galt, Ont.
Lufkin Rule Co., Windsor, Ont.
Starrett Co., L. S., Athol, Mass.

GAGES, RECORDING
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GAGES, SPECIAL MEASURING
(See Tool Work)
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GAGES, THREAD
Brown & Sharpe Mfg. Co., Providence R. I.
Herbert, Limited, Alfred, Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

GALVANIZING
Fittings, Limited, Oshawa, Ont.

GAS, COAL COMPRESSED
L'Air Liquid Society, Toronto, Ont.

GAS, COMPRESSED
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

GASKETS
Diamond State Fibre Co. of Ca., Ltd., Toronto, Ont.
Smooth Mfg. Co., Jersey City, N. J.

GAUGES VACUUM AND PRESSURE
Taylor Instrument Co. Toronto, Ont.

GEAR BLANKS
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.
Dominion Engineering Works, Limited, Montreal, Que.

GEAR COUNTERS
Hart Mfg. Co., R. A., Battle Creek, Michigan.

REAP CUTTING MACHINES
Bertram & Sons Co., Ltd., The John, Dundas, Ont.

Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Fellows Gear Shaper Co., Springfield, Vt.
Whiton Machine Co., D. E., New London, Conn.

GEAR TESTING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.

GEARS, CAST
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Hull Iron & Steel Foundries, Hull, Que.
Dominion Engineering Works, Limited, Montreal, Que.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

GEARS, CUT
Brown & Sharpe Mfg. Co., Providence, R. I.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Gardner & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto, Ont.
Hepburn Ltd., John T. Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

GEARS, DRESSED
Kennedy & Sons, Wm., Owen Sound, Ontario.

GEARS, FORGED
Canada Foundries & Forgings Co., Welland, Ont.

GEARS, HERRINGBONE
Hamilton Gear & Machine Co., Toronto, Ont.

GEARS, RAWHIDE (See Gears, Cut)
Hamilton Gear & Machine Co., Toronto.

GEAR, SILENT CHAIN
Gardner & Son, Robt., Montreal, Que.
Can. Link-Belt Co., Ltd., Toronto, Can.
Hans Renold of Canada, Ltd., Montreal, Quebec.

GEARS, WORM
Hamilton Gear & Machine Co., Toronto.

GENERATORS ACETYLENE
L'Air Liquide Society, Toronto, Ont.

GOGGLES, SAFETY
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

GRAB BUCKETS
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Cleveland Twist Drill Co., Cleveland, O

GREASE CUPS, PRESSED STEEL AND BRASS
Can. Winkley Co., Ltd., Windsor, Ont

GREASES, LUBRICATING
Canadian SKF Co., Toronto, Ont.

GRINDERS, ELECTRIC
Black & Decker Mfg. Co., Ltd., Montreal, Que.
U. S. Electrical Tool Co., Cincinnati, Ohio.

GRINDERS TOOL POST
U. S. Electrical Tool Co., Cincinnati, Ohio.

GRINDING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Norton Co., of Canada, Ltd., Hamilton

GRINDING MACHINES, ABRASIVE BELT
Norton Co. of Can. Ltd., Hamilton, Ont.

GRINDING MACHINES, AUTOMATIC
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, BENCH
Blount Co., J. G., Everett, Mass.
Geometric Tool Co., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co. of Canada, Ltd., Hamilton, Ont.
Pratt & Whitney Co. of Canada, Ltd.

GRINDING MACHINES, CENTER
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES, CUTTER AND REAMER
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, CYLINDRICAL
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.
Norton Co., of Canada, Ltd., Hamilton

GRINDING MACHINES, DIE
Geometric Tool Co., New Haven, Conn.
National Acme Co., Cleveland, O.
National Machinery Co., Tiffin, Ohio

GRINDING MACHINES, DRILL
Bellevue Industrial Furnace Co., Detroit, Mich.
Bertram & Son Co., Ltd., The John, Dundas, Ont.

GRINDING MACHINES, ELECTRIC
Strand & Co., N. A., Chicago, Ill

GRINDING MACHINES, FLOOR AND TOOL
Blount Co., J. G., Everett, Mass.
Herbert, Limited, Alfred, Toronto, Ont.
National Acme Co., Cleveland, Ohio.
Norton Co. of Canada, Ltd., Hamilton, Ontario.
Greenfield Tap & Die Corp., Galt, Ont.
U. S. Electrical Tool Co., Cincinnati, Ohio.

GRINDING MACHINES, INTERNAL
Garlock Machinery Ltd., Toronto, Ont
Greenfield Tap & Die Corp., Galt, Ont
Cleveland Pneumatic Tool Co., Toronto Ont.
Wisconsin Electric Co., Racine, Wis

GRINDING MACHINES PORTABLE
Strand & Co., N. A., Chicago, Ill

GRINDING MACHINES, SNAGGING
Blount Co., J. G., Everett, Mass.
Norton Co., of Can. Ltd., Hamilton, Ont.
U. S. Electrical Tool Co., Cincinnati, Ohio

GRINDING MACHINES, SURFACE
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, THREAD
Pratt & Whitney Co., of Canada, Ltd., Strand, Ont.

GRINDING MACHINERY, TOOL POST
Gisholt Machine Co., Madison, Wis.
Grenfield Tap & Die Corp., Galt, Ont.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES, UNIVERSAL
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Herbert, Limited, Alfred, Toronto, Ont.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co., of Canada, Ltd., Hamilton Ontario.

GRINDING WHEELS
Lion Grinding Wheels, Limited, Montreal, Que.
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Norton Co. of Can., Ltd., Hamilton, Ont.

GUN-BARREL MACHINERY
Steinle Turret Machine Co., Madison, Wisconsin.

HACK SAWS, POWER
Atkins & Co., Inc., E.C., Indianapolis, Indiana.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.

HAMMERS, CHIPPING
Cleveland Pneumatic Tool Co., Toronto, Ont.
High Speed Hammer Co., Rochester.

HAMMERS, DROP
Bertram & Son Co., Ltd., The John Dundas, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland Ont

HAMMERS, ELECTRIC
Brown, Boggs & Co., Ltd., Hamilton, Ont

HAMMERS, PNEUMATIC
Can. Steel Foundries, Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto Ont.

HANGERS, SHAFTING
Canadian SKF Co., Toronto, Ont.
Brown & Sharpe Mfg Co., Providence, R.I.
Hamilton Gear & Machine Co., Toronto.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

HOBBING MACHINES
Shore Instrument Co., Jamaica, N.Y.

HARDENING, CASE-HARDENING AND TEMPERING
Barnes Company, Wallace, Hamilton.
Gisholt Machine Co., Madison, Wis.
Cleveland Pneumatic Tool Co., Toronto Ont.

HAMMERS, POWER
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Jardine & Co., A. P., Hespeler, Ont.

HOBS
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

HOISTS, ELECTRIC
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Northern Crane Works, Walkerville, Ont.
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.

HOISTS, HAND
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg Co., Lisbon, Ohio

HOISTS, PNEUMATIC
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

HOLDERS-ON, PNEUMATIC
Cleveland Pneumatic Tool Co., Toronto Ont.

HYDRAULIC MACHINERY
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Kennedy & Sons, Ltd., Wm., Owen

IGNITERS, GAS ENGINE
Canada Foundries & Forgings Co., Welland, Ont.
Burke Machine Tool Co., Conneaut, O

INDICATORS, SPEED AND TEST
Brown & Sharpe Mfg. Co., Providence, R.I.

INSULATION
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.

IRON BARS
Steel Co. of Canada, Ltd., Hamilton, Ont.

JACKS, HYDRAULIC
Norton, A. O., Boston, Mass.

JACKS, PLANER
Armstrong Bros. Tool Co., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

JAPANNING AND VARNISHING OVENS
Brantford Oven & Rack Co., Brantford, Ont.

JIGS AND FIXTURES (SEE TOOL WORK)
Fisher Motor Co., Ltd., Orillia, Ont.
Gisholt Machine Co., Madison, Wis.

KEYSEATING MACHINES
Morton Mfg. Co., Muskegon, Mich
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

KEYS, MACHINE
Can. Drawn Steel Co., Hamilton, Ont.
Morton Mfg. Co., Muskegon, Mich.

KNIVES, MACHINE
Atkins & Co., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

KNURL HOLDERS
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

LATHE ATTACHMENTS
Hendey Machine Co., Torrington, Conn.

LATHE TOOLS
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

LATHES, AUTOMATIC AND SEMI-AUTOMATIC
Gisholt Machine Co., Madison, Wis.
Herbert, Limited, Alfred, Toronto, Ont
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, BENCH
Hardinge Bros., Inc., Chicago, Ill.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

LATHES, BORING
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, CHUCKING (SEE LATHES, HORIZONTAL TURRET, AND LATHES, VERTICAL TURRET)
Acme Machine Tool Co., Cincinnati, O.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
Herbert, Limited, Alfred, Toronto, Ont
Steinle Turret Machine Co., Madison Wisconsin.

LATHES, ENGINE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hendey Machine Co., Torrington, Conn
Herbert, Limited, Alfred, Toronto Ont

LATHES, EXTENSION AND GAP
Bertram & Son Co., Ltd., The John Dundas, Ont.
Gisholt Machine Co., Madison Wis
Herbert, Limited, Alfred, Toronto, Ont
National Acme Co., Cleveland, O.
Steinle Turret Machine Co., Madison, Wis.

LATHES, PRECISION
Hardinge Bros., Chicago.

LATHES, RELIEVING
Hendey Machine Co., Torrington, Conn

BUYERS' DIRECTORY

LATHE, UNIVERSAL HAND
Brown & Sharpe Mfg. Co., Providence, Rhode Island.

LATHE, SPEED AND HAND
Blount Co., J. G., Everett, Mass.

LATHES, SPINNING
Pryibil Machine Co., Torrington, Conn.

LATHES, VERTICAL TURRET
Bertram & Son, Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

LATHES, WOOD TURNING
Blount, Co., J. G., Everett, Mass.
Can. Fairbanks-Morse Co., Ltd., Montreal.

LEAD PIPE
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

LEATHER FILLET
D. K. McLaren, Limited, Montreal.

LINOLEUM MILL MACHINERY
Bertrams, Ltd., Edinburgh, Scotland.

LIQUID AIR PLANTS
L'Air Liquide Society, Toronto, Ont.

LOCKERS, CLOTHES
Dennis Wire and Iron Works, London, Ont.

LUBRICANTS
Oakley Chemical Co., New York, N.Y.

LUBRICATING SYSTEMS
Bowser, S. F., & Co., Ltd., Toronto, Canada.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Ltd., Welland, Ont.
Ker & Goodwin Machine Co., Brantford, Ont
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R. Toronto Ont.

MANGANESE STEEL
Can. Steel Foundries, Montreal, Que.

MANDRELS, EXPANDING
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont.

MANDRELS, SOLID
Greenfield Tap & Die Corp., Galt, Ont.
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Pratt & Whitney Co. of Canada. Ltd., Dundas, Ont.

MEASURING MACHINES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MECHANICS' FINE TOOLS
Lufkin Rule Co., Windsor, Ont

METALS, ALLOY
Canada Metal Co., Toronto, Ont.
Can. Steel Foundries, Montreal. Que

METAL WORKERS
Parker Co., Charles, Meriden, Conn

MICROMETER CALIPERS
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Rice Lewis & Son, Ltd., Toronto, Ont

MILLING ATTACHMENTS
Burke Machine Tool Co., Conneaut, O.
Hendey Machine Co., Torrington, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.

MILLING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Burke Machine Tool Co., Conneaut, O

MILLING MACHINES, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence, R. I.
Hardinge Bros., Inc., Chicago, Ill.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

MILLING MACHINES, BENCH
Burke Machine Tool Co., Conneaut, O
Hardinge Bros., Inc., Chicago, Ill.

MILLING MACHINES, HAND
Brown & Sharpe Mfg. Co., Providence
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MILLING MACHINES, HORIZONTAL PLANER TYPE.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q
Kearney & Trecker Co., Milwaukee, Wis
Williams Machinery Co., A. R., Toronto

MILLING MACHINES, PLAIN
Brown & Sharpe Mfg. Co., Providence, Burke Machine Tool Co., Conneaut, O.
Hendey Machine Co., Torrington, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.

MILLING MACHINES, THREAD
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MILLING MACHINES, UNIVERSAL
Brown & Sharpe Mfg. Co., Providence,
Hendey Machine Co., Torrington, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis

MILLING MACHINES, VERTICAL
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, O.
Herbert, Limited, Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto.

MILLING TOOLS, ADJUSTABLE HOLLOW
Geometric Tool Co., New Haven, Conn.

MOTORS, ELECTRIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Roelofson Elevator Co., Galt, Ont.
Williams Machinery Co., A. R., Toronto,
Wisconsin Electric Co., Racine Wis.

NAILS AND STAPLES
Canada Metal Co., Ltd., Toronto, Ont.

NIPPLES
Canada Metal Co., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton

NITROGEN
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

NUT TAPPERS
(See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
National Acme Co., Cleveland, Ohio.

NUTS, FINISHED and SEMI-FINISHED
Galt Macine Screw Co., Galt, Ont.
National Acme Co., Montreal, ue.

NUTS (Up to 4-in.)
Steel Co. of Canada, Ltd., Hamilton.

NUTS, S.A.E., PLAIN AND CASTELLATED
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

OIL FILTERING AND STORAGE SYSTEMS
Bowser, S. F., & Co., Ltd., Toronto,

OIL STORAGE ENGINEERS
Bowser, S. F., & Co., Ltd., Toronto

OIL HOLE COVERS
Can. Whitney Co., Ltd., Windsor, Ont.

OILS, SOLUABLE
Brantford Oven & Rack Co., Brantford, Ontario.

ORNAMENTAL IRON AND WIRE WORKS
Roelofson Elevator Works, Galt, Ont.

OXYGEN
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

OXY-ACETYLENE APPARATUS
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Atlas Press Co., Kalamazoo, Mich.

PAPER MILL CONVEYORS
Bertram Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd., Montreal, Que.

PAPER MILL MACHINERY
Dominion Engineering Works, Limited, Montreal, Que.

PATTERNS, WOOD AND METAL
Fittings, Limited, Oshawa, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.
Victoria Foundry Co., Ltd., Ottawa.

PHOSPHOR TIN
Canada Metal Co., Ltd., Toronto, Ont.

PHOTOGRAPHIC DUPLICATING MACHINES
Photostat Corp., Providence, R. I.

PIPE BENDING MACHINES
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Underwood Corp., H. R., Philadelphia, Pa.
Williams Machinery Co., A. R., Toronto.

PIPE CUTTING AND THREADING MACHINES
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.

PIPE
Canada Metal Co., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.

PIPE FITTINGS
Canada Metal Co., Toronto, Ont.
International Malleable Iron Co., Guelph Ont.

PIPE AND NIPPLE THREADING MACHINES
Landis Machine Co., Inc., Waynesboro, Pa.

PIPE FITTERS' TOOLS
Rice Lewis & Son, Ltd., Toronto, Ont

PIPE THREADING DIE HEADS
Landis Machine Co., Inc., Waynesboro, Pa.

PISTON-RING MACHINES
National Acme Co., Cleveland, Ohio
Steinle Turret Machine Co., Madison Wis.

PLANING MACHINES
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont
Morton Mfg. Co., Muskegon, Mich.
Williams Machinery Co., A. R., Toronto

PLANING MACHINES, ROTARY
Bertram & Son Co., Ltd., The John Dundas, Ont.
Herbert, Limited, Alfred, Toronto, Ont

PLATE ROLLS
Bertram & Son Co., Ltd., The John Dundas, Ont.

PNEUMATIC TOOLS
Cleveland Pneumatic Tool Co., Toronto

POLISHING AND BUFFING MACHINES
Lion Grinding Wheels, Limited, Montreal, Que
Blount Co., J. G. Everett, Mass
Brown & Sharpe Mfg. Co., Providence
Pryibil Machine Co., New York, N Y

PRESSED STEEL PARTS
American Pulley Co., Philadelphia, Pa

PRESSES, ARBOR
Atlas Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que

PRESSES, DROP AND FORGING
Brown, Boggs & Co., Ltd., Hamilton
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

PRESSES, FOOT AND HAND
Brown, Boggs & Co., Ltd., Hamilton

PRESSES, HYDRAULIC
Bertram & Son Co., Ltd., The John Dunidas, Ont.
Cleveland Twist Drill Co., Cleveland, O
Perrin Ltd., W. R., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

PRESSES, POWER
Bliss Co., E. W., Brooklyn, N. Y
Brown, Boggs, & Co., Ltd., Hamilton
Hepburn Ltd., John T., Toronto, Ont
Stoll Co., Inc., D. H., Buffalo, N Y

PRESSES, SCREW
Brown, Boggs & Co., Ltd., Hamilton

PROFILING MACHINES
Pratt & Whitney Co. of Canada, Ltd Dundas, Ont.

PROTRACTORS
Brown & Sharpe Mfg. Co., Providence
Lufkin Rule Co., Windsor, Ont.

PROPELLERS
Kennedy & Sons, Wm., Owen Sound Ontario.

PULLEYS, CORK INSERT
American Pulley Co., Philadelphia, Pa

PULLEYS, METAL AND FIBRE
American Pulley Co., Philadelphia, Pa
Can. Fairbanks-Morse Ltd., Montreal, Q.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.
D. K. McLaren Co., Limited Montreal, Que.

PULP AND PAPER MILL EQUIPMENT
Dominion Engineering Works, Ltd., Montreal, Que.

PUMPS, HYDRAULIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Dominion Engineering Works, Ltd. Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont

PUMPS, LUBRICANT AND OIL
Bowser, S. F., & Co., Ltd., Toronto.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Hepburn Ltd., John T., Toronto, Ont.

PUMPS, POWER
Bowser, S. F., & Co., Ltd., Toronto.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hepburn Ltd., John T., Toronto, Ont.

PUNCHES, CENTER
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

PUNCHES, HAND
Brown Boggs & Co., Ltd., Hamilton.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Jardine & Co., A. B., Hespeler, Ont.

PUNCHES, POWER
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

PUNCHING MACHINES, HORIZONTAL
Bertrams Ltd., Edinburgh, Scotland.

PYROMETERS, ELECTRIC
Bristol Co., Waterbury, Conn.
Flexible Shaft Co., Ltd., Toronto, Ont.
Taylor Instrument Co., Toronto, Ont.
Hiram Walker & Sons Metal Products Co., Walkerville, Ont.

RACKS, CUT
Hamilton Gear & Machine Co., Toronto.

RACKS, STORAGE
(See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ontario.

REAMER HOLDERS
Simonds Canada Saw Co., Montreal, Q.

REAMERS, ELECTRIC
U. S. Electrical Tool Co., Cincinnati, Ohio.

REAMERS, EXPANDING
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

REAMERS, SOLID
Butterfield & Co., Inc., Rock Island, Q.
Morse Twist Drill & Machine Co., New Bedford, Mass.

REAMERS, TAPER
Brown & Sharpe Mfg. Co., Providence, R. I.
Butterfield & Co., Inc., Rock Island, Q.
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canad, Ltd., Dundas, Ont.

RECORDERS, TEMPERATURE
Taylor Instrument Co., Rochester, N. Y.

RECORDERS, TIME
Gisholt Machine Co., Rochester, N. Y.
Taylor Instrument Co., Toronto, Ont.

REGULATORS, TEMPERATURE
Taylor Instrument Co., Toronto, Ont.

RIVETS AND BURRS
Parmenter & Bulloch Co., Gananoque, Ont.
Steel Co., of Canada, Ltd., Hamilton,

RIVET-MAKING MACHINERY
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio

BUYERS' DIRECTORY

RIVETING MACHINES
Can. Fairbanks-Morse Ltd., Montreal Q.
High Speed Hammer Co., Rochester, N.Y.
Parmenter & Bulloch Co., Gananoque Ont.

RUDDER FRAMES, STEEL
Can. Steel Foundries, Montreal, Que.

RUBBER MILL MACHINERY
Bertram Ltd., Edinburgh, Scotland.

RULES, STEEL AND WOOD
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Windsor, Ont.

RUST PREVENTATIVES
Oakley Chemical Co., New York, N. Y.

SAND EQUIPMENT
Can. Link-Belt Co., Toronto, Ont.

SAND RAMMERS, PNEUMATIC
Cleveland Pneumatic Tool Co., Toronto.

SAW FRAMES AND BLADES, HACK
Atkins & Co., Inc., E. C., Indianapolis.
Diamond Saw & Stamping Works, Buffalo, N. Y.
Rice Lewis & Sons, Ltd., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWING MACHINES, POWER HACK
Atkins & Co., Inc., E. C., Indianapolis.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

SAW SHARPENING MACHINES
Atkins & Co., Inc., E. C., Indianapolis.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

SAWS, CIRCULAR METAL
Atkins & Co., Inc., E. C., Indianapolis.
Pryibil Machine Co., New York, N. Y.
Gisholt Machine Co., Madison, Wis.

SAWS, HAND
Atkins & Co., Inc., E. C., Indianapolis
Simonds Canada Saw Co., Montreal, Q.

SAWS, HOT AND COLD
Atkins & Co., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Q.

SAWS, HIGH SPEED STEEL
Atkins & Co., Inc., E.C., Indianapolis, I.
Butterfield & Co. Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWS, METAL BAND
Atkins & Co., E. C., Indianapolis, I.

SAWS, METAL CUTTING
Brown & Sharpe Mfg. Co., Providence,
Butterfield & Co., Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.
Starrett Co., L. S., Athol, Mass.

SAWS, SCREW SLOTTING
Atkins & Co., Inc., E., C., Indianapolis.
Butterfield & Co., Inc., Rock Island, Q.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canda, Ltd., Dundas, Ont.

SAWS, SCREW SLOTTING
Atkins & Co., Inc., E. C., Indianapolis.
Butterfield & Co., Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWS, WOOD
E. C. Atkins & Co., Indianapolis, Ind.

SCALES
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Lufkin Rule Co., Windsor, Ont.

SCREENS
Dominion Engineering Works, Ltd., Montreal, Que.

SCREW DRIVERS, OPTICAL, JEWELRY AND NOVELTY
Strand & Co., N. A., Chicago, Ill.

SCREW MACHINE WORK
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Montreal, Que.

SCREW MACHINERY, WOOD AND LAG
Cook Co., Asa S., Hartford, Conn.

SCREW MACHINES
Brown & Sharpe Mfg. Co., Providence, Rhode Island.

SCREW MACHINES, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.

SCREW MACHINE PRODUCTS
National Acme Co., Montreal, Que.

SCREW PLATES
Butterfield & Co., Inc., Rock Island. Que.
Jardine & Co., A. B., Hespeler, Ont.

SCREWS, CAP AND SET
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

SCREWS, SAFETY, SET
Galt Machine Screw Co., Galt, Ont.

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SEPARATORS, MOISTURE AND OIL
Bowser, S. F., & Co., Ltd., Toronto, Canada.

SEPARATORS, OIL AND WASTE
Bowser, S. F., & Co., Ltd., Toronto.

SHAFTS, FLEXIBLE
Strand & Co., N. A., Chicago, Ill.

SHAFTING
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
Williams Machinery Co., A. R., Toronto.

SHAPES, COLD-DRAWN SPECIAL STEEL
Union Drawn Steel Co., Hamilton, Ont.

SHAPING MACHINES
Hendey Machine Co., Torrington, Conn.
Morton Mfg. Co., Muskegon, Mich.
Williams Machinery Co., A. R. Toronto.

SHEARS HAND
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

SHEARS, POWER
Bliss Co., E. W., Brooklyn, N. Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Stoll Co., Inc., D. H., Buffalo, N. Y
Williams Machinery Co., A. R., Toronto, Ont.

SHEARING MACHINES, ANGLE, IRON BAR AND GATE
Bertrams Ltd., Edinburgh, Scotland.

SHEET LEAD
Canada Metal Co., Ltd., Toronto, Ont.

SHEET METAL WORKING MACHINERY
Bliss Co., E. W., Brooklyn, N. Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Stoll Co., Inc., D. H, Buffalo, N.Y.

SHEETS, NICKEL, MONEL AND FIBRE
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.

SHEETS, O.P.C.R. & B. A. AND BLUE ANNEALED
Steel Co., of Canada, Ltd., Hamilton, Ont.

SIDE FRAMES, LOCOMOTIVE
Can. Steel Foundries, Montreal, Que.

SLOTTING ATTACHMENTS
Brown & Sharpe Mfg. Co., Providence, R.I.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

SLOTTING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.

SOLDERS
Canada Metal Co., Ltd., Toronto, Ont.

SPECIAL MACHINERY AND TOOLS
Brown Engineering Corp., Ltd., Toronto.
Gisholt Machine Co., Madison, Wis.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont
National Acme Co., Cleveland, O.

SPIKES, RAILWAY AND PRESSED
Steel Co of Canada, Ltd., Hamilton, Ont.

SPINNING LATHES
Prybil Machine Co., P., New York City.

SPRING, MILLED
Barnes & Co., Wallace, Hamilton, Ont.

SPRINGS, SMALL SPIRAL HELICAL, COMPRESSION, EXTENSION, TORSION AND SPECIAL
Barnes Company, Wallace, Hamilton.

SPRINGS
Barnes Company, Wallace, Hamilton.
Cleveland Wire Spring Co., Clevleand, O
Steele Ltd., James, Guelph, Ont.

SPRINGS, FLAT STEEL, BRUSH HOLDER, CLOCK, SMALL FLAT SPRINGS
Barnes Company, Wallace, Hamilton.

SPROCKETS AND CHAINS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Renold Hanson of Canada, Ltd., Montreal, Que.

SQUARES
Brown & Sharpe Mfg. Co., Providence, R.I.
Lufkin Rule Co., Windsor, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

STAMPING, METAL
American Pulley Co., Philadelphia, Pa.
Barnes Company, Wallace, Hamilton.
Diamond Saw & Stamping Works, Buffalo, N. Y.
Parmenter & Bulloch Co., Gananoque, Ont.

STAMPS, STEEL
Diamond Saw & Stamping Works, Buffalo, N. Y.

STEEL CONCRETE REINFORCEMENT
Steel Co. of Canada, Ltd., Hamilton.

STEEL PLATE
British Empire Steel Co., Montreal, Que

STEEL AND IRON BARS
Steel Co. of Canada, Ltd., Hamilton.

STEELS TOOL
British Empire Steel Co. Montreal Q.

STEEL, COLD-ROLLED STRIP
British Empire Steel Co., Montreal, Q.
Barnes Company, Wallace, Hamilton.

STEEL, CRUCIBLE, SPRING
Barnes, Company, Wallace, Hamilton
British Empire Steel Co., Montreal. Q

SHEETS, OPEN HEARTH STEEL
Steel Co., of Canada, Ltd., Hamilton

STEEL, SHAFTING AND FREE CUTTING SCREW
Union Drawn Steel Co., Hamilton, Ont

STEEL, SHEET
British Empire Steel Co., Montreal, Q.
Rice Lewis & Son, Ltd., Toronto, Ont.

STEEL, STAINLESS
Steel Co., of Can. Ltd., Hamilton, Ont.

STEEL STAIRS
Rodofson Elevator Works, Galt, Ont

STEELS, ALLOY AND CARBON
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Can Steel Foundries, Montreal, Que
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton Ont.

STEELS, HIGH-SPEED
Armstrong Bros. Tool Co., Chicago, Ill
Atkins & Co., Ltd., Wm., Sheffield, England.
British Empire Steel Co., Montreal, Q
Rice Lewis & Son, Ltd., Toronto, Ont
Steel Co., of Canada, Ltd., Hamilton

STEEL TUBING, CLOSE JOINT AND WELDED
Standard Tube & Fence Co., Ltd., Woodstock, Ont

STERN FRAMES, CAST STEEL
Can Steel Foundries, Montreal, Que

STRAIGHTENING MACHINERY
Bertram Ltd., Edinburgh, Scotland.
Williams & Co., Ltd., J. H., Brooklyn N.Y

STUDS
Galt Machine Screw Co., Galt, Ont.

STUD SETTERS, SELF OPENING
Geometric Tool Co., New Haven, Conn

SWAGING MACHINES
Atkins & Co., Inc., E. C., Indianapolis, Indiana

SWITCHES, RAILWAY
Can Steel Foundries, Montreal, Que

TACHOMETERS
Bristol Co., Waterbury, Conn.

TANKS AND PUMPS, OIL
Bowser, S. F., & Co., Ltd., Toronto.

TAP HOLDERS
Brown & Sharpe Mfg Co., Providence, R. I
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
William L. Procunier, Chicago, Ill.

TAPER PINS
Galt Machine Screw Co., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

TAPES, MEASURING
Starrett Co., L. S., Athol, Mass.
Lufkin, Rule Co., Windsor, Ont.

TAPPING MACHINES AND ATTACHMENTS
Burke Machine Tool Co., Conneaut, O
Geometric Tool Co., New Haven, Conn
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio
Wm. L. Procunier, Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

TAPS AND DIES
Butterfield & Co., Inc., Rock Island, Q.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont
Herbert, Limited, Alfred, Toronto Ont
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

TAPS, COLLAPSING
Geometric Tool Co., New Haven, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.

TEETH, DREDGE BUCKET
Kennedy & Sons, W., Owen Sound, Ont.

THERMOMETERS
Bristol Co., Waterbury, Conn.
Flexible Shaft Co., Ltd., Toronto Ont
Taylor Instrument Co., Toronto, Ont.
Greenfield Tap and Die Corp., Galt, Ontario.

THREAD-CUTTING TOOLS
Butterfield & Co., Inc., Rock Island, Q
Greenfield Tap and Die Corp., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

THREAD CUTTING MACHINES
Landis Machine Co., Inc., Waynesboro, Pa.

THREADING MACHINES
Acme Machinery Co., Cleveland, Ohio.
Geometric Tool Co., New Haven, Conn.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Williams Tool Corp., of Can. Ltd., Brantford, Ont.

THREAD LEAD TESTING MACHINES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

THREAD-ROLLING MACHINES
Bliss Co., E. W., Brooklyn, N. Y.

TIE PLATES
Steel Co. of Canada, Ltd., Hamilton.

TIME RECORDERS
International Business Machine Co., Ltd., Toronto, Ont.

TONGS
Hepburn Ltd., John T., Toronto, Ont

TOOL CASES
Rice Lewis & Son, Ltd., Toronto, Ont.

TOOL HOLDERS
Armstrong Bros., Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis
Bertrams Ltd., Edinburgh, Scotland.

TOOL POSTS, LATHE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Williams & Co., Ltd., J. H., Brooklyn, N.Y.

TOOLS, SMALL
(See Machinists' Small Tools)
Armstrong Bros. Tool Co., Chicago, Ill.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Lufkin Rule Co., Windsor, Ont.
National Machine Tool Co., Racine, Wis.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S. Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A.R., Toronto.

TOOL WORK
Brown Engineering Corp., Ltd., Toronto, Ontario.

TORCHES, BLOW
Rice Lewis & Son, Ltd., Toronto, Ont.

TRACKWORK, RAILWAY
Can. Steel Foundries, Montreal, Que

TRACKWORK, MANGANESE STEEL
Can. Steel Foundries, Montreal, Que.

TRANSMISSION MACHINERY
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound.
Renold, (Hans) of Canada, Ltd., Montreal, Que.

TROLLEYS AND TRAMWAYS
Can Link-Belt Co., Toronto, Ont.
Northern Crane Works, Walkerville, Ont
Wright Mfg. Co., Lisbon, Ohio.

TROLLEY WHEELS
Langley & Austin, Galt, Ont.

TROWELS, PLASTERING
E. C. Atkins & Co., Indianapolis, Ind.

WRENCHES, MACHINISTS'
Armstrong Bros. Tool Co., Chicago, Ill

TRUCKS
Can Fairbanks-Morse Ltd., Montreal, Q
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.

BUYERS' DIRECTORY

TUBING, SEAMLESS STEEL, BRASS AND COPPER AND FIBRE
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.

TURRET HEADS
Bertram & Son Co., Ltd., The John Dundas, Ont.

TURRET MACHINES
(See Lathes, Horizontal Turret)
Acme Machine Tool Co., Cincinnati, O.
Cook Co., Asa S., Hartford, Conn.
Gisholt Machine Co. Madison Wis.
Herbert, Limited, Alfred, Toronto, Ont.
National Acme Co. Cleveland O.
Pratt & Whitney Co. of Canada Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin

TURRETS, TOOL POST
Gisholt Machine Co. Madison, Wis.

UNIONS, PIPE
Fittings, Limited, Oshawa, Ont.

VALVES
Canada Metal Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Mon-
Dominion Engineering Works, Limited, Montreal, Que.

VISES, DRILLING MACHINE
Burke Machine Tool Co., Conneaut, Ohio.
Charles Parker Co., Meriden, Conn.
Cleveland Pneumatic Tool Co., Toronto, Ontario.
Kempsmith Mfg Co., Milwaukee, Wis.

VISES, PIPE
Charles Parker Co., Meriden, Conn.

VISES, PLANER AND SHAPER
Bertram & Son Co., Ltd., The John Dundas, Ont.
Philip Gies Foundry, Kitchener, Ont.
Hendley Machine Co., Torrington, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.

VISES, WOOD WORKERS'
Charles Parker Co., Meriden, Conn.
Parmenter & Bulloch Co., Gananoque, Ontario.

VOLTMETERS
Bristol Co., Waterbury, Conn.

WAGON LEADERS
Can. Link-Belt Co., Toronto, Ont.

WASHERS, LOCK, SPLIT AND SPRING
Barnes Company, Wallace, Hamilton.

WATER POWER PLANTS
Dominion Engineering Works, Limited, Montreal, Que.

WELDING APPARATUS, OXY-ACETYLENE
L'Air Liquide Society, Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto, Ont.

WELDING APPARATUS
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.

WELDING, ELECTRIC, ARC, SPOT AND BUTT
International Malleable Iron Co., Guelph, Ont.

WELDING MACHINES, OXY-ACETYLENE
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.

WELDING, ELECTRIC
McLaren Belting Co., J. C., Montreal, Que.
Steel Co. of Canada, Ltd., Hamilton.

WELDING ROD, TOBIN, MANGANESE, BRONZE AND ALUMINUM
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto, Ont.

WELDING SUPPLIES
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.

WHEELS, INDUSTRIAL
American Pulley Co., Philadelphia, Pa
Hull Iron & Steel Foundries, Hull, Que.
Kennedy & Sons, Wm., Owen Sound, Ontario.

WINCHES, HEADGATE
Kennedy & Sons, Wm. Owen Sound, Ontario.

WINCHES, STOPLOG
Kennedy & Sons, Wm., Owen Sound, Ontario.

IPING PRODUCTS
Sanitary Wiping Products Co., Toronto, Ont.

WIRE
Barnes Company, Wallace, Hamilton.
Canada Metal Co., Ltd., Toronto, Ont
Dennis Wire & Iron Works, London, Ontario.
Greening Wire Co., B., Hamilton, Ont
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

WIRE, BLACK TEMPERED, MUSIC PHOSPHOR BRONZE AND PREMIER
Barnes Company, Wallace, Hamilton

WIRE, COPPER AND BRASS, FINE AND HEAVY
Steel Co., of Canada, Ltd., Hamilton Ontario.

WIRE STRAIGHTENING AND CUTTING MACHINERY
Brown, Boggs & Co., Ltd., Hamilton, Ontario.

WIRE, WELDING
L'Air Liquide Society, Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.

WIRES, SPECIAL
Dennis Wire & Iron Works, London, Ontario.
Greening Wire Co., B., Hamilton, Ont

WOODWORKING MACHINERY
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Williams Machinery Co., A. R., Toronto, Ontario.

WRENCHES, DROP FORGED
Armstrong Bros. Tool Co., Chicago, Ill
Canada Foundries & Forgings Co., Welland, Ont.

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MACHINE TOOLS, ETC.

Bertram & Sons, Ltd., John, Dundas, Ont.
The Canadian Fairbanks-Morse Co., Montreal, Que.
Garlock Machinery Ltd., Toronto.
Herbert Ltd., Alfred, Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

SHOP and FACTORY SUPPLIES

The Canadian Fairbanks-Morse Co., Montreal, Que.

Garlock Machinery Ltd., Toronto.
Herbert Ltd., Alfred, Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

POWER EQUIPMENT, ETC.

The Canadian Fairbanks-Morse Co., Montreal, Que.
Herbert Ltd., Alfred, Toronto, Ont.

WOODWORKING MACHINERY

The Canadian Fairbanks-Morse Co., Montreal, Que.

Garlock Machinery Ltd., Toronto.
Herbert Ltd., Alfred, Toronto, Ont.

A. R. Williams Machinery Co. Toronto, Ont.

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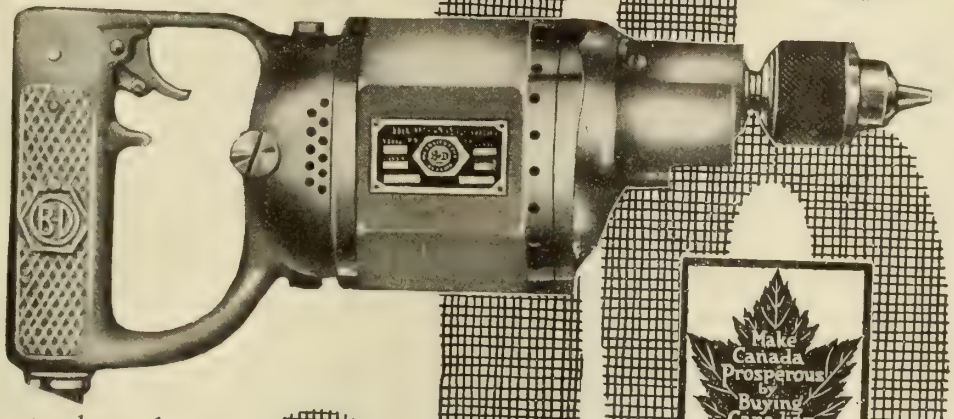
¼ inch PORTABLE ELECTRIC DRILL

"With the Pistol Grip and Trigger Switch"

Price reduced to
$36.00
was $49.00



Owing to the large demand for the Black & Decker Quarter-Inch Portable Electric Drill our production on this unit this year has been practically trebled. This has enabled us to reduce our manufacturing costs, and in accordance with our established policy we are passing the saving on to you.

This is the standard Black & Decker Quarter-Inch Drill, exactly the same as has previously been sold for $49.00 except that it has been improved by the addition of a geared-nut chuck instead of a hand operated chuck.

A new folder describing this unit in detail, INCLUDING SPECIFICATIONS, is yours for the asking.

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A. J. HOPKINS, Manager

"The Well-Equipped Shop Gets the Business"

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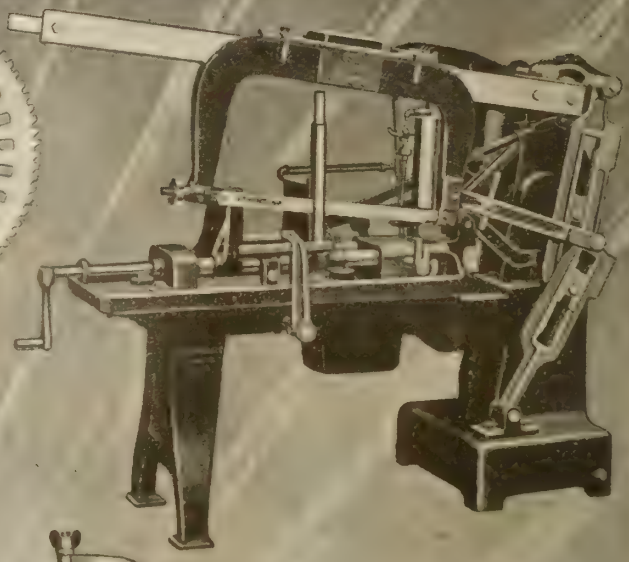


O'er Land and Sea
North South East West

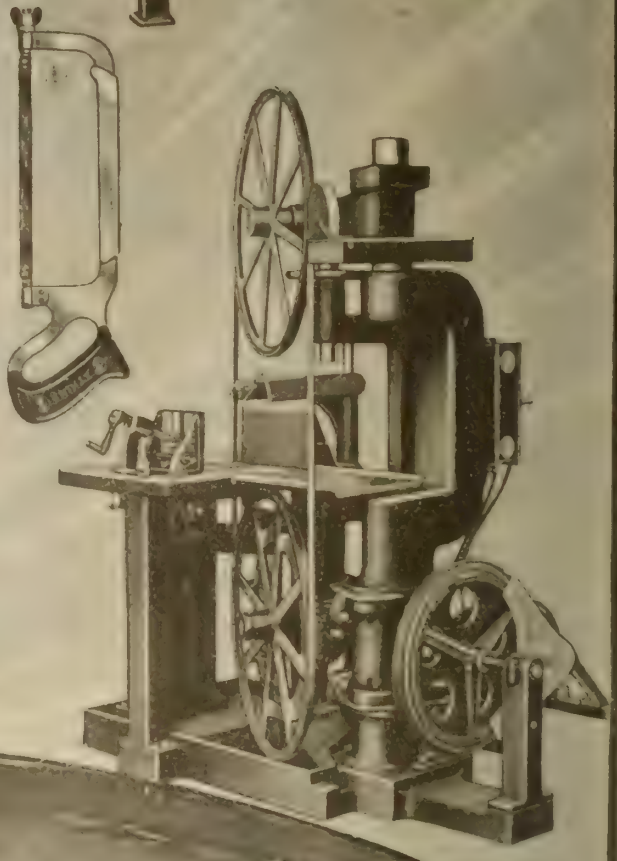
Atkins Sterling Quality Saws

are noted for their efficiency. Their use will increase your production.

Ask for new literature describing Atkins Kwik Kut Power Hack Saw and Metal Cutting Band Saw Machines, Circular Metal Cutting Saws, AAA Hack Saw Blades and Frames, etc.

"A Better Saw For Every Use"

Write for Catalog



E. C. Atkins & Co.

Established 1857

"The Sterling Quality Saw People"

Factory: HAMILTON, ONT.

Branch: VANCOUVER, B. C.

CANADIAN MACHINERY AND MANUFACTURING NEWS

Vol. XXVIII. No. 24 | Published Weekly by the MacLean Publishing Company, Limited, Toronto, Ont. | Dec. 14, 1922 | $4.00 a Year Subscription Price

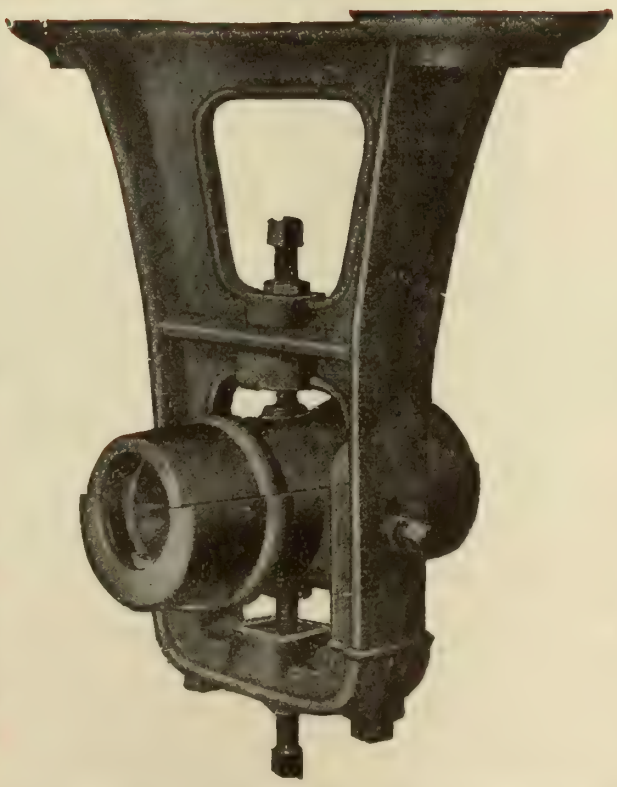
READ AND PASS TO	Check	See Page	READ AND PASS TO	Check	See Page

Bond

Our Universal Four-Point Adjustment Hanger frames will accommodate
Bond Ro. Babbitted Bearings
Bond Roller Bearings and
Bond Ball Bearing Hanger Boxes
(latter equipped with SKF Ball Bearings)

Ball Bearing Loose Pulleys

These are also equipped with SKF Ball Bearings and are guaranteed to operate at any speed. Supplied in any combination of sizes for all Loose Ball Bearing Countershafts.



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Pillow Blocks
Shaft Couplings
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Ro. Drop Hangers and all
Power Transmitting Appliances.

Our Engineering Dept. will gladly give any assistance on your transmission problems.

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& Company Limited.

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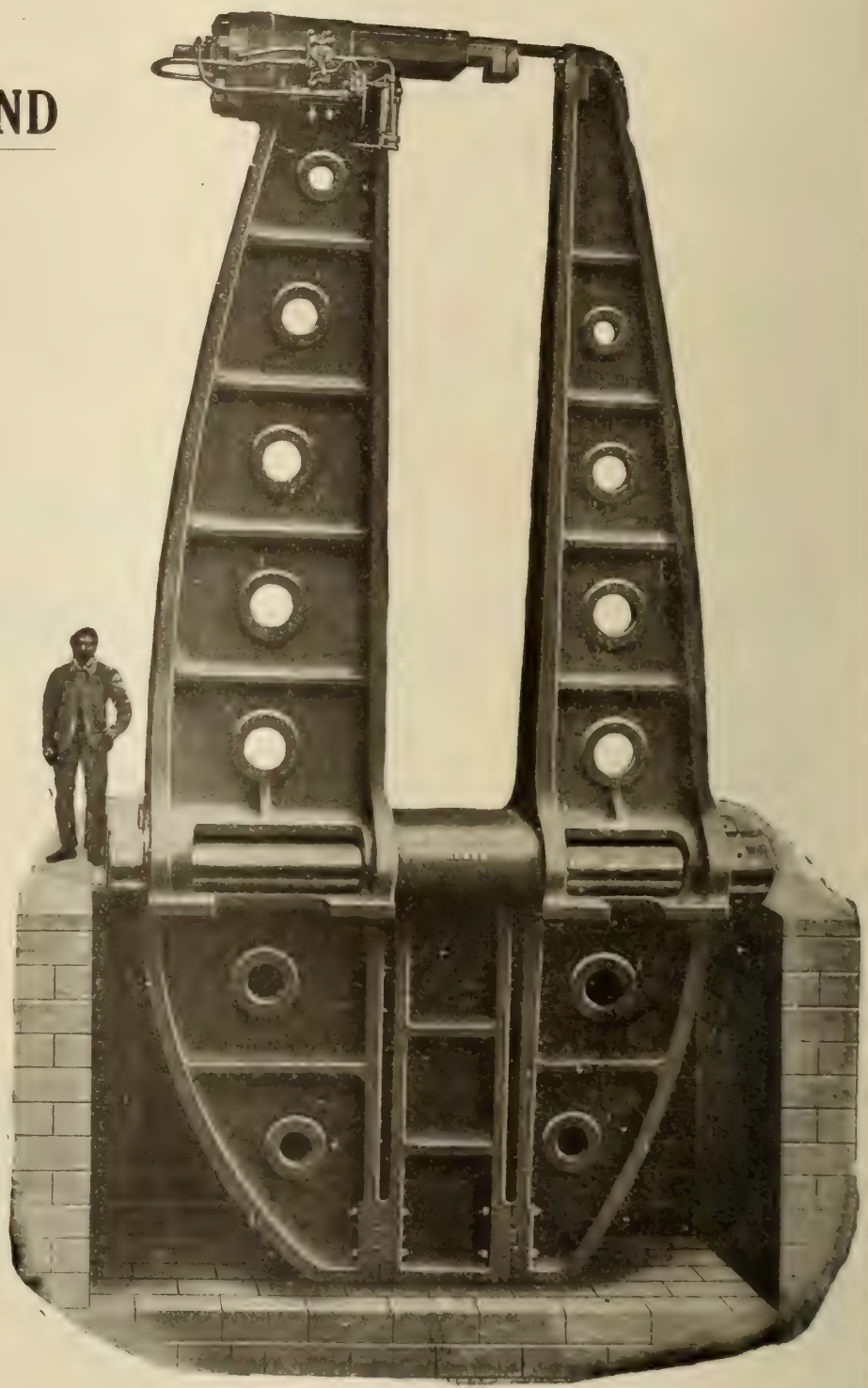
ENGINEERING
-:- SPECIALISTS

Makers of
EXCAVATORS

SHIPYARD PLANT

PLANT for STEELWORKS
and
RAILWAY SHOPS



17'6" gap Fixed Hydraulic Rivetting Machine

3 Powers—33, 67 and 100 Tons.

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We make these three right.

1. Exacting analysis of the physical and chemical properties of our steel insures a uniform product.
2. Intelligent workmanship constantly striving to produce the better tool yields the Pratt & Whitney quality.
3. Rigid inspection of the work in process and of the finished product guarantees tools for longest service.

The finished product must be right

PRATT & WHITNEY

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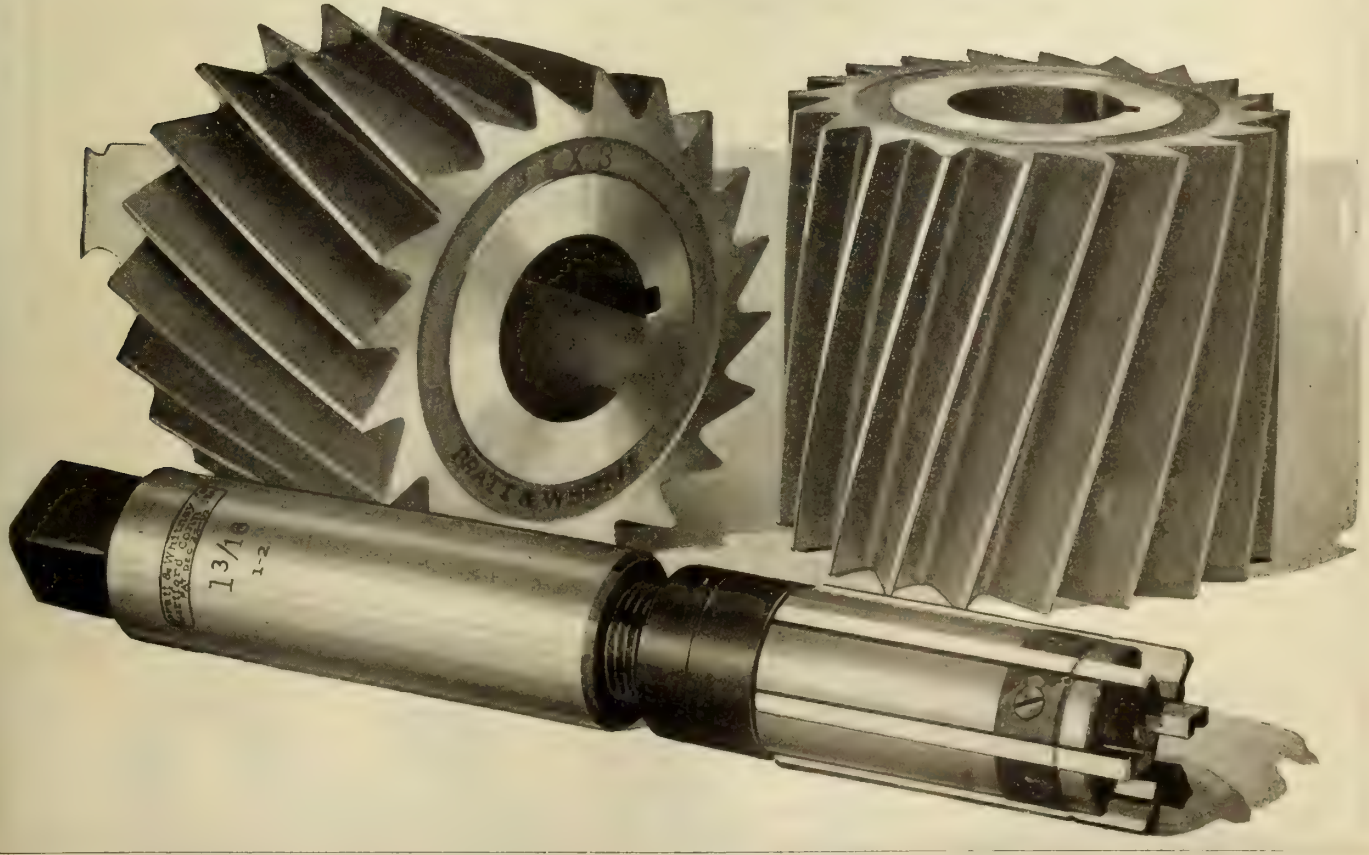
PRATT & WHITNEY COMPANY

Small Tool Works—Hartford, Conn.

General Offices : 111 Broadway, New York



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THE "RED RIBBON" BELTING
Benefits Your Plant by

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TELEPHONE or telegraph to the nearest Oakite Service Man. He will come—quickly—armed with a 14-year experience on all kinds of cleaning jobs in all kind of plants. And he will clear up the situation just as effectively as an Oakite Service Man helped this wrench plant out of trouble.

Production was at a standstill. They could not get their wrenches clean enough so that the japan would stick. The wrenches were piling up all over the shop.

In desperation they used a japan "thinner," and managed to sufficiently remove the burned-on quenching oil so they could put through a few wrenches. But this method was too impractical and costly.

Production

has stopped in some plants when their cleaning department fell down. Oakite cleaning methods have pulled many plants out of a bad fix.

The superintendent had heard of an Oakite Service Man getting a neighboring plant out of much the same sort of a jam, so put in a hurry call for him.

With no change in equipment, and by swinging over to Oakite cleaning materials, the wrenches immediately started coming through with a surface so clean that the japan takes perfectly.

There are many tough cleaning jobs that are to-day running along smoothly because Oakite materials are used. If you are getting rejects in your shop after japanning or plating, stage a competitive test between Oakite materials and whatever you are using. If you can't clean your work better, faster, and for less money with Oakite, it won't cost you a cent.

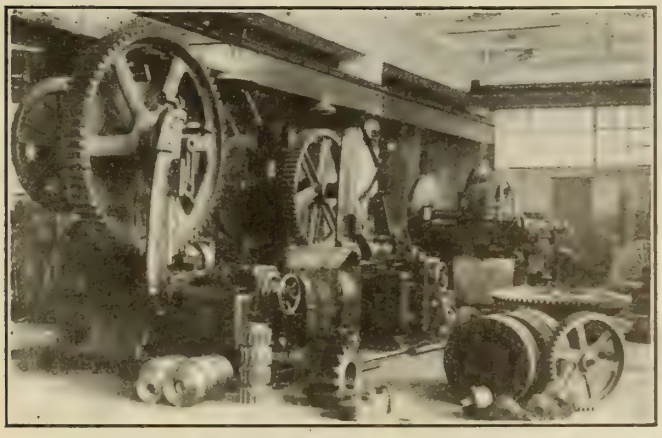
Ask one of our experienced Service Men to call. There is no obligation.

Resident Canadian Representatives: Mr. C. P. Murphy, Toronto, and Mr. C. Burgin, Montreal.

OAKITE

MANUFACTURED BY OAKLEY CHEMICAL CO. 44 THAMES ST. NEWYORK

Cut Gears of all Kinds



Let us be Your Gear Shop

Gear Data for Your Note Book

Cut this out--more coming later.

Capacities of Machines
at Hamilton Gear & Machine Co., Toronto

Spur Gears up to	91	ins. diam.
Internal Gears	26½	ins. diam.
Bevel Gears	62	ins. diam.
Worm Wheels	52	ins. diam.
Helical Spiral or Double Helical	51	ins. diam.
Racks	25	ft. long
or, by reversing,	45	ft. long

Write for Quotations

Hamilton Gear & Machine Co.

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8% or 1% on Files?

Money that is bringing low returns on an investment you withdraw and re-invest.

Why not do the same with files?

A file that is slightly dull is a low dividend earner. Scrap it, and buy a new file that bites clean and deep at every stroke. It is a better investment.

Make this a rule. And to make sure of long service before that first dullness comes, specify one of these standard brands:

KEARNEY & FOOT
GREAT WESTERN
AMERICAN
ARCADE
GLOBE

Standard for over Fifty Years

Made in Canada by

Nicholson File Company

PORT HOPE - ONTARIO

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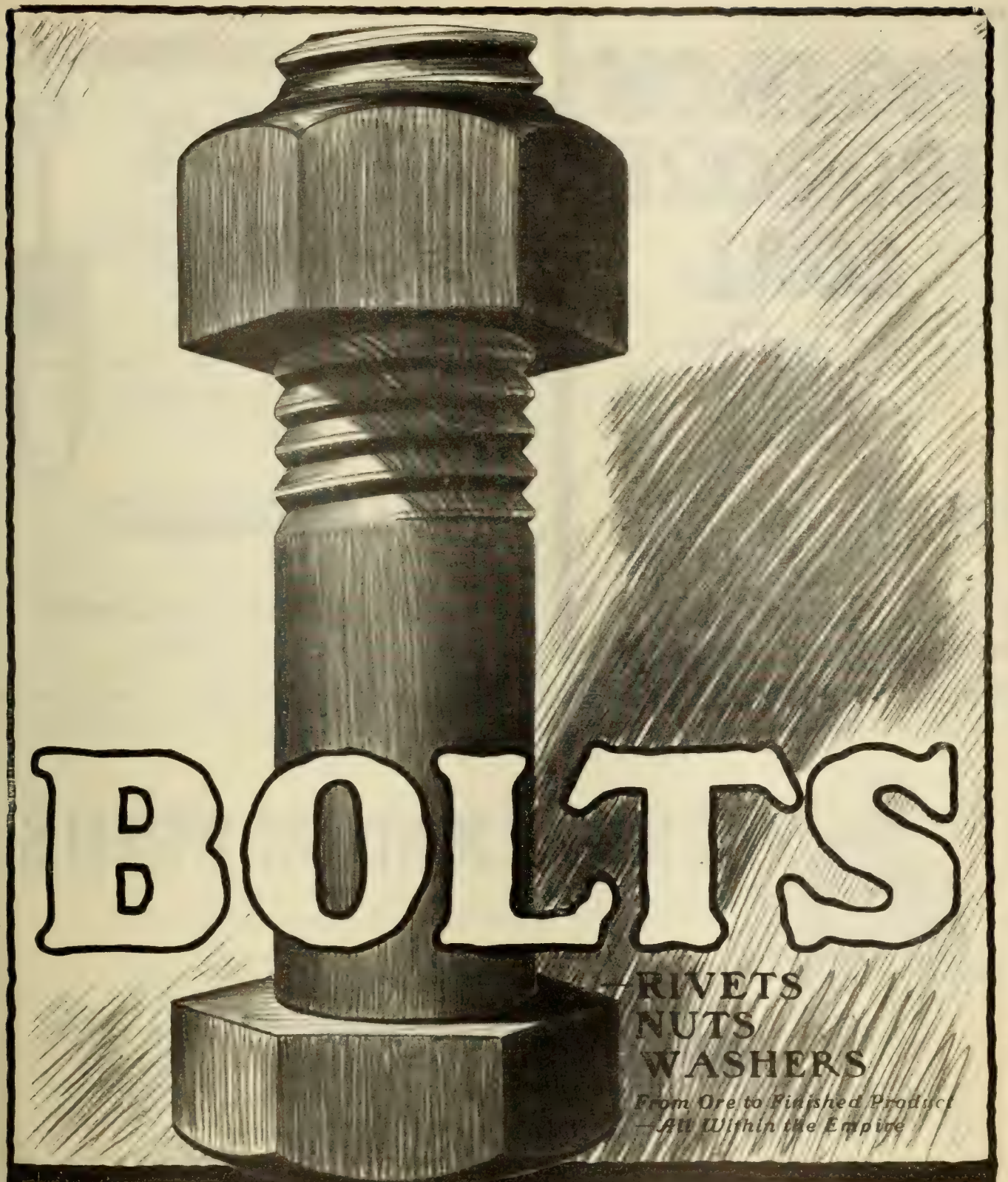

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NUTS
WASHERS

From Ore to Finished Product
—All Within the Empire

All sizes and shapes for every purpose, including machine and carriage bolts and nuts (*square or hexagonal*), with rolled or cut thread; track bolts and nuts (*square or hexagonal*).

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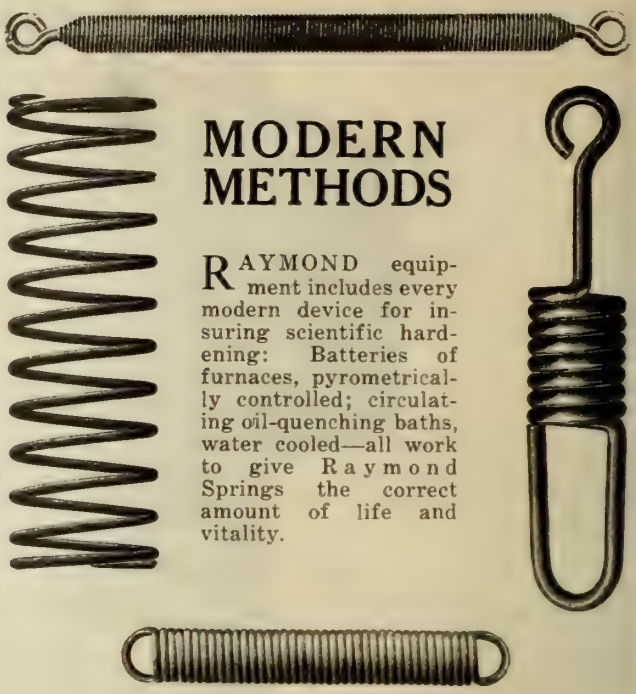

MODERN METHODS

RAYMOND equipment includes every modern device for insuring scientific hardening: Batteries of furnaces, pyrometrically controlled; circulating oil-quenching baths, water cooled—all work to give Raymond Springs the correct amount of life and vitality.

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"LION" GRINDING WHEELS

LION GRINDING WHEELS LIMITED CANADA TRADE MARK

MANUFACTURERS OF HIGH GRADE GRINDING WHEELS

ALU-LION

For Grinding High Tensile Material

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For Grinding Low Tensile Material

The Wheels You Will Eventually Buy. Why Not Now?

LION GRINDING WHEELS Ltd.

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Agents for Prov. Quebec
J. R. Baxter & Co., Ltd.
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For Making
Perfect
Screw-Thread Joints

SMOOTH-ON

ELASTIC CEMENT NO. 3

A screw-thread joint made with Smooth-On Elastic Cement No. 3, will not leak, because the Smooth-On expands in metallizing and so closes up any defective places which otherwise would cause leaks; yet, the joint may be taken apart when desired.

Smooth-On Elastic Cement No. 3, is sold ready for use in paste form. It is applied to the screw-threads with a brush. Especially useful for high pressure steam or water joints, for ammonia joints, for coating flanged joint faces and for coating gaskets.

Send for our NEW Small Size Instruction Book No. 19. It illustrates and describes how to make perfect screw-thread joints and hundreds of other repairs. You will marvel at its contents. The book is FREE.
Smooth-On Elastic Cement No. 3 comes in 5 lb., 10 lb., and 25 lb. tins. Also in larger sizes.

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CLEAN and SOUND

Whenever you require castings of any kind—malleable iron, grey iron, steel, aluminum, brass and bronze—order Kennedy Castings. They are guaranteed thoroughly dependable.

Special machinery built to engineers' drawings and specifications.

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The proof of the pudding

We have unceasingly claimed in our advertising that **Diamond Fibre** "increases production and decreases production costs."

Listen to what the manager of the Knit-to-fit Manufacturing Co., Ltd., of Montreal, has to say about **Diamond Fibre.**

"It has helped us to make our Truck System a success for efficiency and economy in production."

We are naturally gratified at this acknowledgement of the help that Diamond Fibre has afforded to one of Canada's largest manufacturers and we are anxious to have you prove it out for your business.

Diamond-F

Diamond Fibre is supplied in sheets, rods and tubes, fish paper or in parts machined to your specifications.

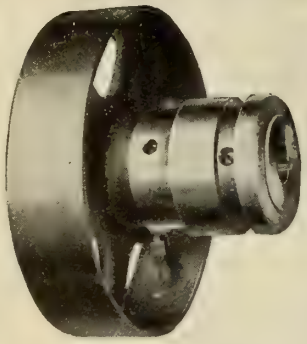
DIAMOND FIBRE is incontestably superior for receptacles of all kinds, insulation noiseless gears, pinions, bushings, washers, handles and in every case where great strength and toughness combined with light weight and easy machinability are all important.

DIAMOND STATE FIBRE COMPANY of CANADA Ltd.
TORONTO, ONT.

THE JOHNSON FRICTION CLUTCH

AS USED ON THE

"NEW" 24" SPRINGFIELD GEARED-HEAD ENGINE LATHE



Single Clutch With Pulley.

A No. 10 single clutch is placed in the main drive pulley.

Springfield people say: "The lathe can be instantly stopped by means of friction drag, which is quite an advantage."

The sliding sleeve of clutch is beveled off to act as a brake to stop machine instantly.

We specialize in applying clutches to machinery of all kinds.

Send us data covering your requirements.

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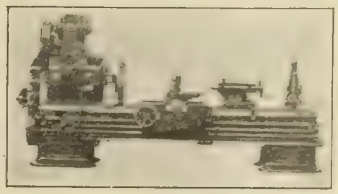

Courtesy: Springfield Machine Tool Co., Springfield, Ohio.

THE CARLYLE JOHNSON MACHINE CO. MANCHESTER, CONN.

THE PRESCOTT PAT. APR. 10, 1883 PRESCOTT EMERY WHEEL CO. LTD.

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There's a **PRESCOTT WHEEL** *for every purpose*

Est. 187

MADE of the very best abrasives, carefully graded and requiring very little dressing, Prescott Grinding Wheels have earned a well-merited reputation for efficiency and economy. An absolutely uniform service makes them unsurpassed for all iron and steel grinding.

There's a Prescott Wheel to meet every grinding requirement—let our engineers advise on yours.

MADE IN CANADA

PRESCOTT EMERY WHEEL CO.

LIMITED

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HEAVY FORGINGS

Ship Forgings Car Axles
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FORGED SHAFTINGS

Up to
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Send Blue Prints for Prices
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Hand Operated
For Chucking and Bar Work
AUTOMATIC TURRET LATHES
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VERTICAL BORING and TURNING MILLS
UNIVERSAL TOOL GRINDERS
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BORING BARS
With Adjustable Cutters
PERIODOGRAPH
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Separate Catalogs on each Product
Send for the ones you want

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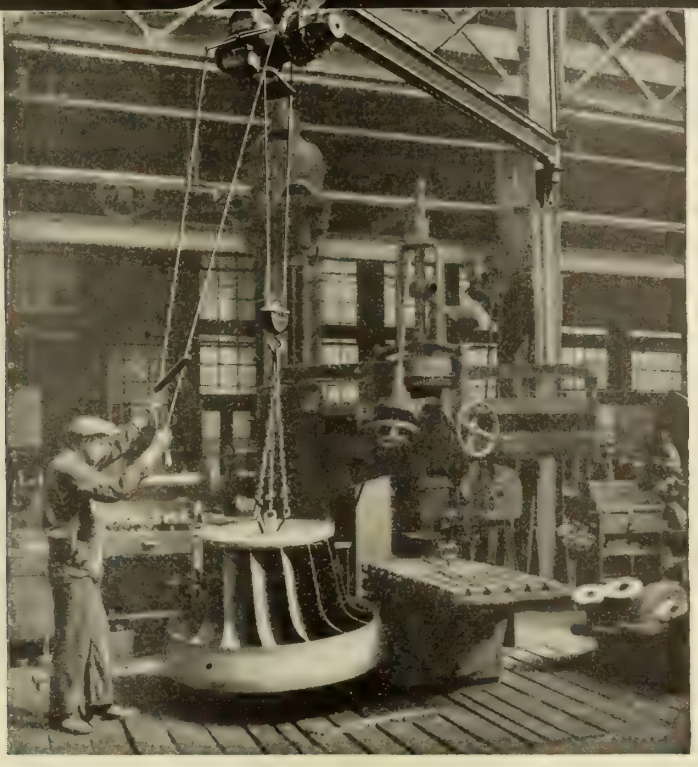
THE SHEPARD ELECTRIC

LIFTABOUT



He waives assistance

GIVE a man a *LiftAbout* and he can handle heavy pieces unassisted. He need not send out an "S.O.S." to fellow workmen, and take them from their work.

Machining operations are speeded, and a machinist can proceed steadily and efficiently with his work. Parts and pieces may be accurately mounted for machining operations, for a *LiftAbout* is sure and precise in control.

A *LiftAbout* quickly pays for itself. It provides *good, ever-available* hoisting service at a remarkably low cost.

Has same features of design and construction that have made "Shepards" the most widely used hoists in America. Send for illustrated bulletin.

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ELECTRIC CRANE & HOIST CO.
426 Schuyler Ave., Montour Falls, N.Y.

BRANCHES IN PRINCIPAL CITIES
Member Electric Hoist Mfrs. Assn.

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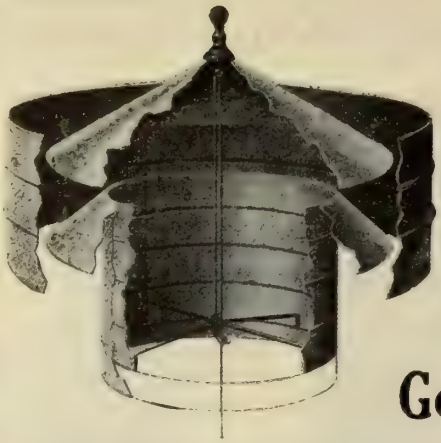
SHEPARD
ELECTRIC CRANES & HOISTS

If what you need is not advertised, consult our Buyers' Directory and write advertisers listed under proper heading.



Increase Your Production

Impure air lessens the working ability of your employees—retards production.

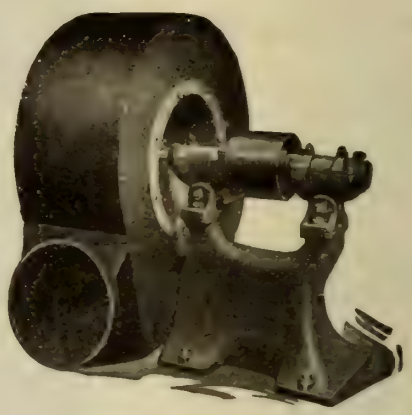
Remove all foul odors—gases and vapors. Give your staff plenty of good fresh air and you'll quickly note the difference in your profits.

Let REED Engineers and "Burt" Ventilators make your plant a greater producer. We will gladly submit our proposals without any obligation on your part.

Geo. W. Reed & Co. Limited, Montreal

"CANADIAN" MILL EXHAUSTERS

Handle Any Material



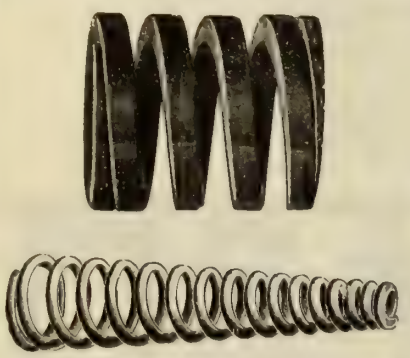
The Canadian Standard Mill Exhauster will handle any kind of material efficiently—sawdust, shavings, cotton lint, or stringy material, gases, fumes, smoke, etc.

They are adjustable to any angle of discharge instantly—have universal type of wheel and carefully constructed, self-aligning oil-ring bearings.

Catalog 410-77—gives technical data and prices. Write for a copy.

Canadian Blower & Forge Co., Ltd.

KITCHENER, ONT.



THE WALLACE BARNES CO. LIMITED
WIRE
BARNES CANADIAN SPRINGS
STEEL
HAMILTON, ONTARIO
CANADA

PRECISION SPRINGS OF HIGHEST GRADE

--FOR--

ENGINES, VALVES, DIES, AND SPECIAL MACHINERY

ALSO SPECIAL DESIGNS AND TYPES

If interested tear out this page and place with letters to be answered.

the basis of hack saw economy

No. 1
COMPOSITION OF BLADE

Any discussion of the merits of a hack saw leads straight to the first step in its manufacture—the composition of the blade itself. Here the maker is confronted with a situation which at best is a difficult one. Briefly, it is this. One metal, to successfully cut another, must be considerably harder than the opposing metal. Yet as the hardness increases—so does the brittleness, and a hack saw blade that is excessively brittle will not stand up in actual service.

Repeated tests have shown that the best grade of hack saw steel, such as is used in Starrett Hack Saws, contains approximately 0.90% carbon content, 1.25% tungsten and about 0.25% each of manganese, chromium and vanadium. The percentage of carbon gives a hard blade with great cutting speed, while tungsten adds to the blade the ductile strength necessary for satisfactory wear under the hardest usage.

Good Hack Saw Steel should contain approximately:	
Carbon	0.90%
Tungsten	1.25%
Manganese	0.25%
Chromium	0.25%
Vanadium	0.25%

The other elements mostly affect the depth to which the hardening penetrates through and beyond the teeth of the blade.

Heat Treatment and Tempering

Heat treatment adds a great deal to the efficiency of a hack saw blade. The heat treatment of each Starrett Hack Saw gives the exact quality that best suits the conditions under which it is to be used.

Naturally the degree of temper varies with the material to be cut, but a uniformly tempered blade is always hard and tough and has a surface that will not shell off.

Effect of Abuse

More saws break than wear out. Using a hard tempered blade for metals which should be cut by a soft blade is probably the most common cause of breakage that exists. On the other hand a soft blade similarly misused dulls rapidly and wastes the workman's time.

Knowing vs. Guessing

The one sure way to cut different metals and shapes *economically* is to use blades of recognized high quality and use each hand or power hack saw blade on the metal it will cut best. The L. S. Starrett Co., makers of unexcelled Hack Saws, has prepared a chart which makes proper blade selection a *certainty*. It shows at a glance just what blade to use for cutting any metal and shape. Its use eliminates the most common cause of breakage and will help you reduce cutting costs by reducing to a minimum the cost of every cut. The L. S. Starrett Co. will send copies of this Hack Saw Chart free on request to any user of hand or power hack saws.

THE L. S. STARRETT CO.

The World's Greatest Toolmakers
Manufacturers of Hacksaws Unexcelled
ATHOL, MASS.

THE BASIS:

1 Composition of blade
2 Design of blade
3 Material to be cut
4 Lubrication
5 Pressure
6 Speed
7 Number of cuts for blade
8 Cost per cut

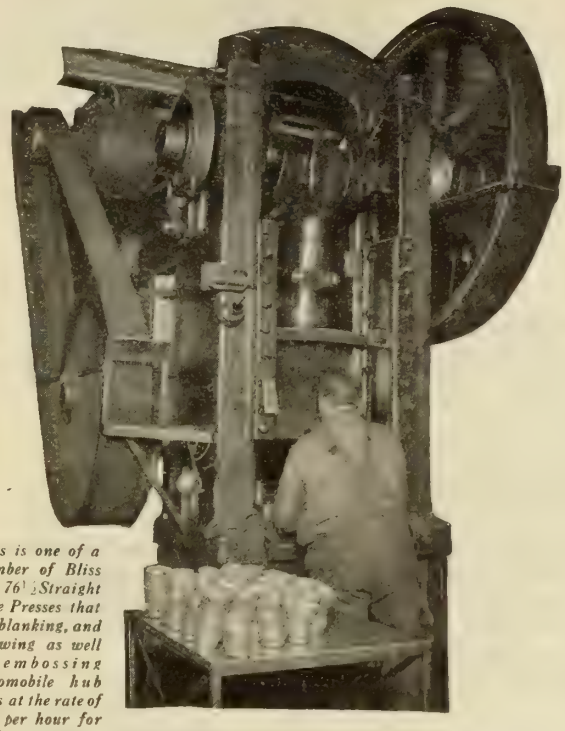
42-444

Starrett Hack Saws

Write for Catalog No. 22 "3" and Supplement describing the new Starrett Tools.

Sheet-Metal Embossing—

a job for a Bliss Press



This is one of a number of Bliss No. 76½ Straight Side Presses that are blanking, and drawing as well as embossing automobile hub caps at the rate of 900 per hour for each operation.

—Bliss for Machinery—

Whether you wish to emboss a tiny trade-mark on a delicate mechanism or a large and complicated design on a heavy sheet-metal part, it can be done rapidly and accurately with a BLISS Press. We have specialized on work of this nature for 65 years and our experience is sure to be helpful to you. If you are embossing, stamping, trimming, or punching sheet-metal parts, let us check your operations. We may be able to point the way to unexpected possibilities for saving.

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No. 347

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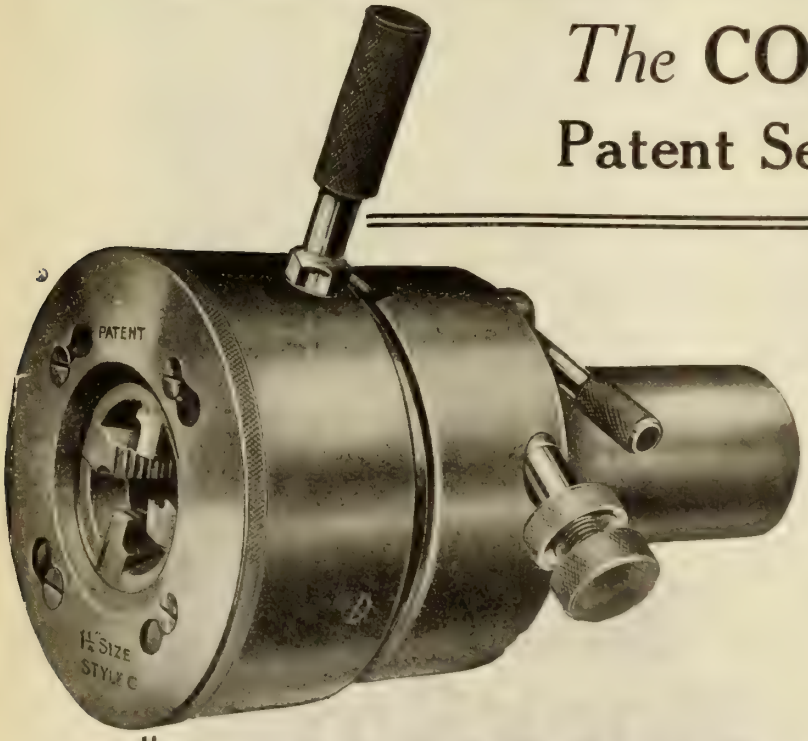

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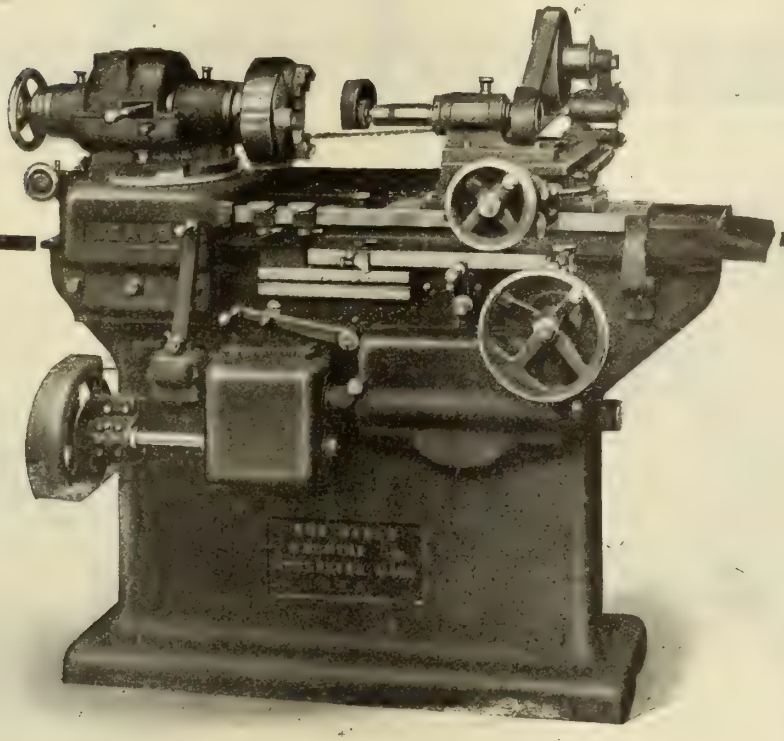

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It is as rigid and massive a machine as can be built, with the iron properly distributed to absorb any vibration. Instantaneous changes of speeds and feeds, together with centralized control of all the levers give the operator every opportunity for finish and production.

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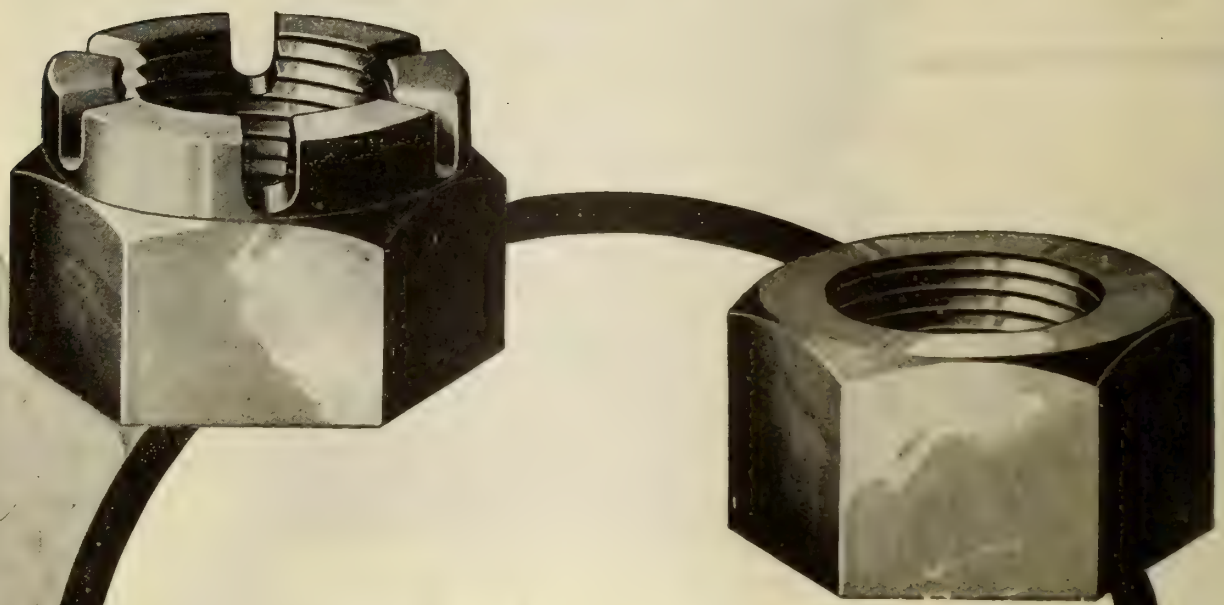
51 New Bond St., WORCESTER, MASS.

Namco Nuts

Standard or Special



Standard

Plain and Castellated S.A.E. Nuts
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Special

Screw Machine Product up to 2¼" diameter —to specifications.

Special Product Hardened and Ground to specifications.

THE NATIONAL ACME COMPANY

MONTREAL, QUE.

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CANADIAN MACHINERY
AND
MANUFACTURING NEWS

VOL. NO. XXVIII, No. 24. DECEMBER 14, 1922

Assembling Parts By Pressure At The Bench

When the Hammer May be Used to Advantage—Steady Pressure Best for Accuracy—Special Fixtures for Locating to Exact Position—Means of Supporting the Work

By FRED HORNER

THE hammer as an instrument for putting together or dismantling tight-fitting parts now holds a secondary place alongside the alternative of forcing by screw or lever pressure. This is particularly so in cases where injury or distortion of the piece must be avoided. In mere breaking-up processes the thing is to do the job in the shortest time, and blows or pressure are used indifferently, according to which gives the quicker results. Frequently a few smart blows will start a hard fit or rusted joint immediately, and here discretion must be exercised, if hammering can be safely done. In considering the small class of forcing that is practicable on the bench, we are faced with the choice of three methods—the vise, the arbor press, and screws or bolts. Each has a sphere of its own. The vise is very powerful, but slow, and owing to the vertical attitude of the jaws, some articles (with their packings which may be necessary,) are awkward to keep in position. The arbor press offers the advantage of a horizontal surface, and is much quicker in operation. It also provides a greater amount of "daylight" than the vise, and freedom below for the projection of shafts. The bolt method generally comes in for situations where neither of the other appliances are available, owing to the conformation of the work, or because it is partly assembled. And, of course, away from the shop, bolts may play a much more important part, as there might not be any convenient alternative.

Use of the Vise

In the vise, the usual objects dealt with are rods, plates, wheels, gears, etc. that require to have pins or bushings forced into or out of them. The chief aim lies in taking the pressure against the piece in such a manner that distortion, or risk of fracture are not likely. Pressure must be preferably localised around the area of the hole where the pin or bush fits, and not allowed to reach to a rim or other distant part. Risks of the sort just mentioned are thus eliminated, and the pressing becomes more effective. Danger of marking finished surfaces exists, from the serrations on the jaws, and so the packing at the back serves a double purpose. Fig. 1 shows the ordinary disposition of the parts, including packings, for pressing in a bush, and Fig. 2 a plan of the opposite condition, that of extraction. Rear packings (or a tube) with clearance are likewise necessary if a pin or bush requires to be pushed into a rod so as to hang out, instead of lying flush. The assembling of parts such as strips or discs with two or more pins concerned sometimes involves the preparation of a special pad or die to effect an even pressure all over the surface, and at the same time clearing the pins.

Special Pad or Die

Fig. 3 gives such a rig-up where three or four pins have first to be pressed into the bottom plate (A) and then plate B pushed down to a certain distance. The pressing plate, C, enables this to be done accurately, the distance between the plates being ascertained by a gauge or other means. Tube packings of small diameter are useful for taking the pressure at the back of an awkwardly-formed article, liable to tilt more or less out of truth when merely resting against the jaw. The tube just surrounds the hole where the pin is forced in, or rests on an equivalent area, so that the resistance comes in exact line with the direction of forcing. An encircling tube offers advantages for some sorts of pressing, in which close contact

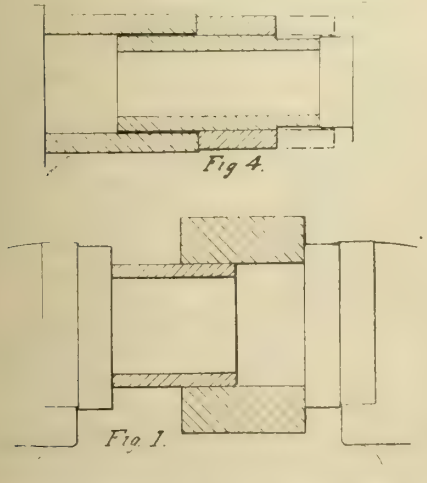
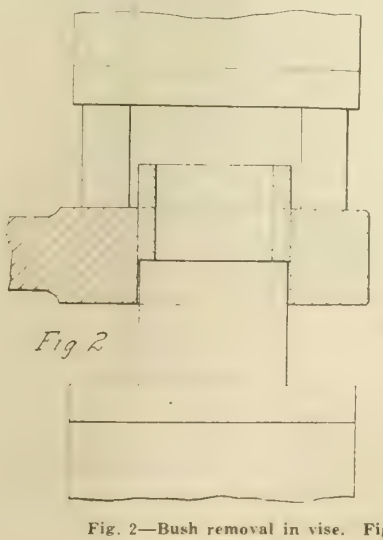


Fig 4—Thrusting bush from ferrule. Fig. 1—Ordinary method of forcing in vise.



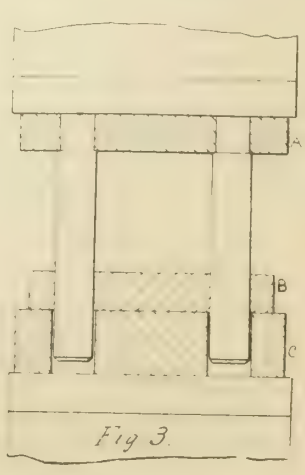


Fig. 2—Bush removal in vise. Fig. 3—Pushing plate down over pins.

without risk of slip precludes the use of separate strip packings. This is evident from Fig. 4, illustrating the pushing off of a ferrule from a bush. A similar arrangement suits for forcing on, with the difference that a reduced support such as drawn at the end would not be necessary. If pressing on to an exact distance, not evidenced by the presence of a shoulder as a guide, is wanted, such distance from the end of the work can be controlled by making the forcing ring of suitable length, so that when the ferrule has been thrust far enough, the vise jaw will come into contact with the end of the work.

Accurate Locating

Besides the limitations imposed on length between the vise jaws, there is also the disadvantage that wheels and other specimens extending out some way from a shaft cannot be got into the vise for forcing, hence the arbor press is preferable in regard to these two points. Methods of ensuring a definite degree of projection depend upon the number of articles to be done. For one, or a small number, the mode of actual measurement of work is sufficient. For batches of pieces, the ram may be fitted with a strongly-clamped ring encircling it above the bearing, and adjusted after the first sample has been pressed. The possible uncertainty, due to the chance of slip of this collar, may be abolished by applying a ring around the pin, after the style drawn in Fig. 5. Shouldered pins, judged by sight as to the flush state of the shoulders, may be pushed a little too far, and then have to be retracted; to avoid this waste of time a close-fitting washer (see Fig. 6) underneath the job will be useful, arresting the shoulder positively. The use of a plate slightly larger than the bush, Fig. 7, is also recommended for flush pressing, in circumstances where the underside of the bush cannot be met and checked by the table or plate.

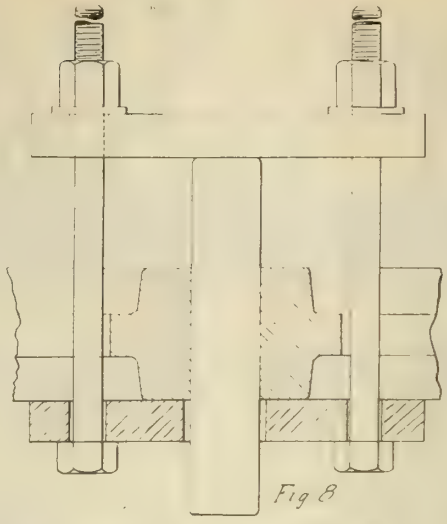


Fig. 8—Rig-up for forcing pin in wheel.

Bolts and plates chiefly come in when large wheels, frames, and so forth cannot be put in the vise or the press. Methods of application are generally simple, comprising a stout bolt and two plates or hair-pin clamps, one spread over the hole at the rear and the other comes against the bush, the nut being tightened until the latter is home. Solid holes in the wheel or arm spaces or apertures in a framing are essential to permit a set-up resembling that illustrated by Fig. 8 to be employed. A like affair can be utilized to force bushes out, interposing a piece of shaft between the top clamp and the face of the bush, the shaft being just small enough to pass into the wheel hole.

Plant executives should encourage the submission of ideas for improvements from the workmen. Employees that are continuously doing certain classes of work are frequently in a position to suggest changes that will facilitate production, and something should be done to stimulate initiative of this kind.

CONDENSITE CELERON IN THE RADIO INDUSTRY

WITH the development and expanding use of radio, condensite celoron and vulcanized fibre hav efound many new uses. Radio transmitting apparatus often demand very high voltages an currents which, at the high rate of vibration or, in other words, "frequency" developed, would soon destroy all but the best insulation. The essential electrical qualities of an insulator are that it shall have high volume and surface resistivity; high dielectric strength, and a low power loss or "phase angle." An explanation of the above terms condenses down to the fact that the insulation must be the best nonconductor of electricity that can be had. Condensite celoron is stated to possess certain mechanical properties that are especially adapted to radio service.

Radio voltages and currents are very much more destructive to insulation than equal voltages and currents used in commercial work. This is due, as stated above, to the high frequency involved. Where very high frequencies are used even the best insulation becomes a conductor of the current. In comparing the electrical qualities of an insulator, the surface and volume resistivity, dielectric strength and phase angle are all interrelated. If the material is of such a character that part of the current will tend to flow through it, or be absorbed by it, then a power loss develops measured by the phase angle, which is another way of expressing in degrees the percentage of power lost. Therefore the resistance which the material possesses to withstand these current leakages is expressed in terms of volume and surface resistivity. Another important property of the material is its dielectric strength or, in other words, the voltage required to puncture the insulation. This last-

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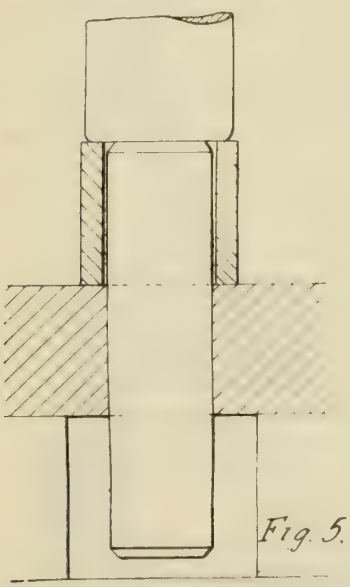

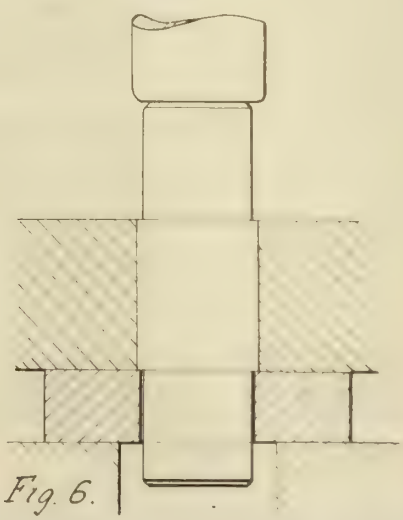

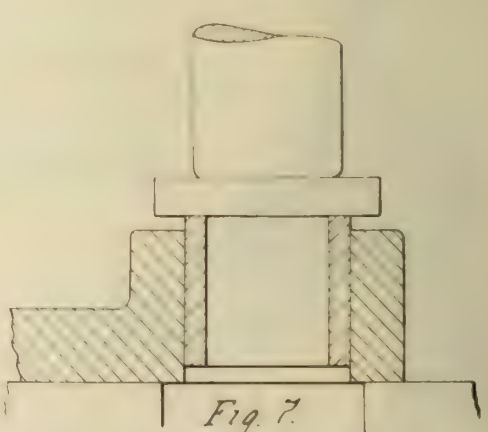

Fig. 5—Stop tube for controlling insertion of pin in arbor press. Fig. 6—Under-washer acting as shoulder stop bushing flush. Fig. 7—Top plate used to bring

Trend of Industrial Employment Is Favorable

Toronto Reports Drop From 14,000 to 5,000—Seasonal Activities Cease, Releasing Large Numbers—Lumbering Operations Create Demand—Official Figures Show Steady Improvement

THAT unemployment to date is far below the record of last year is the report of the government employment services in Toronto. While there were 14,000 out of work at the beginning of 1922, there are at the present time only about 5,000 registered. Absorption during the summer months is shown in that from June to the first of October the number was only 2,000 to 2,500, and that, of this number, there were probably 1,200 listed as handicapped men.

Continued mild weather has made possible the continuation of outside work that would otherwise stop. There is still considerable activity in the building industry, and it is reported that certain contracts on the Welland ship canal will be proceeded with unless extreme weather sets in. The lumbering industry has absorbed several thousand men, while last year there were probably not more than 250 shipped out of Toronto during the season. An unusually large amount of lumber is being cut this year. Wages paid are from $35 to $40 a month, with board and equipment found.

Trained Mechanics Scarce

There is a scarcity of trained mechanics. Massey-Harris Co. have been looking for moulders and core-makers, and are employing girls in the latter department. Foundry wages run from 55 to 60 cents an hour. The demand for machinists is very light, and it is reported that quite a number of the younger mechanics have been attracted to the States by reports of prosperous conditions. In the building trades there has been a scarcity of bricklayers, carpenters and plasterers and conditions have been such as to encourage the development of a considerable number of apprentices.

Farmers have appeared in the labor market in considerable numbers looking for men willing to sign up for the winter. There is some anxiety that when the spring opens, there will be a shortage of this class of work, and farmers are realizing that with prices at their present level, it is a matter of production. During the past season Toronto has cleared 4,745 men for the farm. Of this number 600 were married. There is quite a movement among agriculturists to secure married couples to locate on their farms. In most cases a plot of ground, poultry and some livestock, are made available and it is stated that at the rate of $600 a year a farm hand. under these circumstances, is as well off as a city man with $2,000 a year or better.

Ranks of the unemployed have been swollen by the closing of navigation, by cessation of certain track and bridge activities by the railways, by the closing of summer hotels and resorts, by postponement of highway work and many other seasonal activities. It is predicted that in the spring there is likely to be pronounced labor shortage.

Less Construction

The volume of employment afforded in construction declined largely, over 7,000 men having been let out by employers in these industries. The majority of the workers were released from employment on highways, mainly in Ontario.

The following table shows the index members of employment by industrial groups. Relative weight represents the proportion of employees in the indicated district or industry to the employees reported in all districts or in all industries for the period reviewed:

	Relative Weight	Oct. 1 1922	Nov. 1 1922	Nov. 1 1921
Manufacturing	55.5	86.7	87.7	81.1
Logging	3.1	42.1	66.0	59.7
Mining	5.8	101.1	104.5	98.1
Communication	2.7	102.8	102.2	104.5
Transportation	14.6	114.0	114.7	110.5
Construction	9 3	116.2	153.2	139.9
Services	1.6	102 0	96.6	96.0
Trade	7.4	91.9	93.8	93.0
All industries	10.0	94.6	95.8	90.2

Trend is Favorable

That the trend of employment in the manufacturing industries is favorable is the report based on employment statistics issued by the Dominion Bureau of Statistics for November.

There were seasonal declines in sawmilling operations. Textile factories were considerably busier. In the iron and steel industries, in addition to the revival of activity in automobile plants, there were additions to staffs in shipyards, foundries, heating appliance and machine shops. The production of crude, rolled and forged products, however, declined. Boot and shoe factories and tanneries were decidedly busier, the period under review being characterized by the most marked improvement recorded in the leather group in any one month of the present year. Logging camps reported considerable extension of operations The increase in the personnel registered exceeded those indicated during any month of 1921. Coal mining in both eastern and western fields was much more active, although other branches of the mining industries were slacker. Railway transportation afforded increased employment, particularly in the prairie district. Seasonal improvement was evidenced in the payrolls of wholesale and retail establishments, especially in the latter.

Improvement Over 1921

The volume of employment afforded by some 6,600 firms at the beginning of November showed an increase, thus maintaining the steadily upward movement indicated by employers since April. The working payrolls of these concerns aggregated 785,451 persons or 6,810 more than in their last report, and the index number of employment stood at 95.8 as compared with 94.6 at the beginning of October and with 90.2 on November 1, 1921. Activity in the manufacturing industries as a whole, and in logging, mining, transportation and trade divisions increased considerably; the gains in some case indicated the resumption of seasonal operations. The only pronounced declines recorded were those in sawmills and in the construction industries, both of which were entirely seasonal in character.

All provinces, except British Columbia, shared in the favourable movement. The advances in Ontario and the three prairie provinces, in each case providing work for approximately 3,300 workers, were the most extensive. The gains in the former district occurred very largely in automobile factories, (representing recovery from previous shutdowns), in logging camps and in textiles. In the prairie district considerable improvement was eported in the coal fields and in railway transportation. The declines in British Columbia were mainly attributable to contractions in water transportation, fishing and canning.

How Cities Stand

In Montreal practically no change, on the whole, was indicated by the employers making returns. The level of activity in Toronto was decidedly higher than at the beginning of the preceding month, while Ottawa and Hamilton firms also afforded more employment. In Winnipeg fairly large additions to staffs were registered, mainly in retail stores. The tendency in Vancouver was distinctly downward, contractions affecting over 1,500 workers being recorded by the concerns reporting.

To obtain the best results from tool steel in gage work, it is always best to heat treat or anneal material before using. In this respect it is better to select stock somewhat larger than ordinarily used, as the annealing process renders the outer stock useless to a certain depth, and unless this defect is removed, failure in hardening will result.

Practical Application of Mechanical Oscilloscope

Tuning Down High Speed Mechanisms so That Same Are Visible to Naked Eye—High Tension Current Employed for the Lamps—Use of the "Creeper" Gear

MINUTE visual examination of mechanisms operating at high speed is made practical by the use of a recently developed instrument known as the oscilloscope. A simple mechanical principle underlies the action of the Elverson oscilloscope, and its operation has been perfected after considerable experimenting on the part of the makers, Herbert Kennedy & Co., of London, Eng. Actually the oscilloscope is a commercial and workable application of the effect obtained when moving machinery is viewed in an intermittent artifical light. In such cases, however, the synchronism of moving parts with the frequency of the light flashes is purely accidental, whereas in the case of the instrument here described the results obtained are subject to delicate and accurate control.

Simple Method of Operation

Possibly the best estimate of the wide range of practical applications covered by this instrument will be obtained by first describing the method adopted for obtaining the desired result, and this is in reality remarkably simple. In the first place it must be remembered that the human organs of vision, including the eye, optical nerves, and the area of the brain concerned, require a definite time for operation, so that an impression, however transient, will, if sufficiently intense, occupy a definite period so far as the human capacity for vision is concerned. This period varies in normal cases between 1-10 and 1-5 of a second. In the second place it will be obvious that on account of the above considerations, all except slowly-moving parts of machinery will be invisible to the naked eye, or, at the best, visible only as a confused blur, on account of the multitude of different impressions which are received by the eye within a very short space of time.

If, however, the mechanism is rendered visible for a very minute period of time,

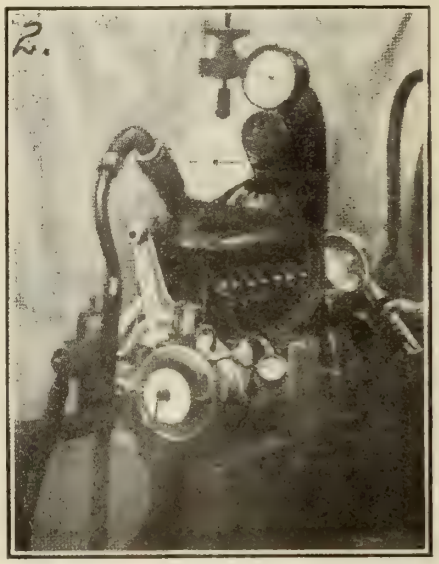

Fig. 2—Oscilloscope applied to automobile engine.

after which comparative darkness supervenes, a definite image will be registered by the brain, whilst if several repetitions of this image occur within a fraction of a second, the effect will be correspondingly intensified as far as human vision is concerned. This briefly is the principle upon which the oscilloscope operates.

Essentially it consists of a special type of electric lamp which may be made to give a definite number of flashes of light per minute, the exact number depending upon the cyclic period of the mechanism which it is desired to examine. Thus the complete instrument comprises the lamp with an accumulator and induction coil and means for interrupting the current and controlling the number of flashes per minute. Considerable experiment was, however, necessary before these requirements could be embodied in practical form, and the equipment finally evolved is shown in Fig. 1.

This shows two lamps provided with shades and suitable holders and an accurately-made gear box, these units being connected up with an accumulator, induction coil, and condenser enclosed in a wooden case. It should be mentioned that the connections are so made that the equipment can be operated only when the lid is in position on the case, thus ensuring protection of the apparatus and of the operator against the high-tension current employed for the lamps.

Gas-Filled Lamps

The lamps are of a special gas-filled type, in which an electric discharge takes place between a point and plate electrode in an atmosphere of neon, these lamps having been evolved as the result of considerable experiment to give flashes of light of great brilliance and of exceedingly short duration. One of the lamps shown is a master unit upon which a control switch is fitted in the form of a spark gap which is rendered necessary by the intermittent nature of the current. This spark gap nullifies the effect of inductance in the lamp circuit, confining reactionary currents to the bulb, so that for a given current the maximum discharge is obtained between the electrodes. Consequently, since one or more lamps may be connected in parallel with the master unit, the maximum amount of light may be obtained from a given current.

Action of Gear Train

On the right in Fig. 1 is shown the gear box, which consists of a graduated circular casing in which two accurately-made gear trains are enclosed. Each of these trains receives its motion from a primary pinion on the central shaft, which is coupled directly to the mechanism to be tested, and each of them drives a contact breaker, which may be switched into the lamp circuit. In the case of one gear train, the speed is so arranged that the flashes of the lamp

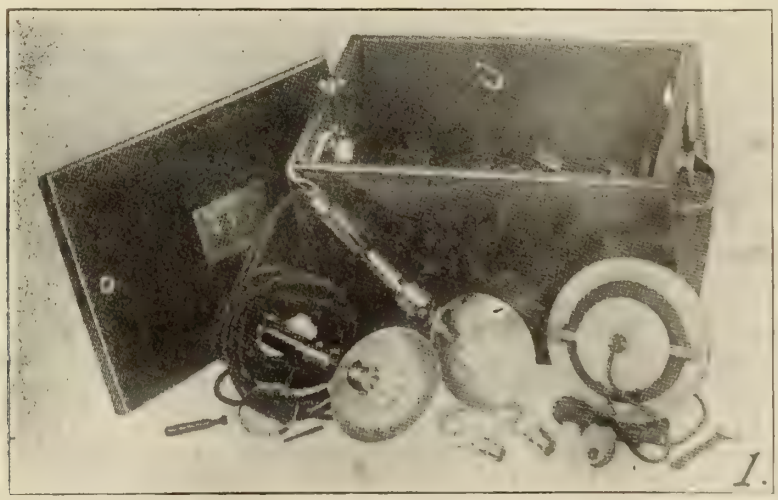

Fig. 11—Elverson oscilloscope and accessories.

synchronize exactly with the revolutions of the primary pinion, whilst in standard sets the other gear train gives 100 flashes of the lamp in 99 revolutions of the pinion. A switch working about the centre of the gear box brings either circuit into operation as desired, or, if required for special purposes, radial slides may be moved by hand to give one, two, or four flashes per revolution with either current.

In the case of the gear train where the number of flashes coincides with the number of revolutions of the primary pinion, it will be obvious that each flash occurs at a particular point in the revolution of the pinion. Thus the revolving member of the mechanism to be tested is illuminated in exactly the same position at successive revolutions, with the result that, if external light is sufficiently reduced, the mechanism appears to be stationary, although in reality it may be moving at a high speed. Similarly all part mechanically coupled to the revolving shaft will be illuminated at definite points in the cycle of movements, so that any mechanism may be subjected to minute visual examination under actual working conditions irrespective of the speed employed.

Apparent Speed Reduction

On the other hand, if the alternative circuit or "creeper" gear is brought into action, successive flashes of the lamp will illuminate the mechanism in positions removed from one another by 1-100 of the cycle, despite the fact that actually the mechanism has passed through 101-100 of a complete cycle during the space of time between successive flashes. This, in effect, means that the apparent speed at which the mechanism is functioning is reduced to 1-100th of the actual speed, so that parts revolving at, say, 1,000 r.p.m. appear to be moving at the low speed of 10 r.p.m., at which speed, of course, visual examination is not only possible, but exceedingly useful, since the actual working movements of the parts are reproduced for inspection.

Typical Examination

If the primary shaft of the gear box be coupled directly to the cam-shaft of an internal-combustion engine, the action of the valve and rocker mechanism may be analysed minutely. Actual tests with the instrument have, in fact, already revealed a number of interesting points in connection with valve gear. Thus in many cases the lag which takes place in the closing of the valve when the valve stem is heated up may be distinctly observed, whilst failures of the roller to follow exactly the cam profile are equally noticeable. In the last-named case the roller may be seen to bounce on the cam and to be accompanied by a corresponding movement of the valve on the seating.

Testing Gear Action

Another important application of the device is in connection with gear testing, since errors in the interaction of two gears are rendered readily apparent. It should, of course, be pointed out that gears which apparently mesh correctly when running at 10 r.p.m. may exhibit several serious defects if the speed be increased to 1,000 r.p.m. or more. When using the oscilloscope, however, the majority of the defects remain apparent, whilst the speed at which the gears are revolving appears to be reduced, in this case by 100 to 1.

Actual tests show that periodic errors due to inaccuracies in circular pitch or lack of concentricity are visible as a slow oscillation of the various members of a gear train, whilst in cases where variable stresses are encountered in the drive the presence of backlash in the gears gives rise to the same visual phenomenon.

Studying Moving Mechanisms

Another important point is the fact that moving machinery may be made to appear stationary at any desired point in the cycle of operations. This is effected by moving the switch on the gear box to the stationary position, after which the complete unit, i.e., the gear box and contact breaker, may be rotated about its axis until the mechanism is observed to be in the desired position. This fact suggests several interesting possibilities in connection with the study of vibration and torsional stresses.

Thus in the case of machinery where an undesirable degree of vibration is apparent it will be found in the majority of cases that the vibration is periodic and synchronous with the movement of one of the main components. Whether this is the case or not may readily be determined by coupling the primary shaft of the gear box to the main revolving members in turn. If then the contact breaker is set so that two or four flashes per revolution are made, periodic vibration synchronising with the movement of the shaft will result in two or more images of the various parts being visible. Further, the planes or points where the amplitude of the vibration is at a maximum may readily be determined by setting the instrument to give two flashes per revolution and then rotating the gear box about its axis until the maximum distance is obtained between the two images. Thus it is possible actually to measure the extent of the vibration, and, in addition, to determine the direction and period of the movement, a factor which should be of great importance when testing high-class mechanisms with a view to improvements in design.

Examining Shaft Stresses

With regard to torsional vibration and torsional stresses in shafts, the method of application is equally simple, and in this case the protractor scale on the rim of the gear box housing is utilized. In the first place, the gear box is mounted in a suitable support, whilst two lines are scribed near opposite ends of the shaft to be tested, the lines being parallel to the axis of the shaft and in line one with the other. The primary shaft of the gear box is then coupled to the member under test, and both are rotated, whilst the contact breaker is switched to the stationary position so that the test lines become visible. Next the gear box is rotated by hand to bring one of the test lines under a pointer which may be attached to any conven-

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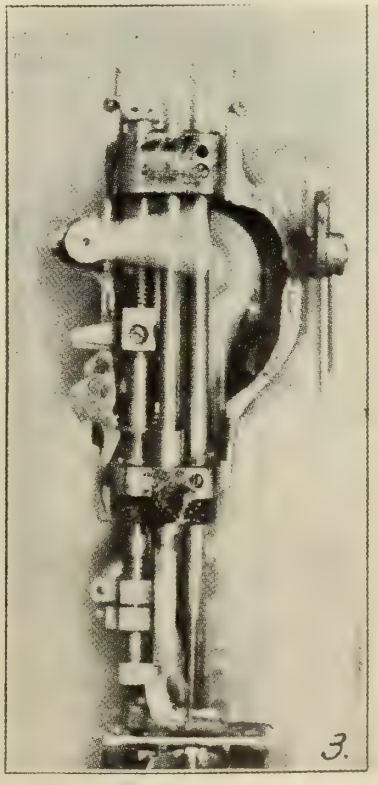


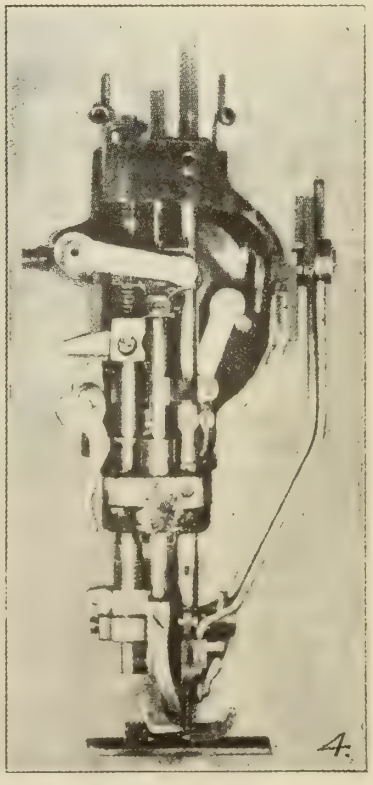


Fig. 3—Headstock of sewing machine running at 1,500 r.p.m. Fig 4—Machine still running, photographed by light from oscilloscope.

Calculating the Power Transmitted by Gears

Method of Figuring the Various Classes of Teeth—Point of Application and Degree of Impact—Pinion Tooth Generally the Weaker—Possibility of Load Concentrated at One Point

By CHESTER B. HAMILTON, Jr., B.A.Sc., M.E.

THERE are several methods of calculating the power-transmitting capacity of gears, but the generally-accepted way is by the Lewis formula, or some one of its amplifications. The calculations for a bevel gear are based on a pitch and pitch diameter at the middle of the face, thus averaging the strength between the large and small end. Worm gear strength may be calculated like a narrow-face spur gear, but the strength of worm gears is usually of minor importance; as wear and bearing surface are the features that determine the size of a worm gear rather than tooth strength. The same applies to helical gears with shafts not parallel. Helical gears with parallel shafts, or double helicals, are treated as spurs, except that their constants are different on account of smoother action and more teeth in mesh, which minimizes the shock factor and permits a higher speed.

Spur Gear Tooth

The spur gear tooth is essentially a cantilever of definite form and strength, but subject to applied bending movements which vary in amount, point of application and degree of suddenness of application. The pinion tooth is the weaker in form, being narrower at the root, so if the gear and pinion are of like material, only the pinion need be calculated. If the pinion is steel and the gear cast iron or semi-steel, or if the pinion is heat-treated steel and the gear annealed steel casting, both members should be calculated.

Lewis Formula

The Lewis formula gives the tangential load or tooth pressure in pounds, which can be transmitted by a gear of given pitch, face, number of teeth and material.

$$W = S P' f y \frac{600}{600 \text{ plus } V}$$

W = Load transmitted in pounds.
P' = Circular pitch.
f = Face.
y = Factor for number and form of teeth.
S = Safe working stress of material.
V = Velocity in feet per minute.

The strength of the tooth is taken as directly proportional to the circular pitch or centre to centre distance of the teeth at the pitch line. If the diametrical pitch is given, it may be converted to circular pitch by dividing 3.1416 by the diametrical pitch.

Bevel Gear Proportions

It is assumed that the power a gear can transmit is proportional to its face, but this is only true within reasonable limits, depending on the workmanship, rigidity of the bearings, size of shafts, whether gear is overhung and like factors. If the face is not over twice the pitch for overhung gears, or three times the pitch for gears centrally mounted, the formula applies. Beyond this the chance of too much load being concentrated on one end of a tooth must be taken into account. The face of a bevel gear should not be over one-third, and preferably not over one-quarter of the cone distance. Any length over one-third adds nothing to the strength.

The factor "y" is taken from the following table:

Value of Factor "Y"

Number of Teeth.	Involute 20 Degrees.	Involute 15 Degrees Cycloidal.	Radial Flanks.
12	0.078	0.067	0.052
13	0.083	0.070	0.053
14	0.088	0.072	0.054
15	0.092	0.075	0.055
16	0.094	0.077	0.056
17	0.096	0.080	0.057
18	0.098	0.083	0.058
19	0.100	0.087	0.059
20	0.102	0.090	0.060
21	0.104	0.092	0.061
23	0.106	0.094	0.062
25	0.108	0.097	0.063
27	0.111	0.100	0.064
30	0.114	0.102	0.065
34	0.118	0.104	0.066
38	0.122	0.107	0.067
43	0.126	0.110	0.068
50	0.130	0.112	0.069
60	0.134	0.114	0.070
75	0.138	0.116	0.071
100	0.142	0.118	0.072
150	0.146	0.120	0.073
300	0.150	0.122	0.074
Rack	0.154	0.124	0.075

The last portion of the formula recognizes the fact that a gear will not carry as great a tooth pressure at high speed as at low. The form of the fraction is such that velocity is a relatively negligible factor at very low speeds, but becomes of increasing importance as the speed rises, and soon imposes a practical limit on increases of speed. This agrees with observed good practice.

It is thus comparatively simple to find the strength of any gear, but there is no satisfactory method of reversing the process so that a gear might be designed by formula for given conditions. It is customary, therefore, to proceed by the trial and error method. The table, chart and instructions for use which are given with the illustrations hereto give a good straightforward procedure. The table is by Henry Hess.

Shrouding the Teeth

The shrouding of the teeth of cast gears or pinions was an expedient to increase their load carrying capacity that was formerly much in vogue. In these modern days of accurate cut teeth and high-grade materials, it is safe to say that shrouding is obsolete. Even with slow-moving steel pinions there is more lost due to inability to obtain a good tooth form and even contact than is gained by the added support. The end milling process is the only practical one for cutting shrouded gears. In general this form is confined to rough castings.

Division By Grades

The quality of workmanship and degree of accuracy of fits of gears have been subdivided into three grades by the American Gear Manufacturers' Association Standardization Committee. This was brought about in the course of establishing standard inspection limits on the diameter of bore for different classes and sizes of work.

The first grade is "Precision, for Aircraft, Printing Machines, etc." In this class the accuracy requirements, not merely on the bore, but in all ways, are held very high, in fact as high as it is possible and yet get out the work on a production basis. Such quality was, a few years ago, confined to the tool room.

The second grade is that used on "gears for automobile and machine tools." While the limits are close, they lend themselves to mass production with fixed tools. Silence of tooth action is a big feature when judging the quality of automobile gears. The same applies to machine tools, though here, freedom from vibration is more important than the actual silence which results therefrom. In both this and the preceding class, all gears are supposed to be absolutely interchangeable.

The third grade is specified under the term "Standard Jobbing Gears." It includes most large heavy work, and gears

(Continued on page 28)

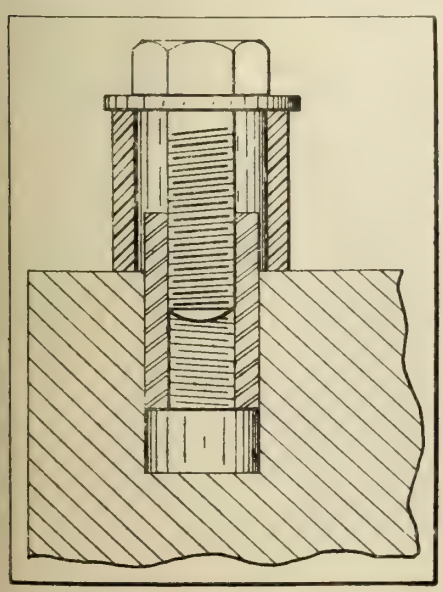
Author is President of the Hamilton Gear and Machine Co., and a member of the American Society Mechanical Engineers; Engineering Institute of Canada; Society of Automotive Engineers; American Gear Manufacturers' Association; Steel Treating Research Society; Standardization Committee of A.G.M.A.; Member of Canadian Engineering Standards Association.

Practical Ideas From Practical Men

REMOVING BUSHINGS

By A. Le Marshall

A method which the writer has used for a number of years in removing bushings from blind holes, and one that has given good satisfaction, is to run a tap of the nearest size into the hole of the bush so that a shallow thread will result. By placing a sleeve, a little larger than the bush, over the opening and using a washer and cap screw as shown in the sketch, the bush can be drawn out quite easily. This method will be found useful in automobile work, where the through hole is a trifle larger than the inside diameter of the bush. The writer has used this method in removing hardened bushings from air hammers. First plug the hole with fire clay to keep flame out of cylinder then heat and anneal bush, after which tap and draw out as stated.

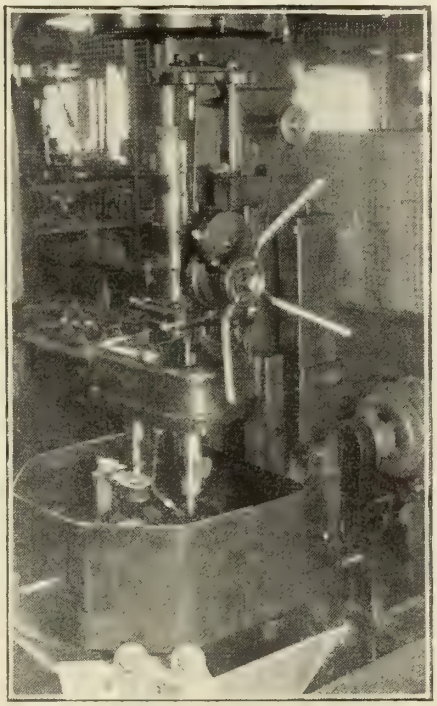


Removing tight bushings.

DRILL ADAPTED TO SPECIAL OPERATION

An interesting drilling and reaming operation on a regular Rockford 20 in. box column drilling machine is shown in the accompanying illustration and described herewith. The drill is regularly rated as having a capacity to drive a 2 in. high speed drill in solid steel. The drive is direct by silent chain from electric motor through interchangeable pick-off gears for speed changes. Four speed changes are regularly provided in a simple feed box.

A four station rotary table, with index plunger worked by foot treadle, is applied to the regular table. The rotary table is indexed by hand after the locating plunger is pulled. The table is provided with four two-jaw chucks, with formed jaws to suit the work. An extended wrench is provided so that the work of tightening the chuck screws takes place outside of the chip guard. These chucks are under work spindles with operation going on while the fourth is being loaded. A finished piece is removed at each index. A three spindle drive head equipped with a "V" gibbed slide, is mounted on the table ways. The spindle drives and feeds this head. The head is fully counter-weighed. A positive micrometer adjustment stop on the quill is provided for a depth gauge. An adjustment for height and diameter of drill; drill bushings support is provided under the left hand spindle.



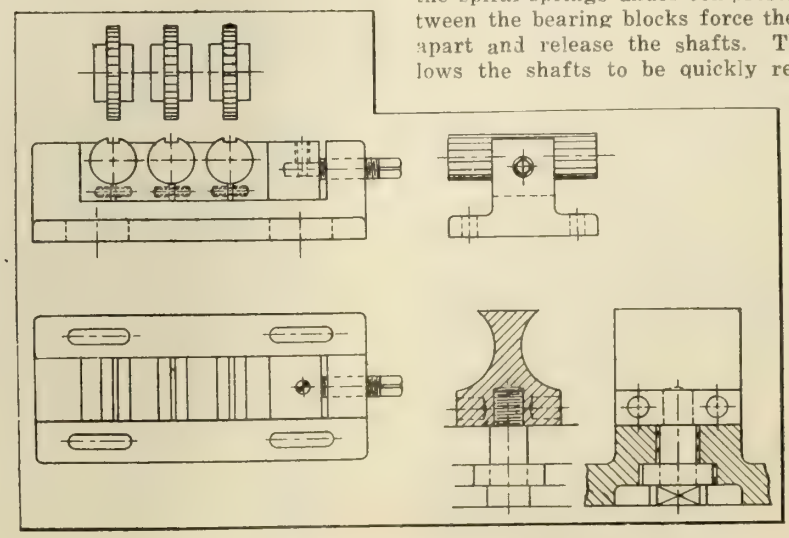
Interesting drilling and reaming operation.

The sequence of operations is given as follows: first spindle, rough drill; second spindle, rough taper ream and face; third spindle, finish taper ream. The work consists of yoke and flange members of a new oil lubricator universal joint, and production is maintained at the rate of 250 pieces a day. Diameter of rough drilled hole, ¾ in., length 2⅝ in.

MILLING KEYWAYS IN SHAFTS

By Hubert Bentley

In order to reduce the time required for milling flats and cutting keyways in a quantity of similar shafts, the vise shown in the accompanying elevations and plan was constructed and has proved extremely useful. This allows the shafts to be milled in threes, but the same principle may, of course, be employed to deal with four or more shafts up to the machine's capacity and simply by the addition of bearing blocks. Originally the shafts to be keywayed were 1¾ in. dia. by 6 in. long, and these were supported by a single vise as shown. For longer shafts two vises would be necessary, while three would be required in the case of very long shafts. The vise is fastened down to the milling machine table by the usual bolts. The bearing blocks for supporting the shafts are loose and each one is held down to the vise by a stud and plate (see enlarged detail.) The blocks, which are adjusted so that there is no lift, are free to move along the vise until the grip screw on the right is tightened up. When the grip screw is slackened the spiral springs under compression between the bearing blocks force the same apart and release the shafts. This allows the shafts to be quickly removed



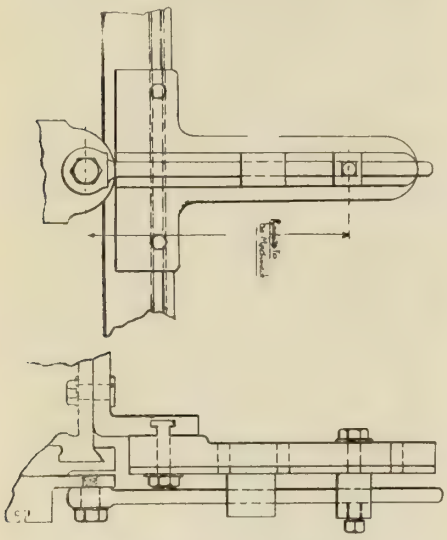
Milling keyways in shafts.

and another set placed in position. The inner end of the grip screw is kept in position in the loose jaw by a screw and groove. The other end is squared to receive a standard spanner. The bearing blocks are bored out to the shaft diameters. Other sizes may be dealt with if additional blocks are provided or split flanged bushes may be used in the existing bearing blocks for shafts of smaller diameter. Although designed for the milling machine, these vises are equally useful for similar jobs on the shaping or planing machine where the work is of a repetition character.

RADIUS FIXTURE FOR LATHE

By T. H. Hargrove

The accompanying sketch illustrates a fixture designed for turning radii in the lathe on such work as the crowning of pulleys, etc. Briefly the various parts consist of the cast-iron angle bracket A secured to the back of the lathe bed by the two bolts shown. On the upper face of this angle a tie slot



Radius fixture for lathe.

is machined, into which the bracket B is fitted. Along the center line of B are drilled four ⅞-in. holes to suit the different radii, adjustment being made by the bolt C along the connecting rod D. This, as shown in the assembled view, is clamped to the bottom slide of the saddle by a pin E through a hole drilled and tapped at the back of the bottom slide. In use the bottom slide screw is released from its nut, the feed-in of the tool being made by means of the top slide. The setting block F is to ensure the cutting point of the tool being central (when so desired) with the work when at the highest point of the radius. It will be observed that the setting block F is the same width as the step on the bracket B. In the crowning of pulleys, for instance, the method of procedure is as follows: the bracket B is moved along the angle plate to a convenient position and then clamped securely. The rod D is then swung by moving the saddle along the bed till it lies along the center line of B, this being known by the sides of the block F being flush with the step on the bracket when placed over the rod. The tool is then set central between the sides of the rim and after adjusting the cross slide to the correct radius the bolt C is tightened down and rod D clamped by means of set-screw shown. The measurement of the radius required to be turned is taken from the center of the bolt C to the center of the pin E.

A POINTER FOR THE DESIGNERS OF SCREW MACHINE PRODUCTS

By D. A. Hampson

"Make wider necks at the ends of threads." Rigid adherence to this rule would save more than one-fourth the cost of screw machine products. And this applies equally well in the small shop that has one hand screw machine and where the boss or the foreman is the designer and in the large plant whose production is in charge of a chief engineer.

Most men, when confronted with the proportions of a threaded piece, conclude that a neck in which to end the thread is the last word in design. They know that it is feasible to design threaded pieces where the die stops anywhere on the bar, hence, if a neck is added it is a refinement that should take all the curse out of die troubles. And so they look at the mouth of dies, see that one and a half or two threads are so flared, and they dimension a neck that is two threads wide.

A two-thread neck may be sufficient on straight bar work but it is not enough on shoulder work. Screw machine men know that the die doesn't always travel the same distance within a sixty-fourth, they know that the different spindles of a multi-spindle automatic will not bring the neck in the same relation to the die by the time the thread is finished, and they know from bitter experience that you cannot set the end of the die closer than 1/32in. from the shoulder, sometimes further away. Also they know that dies that apparently have a short neck, may have a leading section three threads long or more.

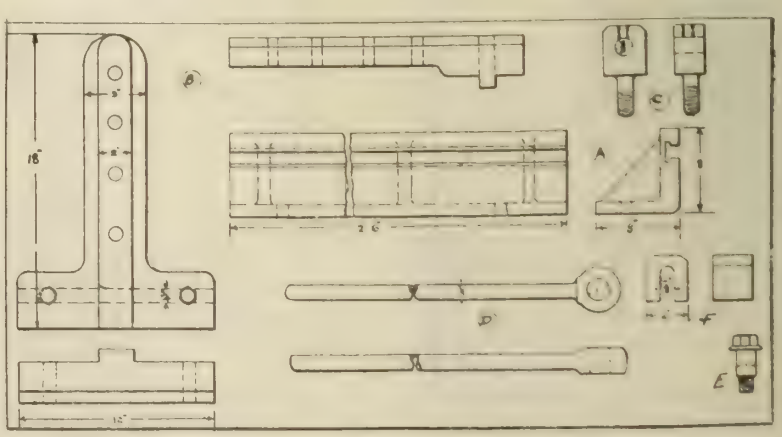
All these truths fairly scream for a wider neck. On such a simple piece as a set screw, there is no reason why the neck shouldn't be wider even if it did not assist the automatic operator. Not once in a hundred times is the last eighth of an inch of thread necessary or used on a set screw.

There is another class of work where wider necks will help materially. That is on work pieces that have a running nut that travels full length. When the assembly department comes to use these parts, they find that the nuts encounter a fat thread just "east of the neck;" the screw machine man had kept the die a little away from the shoulder to avoid jamming, the die either came with a long throat or such a one was put on it in re-grinding, and the fat thread resulted. It would have made no difference if two more threads had been cut out to form a wider neck, for the nut was amply long with bearing enough at all times on the screw.

Threads which go in a long nut or into deep tapped holes come in about the same class. In running on and off, a die naturally makes the end of a screw a shade smaller than the part where it stops its travel under a cut, even though the mouth of the die had passed onto the neck. This leaves a tapered thread to which a close fit cannot be made.

In one case, thousands of ⅜in. x 24 screws 1½in. long were used every week. The nut had to be fitted close and smooth throughout the length of its possible travel. It was found that commercial accuracy was not good enough and so the shop put in their own automatics. Even then they could not get the desired straight screw, free from a fat thread until they had doubled the width of the neck—and so doing avoided the (hand) dieing operation formerly required and produced a more symmetrical screw.

The discovery of rustless iron has made it necessary to be able to treat ferro-chromium by some process which will remove the carbon. Among the methods proposed is that of heating ferro-chromium in contact with hydrogen.

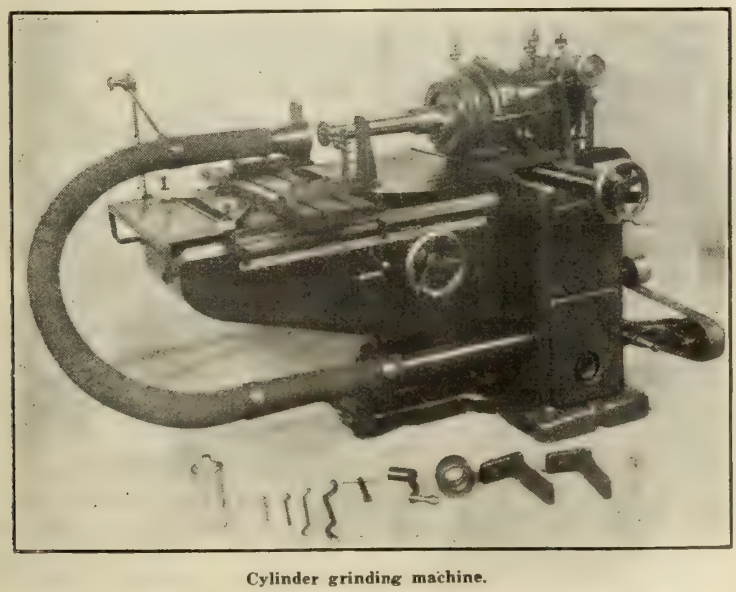


Details of radius fixture for lathe.

New Things in Shop Equipment

CYLINDER GRINDING MACHINE

A new type of cylinder grinding machine that has some interesting features incorporated has recently been placed on the market. The wheel spindle is of the two-piece type, made of special alloy steel, heat treated and ground all over, and carried in a double eccentric sleeve. Wheel spindle position is adjustable by means of suitable extensions, thus eliminating any unnecessary overhang of the wheel. Adjustable bronze bearings are provided for the spindle, which is also fitted with a self-aligning ball bearing to take the end thrust. The eccentric sleeve is driven by worm and worm wheel which assures smooth rotary action. Adjustment of the eccentric sleeve is obtained through a worm and ratchet gear device, which may be operated when machine is running. Final setting is accurately and readily obtained by means of graduated dial. The machine is driven by endless belt through a powerful friction clutch. Individual grinding wheels are assembled on independent collets, thus avoiding truing every time a change is made. Even tension on the drive belts is maintained by special arrangement of pulleys, eliminating need of springs or weights. The headstock carriage is mounted on the bed to traverse at right angles to wheel spindle. The work table is mounted on large heavy knee which is adjustable vertically. Feeding is obtained by parallel motion of the work table. Reversal of feed is obtained automatically by means of adjustable trip blocks. All dust and cuttings are drawn from the wheel and work through a large rubber hose directly connected to an exhaust fan located in the frame of the machine. The vertical distance from the wheel centre to the work table may be varied from 2¼ to 9 in. Table has a travel of 22 in., while the wheel carriage may be traversed 27 in. Wheel spindle may be operated at either 5,000 or 7,000 r.p.m., and feeds of from 4.8 to 9.2 in. per min. are obtainable. Machine requires a floor space of 71 x 58 in. These grinders are now manufactured by the Gisholt Machine Co., Madison, Wis.



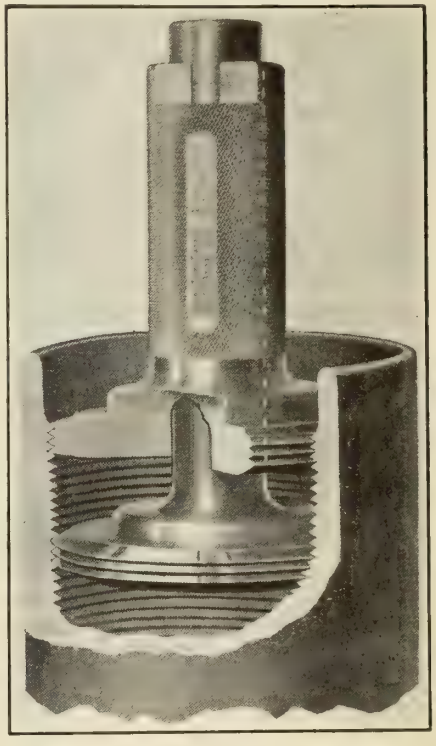
Cylinder grinding machine.

VALVE GRINDING MACHINE

A portable machine for grinding automotive poppet valves to a definite angularity and for grinding reseating cutters used for facing valve seats to the same angularity as the valve has been developed and offered to the trade recently. The machine is not of the adjustable type as it is assembled at the factory to grind at a pre-determined angle, and is therefore a single-purpose tool. The machine is driven by a Westinghouse motor which is mounted on a low, flat base. It is so located on the stand that vibration is reduced to a minimum, so that accuracy of grinding is not affected. Movement of the valve holding spindle is obtained by means of a hand lever. Feed is by a small hand wheel and screw. These tools are made by the Franklin Machine and Tool Co., Springfield, Mass.

DOUBLE-PLUG PIPE GAUGE

A new type of internal gauge for measuring the taper of female pipe threads has just been placed on the market. The general construction and application is clearly shown in the accompanying illustration. The gauge is marked 1 division = .002 in., which signifies that one division on the handle of the gauge represents a variation of .002 in. in pitch diameter in a length of 2 in., this length being the distance covered by the tool. In use the inner plug is first screwed down into the thread by hand,



Double-plug pipe gauge.

followed by the outer gauge, both parts being set hand tight. If the taper is correct the witness line on the inner gauge will come opposite the zero line on the graduations on the outer gauge. Any variation from the true taper is read directly on the scale. As these gauges are made up to order, it is possible to obtain slight variations from the specifications. These gauges are made by the Pratt and Whitney Co., New York.

SENSITIVE DRILLING MACHINE

For taking care of light drilling where extreme accuracy is required, a sensitive drilling machine has recently been placed on the market. It is particularly adapted to precision tool and manufacturing work. The machine and the motor are separated but mounted on the same base, but the design permits of driving the machine from overhead if desired. The base, when located on the bench, rests on three rubber contacts, so that the machine remains steadily in

position without the use of bolts or clamps. The spindle is 9/16 in. dia. and is hardened and accurately ground. It has a vertical movement of 2 in. regulated by adjustable stops. The tension on the drive belt can be adjusted by means of a thumbscrew which regulates the position of the idler pulley bracket. The 1½ in. dia. steel column is 13 in. high. The table may be adjusted both radially and vertically. There is a space of 8 in. between the base and the chuck and 4 in. between the spindle and the surface of column. Chuck has a capacity of drills up to ¼ in. The ratchet lever allows operator to use pressure in the most desirable position. Jigs or fixtures may be used in place of the regular table. The spindle operates at a speed of from 1.500 to 2,500 r.p.m., but machine may be adapted to speeds as high as 8,000 r.p.m. The spindle pulley is adequately protected by means of a suitable guard that is easily detachable. Excess lubrication is thrown off into recesses from which it flows by gravity to an oil chamber. These machines are marketed by Adolph Muehlmatt, Cincinnati, Ohio.

PORTABLE PIPE-VISE STAND

A portable stand for service when considerable pipe fitting is required about the plant has been placed on the market recently. The frame of the appliance is made of malleable iron and fitted with a shelf for holding tools. The pipe bending attachment is a part of the body casting, and is easily mounted or detached. Legs are fitted with holding points and feet to avoid slipping. The stand can be equipped to hold any type of hinged or chain pipe vise having capacities up to 2½ in. Weight is approximately 50 lbs. These stands are made by the American Pipe Tool Co., Chicago, Ill.

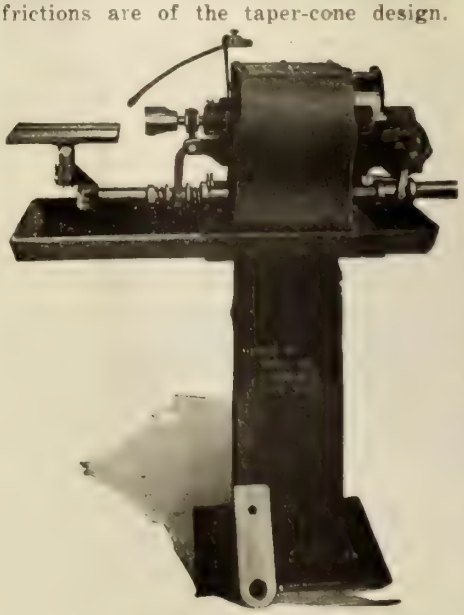
POWER SCREW PRESS

A power-operated screw press capable of exerting a pressure up to 50 tons has been placed on the market recently. When working at a pressure of from 25 to 30 tons the speed of the ram is 7 ft. per minute. A marine type of clutch is used for driving the power screw. The control of the machine is obtained by means of a lever at the side of the machine, this lever being adjustable to suit the convenience of the operator. All working parts of the driving mechanism are mounted on the back of the head and are readily accessible. The vertical pressure screw is 3 in. in dia. and 48 in. long, and is usually furnished with a 2-in. lead double Acme thread. When fitted with a single thread the clutch may be released and the pressure held at any point without consuming power. Special S.K.F. bearings are fitted to take the end thrust of the screw. Worm is fitted with radial and thrust ball bearings. The base is designed so that jigs and fixtures may be accurately fitted. Machine has a capacity between uprights of 37½ in. and a vertical maximum space of 32 in. Ram has a movement of 24 in. When using a motor drive the motor is mounted on a special base at the rear. Floor space required, 27 by 49 in., with a total height of 76 in. These presses are made by the Atlas Press Co., Kalamazoo, Mich.

AUTOMATIC TAPPING MACHINE

A new design of automatic tapping machine has been placed on the market recently. The machine is equipped with a power feed and an automatic reverse. It is not necessary to depend on the pressure on the tap to make the machine drive and reverse itself, which is the case with hand-operated machines. The tap runs perfectly free and for this reason an accurate thread is cut, as the tendency of the tap to cut oversize or the metal to stretch is done away with. The operator has only to place the work on the machine, pushing same against the tap until it has started to enter, at which time the power feed takes hold driving the tap until thread is completed then automatically reverses the spindle and backs out tap at twice the forward speed. This relieves the operator from continually pushing the work against the tap while tap is entering and pulling on the work when tap is reversing, and leaves his hands free to select another piece of work.

The new machine drives through a friction governed by the automatic feed, which is, in turn, controlled by another friction. By this arrangement the machine may be set to be very sensitive and, it is claimed, will slip before breaking the smaller sizes, or it may be adjusted to pull the larger coarse thread taps. Not only are the machines driven through a friction on the forward motion, but they are also driven through frictions on the reverse motion for the reason that taps sometimes become bound and are frequently broken when backing out of the hole. The driving frictions are of the taper-cone design. The face of the friction ring is tapered both sides to fit into the driving and reversing cones and is keyed to the spindle. This design eliminates all shock to the tap and practically overcomes tap breakage.



Automatic Tapping Machine.

The working parts are running in oil. The thrust of the spindle is taken on ball bearings in both the forward and reverse motion. The spindle is regularly equipped with a Skinner positive drive tap chuck and the machine is also equipped with pump and tank supplying lubricant on the tap at all times. The table is full universal and fitted with the slot for attaching jigs, etc. It is therefore possible to tap holes from any angle. A face plate is also furnished with the machine. This plate fits on the draw bar in place of the table. The face of the plate opposite the front of the machine is accurately planed, to which jigs or holding fixtures may be attached, the tap entering the work after passing through the plate which is drilled. This is for use when the part to be tapped is larger than can be easily handled on the universal table.

The machines are single-belt driven and may be belted direct to the line shaft or, if several sizes of taps are to be used, a countershaft giving three speeds can be furnished. The new machine has a capacity from ⅛ to ⅝ of an inch in steel. The machine can be run at very high speeds and the production which can be obtained depends entirely on the stamina of the tap. (The use of relieved taps is recommended). Production does not depend on experienced labor, as a green hand, man, girl or boy, can get the maximum production even though the tap be driven to the bottom of blind holes. These machines are manufactured by the Burke Machine Tool Co., Conneaut, Ohio.

CONDENSITE CELORON

(Continued from page 16)

mentioned property is somewhat dependent upon the other three.

Probably the greatest use for this material in the radio industry is in the manufacture of panels. Possessing a beautiful finish, coupled with the fact that it can be readily machined in the way of being sawed, drilled, tapped or engraved, in addition to its excellent electrical properties, make it an ideal panel material. Its use runs from the simple crystal set to panels two to three feet square and up to one-half inch thick for the ultra-sensitive receiving set with its many stages of amplification. In the construction of the receiving set it finds additional uses in the form of tubes on which to wind the wire, end plates for the condensers, vacuum tube bases, rheostat bases, terminal blocks, etc. In transmitting equipment its insulating properties make it very serviceable for mountings of inductance coils, for high voltage condensers, spark discharges, transformer housings, switchboard panels, antenna switches, relay keys and many other relative applications.

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TORONTO, CANADA

Unemployment Greatly Reduced

IT IS REPORTED from offices of the Government employment service that conditions in the labor market in Toronto are fairly representative of those existing in other parts of the country. At the beginning of the present year, the registered unemployed numbered about 14,000. During the summer months this was reduced to 2,000, and included handicapped men or those who had some disability. At the present time the number reported at the city headquarters is 5,000. This may be increased in January and February, but it is pointed out the tendency reflects seasonal conditions and not a lack of industrial activity.

At this time last year, there was no demand for men from the lumbering industry, whereas this year the call is such as to indicate unusually extensive operations in the bush. Several thousand men have thus been absorbed. There is a great amount of work in hand that will be interfered with by the weather, and there may not develop an activity in manufacturing to absorb quickly the number of men thus made available. There will be unemployment, but not to the same extent as last year.

A phase of unemployment which agencies find it difficult to deal with is that of recently-arrived immigrants who expect a somewhat extreme show of paternalism from municipal or government institutions. They indicate strong preference for the cities, are not the most active in looking for work, and are always the hardest to please. The man who, for the time being, is anxious to do anything as a step towards getting along, is not a prominent feature in the unemployment roster.

Prefers the Trade Newspaper

HENRY FORD prefers trade newspapers to Emerson. In a series of articles on "The Real Henry Ford," now running through the daily press, this is one of the interesting sidelights entering into the portrayal. The motor magnate is described as a man of ideals, emotions and impulses, one in whom there is something that is never still. The industrial organization that he has built up is referred to as representing a far more equable assembly, a more carefully ordered mechanism than that which represents his personality. The latter has been said to be fascinating in its uncertainty; his work as inspiring in its accomplishment. Through it all the trade newspaper has probably been one of his most intimate associates.

Of Henry Ford, it may be a keynote observation that he likes not Emerson the less, because of his large words, but because he likes contact with the world of industrial action more. Trade newspapers are interpreting that world for him. It was in this arena that he fought, experimented, developed, produced. Hence his preference for the trade newspaper. Described as a man of many moods, he expresses a liking for reading that eliminates superficial non-essentials and speaks in terms that he understands by reason of his lifelong association. The trade newspaper records events and developments in the university of industrial progress of which Henry Ford and other successful business men are, in a sense, the alumni.

Trade newspapers, further, may be described as mediums through which men help themselves. Mr. Ford has made available the means whereby great good has been done. His benefactions are extensive and well organized. Yet they largely embody the fundamental idea that a man must help himself. He does not decry education, but his conviction is that of the trade newspaper, that education is valueless unless it can have practical application or expression. He undoubtedly subscribes to Emerson's teaching that "intellectual tasting of life will not supersede muscular activity. If a man should consider the nicety of the passage of a piece of bread down his throat, he would starve. At Education-Farm the noblest theory of life sat on the noblest figures of young men and maidens, quite powerless and melancholy. It would not rake or pitch a fork of hay; it would not rub down a horse; and the men and maidens it left pale and hungry."

There may be those who ascribe to Mr. Ford a desire to interpret, in terms of iron, steel and rubber, the saying of Emerson's that "Everything good is on the highway." There is little comfort in ill-formed impressions. As the apostle of restlessness and action and self-help, Henry Ford is one with the essayist in that "Life is not intellectual or critical, but sturdy. To live the greatest number of good hours, is wisdom. Since our office is with moments, let us husband them. Let us be poised and wise and our own to-day."

Keep the Cars Moving

BUSINESS executives are being advised that a great deal depends upon their co-operation with the railroads, in relieving car shortages. It is important that more goods be loaded in each car and that cars are released promptly. It is pointed out that U. S. traffic is from 5 per cent. to 17 per cent. heavier this Fall, and that Canadian traffic is also increasing. It is essential that available car supply be protected. Shortage is a menace to industrial progress and to every factor entering into satisfactory production. It is up to the manufacturer to consider ways and means of avoiding a costly problem of this kind.

Pig Iron Demand Improves as Price Declines

Cut of Two Dollars a Ton Brings Out the Buyers—Some Large Tonnages Placed for First Quarter—Inventory Season Explains Inactivity in Finished Products—Year Closes With Good Record

COAL STRIKE MENACE BEHIND BUYING MOVES?

THAT the pig iron market is steadily becoming less one-sided and that buyers are booking in fair quantities for future requirements, is the report of furnace representatives. The activity is undoubtedly due in large measure, to the recent reductions that have taken place, amounting in three weeks to $3.00 per ton.

The most recent drop has brought the price to a low of $30.80. This, it is declared, is a rock bottom figure and that conditions are more favorable to an advance early in the New Year. Large buyers have appeared in the market and good tonnages are reported to have been booked.

There is likely to be a very material increase in production shortly. Steel Company of Canada are preparing to blow in their new furnace, the Algoma Steel Co., are doing some extensive rebricking and it is reported may have the full battery running by March. Their requirements in basic pig will have to be considered and there is prospect of increasingly steady merchant demand. Stocks undoubtedly are running low with the foundries.

Pittsburgh also reports an awakening of the pig iron demand. Prices ranging from $25 to $26, valley, represent attractive concessions, and buyers are said to recognize that there can be little room for further reductions. First quarter business therefore, is likely to develop. Among large recent orders is that of General Motors, Detroit, who are said to have ordered 18,000 tons of iron for delivery early in 1923 at $27 Detroit.

Again the menace of a coal strike appears in the prospect. Steel interests who are low in pig iron seem disposed to stock in order to be covered for whatever may transpire April 1. It does not appear that public opinion is entitled to a great amount of confidence as regards the disfavor with which it may stamp a strike movement. Miners' leaders do not show a great deal of respect for that sort of thing. At least it did not appear so in connection with the last strike. There is said to be, however, another reason for the present buying movement, aside from fear of strike. In the case of bars, shapes and plates, shipments are at less than current market prices, and it is not advisable that old contracts should be canceled.

Canadian markets are showing a Christmas season inactivity. Inventories are being taken, and while a fair demand for sheets, bars, hoops, etc., is shown, dealers are not looking for anything of a speculative character this year. Prices show no change, and in this they only reflect the year-end characteristic of basic markets.

Machine tool men report that the year to date shows a 50-per cent. improvement over last year, that activity in many important industries is having a beneficial effect and that the demand for supplies of all kinds continues to be a feature of the market.

Toronto

December 13.

REDUCTION in pig iron prices is the feature event of this market. At $30.80 a ton, conditions seem somewhat attractive. Large foundries are placing for advance requirements, and there is considerable wisdom in this for price does not seem the only factor worth considering. Not only is there a likelihood of a stiffer price early in 1923, but it must be remembered that April 1 is the date on which there must be another showdown with the coal miners. It is claimed that there is likelihood of another strike; that there does not appear to be, at least, any influence at work that may be effective in preventing it.

Approach of the Christmas season explains a certain inactivity. With inventories on the schedule, no great amount of buying is looked for. Stability of prices contributes to this condition.

Iron and Steel.—There is no doubt that moderate weather has enabled the market to approach the year end with very encouraging sales records. Bookings show marked improvement over last year, and it is felt that industry generally has by no means found its stride. Sheets show a seasonal falling off, but even here the weather has been favorably disposed and it has been possible to carry a great amount of work to completion. Prices:

Iron bars	3 25	3 40
Steel bars	3 25	3 40
Reinforcing bars	3 15	3 25
Steel hoops		4 75
Tire Steel		3 50
Spring steel	7 00	14 00
Band steel, No. 10 gauge and 3-16 in base		3 90
Small shapes		3 50
Sheets, black, No. 28		4 60
Sheets, blue, ann., No. 10		4 25
Canada plates, dull, 52 sheets		4 90
Canada plates, all bright		5 40
Galvanized Sheets, No. 28		6 00

Old Material.—"It is almost impossible to point to any feature in the market," said a large dealer. "There is not what might be called a good demand, nor is there much material offering. Prices remain steady. We would not be surprised to see advances in copper early in the New Year."

There is reported to be a scarcity in some specialty grades of material. Reports from U. S. centres indicate easier prices on heavy milling steel. Approach of the inventory season accounts, in a measure, for light buying. Dealers' average buying prices:

Copper, light	9 00
Copper, crucible	11 25
Copper, heavy	11 00
Copper wire	11 00
No. 1 composition	9 00
New brass cuttings	7 00
Red brass turnings	7 00
Yellow brass turnings	5 25
Light brass	4 50
Medium brass	6 00
Scrap zinc	3 50
Heavy lead	4 50
Tea lead	3 00
Aluminum	11 00
Boiler plate, per gross ton.	9 00
Heavy melting steel	10 00
Axles (wrought iron)	20 00
Rails (scrap)	11 00
Malleable	10 00
No. 1 machine cast iron	18 00
Pipe, wrought	7 00

Non-Ferrous Metals.—This market shows no outstanding movement so far as Canadian demand is concerned. New York reports copper to be firming. In the likelihood that prices will advance, New York reports that buyers have of late been quite active and that good-sized orders had been booked. Practically all producers are holding at $14.

Again the London tin market is in eruption. A sharp rise of $1 was recently recorded, and this has affected the foreign demand—this and new high records in sterling exchange. Further increases in tin are said to be likely. Zinc prices, according to American advices, are strong and likely to advance. Lead prices continue steady. Current quotations:

Lake copper	17 25
Electrolytic copper	17 00
Castings, Copper	16 50
Tin	41 00
Lead	7 50
Spelter	9 50
Antimony	8 50
Aluminum	22 00

Montreal

December 13.

USUAL seasonal quietness in the steel trade and its allied connections is now making itself evident and will continue so until after the turn of the year. Manufacturers and warehouse firms are preparing to take stock of the year's turnover which, on the whole, will show a great improvement over the previous

year and assuredly will enable them to see more comfortable results of the turnover during the year now ending. This is the month for inventories and from now until the end of it only the most necessary and urgent supplies will be purchased. Stocks in warehouses and in the possession of consumers are at a minimum and even where quantities exist there will be no necessity for writing off anything because of market declines. Values are steady and a feeling of confidence exists that they will hold firm. Very good prospects of bigger business are indicated for the new year in all branches of building and manufacture.

Iron and Steel.—Boiler tubes are in fair demand only, as the rush to obtain supplies for repairs and renewal of steam equipment for the cold weather months is over. Supplies continue difficult to procure promptly and it is necessary to allow the mills about three months for shipment of orders.

Galvanized and black sheets are very dull just now and no movement at all is taking place in these lines, but it is only of seasonal duration. Prices:

Iron bars, base	3 15 to 3 25
Steel bars, base	3 15 to 3 25
Reinforcing bars, base	3 15 to 3 25
Steel hoops	4 00
Tire steel	3 25 to 3 40
Spring steel	7 00
Band steel, No. 10 gauge and 3-16" base	3 65 3 75
Small shapes	3 40
Sheets, black, No. 28	4 75
Sheets, blue, ann., No. 10	4 25
Canada plates, dull, 52 sheets	5 00
Canada Plates, all bright	7 00
Galvanized Sheets, No. 28	6 50

Pig Iron.—A further reduction of $2 a ton in Canadian pig iron is announced. This may be said to represent a stable level. Foundries are realizing this and buying represents larger volume and confidence that bottom has been reached. Prediction is made in some quarters that prices are likely to show an upward trend with the new year. Current quotations.

Algoma, No. 1, car lots on Tracks, nominal quotation		33 15
Summerlee, 30-ton lots, dock	35 00	
Carron, 30 ton lots	35 00	
Do., 5 ton lots, ex. warehouse	40 50	

Non-Ferrous Metals.—Market is quiet with very light demand as is customary at this time of the year. Referring to basic markets, the British Metal Corporation (Canada) Ltd. has this to say:

Copper.—The 14c price is now an established one in the U. S. domestic market, and export offerings are on the same parity. Consumers have enough orders in to keep them going for another month or two and whatever new orders may be booked it is likely that the covering of the necessary raw material will be delayed if possible until early in next year.

In face of the continued appreciation of sterling, the London market has held firm.

Tin.—There has been a net gain of £5-15-0 on the London market, prices closing at £180-15-0 for spot and £181-15-0 for forward. Considerably more interest has been taken, the turnover of standard being 4,600 tons and sales in the East totalling 1,250 tons.

This advance and the rise in sterling has brought New York price from 36.12 cents to 37½ cents.

Lead.—U. S. Eastern prices remain nominally unchanged, though the undertone is weaker due to arrivals from the West owing to the better transport facilities. Supplies, stimulated by high values, are increasing.

Spelter. — Spelter has advanced throughout the week and is now back at its previous high level. Demand from the Continent, where supplies are scarce, added strength to the upward movement.

Prices on Montreal market are as follows:

Lake Copper	17 50
Electrolytic Copper	17 25
Castings, Copper	17 00
Tin	45 00
Lead	8 00
Spelter	9 50
Antimony	7 50
Aluminum	22 00

Pittsburgh

December 13.

THE WEEK'S developments in the iron and steel market are particularly interesting, although it certainly cannot be said that they stand together in making the market situation either better or worse than was estimated before the information came out.

As to production, the steel ingot production rate in November is found to have been almost exactly the same as the rate in October, about 40,000,000 tons a year, while the rate of pig iron production in November was about 34,900,000 tons a year against a rate of 31,350,000 tons in October, showing an increase of 11 per cent. Merchant furnace production of pig iron increased 20 per cent. and steel works' production of pig iron 9 per cent.

As the steel works cannot possibly have had any stocks of pig iron October 1 on which to draw, the October production of steel was no greater than the production of pig iron would support, and with more pig iron made in November and no more steel, the plain inference is that some pig iron was stocked. As to the merchant furnaces, it is known that recently some of them had to begin stocking iron. As the steel production rate did not change, this has no bearing on the question of steel demand, present or prospective, but it does suggest that possibly some steel interests are disposed to stock some pig iron against April 1 when there may be another coal strike. Some observers express the opinion, as the result of their observations, that the majority of men who are following this subject think it more likely than not that there will be another coal strike April 1. Those who think there will not be rest their opinion largely upon the argument that the operators and miners' leaders would not have the courage, in the face of public opinion, to indulge in another strike. Surely, however, their record in the past hardly justifies such confidence.

Continuance of steel ingot production at a 40,000,000-ton rate, which has now been maintained since the beginning of October, is in itself an interesting event, since the rate is 15 per cent. above the average rate in the six months preceding when seasonal conditions were more favorable to steel consumption. One can hardly avoid believing that not all the steel being made and shipped is being currently consumed. If buyers are piling steel there must be a particular reason. Normally they are particularly adverse to doing so late in the year on account of inventory. Probably the strike fear has an influence in a double way. First, the buyers probably feel it a measure of safety to accumulate some steel, for if there is another strike next April the steel mills cannot possibly be as well fortified in the matter of stocks of coal to meet it as they were in the case of the strike last April. Second, much of the steel now being shipped, at any rate in the case of bars, shapes and plates, is at considerably less than current market prices, the purchases having been made some time ago. Requests for postponement would be met by mills with suggestions of cancellation, and while, in general, buyers would probably expect bars, shapes and plates to decline with another coal strike as a possibility, the market may not decline for months, hence cancellation of orders at below present prices would be unwise for the buyer.

Boom in Construction

Developments in finished steel products individually in the week have been of no consequence. There has continued to be heavy pressure upon pipe mills for deliveries, with a fair amount of new buying. On butt weld merchant pipe the earliest delivery promise on new orders seems to be eight weeks. This condition reflects the great boom in garage and dwelling house construction, in which there is no visible prospect of a let-up in the discernible future. The same influence makes nails continue strong. As to demand and supply, the nail price could easily be advanced, but the general conservative policy of the Steel Corporation prevents this. In sheets the market is a shade quieter still. The leading interest, which when opening order books November 23 for the first quarter was really in line to carry over about two months of deliveries, has been booking for March and now has the month pretty well filled up. Sales by independents have been chiefly for prompt shipment. In tin plate the buying is for prompt delivery and delivery in the early part of the new year. While the market was opened November 23 for the half year, few, if any, consumers have availed themselves of the opportunity to cover so far ahead as to July 1. The market is steady, with tin plate at $4.75, blue annealed sheets at 2.50c, black at 3.35c and galvanized at 4.35c. In automobile sheets the leading interest's price is 4.70c and it is understood

to be sold up through first quarter, its present transactions being for second quarter. The independents maintain their old price of 5.00c and are securing first quarter business.

The Carnegie Steel Company have announced $36.50 as their first quarter price on sheet bars, when the common expectation in the trade has been that the figure would not be above $35. For several years there has been no "intercompany" sheet bar price with the Steel Corporation, hence the American Sheet & Tin Plate Company will pay this price along with the independent mills that have long standing agreements with the Carnegie company. The company does not sell sheet bars in the open market, but independent sellers are usually governed by the price. The net influence of the announcement is to increase further the prospect that the regular sheet and tin plate price will not be shaded, as $36.50 bars affords a very small margin for the finished operation.

Pig Iron and Coke

Both coke and pig iron have had important developments. Connellsville furnace coke was expected to advance in December on account of prospective snowstorms and cold snaps slowing down railroad operations, but the weather has been good and consumption has not increased in full keeping with the constant increase in production. The result is a slight curtailment in coke production, the first for a long while, and declines in prices. Spot furnace is $6.50 to $6.75, making 50 cents decline in one week and 75 cents in two weeks, while shipment to January 1, which had been held at a stiff premium, can be done at around $7. Foundry coke is off fully 50 cents, at $7 to $7.50, and some rather good brands can be had at $7 for spot. It is rumored but not confirmed that fair quality has been offered for first quarter at $7.

Since about the middle of September pig iron prices have been declining, at first on account of actual declines in coke prices affecting the cost of production, but later on account of expected declines in coke which had not yet materialized. As a result, with furnaces operating lately under contracts for coke at $8 or higher to the end of the year, they have been shipping pig iron at less than production cost, though at prices that might give them a good profit at some indefinite time in the future when coke is available at something like a reasonable price.

Until the past few days the pig iron market was entirely one-sided, consumers buying very sparingly and only for pressing requirements. Now, with additional price concessions, they have begun to take hold for first quarter. One interest set out to sell, as a backlog, one-third the first quarter output of a valley furnace making foundry iron at $25, furnace. About 10,000 tons were sold and then this interest withdrew the price, but others will no doubt make it. The carload market is at about $26, against $27 a week ago. Basic has declined from $25.50 to $25, valley, without inducing much buying, and a somewhat lower price is in prospect. Buyers think the turn may be near at hand and that in any event they cannot lose much in covering part of their requirements as there is little room for further declines and it is well to be on the safe side with part of the tonnage. Bessemer has declined from $28.50 to $28, valley, and is inactive.

CALCULATING THE POWER

(Continued from page 20)

that are made by ordinary machine shop methods in small quantities or singly. These gears are not usually made with fixed tools. The holes are generally bored instead of reamed, and other lathe work is done to scale and calipers, not to stops and gauges. The tolerance needed for such operations is therefore much greater. Just what the result will be depends most on the general tone of the shop and the standards for quality of workmanship that exist in the minds of the foremen and leading hands. This is one of the most difficult things to build up in a shop organization, and one of the most valuable when obtained. Some shops have the spirit of quality,—quality suitable to the purpose, of course,—so ingrained in their organization that their product is their advocate and advertisement wherever it goes. With others—large and prosperous, some of them—the reverse is true. It would be invidious to mention names of the first, and improper here, of the second, but it may be said that the cut gear and gear cutting machine industries furnish several interesting examples in both classes. Fortunately, the average lies nearer the first and progress is in that direction.

PRACTICAL APPLICATION

(Continued from page 19)

variation will be apparent in the distance between the two lines. The simplicity of this also suggests possible developments in the direction of improved method of measuring horsepower under actual running conditions, since with a shaft of given dimensions and material the angular displacement or torsional strain bears a constant relationship to the load applied.

As indicating the practical applications of the oscilloscope, the accompanying illustrations may be of interest. Thus in Fig. 2 the equipment is shown attached to the half-time shaft of one of the latest types of engines, the object in this case being to examine the working of the valve gear. To attach the primary shaft of the gear box to the desired part, a simple form of adapter is supplied. Some difficulty may, of course, be experienced in the examination of parts which must necessarily remain enclosed, but in this connection it may be mentioned that a considerable amount may be seen through a very small aperture, since the light may be projected in any desired direction, whilst the images formed are perfectly clear and definite.

The last-named point will be appreciated on referring to Figs. 3 and 4, which are reproductions from actual photographs of the headstock of a sewing machine running at approximately 1,500 r.p.m.. In the case of Fig. 3 it will be seen that the moving parts present the usual blurred appearance which precludes the possibility of visual examination of the majority of the components. In Fig. 4, however, every part is distinctly visible, although during the time of the exposure necessary to secure the original photograph the machine made upwards of 2,000 revolutions.

Incidentally it may be mentioned as a curious fact that in general the clearest images are obtained when the mechanism is running at the highest speed. This, of course, is due to the fact that a greater number of like impressions are registered in a given time.

ECONOMIC ESSAY CONTEST

Actuated by a desire to advance the study and more general appreciation of economics, Alvan T. Simonds, president of the Simonds Saw Co. of Fitchburg, Mass., and Chicago, Ill., proposes an essay contest open to pupils of high schools and normal schools in the United States and Canada. Mr. Simonds offers two prizes of $1,000 and $500 for the best essays written by students on the subject: "The Lack of Economic Intelligence and some of the injuries it has caused individual and general welfare since 1860."

Mr. Simonds hopes this contest will interest many in the study of economics, who might otherwise pass it by. He also expects it will aid in creating a public sentiment that will result in the practical study of the subject in secondary schools as part of the training of every teacher. By way of suggestion, the donor of the prizes points to the fact that unemployment, hard times and business failures are economic disorders, which, like the diseases of the human body, can be avoided by greater economic intelligence. The essays which Mr. Simonds anticipates should deal with facts of this kind as well as explain concrete examples of injury to individual or general welfare, due to lack of economic intelligence. The readiness of many to accept economic fallacies and to act upon them is another phase of the subject writers may dwell upon.

As a foundation from which the essays may be constructed Mr. Simonds suggests that facts and example which bear on the subject should come from Canadian and American history since 1860 with special emphasis upon the present. Rules governing the contest have been prepared, and persons interested may obtain copies of them by addressing the Simonds Economic Prize Contest, 470 Main Street, Fitchburg, Mass.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Toronto price:—

Silicon, 2.25% to 2.75%	$30 80
Algoma, No. 1, Montreal	33 15
Summerlee, Scotch, Montreal dock	35 00
Summerlee, Warehouse, 5-ton	40 50
Carron, Montreal docks	35 00
Grey forge, Pittsburgh	26 77
Lake Superior, charcoal, Chicago	36 15
Standard low phos., Philadelphia	37 00
Bessemer, Pittsburgh	32 77
Basic, valley furnace	25 00

METALS

	Montreal	Toronto
Lake copper	$17 50	$17 25
Electrolytic copper	17 25	17 00
Castings, copper	17 00	17 00
Tin	45 00	41 00
Spelter	9 50	9 50
Lead	8 00	7 50
Antimony	7 50	9 00
Aluminum	22 00	22 00

Prices per 100 lbs.

BILLETS

F. O. B. Pittsburgh

	Per gross ton
Bessemer billets, 4 in. x 4 in. and larger	$36 50
Open hearth billets	36 50
O. H. sheet bars	36 50
Forging billets	45 00
Bessemer rods	46 50

IRON AND STEEL

Per 100 lbs. to large buyers

Iron bars, base, Toronto	$3 25	3 40
Steel bars, base, Toronto	3 25	3 40
Small shapes, base		3 50
Iron bars, base, Montreal	3 15	3 25
Steel bars, base, Montreal	3 15	3 25
Reinforcing bars, base	3 15	3 40
Steel hoops		4 50
Tire steel, base		3 50
Spring steel	7 00	14 00
Band steel, No. 10 gauge and 3-16 in. base		3 90
Chequered floor plate ¼" and heavier	6 25	7 00
Chequered plates ¼-in. and heavier, sunken diamond		5 40
Bessemer rails heavy at mill		2 35

PITTSBURGH MILL

Steel bars	2 00
Tank plates	2 00
Structural shapes	2 00
Steel hoops	2 75 to 2 90

F. O. B. Chicago Warehouse

Steel bars	2 80
Structural shapes	2 90
Plates	2 90
Small shapes under 3-in.	2 75 to 2 90

PLATES

Plates 3-16 in.	$3.85	$3 60
Plates, ¼ up	3 50	3 40

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$4 75	$5 10
Sheets, blue ann., No. 10	4 25	4 25
Canada plates, dull, 52 sheets	5 00	4 90
Can. plates, all bright	6 50	6 00
Galvanized sheets, No. 28	6 75	6 25
Queen's Head, 28 B.W.G.	7 25	
Fleur de Lis, 28 B.W.G.	7 00	
Gorbal's best, No. 28, U. S. G.	6 10	
Colborne's Grown, No. 28		
Premier 28	6 10	6 35
Premier 10¾ oz.	6 80	6 75
Zinc sheets	10 25	11 50	11 00

FREIGHT RATES

Pittsburgh to Following Points	Per 100 lbs. C.L.	L.C.L.
Montreal	52	65½
St. John, N. B.	76	96
Halifax	77½	97
Toronto	34	48½
Guelph	34	48½
London	34	48½
Windsor	31½	45½
Kingston	48½	61

OLD MATERIAL

Dealers' Average Buying Prices

	Montreal Per Ton	Toronto Gross
Boiler plate	$ 9 00	$ 9 00
Heavy Melting Steel	10 00	11 00
Axles (wrought iron)	20 00	16 00
Rails (scrap)	11 00	11 00
Malleable scrap	10 00	11 00
No. 1 Machine cast iron	22 00	18 00
Pipe, wrought	7 00	6 00
Car wheel	17 00	16 00
Steel axles	15 00	15 00
Mach. shop turnings	6 00	6 00
Stove plate	16 00	14 00
Cast boring	6 00	6 00
Copper, light	9 00	9 00
Copper, crucible	11 50	11 25
Copper heavy	11 25	11 00
Copper, wire	11 25	11 00
No. 1 machine composition	9 00	9 00
New brass cuttings	7 00	7 00
Red brass turnings	7 25	7 00
Yellow brass turnings	5 25	4 85
Light brass	4 50	3 50
Medium brass	6 00	4 50
Scrap zinc	4 50	4 00
Heavy lead	4 50	4 50
Tea lead	3 00	3 00
Aluminum	11 00	11 00

COLD ROLLED STEEL

(At Warehouse)

Rounds and squares	$4 75 base
Hexagon and flats	$5 75 base
Cumberland ground shafting base	$6 00 base

COPPER PRODUCTS

Prices per lb.

	Montreal	Toronto
Copper bars, 1¼ to 2 in.	28-31	.28
Plain sheets, 16 oz. in. 30 x 72 hot rolled	30 00	.29
Copper sheet, tinned 16 oz.	34 00	.36
Copper sheet, planished, 16 oz. base	40 00	.46
Braziers', in sheets, 6 x 4 base	30	.29
Copper tubing, seamless		.33

LEAD SHEETS

Roll Lot Prices

	Montreal	Toronto
Sheets, 3 lbs., sq. ft.	$10 35	$10 50
Sheets, 3½ lbs., sq. ft.	10 25	10 50
Sheets 4 to 6 lbs. sq. ft.	10 10	9 50

Cut sheets, ¾c. per lb. extra

Cut sheets to size, 1c. per lb. extra

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in.	22
Brass sheets, 24 gauge and heavier base	23
Brass tubing, seamless	30

STANDARD BUTTWELD PIPE S/C

Per 100 feet.

Price List No. 57. November 2, 1922.

	Steel Blk.	Gen. Galv.	Wrot. Iron Blk	Wrot. Iron Galv.
⅛ in.	6 00	8 00	....	....
¼ in.	3 96	6 00	7 20	9 30
⅜ in.	3 96	6 00	7 20	9 30
½ in.	5 02	6 55	7 31	8 93
¾ in.	6 10	7 82	8 86	10 70
1 in.	8 67	11 22	12 75	15 47
1¼ in.	11 73	15 18	17 25	20 93
1½ in.	14 03	18 15	20 63	25 03
2 in.	18 87	24 42	27 75	33 67
2½ in.	29 84	38 61		
3 in.	39 02	50 49		
3½ in.	50 60	64 40		
4 in.	59 95	76 30		

STANDARD LAPWELD PIPE

Per 100 feet.

Below dividing line—price per foot

	Steel Blk.	Gen. Galv.	Wrot. Iron Blk.	Wrot. Iron Galv.
2	22 20	27 75	31 08	37 00
2½	32 76	41 54	46 80	56 16
3	42 84	54 32	61 20	73 44
3½	51 52	65 32	73 60	88 32
4	61 04	77 39	87 20	104 64
4½	71 12	90 17	1 07	1 27
5	82 88	105 08	1 24	1 48
6	1 08	1 36	1 61	1 92
7	1 40	1 79	2 07	2 50
8L	1 48	1 88	2 18	2 63
8	1 70	2 16	2 51	3 02
9	2 07	2 62	....	....
10L	1 92	2 43	2 82	3 63
10	2 47	3 13	3 63	4 37

Prices—Ontario, Quebec and Maritime Provinces.
Terms 2% Cash discount if paid within 30 days.

Provinces

WROUGHT NIPPLES

4-in. and under, close and short, 55 per cent.

4½-in. and larger, close and short, 45 per cent.

4-in. and under running thread, 35%.

Standard couplings 4-in. and under 25%.

Do., 4½-in. and larger 5 per cent.

MALLEABLE FITTING LIST

1 in. elbow	.32	.53
2 in. elbow	1.05	1.70
1 in. tee	.43	.70
2 in. tee	1.45	2.40
1 in. coupling R. & L.	.33	.53
1 in. locknut R. & L.	.15	.23

Discount to dealers—70 per cent.

BOILER TUBES

Sizes	Seamless Lapw'ld Toronto		Seaml'ss Lapw'ld Montreal	
1 in.	20.00	....	23.80	....
1¼ in.	22.00	....	23.80	....
1½ in.	24.00	....	23.80	....
1¾ in.	24.00	....	24.50	24.00
2 in.	22.00	19.00	21.00	19.75
2¼ in.	24.00	21.50	24.00	22.25
2½ in.	27.00	23.50	27.00	23.25
3 in.	34.00	28.50	34.00	29.50
3¼ in.	36.00	....	36.00	....
3½ in.	38.00	33.00	38.00	34.25
4 in.	50.00	42.00	49.00	43.50

Prices per 100 ft., Montreal and Toronto

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, 7-16 and up	30
Carriage bolts, ⅜ in. and smaller 6 in. and shorter	40
Coach and lag screws	45
Stove bolts	72½
Wrought Washers	60
Do., corru. head	60
Machine bolts, 7-16 and over	35
Machine bolts, ⅜-in. and less	35
Blank bolts	35
Bolt ends	35
Machine screws, fl. and rd. hd., steel cut thread	37½ & 10
Machine screws, o. and fil. hd., steel cut thread	30
Machine screws, o, and fil. hd., brass cut thread	15
Standard couplings, 4-in. and under, brass cut thread	30% 30
Nuts, square, blank off net list	$1.00
Nuts, square, tapped off net list	50c.
Nuts, hex., blank off net list	50c.
Nuts, hex., tapped net list	
Copper rivets and burrs, list less	32c.
Burrs only, list plus	10%
Iron rivets and burrs	47%
Boiler rivets, base ¾ in and larger	$5.75
Structural rivets, as above	5 65
Wood screws, O. & R., bright	80
Wood screws, flat, bright	82½
Wood screws, flat brass	77½
Wood screws, O. & R., brass	75
Wood screws, flat, bronze	72½
Wood screws, O. & R., bronze	70

NAILS AND SPIKES

Wire nails, base	$3 65
Cut nails, base	4 35
Miscellaneous wire nails	72½%

MILLED PRODUCTS

(Prices on unbroken packages)

Set screws	65
Square and hexagon head cap screws	60
Round head cap screws	20
Fillister head cap screws	35
Flat head screws	25
Button head cap screws	20
Studs	45
Semi-finished nuts up to and including 9/16 in.	70
Semi-finished nuts ⅝ to 1¼ in.	65
Semi-finished nuts 1⅜ to 2 in	35
Coupling bolts	35
Taper pins, up to and including No. 5	65
Taper pin No. 6 and over	55
Planer bolts without fillet	10
Planer bolts with fillet	Net
Patch bolts	Plus 10%
Hollow set screws	20
Thumb screws	50
Thumb nuts	70

CARBON DRILLS AND REAMERS

	Discount.
S. S. drills, wire size	60
Can. carbon cutters	plus 10
Standard drills, all sizes	60
3-fluted drills, plus	10
Jobbers and letter sizes	60
Bit stock	50
Ratchet drills	25
S. S. drills for wood	10
Wood boring brace drills	50
Electricians' bits	30
Sockets	50
Sleeves	30
Taper pin reamers	20
Drills and countersinks	20
Bridge reamers, carbon	30
Centre reamers	Net
Taps, machine screw	55 to 60
Taps, hand, ¼ in. to ⅜ in	40 to 45
7/16 in. to. ⅝ in.	40 to 50
11/16 in. to 1 in.	35 to 45
Chucking reamers	20 off
Hand reamers	20
High speed drills, list	40
Can. high speed cutters	plus 10
American	plus 40

FILES AND RASPS

Globe	60/5
Vulcan	50
P. H. and Imperial	60
Nicholson	35/5
Black Diamond	35/5
Heller	40
Jowitts	net
J. Barton Smith, Eagle	55
McClelland, Globe	50
Delta Files	20
Disston	40
Disston	50
Great Western-American	50
Kearney & Foote, Arcade	60/5

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

PROOF COIL CHAIN

B. B. B. CHAIN

⅜ in., $16.45; 7-16 in., $14.00; ½ in., $12.95; 5-8 in., $13.15; ¾ in., $12.75; ⅞ in., $12.25; 1 in., $11.85; 1⅛ and 1¼ in., $10.55. Fire weld chain same sizes respectively are $14.00; $11.50; $10.40; $10.55; $10.15; $9.75; $9.35; and $8.25.

ELECTRIC WELD COIL CHAIN B.B.B. ⅛ in. $20.00; 3-16 in. $16 50; ¼ in. $15.50; 5-16 in. $12.70.

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	30%
Standard	30 and 10%
Cut leather lacing, No. 1	1.60
Leather in side, (Lacing)	1.50

RUBBER BELTING

Standard 36 ....28% Best grades 28%

TAPES

Chesterman Metallic, 50 ft.	$5 00
Lufkin Metallic, 603, 50 ft.	3 17
Admiral Steel Tape, 50 ft.	3 00
Admiral Steel Tape, 100 ft.	4 50
Major Jun. Steel Tape, 50 ft.	3 75
Rival Steel Tape, 50 ft.	4 40
Rival Steel Tape, 100 ft.	8 75
Reliable Jun. Steel Tape, 50 ft.	5 25

PLUMBING SUPPLIES

Plumbers' oakum, per cwt.	$ 6 40
Navy oakum, cwt.	13 00
Solder, strictly	0 25
Solder, guaranteed	0 26½
Soldering coppers, lb.	0 62½
White lead, pure, cwt	13 20
Red dry lead, 100-lb. kegs, per cwt.	9 75
Wood alcohol, per gal.	1 75
Whiting, plain, per 100 lbs.	3 00

ROPE AND PACKING

Packing, square braided	0 38
Packing, No. 1 Italian	0 31
Packing, No. 2 Italian	0 24
Pure Manila rope ¾ and larger, base	0 20
British Manila rope	18
New Z aland hemp	0 18
Jute packing, fine	15c
Jute packing, coarse	11c

OILS AND COMPOUNDS

Castor Machine Oil, per lb.	34½
Royalite, per gal. bulk	21
Machine oil, per gal.	39
Black oil, per gal. (Summer)	19
Cylinder oil, Capital	69½
Turp., single bbls., gal.	2 20
Linseed oil, raw, single bbls.	1 06
Premier gasoline	29 00
Fuel oil, bbls., gal.	10 80

WASTE

XXX Extra	17	Atlas	18
Peerless	21	X Empire	13½
XX Grand	16	Ideal	18
Superior	20	X Press	12
X L C R	15		

Colored

Lion	12½	Fancy	12
Standard	11	Popular	9½
No. 1	13	Keen	8

Wool Packing

Arrow	24	Anvil	16
Axle	20		

Washed Wipers

Select White	18	Dark colored.	13
Mixed Colored	14		

This list subject to trade discount

PLATING SUPPLIES

Polishing wheels, felt	$3 25
Polishing wheels, bull-neck	1 60
Emerey in kegs, Turkish	7½
Pumice, ground	3 to 4½
Emery glue	18
Tripoli composition	6 to 8
Crocus composition	12
Emery composition	11
Rouge, silver powder	60
Rouge, powder, nickel	35

Prices per lb.

ANODES

Nickel	40 to 45
Copper	22to 24
Zinc	14 to 14½

PLATING CHEMICALS

Acid boracic	.20
Acid, hydrochloric	.03¾
Acid, nitric	.10¼
Acid, sulphuric	.03¾
Ammonia, aqua	.20
Ammonium, Carbonate	.15
Ammonium, chloride	.13
Ammonium, hydrosulphuret	.75
Ammonium, sulphate	.10
Arsenic, white	.18
Copper carbonate, anhy.	.26
Copper, sulphate	8 to 10
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.14
Nickel carbonate	.32
Nickel sulphate	.14
Potassium sulphide (substitute)	.40
Silver chloride (per oz.)	.85
Silver nitrate (per oz.)	.70
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.31
Sodium hyposulphite	.08
Sodium phosphate	.10
Tin chloride	.50
Zinc chloride, C. P.	.30
Zinc sulphate	.06

Prices per lb. unless otherwise stated

News From the Industrial Field

Ford Motor Company, Detroit, has removed oil burning apparatus from boilers in Highland Park plant and is again using coal for fuel.

Foreign pig iron arrivals at Philadelphia during the past week totaled close to 21,000 tons, the largest tonnage since heavy import movement started.

In the first eleven months this year Clyde Shipbuilders launched 113 vessels, totaling 369,326 tons, which is 52,500 tons behind last year and 260,000 behind the largest output of the yards.

In the motorizing of machinery in the Ford plant at Walkerville and in the new extension, as proposed, the motors will be of the direct current variable speed type of various sizes for the equipment of each tool.

A Japanese firm of copper producers and electricians have agreed with a German firm for erection of a $5,000,000 factory to be built between Tokio and Yokohama. The Germans are contributing certain inventions in exchange for 20 per cent. of the stock. The factory will be under German management.

Port Arthur, Ont.—With twenty-three vessels in port one day recently the Port Arthur-Fort William harbor presented a scene of great activity. Fifteen of the largest vessels on the lakes were loading grain; twelve vessels were expecting to clear during the day, taking out 3,225,000 bushels. This is the largest single day's shipment by water so far this year.

Motor vehicles registered in Canada during the year 1922 numbered 470,000, as compared with 402,029 cars in 1920 and 2,100 cars in 1907, according to the latest government figures. During the past four years the car registration in Canada has almost doubled, and the Dominion now holds second place in per capita possession of automobiles—about one car to every eighteen people.

Passenger steamers in the Canadian service head the list among the large steamships built during the year, according to Lloyds Register of Shipping report, just issued. Thirty-two ships exceeding 10,000 tons are listed. Of these the Canadian Pacific "Empress of Canada," 21,517 tons, in service between Vancouver and the Orient, was the largest Canadian steamship.

That an American firm is willing to erect a one-million dollar plant and employ about 2,000 hands in Scarboro if water at reasonable rates can be supplied is the statement of J. Kennedy of the Scarboro Industrial Committee. He says further, that the firm has searched a radius of thirty miles, and had found a suitable site there. The amount of water they will use is 1,500,000 to 2,000,000 gallons per month at the start, and will later require 4,000,000 per month. In New Toronto the price to manufacturers is 10 cents per thousand, but in Scarboro it is 25 cents per thousand. They have located a suitable site at about $2,000 an acre, and will require 20 acres, later extending to 65 acres.

John Irving, general sales manager of Nova Scotia Steel and Coal Co., is dead. Mr. Irving was president of the Hattie Gold, and while visiting the property he contracted a severe cold which resulted in his death. He was at one time a resident of Toronto and was a member of Toronto Lacrosse Club.

The twelve-hour day and the type of worker it produces have outlived their usefulness in American life, President Harding is quoted as saying in a statement made public recently. He adds:—

"The old order of the twelve-hour day must give way to a better and wiser form of organization of the productive forces of the nation, so that proper family life and citizenship may be enjoyable suitably by all our people."

Newfoundland.—Subject to ratification by the Newfoundland legislature the Premier of Newfoundland has concluded an agreement of settlement between the Reid Newfoundland Company, the Government of Newfoundland, Armstrong, Whitworth, Ltd., and the British Government, the outcome of which is expected to be the erection of a pulp and paper plant at a cost of $18,000,000, which will outrival the famous mills established by the late Lord Northcliffe.

Exports of pulp and paper during October amounted in value to $9,897,356, of which $5,811,954 was in newsprint and $3,936,367 in wood pulp, $49,035 being in other kinds of paper. There were 1,631,043 cwts. of newsprint, and 1,147,199 cwts. of wood pulp shipped. The United States took all but 146,862,000 cwts. of the newsprint exported. As compared with September there was a falling off in the exports of wood pulp, but an increase in those of newsprint.

A despatch from London, states that several French industrialists are negotiating with German business men, with the object of establishing a big metal trust in Central Europe under French leadership, says a Central News despatch from Berlin. "The leading spirit of the movement," the despatch says, "is stated to be Eugene Schneider (the French steel magnate), who, having a dominating business power in Italy, Jugo-Slavia, Czecho-Slovakia, Austria, Luxembourg and the Sarre, desires to subdue the operations of the German syndicates. He is said to contemplate a trust surpassing in magnitude even the United States Steel Corporation. "The captains of German industry hope that if the plan succeeds this form of Franco-German co-operation will have an effect on reparations."

Crane, Limited, Toronto, expect to occupy, by Jan. 1, their new three-storey office and warehouse, Front St., West, which is to cost $125,000. Architects are Wm. Steele & Sons, and the contractors, Anglin-Norcross, Limited, Toronto.

Victoria, B. C.—All over the province lumbering operations have taken on a new lease of life, and an interesting development in this connection is the erection of a railway line, forty miles long, on Vancouver Island for the Victoria Lumber and Manufacturing Company. It will open up some of the finest timber stands on the Island. To consume the enormous supply of timber tapped by this railway the company proposes to increase the capacity of the mill at Chemainus to 1,000,000 feet a day provided the lumber market remains good.

Montreal.—Mount Royal Metal Co are moving to their new plant, corner Mill and Oak sts. They have been in existence for 35 years as manufacturers of solders, babbitts, type metal and other white metal alloys. The new plant will enable them to increase their present output considerably. The building is of concrete cement blocks with a monitor roof of steel and wood, coated with gravel. This type of roof is considered most satisfactory in carrying off gases and smoke from crucibles and furnaces. In connection with this business, though a separate organization, the National Bronze Co. has been incorporated and will occupy part of the new building. It is their intention to install two furnaces made by the Surface Combustion Co., of Philadelphia. Output will consist of brass and aluminum castings up to 800 lbs.

Manager of the Mount Royal Metal Co., is G. R. Hutchins, who is also secretary-treasurer of the National Bronze Co., of which J. R. Robb is president and H. J. Roast, vice-president and general manager. Both Mr. Hutchins and Mr. Roast are practical men, and graduates of McGill, the former in electrical engineering and science and the latter is a consulting chemist, in which subject he is a lecturer in McGill. He will have personal supervision of the National Bronze chemical laboratories.

Loss of $40,000 was caused when fire destroyed a new filtering plant at the refinery of the Canadian Oil Co., Petrolia. The plant was completed during the summer and had been in operation about two months.

Cobalt is considering the installation of an auxiliary or gasoline-driven duplication of the main water line, and a "loop main" in the business section. The auxiliary system, it is estimated, would cost $10,000.

Ruggles Motor Truck Co., London, are reported to be very busy on export orders. At a recent sales convention in Saginaw, Mich., Canadian delegates were present from as far west as Calgary and as far east as Halifax.

Montreal.—Wage reductions affecting 35,000 railway shopmen, that were imposed on Aug. 16, are to remain in force, as the result of a recent conference. The cuts range from five to nine cents an hour.

The Shawinigan Engineering Co. will construct a water-power development scheme for the Shawinigan Water and Power Co. The cost will be approximately $1,500,000.

It is estimated that ore shipments from Wabana Mines, of the British Empire Steel Corporation, to Germany for the past year will total about 700,000 tons. Officials of the company express the belief that the prospects for a permanent market abroad are now assured. Twelve freighters carrying 11,000 tons a month have been taking ore from Newfoundland to Rotterdam.

W. J. Egan, Canadian Trade Commissioner to South Africa, is now in Canada, and will undertake a business tour throughout the country. Canadian manufacturers and exporters who are desirous of being brought into touch with Mr. Egan, or who wish to interview him during the course of his tour, are requested to communicate with the Director, Commercial Intelligence Service, Department of Trade and Commerce, Ottawa.

CANADIAN-FRENCH AGREEMENT

The trade agreement negotiated by the Canadian Minister of Finance with the French Government opens the way for renewed trading between these two countries. Not only does Canada get equal treatment with the United States in the matter of trade as carried on at present by the latter country but the Dominion gets additional benefits in connection with the exportation of pulp and farm implements and asbestos. The new treaty between France and Canada is calculated to remedy a discrimination which has arisen out of the decree issued by France in March, 1921, increasing nearly all the rates of the French general tariff. Although this decree was aimed at countries with depreciated currency, it had the effect of placing Canadian goods in an unfavorable position as compared with those of the United States.

HOW STEEL COMPANIES STAND

Purchase of the Midvale Steel & Ordnance Company by the Bethlehem Steel Corporation makes a new line-up of the big steel companies of the United States in respect to their steel ingot capacities. The following table classifies the leading nine companies of the country, expressed in percentage of their ingot output possibilities, assuming that the total capacity of the United States is 50,444,000 tons annually:

Company	Per Cent.
United States Steel Corporation.	45.00
Bethlehem Steel Corporation ...	15.50
Jones & Laughlin Steel Company	5.24
Youngstown Sheet & Tube Co...	2.98
Republic Iron & Steel Company	2.77
Colorado Fuel & Iron Company.	2.26
Inland Steel Company	1.98
Steel & Tube Company of Amer.	1.79
Brier Hill Steel Company	1.19
Other steel companies	21.29
	100.00

QUEBEC BUILDING PROSPECTS PROMISING

Quebec.—Prospects in regard to the building trade for the coming year are very promising. This judgment is based on interviews with contractors and wholesale hardware men in Quebec. A feature in the New Year will be, no doubt, the renewed demand for fabricated steel and iron to be used in building construction in place of wood. It is only within the past few years that there was a demand for steel in connection with house and warehouse building in the city and district. Being the central market for timber, this material was generally used. But the many fires in the past few years, which have destroyed churches and colleges, has directed attention to steel.

Business in the city and district of Quebec has been about normal during the past year. Employment of labor has been fairly steady. Four hundred and fifty new dwellings were erected with prospects of as many more next spring. Reports from the rural districts indicate that the farmers all made money during the past five years and are now arranging for more extensive farm homesteads. This is bringing orders in plenty to the hardware trade. The Quebec farmers are beginning to go in for farm machinery to equip their farms, and there are splendid possibilities for this line of trade. The provisional government is generous in its assistance to the farmer, who is enabled to borrow money on easy terms. On the whole, the coming year promises to be a banner one so far as building is concerned.

Proper storage of patterns is essential to profitable manufacturing. This, usually, is expensive equipment and replacements and repairs should be reduced to the minimum.

McAVITYS' TO HAVE NEW CENTRAL PLANT

St. John, N. B.—The firm of T. McAvity and Sons, Limited, one of the leading machinery manufacturing concerns in the maritime provinces, is gradually removing its widely separated plants in St. John to one centralized plant. The new plant consists of three buildings of one story, of steel, concrete and glass, with the roofs and parts of the sides of each building entirely of glass.

For many years part of the machinery plant of T. McAvity and Sons, Limited, has been in the south end of St. John, where it was known as the Vulcan Machine Works. This group of buildings has been closed to manufacturing and is now being used as a group of war houses. The work of removing the plant was effected in a week. One of the new buildings has been devoted to the former Vulcan works.

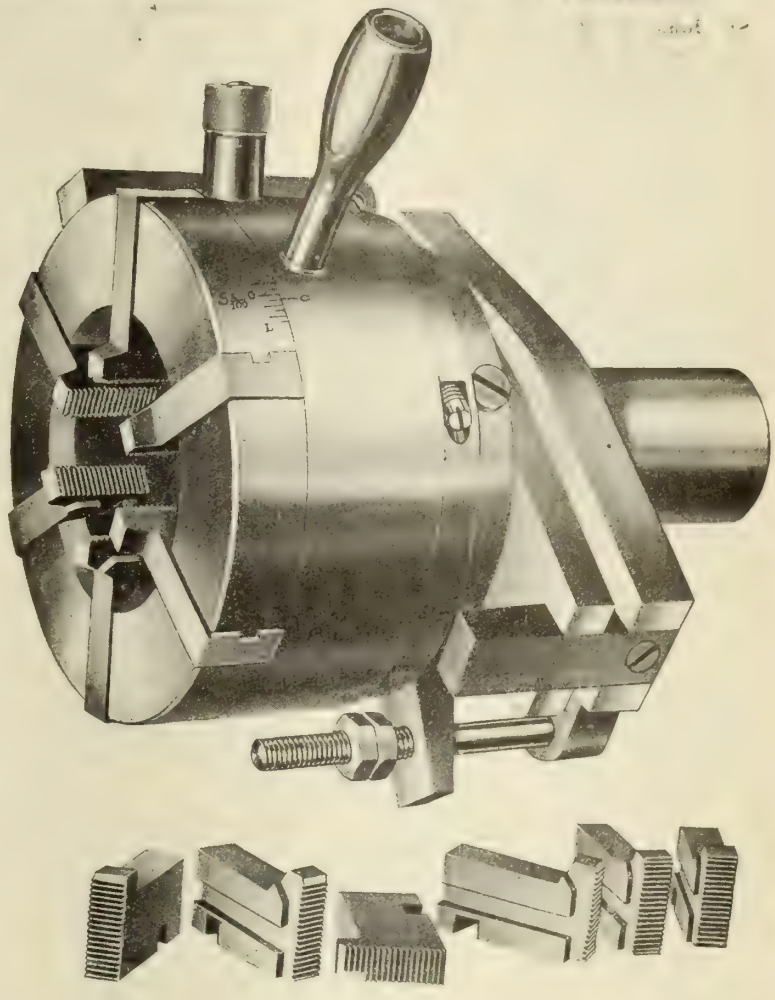
During 1923, it is expected that all of the manufacturing plant of T. McAvity and Sons, Limited, will have been removed to the new location. This will include the plant on Water Street in St. John, on the waterfront, which has been in existence for sixty years. In this plant brass machinery of different kinds is manufactured. T. McAvity and Sons produce hydrants, pumps, valves, boilers, pipes, etc.

The firm was founded by the late Thomas McAvity and later Mr. Avity took his sons into partnership with him, including, the late James H. McAvity, Thomas McAvity, Jr., George McAvity and Stephen McAvity and John McAvity. For many years, Thomas McAvity Jr. has not been active in the business of the firm. The active head of the manufacturing department of the firm has been George McAvity, who also directed the operations of the firm during the war period, when shells were largely manufactured by T. McAvity and Sons, for four years.

The new plant is located near the eastern gateway to St. John. A spur line of the Canadian National Railway connects the plant with the main line of the road which is but a few hundred yards away. A short distance from the plant are the new Courtenay Bay docks and the new dry dock.

At one time the terms "wrought pipe" and "wrought-iron pipe" were virtually synonymous, as all pipe was originally made of wrought iron. The use of steel pipe, however, has increased so rapidly that now about 90 per cent. of the wrought pipe manufactured is made of steel. According to the National Tube Co., "wrought pipe" is a term that is applied to both steel and iron pipe, and a man who advertises that he is a dealer in wrought pipe means that he sells pipe made of both materials. The term "wrought-iron pipe" means that the pipe is made of wrought iron, which is the product of the puddling furnace; while "steel pipe" is applied to pipe made of steel.

DIE HEADS THAT SHOULDER THE WORK



One simple way to reduce production costs is to increase production. More and more shops are becoming 100% Geometric in their tool equipment, because they know that increased production invariably follows where Geometric Tools are used.

A Screw Thread Geometrically cut is correctly produced.

Geometric Die Heads can be fitted with Chasers for cutting close to a shoulder when required.

This Geometric Die Head is arranged for the Potter & Johnston Automatics. Note the Floating Shank, which makes close Camming unnecessary and also prevents inaccuracies caused by either forcing or holding back the Turret.

When you put a Geometric Die Head or Collapsing Tap on your Screw Machine or Turret Lathe, you put the name of the Geometric Tool Company there, and thereafter **they have a record to keep with you.**

Send in Your Specifications and Let Us Match Them With a Die Head That is Right

The Geometric Tool Company

New Haven, Connecticut, U.S.A.

Canadian Agents:

Williams & Wilson, Ltd., Montreal. **The A. R. Williams Machinery Co., Ltd., Toronto**
St. John, N.B.; Halifax, N.S.; Vancouver, B.C.

COMPENSATION LEVY SUBJECT OF PROTEST

St. John, N. B.—The Bathurst Company, Limited, Bathurst, N. B., controlling a pulp mill, three saw mills, steamship docks, 2,563 square miles of timber land, and which is building a new paper mill, all at Bathurst, has not relinquished efforts to nullify the program of the Workmen's Compensation Board of New Brunswick.

For several years the Bathurst Company, which was recently renamed from Bathurst Lumber Company, has been contesting the right of the New Brunswick Workmen's Compensation Board, to assess the manufacturers so exorbitantly. The levy is believed to be the highest of any board of this nature in the world.

Angus McLean, president of the Bathurst Company, has stood resolutely against the extravagances of the board. He has pointed out that the bulk of the aggregated amount obtained by assessments on manufacturers each year goes towards defraying expenses and salaries of the members of the board and staff. Only a minor proportion is used to pay the compensation claims that come before the body per annum. The expense items are especially heavy, and Mr. McLean believes it is unfair that the manufacturers should be forced to pay all the cost of operation for such an expensive commission, and the employee escape without being called on to pay even a fraction of what the manufacturer pays.

Mr. McLean has brought this subject before the Canadian Manufacturers' Association, and it has created much discussion among the members. At the 1922 annual meeting which was held at St. Andrews, N. B., this subject, which was introduced by Mr. McLean, was one of the leading topics of the convention.

Although the New Brunswick courts have upheld the claim of the board to collect $20,000 from the Bathurst Company, the company will not rest the case there. It will be taken to the highest tribunal as a test case. As such it will be of vital interest to all manufacturers.

SHIPPERS CO-OPERATE AGAINST CAR SHORTAGE

Improvement in business conditions has increased demand for cars, and the Railway Association of Canada is calling the attention of executives in all Canadian concerns interested in shipping or receiving shipments of goods without delay, to the necessity for public co-operation to offset the difficulty.

At the present time, it is pointed out, there are approximately 24,000 more Canadian box cars in the United States than United States cars of a similar class in Canada.

In addition to this factor of impaired railway service, the recent termination of the coal strike throws on the American railways a suddenly increased demand for cars and motive-power to move accumulated orders for coal. This makes it even more difficult for the Canadian roads to keep down the number of their cars on foreign rails.

To meet the situation, the Railway Association of Canada has made special direct representations to Washington and obtained assurances that the United States railways will do their best to hurry the return of cars; and the Canadian roads, through this Association, will maintain constant pressure to see that this is done. Furthermore, the dwindling supply of cars will be offset as far as possible by the usual effort of Canadian roads to move cars faster and farther and thereby make each car carry more in a day. In spite of the railways' best efforts, however, the shortage is becoming daily more acute.

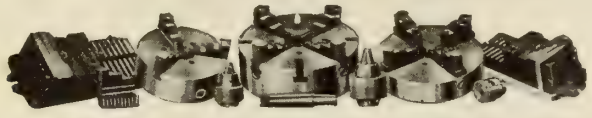
One great factor in car economy lies out of the railways' control—and in the hands of your Shipping and Receiving Departments. If they will take pains to load more goods in each car and release cars promptly, they will help protect their plant and their neighbors' plants against the further danger of car shortage.

There was an increase of over 28 per cent. in the traffic through the Welland Canal during October, and this was almost entirely due to wheat shipments which amounted to 10,878,300 bushels as against 3,403,300 bushels for 1921. The anthracite coal passed through the canal and bituminous coal fell off 57,826 tons. In the Sault Ste. Marie canals, iron ore shipments amounted to 5,906,298 tons, as against 3,209,886 tons in October, 1921.

It must be realized that while lack of lubrication will in time always cause mechanical failures, all such failures are by no means due to this cause. Faulty metals, poor design, careless alignment or adjustment, can never be corrected by lubrication. This is certainly obvious—but it is frequently lost sight of.

The metals that can be held by magnetism are cast iron, wrought iron, malleable iron and steel. Many magnetic chucks can be used with or without water or other lubricants for cooling the work, which increases their range of usefulness.

SKINNER CHUCKS
Accurate Through Careful Manufacture
THE SKINNER CHUCK COMPANY
NEW BRITAIN, CONN U.S.A Established 1887.



CLASSIFIED OPPORTUNITIES
on Page 40

LUFKIN

COMBINATION SQUARES

LUFKIN

BEVEL PROTRACTORS
COMBINATION SETS

YOUR CLOSE INSPECTION INVITED BY THEIR NICETY OF DESIGN AND FINISH

You will then see, among other improved features, center head with both legs exactly same length and ends formed, insuring accuracy on any circumference, large or small. Double protractor readily convertible into single protractor, serving perfectly for every sort of work.

THE LUFKIN RULE CO. OF CANADA LTD. WINDSOR ONT.

CLECO PRESSURE SEATED AIR VALVES

Style PO

Style PO: Parallel Valve has "waste port" to bleed the air from hose after valve is shut off, sizes ¼" ⅜" ½" ¾" 1" 1¼" 1½" and 2" Standard Pipe Thread Outlets.

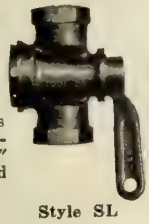
Style A

Style A: 30-degree Angle Valve, sizes: ½" and ¾". Standard Pipe Thread Outlets.

Styles A, RA and SL also have waste-ports to bleed air from hose.

Style RA: 90 degree Angle Valve sizes ¼" ⅜" ½" and ¾". OUTLETS Standard Pipe Thread.

Style RA



Style SL

Style SL: The Inlets and Outlets are the same size and in alignment. Sizes ¼" ⅜" ½" ¾" 1" 1¼", 1½" and 2" standard pipe threads.

The Air Pressure is always on the Large end of Valve Plug holding it firmly on Seat.

The Valve That Improves With Use
Requires no attention after installation.

IN STOCK

Riveting Hammers, Chipping Hammers, Sand Rammers, Air Drills, Grinders, Corner Drills, Bowes Hose Couplings, Cleco Air Valves, etc.

Style F.W.L.: Four-way valve controls the supply and exhaust from both ends of a double acting piston. Sizes: ⅜" ½" ¾" and 1" Outlets.

Style FWL

Style LW

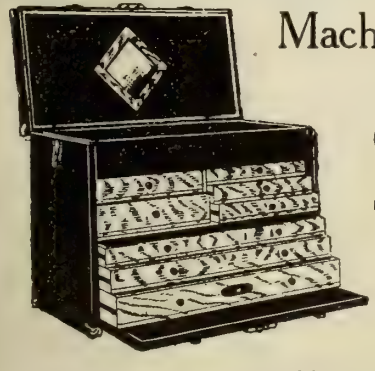
Style LW: Three way valve sizes ½" ¾" and 1." Standard pipe thread Outlets.

Write for Illustrated Bulletin No. 50

CLEVELAND PNEUMATIC TOOL CO., of Canada Ltd.
84 Chestnut Street, Toronto **337 Craig Street, Montreal**

Ask for Quotations on Iron and Steel

We have in stock for immediate shipment the highest grade Bar Iron, Black and Galvanized Sheet Iron, Machine Steel, Cast Steel, High Speed Steel, Cold Rolled Steel, etc.



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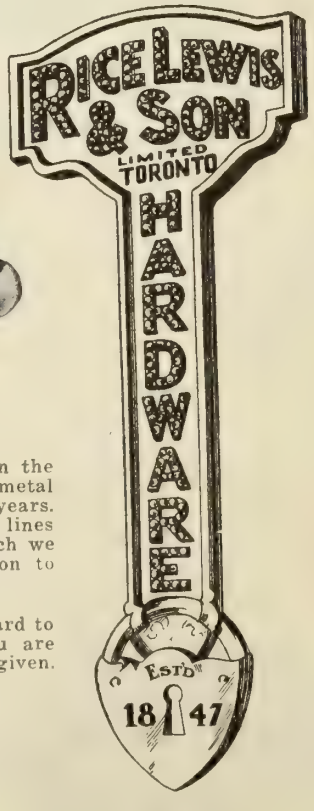
Machinists' Chests: Machinists remark daily on the strength of construction and compact design of our tool chests. Do you want full particulars?

We have been in the hardware and metal business for 75 years. We handle only lines of **proven** reliability, which we **know** will give satisfaction to our customers.

Any information with regard to those lines in which you are interested will gladly be given.



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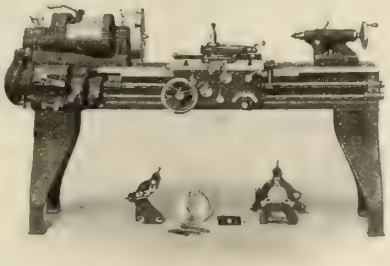
A Powerful Tool Room Lathe

SMALL in size, but big in production; 32 changes of thread without reversing; completely covered all-steel gears and other practical features go with this double back geared engine lathe. 12" 14", 18," and 22" swing.



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ROCKFORD LATHE & DRILL CO., Rockford, Ill.

ATKINS Sterling Quality SAWS

When in need of Circular Metal Cutting Saws, Hack Saw Blades, Hack Saw Frames, Kwik-Kut Power and Metal Cutting Band Saw Machines we will be pleased to have your specifications.

"A BETTER SAW FOR EVERY USE"

Address the nearest point below

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Building for the Future

On the Experience of the Past

The "Incomparable"

That New Steel Chuck

Style 214

THE CUSHMAN CHUCK CO. HARTFORD, CONN., U.S.A.

DUMORE HIGH SPEED GRINDERS

combine perfect balance with correct speed to insure a degree of accuracy never before obtained with portable grinders. Write for information concerning what they will do for you.

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For Hardness Testing

in shop and laboratory use the

Standard Scleroscope

Universally adopted; direct reading; inexpensive, and the only instrument that agrees with others of its kind in all parts of the world, thus solving problems of ordering materials to specification

BOOKLET FREE.

Heat Indication

by optical means is fast becoming the correct thing. The PYROSCOPE has solved the problem

THE PYROSCOPE

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Perfect constancy, inexpensive, no electricity used to stand rough usage, and upon common-sense lines Built Used by the Government and best firms.

The Shore Instrument & Mfg. Co. Van Wyck Ave. & Carll St. JAMAICA, N.Y.

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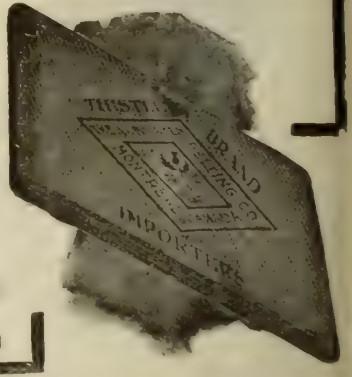
"Maintenance of Quality"

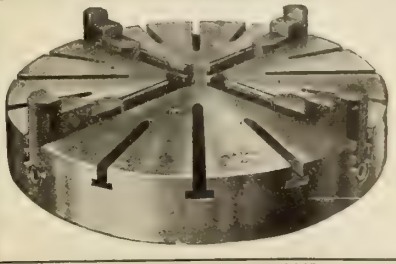
is our motto, and our experience in the manufacture of belting since the year 1856 should be invaluable to you. Let us tell you all about this friction faced belting. The price will appeal to you.

Write to-day.



J. C. McLAREN BELTING CO., LTD.

TORONTO, MONTREAL, WINNIPEG



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They represent strength and economy with high-speed cutting tools. Accurate and dependable always.

Our All-Steel Independent Chucks have established records for accurate, long-wearing qualities. We also make Geared Scroll Chucks and the Geared Scroll Combination. Ask for particulars.

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If interested, tear out this page and place with letters to be answered

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IMPORTERS OF
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Gooda Submitted on Memorandum if Desired
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MANUFACTURERS OF
DIAMOND POINTED TOOLS
All Mountings Fully Guaranteed
Office and Factory:
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ACCURATE RIGID DEPENDABLE
Manufactured in various types and sizes for all classes of milling.
KEARNEY & TRECKER CORPORATION
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Founders, Machinists, Millwrights and Engineers
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Contractors' Derricks and Equipment—Belt and Chain Elevators—Conveyors—Paint Machinery

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FOR ALL KINDS OF HEAVY LIFTING
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Flexible shaft equipments for grinding, polishing, drilling, reaming, scraping, scratch brushing, power screw driving and nut setting.
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Sheet Metal Working Machinery
THE D. H. STOLL CO., INC.
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Semi-Automatic, Fully Automatic
Also Lathe Chucks and Centering Machines
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Let Us Tell You About Our Machine
"TRY THE STEINLE"
Send Us Blueprints of Your Work
STEINLE TURRET MACHINE CO
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MORTON 30-INCH DRAW-CUT SHAPER
Investigate this machine to-day. The most powerful shaper. Wide range of work. Ask for bulletin 3A.
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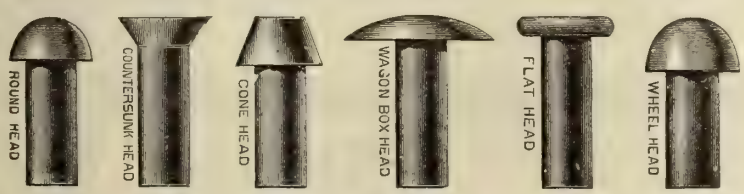
VICTORIA Special Machinery
DESIGNS PATTERNS
CASTINGS FORGINGS
Send for Catalogue
Victoria Foundry Co., Limited, Ottawa, Canada



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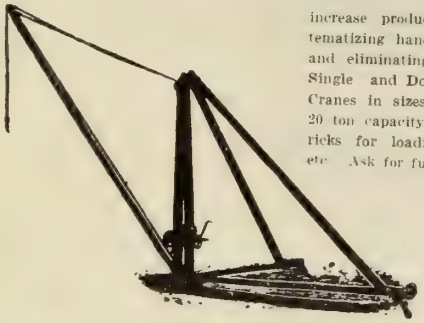
GANANOQUE, ONTARIO

Organize Your Production

There is always loss of time and labor when men work individually instead of in unison.

HEPBURN
Cranes and Hoists



increase production by systematizing handling methods and eliminating time losses. Single and Double I-Beam Cranes in sizes from 1-4 to 20 ton capacity. Scotch Derricks for loading, moving, etc. Ask for full particulars.

JOHN T. HEPBURN, LIMITED
ENGINEERS and IRON FOUNDERS
18-60 VAN HORNE STREET, TORONTO, CANADA

The Hammer With The Human Stroke

HEADS RIVETS COLD

Heads 'em tight or loose, flush, countersunk, or finishes heads any shape desired, and at the rate of:
A rivet a second, sizes up to 3/16".
A rivet in two seconds, size ¼" to ⅜".
A rivet in three seconds, size 7/16" to ½".
And on special order we build machines to handle rivets up to 1½" with proportionate rapidity.
Built in eight sizes.
Besides riveting, the High Speed Riveting Hammer does all kinds of peining, swaging, upsetting, etc.
Send us sample assembly parts with rivets or sketch of your work,
and
Let us shoulder your riveting problems.
Send for the High Speed Hammer Book.

THE HIGH SPEED HAMMER COMPANY, INC.
ROCHESTER, N.Y.

THOMPSON
UNIVERSAL GRINDING MACHINES
THE THOMPSON GRINDER CO.
SEND FOR BULLETIN NO. U.13. SPRINGFIELD, OHIO.

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OF QUALITY SINCE 1878.
SMITH'S FALLS MALLEABLE CASTINGS LTD
SMITH'S FALLS, ONTARIO.

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CLOSE Joints and Welded Steel Tubing for Bedsteads, Trolley Arms, Agricultural Implements, and all other manufacturing purposes, reliable quality, uniform in size, 14 to 20 gauge, 3-8 inch to 2 inch outside diameter.

STANDARD TUBE COMPANY, LIMITED
WOODSTOCK, ONT.

If interested, tear out this page and place with letters to be answered

The Perfect Grip

An ordinary hammer will slice the head off a nail, because it gets a grip on the head and not on the nail. With the head off, it's all off.

Williams' perfectly balanced Hammers will grip the **body** of a nail, and pull it, head and all, clear through a plank. All nails are trailers to Williams' hammers.

Heads on or heads off, for drive or pull, Williams' Superior Drop-Forged Hammers are the bosses in the nail world. Good workmen want them because they fit the hand, are perfectly balanced and are good all through.

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YOU MUST HAVE-- BABBITT METAL

that can be depended on.

Because—

our products bear this reputation they are being used extensively from coast to coast.

HARRIS HEAVY PRESSURE

The BABBITT METAL—

unequalled for all General Service and of such high quality that it can be employed in many cases where a Genuine Babbitt has been used

without a fault

IMPERIAL GENUINE

For your main bearings and where excessive shock, strain or friction is encountered.

No Finer Babbitt Manufactured

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Two cents a word, including "Canadian Machinery" box numbers; minimum charge is $1.00 per insertion for 50 words or less, set in 6-pt. type. Each figure counts as a word. Display ads., or ads. set in border, are at the card rates.

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BRANTFORD PATTERN WORKS ARE PREpared to make up patterns of any kind—including marine works—to sketches, blue prints or sample castings. Prompt, efficient service. Bell 'Phone 631; Machine 'Phone 733. Brantford Pattern Works, 49 George St., Brantford, Ont (ctfm)

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PRACTICAL AND VIGOROUS FACTORY EXecutive desires a change. Is now employed as manager in charge of office and mechanical ends. Highest references, character and ability Apply Box 820, Canadian Machinery. (C.22M).

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WANTED ONE SECOND-HAND ELECTRIC blue printing outfit. John T. Hepburn, Ltd., 18 Van Horne St., Toronto, Ont.

WANTED—200 to 300 H.P 3 phase, 25 cycle, 550 volt, belt driven Generator set, used equipment preferred; must be in good working order Box 821, Canadian Machinery.

WANTED—ENERGETIC YOUNG MAN, assistant to Production Superintendent, General Engineering Plant. Certain mechanical knowledge required. Energy and ability to work principal features. Box 819, Canadian Machinery (C.23.M.)

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Reasonable rent to responsible party. For further particulars write Box No. 818.

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Japanning Oven Electrically Heated

Size Over All: **Height, 60"** **Width, 36"** **Depth, 57"** — 500 lbs. dead weight, will reach temperature 370 deg. F. in 1 hour.

Core Ovens—Swing door type, 5 shelves or sectional wall construction.

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Double ball bearing casters with 4" single wheels. The best truck caster made and with an easy swivel.

Fully illustrated catalog on application.

Industrial Ovens of all kinds—Heated by Gas, Electricity, or Fuel Oil.

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We have just taken over the Smith Invention's complete line of Welding and Cutting apparatus with a full line of miscellaneous welding supplies.

Write us for full particulars.
THE ACME WELDING CO.,
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Grey Iron Castings

Light and Medium-Bench and Floor Repetition Castings; Capacity 15 tons per day.
Expert Metal and Wood Pattern Work. Our advice and estimates will save you money.
Semi-finishing operations on Lathe or Grill on Castings supplied if required.

ASK US

THE KATIE FOUNDRY, GALT, ONT.

GRINDERS and SPECIAL MACHINERY

We make a complete line of Bench and Floor Grinding Machines, equipped with Patented Adjustable Guards and Tool Rests, and Special Mounting Means. We also design and manufacture special machinery for any purpose. Let us have your enquiries.

SUMBLING MACHINERY Company Ltd.
7 St. Mary St. – Toronto, Ont.

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SCRAP ENDS
STEEL PLATES 9, 10, 11 Gauge

Carloads or less. Suitable for making Iron Washers.

The Graham Nail Works
Toronto

CLOSING TIME

Advertisements for this section must be in our composing room Tuesday morning prior to day of issue.

In order that the announcements of your wants, machinery for sale, etc., etc., shall not be delayed, please try to have them in our office with the Tuesday morning mail.

Canadian Machinery

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FOR SALE:—1 ONLY No. 1A PARKINSON Plain Milling Machine, with countershaft, Back Geared and Power Feed. Good working condition. Price $300.00 Cash F.o.b. London. Write or call, Superior Machinery Co., Ltd., 151 York St., London, Ont.

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We have a complete Belknap Equipment for sale. This equipment is still in use in our Subscription Department and is in excellent working order. We have placed an attractive price on this outfit, and would advise manufacturers or merchants having a mailing list to let us tell you how it will save you money. We will give a guarantee as to the proper working condition of this equipment.

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10,000 GALS. CAPACITY

This is a new tank. We have not yet taken delivery of it, and offer it at a very attractive price. It will be sold shortly so phone or wire to—

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Paper Mill Machinery

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Air Pressure Tanks, Air Receivers, Steel Plate Tanks, Pneumatic Tanks, Tote Boxes, Shop Barrels, Steel Factory Equipment, Smoke Stacks, Gasoline Tanks.
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THE STEEL TROUGH & MACHINE CO. LTD.
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WIPING PRODUCTS

Manufactured and sold by
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COSTS LESS AND GOES FARTHER

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Brass, Bronze, Copper and Aluminum.

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Malleable.

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HULL, CANADA.
Steel, Manganese, Chrome.

John T. Hepburn, Limited
TORONTO, ONT.
Grey Iron.

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HAMILTON, CANADA
Brass, Bronze, Manganese Bronze, Aluminum.

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HAMILTON, CANADA.
Steel Castings all sizes.

Manitoba Steel Foundries, Ltd.
Office Winnipeg. Works Selkirk, Man.
Steel Castings up to 5,000 lbs.

Brantford Brass Foundry Co.
BRANTFORD, ONT.
Aluminum, Brass, Bronze, Specialty.

The Katie Foundry
GALT, ONT.
Grey Iron, Semi-Steel, Brass, Aluminum.

William Kennedy & Sons, Ltd.
OWEN SOUND, ONT.
Steel, Malleable and Heavy Grey Iron.
See Advertisement Page 7

Machinery & Foundries, Ltd.
BROCKVILLE, ONT.
Light and Medium Grey Iron.

A. F. McCulloch
OSHAWA, ONT.
Brass, Alum. Castings—Wood, Metal Patterns.

Corbet Foundry & Machine Co. Ltd.
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Fittings Limited,
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Malleable, Grey Iron, Brass, Aluminum.

W. W. Wells
370 Victoria Street, TORONTO, ONT.
Nickel and Monel Metal.

The Robert Mitchell Co., Ltd.
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Light Grey Iron.

Canadian Steel Foundries, Ltd.
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Light Grey Iron, Tinning same a specialty.

The Eureka Planter Co., Ltd.,
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Victoria Avenue, LINDSAY, ONT.
Grey Iron and Semi-Steel

Dominion Engineering Works, Limited
MONTREAL, QUE.
Grey Iron and Semi-Steel to 75 tons.

Smith's Falls Malleable Castings, Limited
SMITH'S FALLS, ONT.
Malleable.

Imperial Foundry Company
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Grey Iron Castings. Phone Junction 7935.

International Malleable Iron Company, Limited
GUELPH, ONT.
Malleable.

YOU ARE INVITED

The foundries represented on this page are well equipped, progressive, and their product is of known high quality. If you are a foundry owner and you can say the same of your service and product, we shall be glad to list you in this department. Write us for particulars.

Canadian Machinery & Mfg. News
153 University Ave., Toronto.

Canadian Machinery BUYERS DIRECTORY

If what you want is not here, write us, and we will tell you where to get it. Let us suggest that you consult also the advertisers' index— last page of book, after having secured advertisers' names from this directory. The information you desire may be found in the advertising pages. This department is maintained for the benefit and convenience of our readers. The insertion of our advertisers' names undr proper headings is gladly undertaken, but does not become part of an advertising contract.

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Lion Grinding Wheels, Limited, Montreal, Que.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John, London, S.E., Eng.

ABRASIVE MATERIALS
Lion Grinding Wheels, Limited, Montreal, Que.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John, London, S.E., Eng.

ACETYLENE, DISSOLVED
Dominion Oxygen Co., Toronto.
Liquide Air Company, Toronto.

ANCHOR BELTS
Steel Co. of Can. Ltd., Hamilton, Ont

ANGLE BARS
Steel Co. of Can. Ltd., Hamilton, Ont.

ANVILS
Aikins & Co., Inc., E.C., Indianapolis, I.

ANCHOR BOLTS
Steel Co. of Can., Ltd., Hamilton, Ont.

ARBORS
Atkins & Co., Inc., E. C., Indianapolis,
Brown & Sharpe Mfg.Co., Providence,R.I.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.

BELLS, BRASS, BRONZE and STEEL
Canada Foundries & Forgings Co., Welland, Ont.
Canadian SKF Co., Toronto, Ont.

BARS, BORING
Armstrong Bros. Tool Co., Chicago, Ill.
Bertram & Son Co., td., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

BARS, BORING, PORTABLE
Underwood Corp., H. B., Philadelphia.

BARS, STEEL
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
British Empire Steel Corporation, Montreal, Que.

BEARINGS, BALL
Canadian SKF Co., Toronto, Ont
Corman Engineering Co., Toronto, Ont

BEARINGS, ROLLER
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

BELT CEMENT
D. K. McLaren, Limited, Montreal,
McLaren Belting Co., J. C., Montreal, Que.

BELT DRESSINGS AND FILLERS
Dom. Belting Co., Ltd., Hamilton, Ont.
D. K. McLaren, Limited, Montreal,

BELT FASTENERS
Bristol Company, Waterbury, Conn.
D. K. McLaren, Limited, Montreal,
McLaren Belting Co., J.C., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

BELT HOOKS
Bristol Co., Waterbury, Conn.
D. K. McLaren, Limited, Montreal,

BELT LACING
Bristol Company, Waterbury, Conn.
D. K. McLaren, Limited, Montreal,
McLaren Belting Co., J. C., Montreal,

BELT LACING, STEEL
Bristol Company, Waterbury, Conn.

BELT LACING MACHINES
D. K. McLaren, Limited, Montreal,
McLaren Belting Co., J. C., Montreal, Que.

BELTING, CHAIN
Can. Link-Belt Co., Toronto, Ont.
Fittings, Limited, Oshawa, Ont.
Jones & Glassco, Montreal, Que.
Renold (Hans) of Canada, Ltd., Montreal, Que
Renold (Hans) of Canada, Ltd., Montreal, Que.

BELTING, FABRIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Dom. Belting Co., Ltd., Hamilton, Ont.
D. K. McLaren, Limited, Montreal,
McLaren Belting Co., J. C., Montreal, Que.

BELTING, LEATHER
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Can. Fairbanks-Morse Ltd., Montreal, Q.
D. K. McLaren, Limited, Montreal,
McLaren Belting Co., J. C., Montreal, Que.

BELTS, ABRASIVE
Oakey & Sons, Ltd., John, London, S.E., Eng.

BENDING MACHINES, POWER
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bertrams Ltd., Edinburgh, Scotland.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

BILLETS, BLOOMS and SLABS
Steel Co., of Can. Ltd., Hamilton, Ont.

BLAST GATES
Rockwell Co. W. S., New York, N. Y.

BLOCKS
Wright Mfg. Co., Lisbon, Ohio.

BLOCKS, CHAIN (See Hoists, Hand)
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

BLOCKS, DIE
Canada Foundries & Forgings Co., Welland, Ont.

BLOCKS, PILLOW
Can. Link-Belt Co., Toronto, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

BLOWERS
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Flexible Shaft Co., Ltd., Toronto, Ont.

BOLT AND NUT MACHINERY
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Montreal, Que.

BOLT AND NUT MACHINERY, Automatic
National Acme Co., Cleveland, Ohio

BOLTS AND NUTS
British Empire Steel Corporation, Montreal, Que.
National Acme Co., Montreal, Que

BOLT THREADING DIE HEADS
Landis Machine Co., Inc., Waynesboro Pa.

BOLTS, TRACK
Steel Co. of Canada, Ltd., Hamilton, Ont.

BORING and TURNING MILLS, Vertical
Bertram & Sons Co., Ltd., The John Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

BORING, DRILLING and MILLING MACHINES, Horizontal.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
Herbert, Limited, Alfred, Toronto, Ont.
Landis Tool Co., Waynesboro, Pa
Vertical
Can. Fairbanks-Morse Co., Ltd Montreal, Que

BORING TOOLS
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.

BUCKET CARRIERS, Pivoted
Can. Link-Belt Co., Toronto, Ont.

BUFFERS
Pryibil Machine Co., New York, N.Y.

BUFFING OR POLISHING MACHINES (See Polishing and Buffing Machines)
Blount Co., J. G., Everett, Mass.
Herbert, Limited, Alfred, Toronto, Ont.
Pryibil Machine Co., New York, N.Y.
U. S. Electrical Tool Co., Cincinnati, O.

BUILDING MATERIALS
Bertram & Son Co., Ltd., The John Dundas, Ont.

BURNERS, OIL AND GAS
Rockwell Co., W.S., New York City.

BURRS
Steel Co. of Can. Ltd., Hamilton Ont

CABINETS, OIL
S. F. Bowser & Co., Ltd., Toronto, Ont

CALIPERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Starrett Co., L. S., Athol, Mass.

For list of Dealers see the last page of This Buyers Directory

CAMS
Canada Foundries & Forgings Co., Welland, Ont.

CAN-MAKING MACHINERY (See Sheet Metal Working Machinery)
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Bliss Co., E. W., Brooklyn, N. Y.
Smooth Mfg. Co., Jersey City, N. J.

CARBONIZING AND HARDENING
Corman Engineering Co., Toronto, Ont

CEMENTS, IRON CENTERING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.

CHAINS (See Sprockets and Chains)
Reynold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

CARD CLOTHING
D. K. McLaren, Limited, Montreal.

CASTINGS, ALUMINUM, BRASS, BRONZE, COPPER, DIE-MOLDED, FERRO-ALLOY, IRON, SEMI-STEEL, STEEL.
See "Where to buy your castings" Section Page number may be found by turning to Advertisers' Index.

CHAINS, DRIVING
Can. Link-Belt Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont
Jones & Glassco, Montreal, Que.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

CHASERS
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, a.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CHUCKING MACHINES
Acme Machine Tool Co., Cincinnati, O
Brown & Sharpe Mfg. Co., Providence, R. I.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

CHUCKS, DRILL AND TAP
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canadian SKF Co., Toronto, Ont.
Cushman Chuck Co., Hartford, Conn.
Geometric Tool Co., New Haven, Conn.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn
Union Mfg., New Britain, Conn.

CHUCKS, LATHE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Cushman Chuck Co., Hartford, Conn.
Geometric Tool Co., New Haven, Conn.
Gisholt Machine Co., Madison, Wis.
Herbert, Limited, Alfred, Toronto, Ont.
Ker & Goodwin Machine Co., Brantford, Ont.
Pryibil Machine Co., New York, N.Y.
Skinner Chuck Co., New Britain, Conn
Union Mfg. Co., New Britain, Conn.

CHUCKS, MAGNETIC
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

CHUCKS, PLANER
Bertram & Son Co., Ltd., The John Dundas, Ont.
Cushman Chuck Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn
Union Mfg. Co., New Britain, Conn.

CHUCKS, TAPPING
William L. Procunier, Chicago, Ill

CHUCKS, VERTICAL BORING MILL
Bertram & Son Co., Ltd., The John Dundas, Ont.
Gisholt Machine Co., Madison, Wis
Skinner Chuck Co., New Britain, Conn
Union Mfg. Co., New Britain, Conn

CLAMPS, MACHINISTS'
Brown & Sharpe Mfg. Co., Providence.
Starrett Co., L. S., Athol, Mass.

CLEANERS, METAL, WASTE, GENERAL
Oakley Chemical Co., New York, N. Y

CLOCKS
Chicago Watchman's Clock Co., Chicago
Hardinge Bros., Limited, Toronto, Ont

CLOCKS, TIME
Gisholt Machine Co., Madison, Wis.

CLOCKS, WATCHMEN'S
Chicago Watchman's Clock Co., Chicago Ill.
Hardinge Bros., Limited, Toronto, Ont

CLUTCHES, FRICTION
Can.-Link-Belt Co., Toronto, Ont
Johnson Machine Co., Carlyle, Manchester, Conn.

COAL AND ASH HANDLING MACHINERY
Can.-Link Belt Co., Toronto, Ont
Rodolfson Elevator Works, Galt, Ont

COAL-STORAGE SYSTEMS
Can. Link-Belt Co., Toronto, Ont

COLLARS, SHAFT OR SET
Canada Foundries & Forgings Co., Welland, Ont
Can. Link-Belt Co., Toronto, Ont
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont

COLLETS
Butterfield & Co., Inc., Rock Island, Que
Geometric Tool Co., New Haven, Conn
Hardinge Bros., Inc., Chicago, Ill.
Hendley Machine Co., Torrington Conn
Kearney & Trecker Co., Milwaukee, Wis
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont.

COMPOUNDS, CLEANING
Oakley Chemical Co., New York, N.Y.

BUYERS' DIRECTORY

COMPOUNDS—CUTTING, DRILLING, GRINDING, SCREW CUTTING
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Oakley Chemical Co., New York, N.Y.

COMPRESSORS, AIR AND GAS
Can. Fairbanks-Morse Co., Ltd., Montreal.

CONES, FRICTION
Norton Co., of Can. Ltd., Hamilton, Ont.

CONNECTING RODS AND STRAPS
Canada Foundries & Forgings Co., Welland, Ont.

CONTRACT WORK
Dominion Engineering Works, Limited, Montreal, Que.
Victoria Foundry Co., Ltd., Ottawa, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

CONVEYORS AND ELEVATORS (SEE ELEVATORS)
Jones & Glassco, Montreal, Que.

COTTERS
Steel Co. of Canada, Ltd., Hamilton, Ont.

COUNTERBORES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

COUNTERS, REVOLUTION
Starrett Co., L. S., Athol, Mass.

COUNTERSHAFTS
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Johnson Machine Co., Carlyle, Man.
Kempsmith Mfg. Co., Milwaukee, Wis.

COUNTERSINKS
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

COUPLERS, CAR AND LOCOMOTIVE
Can. Steel Foundries, Montreal, Que.

COUPLINGS
Steel Co. of Canada, Ltd., Hamilton, Ont.

COUPLINGS, SHAFT
Can. Link-Belt Co., Toronto, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

CRANES, ELECTRIC
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can.-Link-Belt Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Northern Crane Works, Walkerville, Ont.
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.

CRANES, LOCOMOTIVE
Can. Link-Belt Co., Toronto, Ont.

Bertram & Son Co., td., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Northern Crane Works, Walkerville, Ont.

CRANK PIN TURNING MACHINE
Underwood Corp., H.B., Philadelphia, Pa.

CUTTERS, GEAR
Brown & Sharpe Mfg. Co., Providence, R. I.

Butterfield & Co., Inc., Rock Island, Q. Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CUTTERS, HIGH SPEED
Atkins & Co., Inc., E. C., Indianapolis.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CUTTERS, MILLING
Brown & Sharpe Mfg. Co., Providence, R. I.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.

CUTTERS, STAY BOLT
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.

CUTTING-OFF MACHINE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Starrett Co., L. S., Athol, Mass.

CUTTING OFF MACHINES, PIPE (SEE PIPE-CUTTING AND THREADING MACHINES)
Landis Machine Co., Inc., Waynesboro, Pa.

CUTTING-OFF TOOLS
Armstrong Bros. Tool Co., Chicago, Ill.

CUTTING OIL FILTERS (SEE OIL FILTERING SYSTEMS
Bowser, S. F. & Co., Ltd., Toronto.

CUTTING, OXY-HYDROGEN
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

CYLINDER GRINDING
Corman Engineering Co., Toronto, Ont.

DETACHABLE CHAIN
International Malleable Iron Co., Guelph, Ont.

DIAMONDS, BLACK AND ROUGH
Can. Desmond-Stephan Mfg Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

DIAMOND TOOLS
Can. Desmond-Stephan Co., Hamilton,
Wheel Trueing Tool Co., Windsor, Ont.

DIAMOND CROSSINGS
Can. Steel Foundries, Montreal, Que.

DIAMONDS, IMPORTERS
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Co., Windsor, Ont.

DIES, SCREW AND THREAD CUTTING
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.

DIES, SHEET-METAL AND SUB-PRESS (See Tool Work)
Brown, Boggs & Co., Ltd., Hamilton, Ont.

DIES, FORGING
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

DIES, SCREW AND THREAD CUTTING
Morse Twist Drill & Machine Co., New Bedford, Mass.

DIES, SELF-OPENING, ADJUSTABLE
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Landis Machine Co., Inc., Waynesboro,
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DIES, THREADING-OPENING
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DIVIDING HEADS
Burke Machine Tool Co., Conneaut, Ohio.
Hendey Machine Co., Torrington, Conn.
Kearney & Treacker Co., Milwaukee, Wis.

DOGS, LATHE AND MILLING MACHINE
Armstrong Bros. Tool Co., Chicago, Ill.

DRAFTING MATERIALS
American Lead Pencil Co., New York City, N.Y.

DRESSERS, GRINDING WHEEL
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ont.
Norton Co., of Can., Ltd., Hamilton.
Wheel Trueing Co., Windsor, Ont.

DRESSING TOOLS
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Co., Windsor, Ont.

DRILL HOLDERS
Armstrong Bros. Tool Co., Chicago, Ill.

DRILLING MACHINES, BENCH
Burke Machine Tool Co., Conneaut,, Ohio.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Hardinge Bros., Inc., Chicago, Ill.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, ELECTRIC AND HAND
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis

DRILLING MACHINES, GANG
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

DRILLING MACHINES, HEAVY DUTY
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
Herbert, Limited, Alfred, Toronto, Ont.

BORING, DRILLING AND MILLING MACHINES, (HORIZONTAL.)
Gisholt Machine Co., Madison, Wis.
Herbert, Limited, Alfred, Toronto, Ont.

DRILLING MACHINES, Multiple Spindle
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
National Acme Co., Cleveland, Ohio.

DRILLING MACHINES, Pneumatic
Cleveland Pneumatic Tool Co., Toronto. Ont.

DRILLING MACHINES, PORTABLE
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, RADIAL
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Herbert, Limited, Alfred, Toronto, Ont.
Williams Machinery Co., A. R., Toronto.

DRILLING MACHINES, SENSITIVE
Burke Machine Tool Co., Conneaut, O.
Herbert, Limited, Alfred, Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Williams Machinery Co., A. R., Toronto.
Wisconsin Electric Co., Racine, Wis

DRILLING MACHINES, TURRET
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wisconsin.
Williams Machinery Co., A. R., Toronto.

DRILLING MACHINES, VERTICAL
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Herbert, Limited, Alfred, Toronto, Ont.

DRILLS, CENTRE
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DRILLS, ELECTRIC
U. S. Electrical Tool Co., Cincinnati, Ohio
Black & Decker Mfg. Co., Ltd., Montreal, Que.

DRILLS, HIGH SPEED TWIST
Butterfield & Co., Inc., Rock Island, Que
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Cleveland Twist Drill Co., Cleveland, O.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DRILLS, RATCHET
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co, New Bedford, Mass.

DRILLS, TWIST AND FLAT
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.

DROP FORGINGS
Steel Co. of Canada, Ltd., Hamilton

DUMB WAITERS
Roelofson Elevator Works, Galt, Ont.

DUST HANDLING EQUIPMENT
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

ELECTRIC DRILLS AND GRINDERS
Black & Decker Mfg. Co., Ltd., Montreal, Que.
U. S. Electrical Tool Co., Cincinnati, Ohio.

ELECTRIC STEAM GENERATORS
Dominion Engineering Works, Limited, Montreal, Que.

ELECTRICAL INSTRUMENTS
Bristol Co., Waterbury, Conn.

ELECTRICAL SUPPLIES
Atkins & Co., Inc., E. C., Indianapolis
Diamond State Fibre Co., Toronto, Ont.

ELECTRIC TOOLS
U. S. Electrical Tool Co., Cincinnati, Ohio.

ELEVATING TRUCKS
Corman Engineering Co., Toronto, Ont.

ELEVATORS AND CONVEYORS
Can. Link-Belt C., Toronto, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q

ELEVATORS, FREIGHT AND PASSENGER
Roelofson Elevator Works, Galt, Ont.

EQUIPMENT, ELEVATOR SAFETY
Jones & Glassco, Montreal, Que.

EMERY WHEELS (See Grinding Wheels)
Lion Grinding Wheels, Limited, Montreal, Que.
Atkins & Co., E. C., Indianapolis, I.
Norton Co., of Canada., Ltd., Hamilton.

ENGINES, CAPSTAN
Kennedy & Sons, Wm., Owen Sound, Ont.

ENGINEERS, MECHANICAL
Dominion Engineering Works, Limited, Montreal, Que.
Gisholt Machine Co., Madison, Wis.
Hamilton Gear & Machine Co., Toronto.

EXPANDERS, TUBE
Jardine & Co., A. B., Hespeler, Ont.

FANS, ELECTRIC
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

FANS, EXHAUST
Can. Blower & Forge Co., Ltd., Kitchner, Ont.

FANS, VENTILATING
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

FIBRE
Diamond State Fibre Co., of Can. Ltd., Toronto, Ont.

FILES AND RASPS
Nicholson File Co., Port Hope, Ont.
Simmons Canada Saw Co., Montreal, Que.

FILLER, IRON (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J.

FIRE ESCAPES
Roelofson Elevator Co., Galt, Ont.

FITTINGS, PIPE
International Malleable Iron Co., Guelph.
Fittings, Limited, Oshawa, Ont.

FLEXIBLE SHAFTS
Flexible Shaft Co., Ltd., Toronto, Ont.
Strand & Co., N. A., Chicago, Ill

FLUXES, WELDING
Dominion Oxygen Co., Ltd, Toronto
Liquide Air Company, Toronto, Ont.

FORGES
Flexible Shaft Co., Ltd., Toronto, Ont.

FORGING MACHINERY
Acme Machinery Co., Cleveland, Ohio
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown Boggs & Co., Ltd., Montreal.
National Machinery Co., Tiffin, Ohio.
Steel Co. of Canada, Ltd., Hamilton

FORGINGS, DROP
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Ltd., Toronto, Ont.

FORGINGS, HAMMER
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Hepburn Ltd., John T., Toronto, Ont.

FOUNDRY EQUIPMENT
Rice Lewis & Son, Ltd., Toronto, Ont.

FOUNDRY SUPPLIES
Rice Lewis & Son, Ltd., Toronto, Ont.

FROGS, SPRING OR RIGID
Can. Steel Foundries, Montreal, Que.

FURNACES, ELECTRIC
Rockwell Co., W. S. New York City.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

FURNACES, HEAT TREATING COAL
Rockwell Co., W. S., New York City.

FURNACES, HEAT TREATING OIL AND GAS
Bellevue Industrial Furnace Co., Detroit, Michigan.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Flexible Shaft Co., Ltd., Toronto Ont
Rockwell Co. W. S., New York, N. Y.

FURNACES TEMPERING AND ANNEALING
Bellevue Industrial Furnace Co., Detriot, Mich.
Brown & Sharpe Mfg., Co., Providence R. I.
Flexible Shaft Co., Ltd., Toronto, Ont
Rockwell Co., W. S., New York City.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

FURNACES AND OVENS, ELECTRIC
Rockwell Co. W. S., New York, N. Y.
Starrett Co., L. S., Athol, Mass.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

BUYERS' DIRECTORY

GAGES, MEASURING (See Tool Work)
Brown & Sharpe Mfg. Co., Providence, R. I.
Greenfield Tap & Die Corp., Galt, Ont.
Lufkin Rule Co., Windsor, Ont.
Starrett Co., L. S., Athol, Mass.

GAGES, RECORDING
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GAGES, SPECIAL MEASURING
(See Tool Work)
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GAGES, THREAD
Brown & Sharpe Mfg. Co., Providence, R. I.
Herbert, Limited, Alfred, Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

GALVANIZING
Fittings, Limited, Oshawa, Ont.

GAS, COAL COMPRESSED
L'Air Liquid Society, Toronto, Ont.

GAS, COMPRESSED
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

GASKETS
Diamond State Fibre Co. of Ca., Ltd., Toronto, Ont.
Smooth Mfg. Co., Jersey City, N. J.

GAUGES VACUUM AND PRESSURE
Taylor Instrument Co., Toronto, Ont.

GEAR BLANKS
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.
Dominion Engineering Works, Limited, Montreal, Que.

GEAR COUNTERS
Hart Mfg. Co., R. A., Battle Creek, Michigan.

GEAR CUTTING MACHINES
Bertram & Sons Co., Ltd., The John, Dundas, Ont.

Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Fellows Gear Shaper Co., Springfield, Vt.
Whiton Machine Co., D. E., New London, Conn.

GEAR TESTING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.

GEARS, CAST
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Hull Iron & Steel Foundries, Hull, Que.
Dominion Engineering Works, Limited, Montreal, Que.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

GEARS, CUT
Brown & Sharpe Mfg. Co., Providence, R. I.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Gardner & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto, Ont.
Hepburn Ltd., John T. Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

GEARS, DRESSED
Kennedy & Sons, Wm., Owen Sound, Ontario.

GEARS, FORGED
Canada Foundries & Forgings Co., Welland, Ont.

GEARS, HERRINGBONE
Hamilton Gear & Machine Co., Toronto, Ont.

GEARS, RAWHIDE (See Gears, Cut)
Hamilton Gear & Machine Co., Toronto.

GEAR, SILENT CHAIN
Gardner & Son, Robt., Montreal, Que.
Can. Link Belt Co., Ltd., Toronto, Can.
Hans Renold of Canada, Ltd., Montreal Quebec.

GEARS, WORM
Hamilton Gear & Machine Co., Toronto.

GENERAL ENGINEERING SERVICE
Corman Engineering Co., Toronto, Ont.

GENERATORS ACETYLENE
L'Air Liquide Society, Toronto, Ont.

GOGGLES, SAFETY
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

GRAB BUCKETS
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Cleveland Twist Drill Co., Cleveland, O.

GREASE CUPS, PRESSED STEEL AND BRASS
Can. Winkley Co., Ltd., Windsor, Ont.

GREASES, LUBRICATING
Canadian SKF Co., Toronto, Ont.

GRINDERS, ELECTRIC
Black & Decker Mfg. Co., Ltd., Montreal, Que.
U. S. Electrical Tool Co., Cincinnati, Ohio.

GRINDERS TOOL POST
U. S. Electrical Tool Co., Cincinnati, Ohio.

GRINDING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Norton Co., of Canada, Ltd., Hamilton.

GRINDING MACHINES, ABRASIVE BELT
Norton Co. of Can. Ltd., Hamilton, Ont.

GRINDING MACHINES, AUTOMATIC
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, BENCH
Blount Co., J. G., Everett, Mass.
Geometric Tool Co., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co. of Canada, Ltd., Hamilton, Ont.
Pratt & Whitney Co. of Canada, Ltd.,

GRINDING MACHINES, CENTER
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES, CUTTER AND REAMER
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, CYLINDRICAL
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.
Norton Co., of Canada, Ltd., Hamilton.

GRINDING MACHINES, DIE
Geometric Tool Co., New Haven, Conn.
National Acme Co., Cleveland, O.
National Machinery Co., Tiffin, Ohio.

GRINDING MACHINES, DRILL
Bellevue Industrial Furnace Co., Detroit, Mich.
Bertram & Son Co., Ltd., The John, Dundas, Ont.

GRINDING MACHINES, ELECTRIC
Strand & Co., N. A., Chicago, Ill.

GRINDING MACHINES, FLOOR AND TOOL
Blount Co., J. G., Everett, Mass.
Herbert, Limited, Alfred, Toronto, Ont.
National Acme Co., Cleveland, Ohio.
Norton Co. of Canada, Ltd., Hamilton, Ontario.
Greenfield Tap & Die Corp., Galt, Ont.
U. S. Electrical Tool Co., Cincinnati, Ohio.

GRINDING MACHINES, INTERNAL
Garlock Machinery Ltd., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Cleveland Pneumatic Tool Co., Toronto Ont.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES PORTABLE
Strand & Co., N. A., Chicago, Ill.

GRINDING MACHINES, SNAGGING
Blount Co., J. G., Everett, Mass.
Norton Co., of Can. Ltd., Hamilton, Ont
U. S. Electrical Tool Co., Cincinnati, Ohio.

GRINDING MACHINES, SURFACE
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, THREAD
Pratt & Whitney Co., of Canada, Ltd., Sound, Ont.

GRINDING MACHINERY, TOOL POST
Gisholt Machine Co., Madison, Wis.
Grenfield Tap & Die Corp., Galt, Ont.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES, UNIVERSAL
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Herbert, Limited, Alfred, Toronto, Ont.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co., of Canada, Ltd., Hamilton Ontario.

GRINDING WHEELS
Lion Grinding Wheels, Limited, Montreal, Que.
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Norton Co. of Can., Ltd., Hamilton, Ont.

GUN-BARREL MACHINERY
Steinle Turret Machine Co., Madison, Wisconsin.

HACK SAWS, POWER
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.

HAMMERS, CHIPPING
Cleveland Pneumatic Tool Co., Toronto, Ont.
High Speed Hammer Co., Rochester,

HAMMERS, DROP
Bertram & Son Co., Ltd., The John Dundas, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

HAMMERS, ELECTRIC
Brown, Boggs & Co., Ltd., Hamilton, Ont

HAMMERS, PNEUMATIC
Can. Steel Foundries, Montreal, Que
Cleveland Pneumatic Tool Co., Toronto Ont.

HANGERS, SHAFTING
Canadian SKF Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Hamilton Gear & Machine Co. Toronto
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

HOBBING MACHINES
Shore Instrument Co., Jamaica, N.Y.

HARDENING, CASE-HARDENING AND TEMPERING
Barnes Company, Wallace, Hamilton
Gisholt Machine Co., Madison, Wis
Cleveland Pneumatic Tool Co., Toronto Ont.

HAMMERS, POWER
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont
Jardine & Co., A. P., Hespeler, Ont

HOBS
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

HOISTS, ELECTRIC
Can. Link-Belt Co., Toronto, Ont
Can Fairbanks-Morse Co., Ltd., Montreal
Northern Crane Works, Walkerville, Ont
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.

HOISTS, HAND
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg Co., Lisbon, Ohio

HOISTS, PNEUMATIC
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont

HOLDERS-ON, PNEUMATIC
Cleveland Pneumatic Tool Co., Toronto Ont.

HYDRAULIC MACHINERY
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Kennedy & Sons, Ltd., Wm., Owen

IGNITERS, GAS ENGINE
Canada Foundries & Forgings Co., Welland, Ont.
Burke Machine Tool Co., Conneaut, O

INDICATORS, SPEED AND TEST
Brown & Sharpe Mfg. Co., Providence, R.I.

INSULATION
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.

IRON BARS
Steel Co. of Canada, Ltd., Hamilton, Ont.

JACKS, HYDRAULIC
Norton, A. O., Boston, Mass.

JACKS, PLANER
Armstrong Bros. Tool Co., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

JAPANNING AND VARNISHING OVENS
Brantford Oven & Rack Co., Brantford, Ont.

JIGS AND FIXTURES (SEE TOOL WORK)
Fisher Motor Co., Ltd., Orillia, Ont.
Gisholt Machine Co., Madison, Wis.

JOB MACHINE AND GRINDING
Corman Engineering Co., Toronto, Ont.

KEYSEATING MACHINES
Morton Mfg. Co., Muskegon, Mich
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

KEYS, MACHINE
Can. Drawn Steel Co., Hamilton, Ont
Morton Mfg. Co., Muskegon, Mich.

KNIVES, MACHINE
Atkins & Co., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

KNURL HOLDERS
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

LATHE ATTACHMENTS
Hendey Machine Co., Torrington, Conn

LATHE TOOLS
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn

LATHES, AUTOMATIC AND SEMI-AUTOMATIC
Gisholt Machine Co., Madison, Wis.
Herbert, Limited, Alfred, Toronto, Ont.
National Acme Co., Cleveland, Ohio
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, BENCH
Hardinge Bros., Inc., Chicago, Ill.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

LATHES, BORING
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, CHUCKING (SEE LATHES, HORIZONTAL TURRET, AND LATHES, VERTICAL TURRET)
Acme Machine Tool Co., Cincinnati, O.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
Herbert, Limited, Alfred, Toronto, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, ENGINE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hendey Machine Co., Torrington, Conn
Herbert, Limited, Alfred, Toronto, Ont

LATHES, EXTENSION AND GAP
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison Wis
Herbert, Limited, Alfred, Toronto, Ont
National Acme Co., Cleveland, O.
Steinle Turret Machine Co., Madison, Wis.

LATHES, PRECISION
Hardinge Bros., Chicago.

LATHES, RELIEVING
Hendey Machine Co., Torrington, Conn.

BUYERS' DIRECTORY

LATHE, UNIVERSAL HAND
Brown & Sharpe Mfg. Co., Providence, Rhode Island.

LATHE, SPEED AND HAND
Blount Co., J. G., Everett, Mass.

LATHES, SPINNING
Pryibil Machine Co., Torrington, Conn.

LATHES, VERTICAL TURRET
Bertram & Son, Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

LATHES, WOOD TURNING
Blount, Co., J. G., Everett, Mass.
Can. Fairbanks-Morse Co., Ltd., Montreal.

LEAD PIPE
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

LEATHER FILLET
D. K. McLaren, Limited, Montreal.

LINOLEUM MILL MACHINERY
Bertrams, Ltd., Edinburgh, Scotland.

LIQUID AIR PLANTS
L'Air Liquide Society, Toronto, Ont.

LOCKERS, CLOTHES
Dennis Wire and Iron Works, London, Ont.

LUBRICANTS
Oakley Chemical Co., New York, N.Y.

LUBRICATING SYSTEMS
Bowser, S. F., & Co., Ltd., Toronto, Canada.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Ltd., Welland, Ont.
Ker & Goodwin Machine Co., Brantford, Ont
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R. Toronto Ont.

MANGANESE STEEL
Can. Steel Foundries, Montreal, Que.

MANDRELS, EXPANDING
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont.

MANDRELS, SOLID
Greenfield Tap & Die Corp., Galt, Ont.
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MEASURING MACHINES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MECHANICS' FINE TOOLS
Lufkin Rule Co., Windsor, Ont.

METALS, ALLOY
Canada Metal Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.

METAL WORKERS
Parker Co., Charles, Meriden, Conn.

MICROMETER CALIPERS
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Rice Lewis & Son, Ltd., Toronto, Ont

MILLING ATTACHMENTS
Burke Machine Tool Co., Conneaut, O.
Hendey Machine Co., Torrington, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.

MILLING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Burke Machine Tool Co., Conneaut, O

MILLING MACHINES, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence, R. I.
Hardinge Bros., Inc., Chicago, Ill.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

MILLING MACHINES, BENCH
Burke Machine Tool Co., Conneaut. O.
Hardinge Bros., Inc., Chicago, Ill.

MILLING MACHINES, HAND
Brown & Sharpe Mfg. Co., Providence
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MILLING MACHINES, HORIZONTAL PLANER TYPE.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Kearney & Trecker Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto.

MILLING MACHINES, PLAIN
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, O.
Hendey Machine Co., Torrington, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.

MILLING MACHINES, THREAD
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MILLING MACHINES, UNIVERSAL
Brown & Sharpe Mfg. Co., Providence,
Hendey Machine Co., Torrington, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.

MILLING MACHINES, VERTICAL
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, O.
Herbert, Limited, Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto.

MILLING TOOLS, ADJUSTABLE HOLLOW
Geometric Tool Co., New Haven, Conn.

MOTORS, ELECTRIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Roelofson Elevator Co., Galt, Ont.
Williams Machinery Co., A. R., Toronto,
Wisconsin Electric Co., Racine Wis.

NAILS AND STAPLES
Canada Metal Co., Ltd., Toronto, Ont.

NIPPLES
Canada Metal Co., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton.

NITROGEN
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

NUT TAPPERS
(See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
National Acme Co., Cleveland, Ohio.

NUTS, FINISHED and SEMI-FINISHED
Galt Macine Screw Co., Galt, Ont.
National Acme Co., Montreal, ue.

NUTS (Up to 4-in.)
Steel Co. of Canada, Ltd., Hamilton.

NUTS, S.A.E., PLAIN AND CASTELLATED
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

OIL FILTERING AND STORAGE SYSTEMS
Bowser, S. F., & Co., Ltd., Toronto,

OIL STORAGE ENGINEERS
Bowser, S. F., & Co., Ltd., Toronto

OIL HOLE COVERS
Can. Whitney Co., Ltd., Windsor, Ont.

OILS, SOLUABLE
Brantford Oven & Rack Co., Brantford, Ontario.

ORNAMENTAL IRON AND WIRE WORKS
Roelofson Elevator Works, Galt, Ont.

OXYGEN
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

OXY-ACETYLENE APPARATUS
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Atlas Press Co., Kalamazoo, Mich.

PAPER MILL CONVEYORS
Bertram Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd., Montreal, Que

PAPER MILL MACHINERY
Dominion Engineering Works, Limited, Montreal, Que.

PATENTS AND INVENTION WORK
Corman Engineering Co., Toronto, Ont.

PATTERNS, WOOD AND METAL
Fittings, Limited, Oshawa, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.
Victoria Foundry Co., Ltd., Ottawa.

PHOSPHOR TIN
Canada Metal Co., Ltd., Toronto, Ont.

PHOTOGRAPHIC DUPLICATING MACHINES
Photostat Corp., Providence, R. I.

PIPE BENDING MACHINES
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Underwood Corp., H. R., Philadelphia, Pa.
Williams Machinery Co., A. R., Toronto.

PIPE CUTTING AND THREADING MACHINES
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.

PIPE
Canada Metal Co., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.

PIPE FITTINGS
Canada Metal Co., Toronto, Ont.
International Malleable Iron Co., Guelph Ont.

PIPE AND NIPPLE THREADING MACHINES
Landis Machine Co., Inc., Waynesboro, Pa.

PIPE FITTERS' TOOLS
Rice Lewis & Son, Ltd., Toronto, Ont.

PIPE THREADING DIE HEADS
Landis Machine Co., Inc., Waynesboro, Pa.

PISTON-RING MACHINES
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

PLANING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Williams Machinery Co., A. R., Toronto

PLANING MACHINES, ROTARY
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Herbert, Limited, Alfred, Toronto, Ont.

PLATE ROLLS
Bertram & Son Co., Ltd., The John, Dundas, Ont.

PNEUMATIC TOOLS
Cleveland Pneumatic Tool Co., Toronto.

POLISHING AND BUFFING MACHINES
Lion Grinding Wheels, Limited, Montreal, Que
Blount Co., J. G. Everett, Mass.
Brown & Sharpe Mfg. Co., Providence.
Pryibil Machine Co., New York, N.Y.

PRESSED STEEL PARTS
American Pulley Co., Philadelphia, Pa.

PRESSES, ARBOR
Atlas Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que

PRESSES, DROP AND FORGING
Brown, Boggs & Co., Ltd., Hamilton.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

PRESSES, FOOT AND HAND
Brown, Boggs & Co., Ltd., Hamilton

PRESSES, HYDRAULIC
Bertram & Son Co., Ltd., The John Dundas, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Perrin Ltd., W. R., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

PRESSES, POWER
Bliss Co., E. W., Prooklyn, N. Y.
Brown, Boggs, & Co., Ltd., Hamilton,
Hepburn Ltd., John T., Toronto, Ont.
Stoll Co., Inc., D. H., Buffalo, N.Y.

PRESSES, SCREW
Brown, Boggs & Co., Ltd., Hamilton.

PROFILING MACHINES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

PROTRACTORS
Brown & Sharpe Mfg. Co., Providence
Lufkin Rule Co., Windsor, Ont.

PROPELLERS
Kennedy & Sons, Wm., Owen Sound Ontario.

PULLEYS, CORK INSERT
American Pulley Co., Philadelphia, Pa

PULLEYS, METAL AND FIBRE
American Pulley Co., Philadelphia, Pa
Can. Fairbanks-Morse Ltd., Montreal, Q.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.
D. K. McLaren Co., Limited Montreal, Que

PULP AND PAPER MILL EQUIPMENT
Dominion Engineering Works, Ltd., Montreal, Que.

PUMPS, HYDRAULIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Dominion Engineering Works, Ltd. Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont

PUMPS, LUBRICANT AND OIL
Bowser, S. F., & Co., Ltd., Toronto.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Hepburn Ltd., John T., Toronto, Ont.

PUMPS, POWER
Bowser, S. F., & Co., Ltd., Toronto.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hepburn Ltd., John T., Toronto, Ont.

PUNCHES, CENTER
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

PUNCHES, HAND
Brown Boggs & Co., Ltd., Hamilton.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Jardine & Co., A. B., Hespeler, Ont.

PUNCHES, POWER
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

PUNCHING MACHINES, HORIZONTAL
Bertrams Ltd., Edinburgh, Scotland.

PYROMETERS, ELECTRIC
Bristol Co., Waterbury, Conn.
Flexible Shaft Co., Ltd., Toronto, Ont.
Taylor Instrument Co., Toronto, Ont.
Hiram Walker & Sons Metal Products Co., Walkerville, Ont.

RACKS, CUT
Hamilton Gear & Machine Co., Toronto.

RACKS, STORAGE
(See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ontario.

REAMER HOLDERS
Simonds Canada Saw Co., Montreal, Q.

REAMERS, ELECTRIC
U. S. Electrical Tool Co., Cincinnati, Ohio.

REAMERS, EXPANDING
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

REAMERS, SOLID
Butterfield & Co., Inc., Rock Island, Q.
Morse Twist Drill & Machine Co., New Bedford, Mass.

REAMERS, TAPER
Brown & Sharpe Mfg. Co., Providence, R. I.
Butterfield & Co., Inc., Rock Island, Q.
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canad, Ltd., Dundas, Ont.

RECORDERS, TEMPERATURE
Taylor Instrument Co., Rochester, N. Y.

RECORDERS, TIME
Gisholt Machine Co., Rochester, N. Y.
Taylor Instrument Co., Toronto, Ont.

REGULATORS, TEMPERATURE
Taylor Instrument Co., Toronto, Ont.

RIVETS AND BURRS
Parmenter & Bulloch Co., Gananoque, Ont.
Steel Co., of Canada, Ltd., Hamilton,

RIVET-MAKING MACHINERY
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio

BUYERS' DIRECTORY

RIVETING MACHINES
Can. Fairbanks-Morse Ltd., Montreal Q.
High Speed Hammer Co., Rochester, N.Y.
Parmenter & Bulloch Co., Gananoque Ont.

RUDDER FRAMES, STEEL
Can. Steel Foundries, Montreal, Que.

RUBBER MILL MACHINERY
Bertram Ltd., Edinburgh, Scotland.

RUBBER MOULDS
Corman Engineering Co., Toronto, Ont.

RULES, STEEL AND WOOD
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Windsor, Ont.

RUST PREVENTATIVES
Oakley Chemical Co., New York, N. Y.

SAND EQUIPMENT
Can. Link-Belt Co., Toronto, Ont.

SAND RAMMERS, PNEUMATIC
Cleveland Pneumatic Tool Co., Toronto.

SAW FRAMES AND BLADES, HACK
Atkins & Co., Inc., E. C., Indianapolis.
Diamond Saw & Stamping Works, Buffalo, N. Y.
Rice Lewis & Sons, Ltd., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWING MACHINES, POWER HACK
Atkins & Co., Inc., E. C., Indianapolis,
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

SAW SHARPENING MACHINES
Atkins & Co., Inc., E. C., Indianapolis,
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

SAWS, CIRCULAR METAL
Atkins & Co., Inc., E. C., Indianapolis.
Pryibil Machine Co., New York, N. Y.
Gisholt Machine Co., Madison, Wis.

SAWS, HAND
Atkins & Co., Inc., E. C., Indianapolis
Simonds Canada Saw Co., Montreal, Q.

SAWS, HOT AND COLD
Atkins & Co., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Q.

SAWS, HIGH SPEED STEEL
Atkins & Co., Inc., E.C., Indianapolis, I.
Butterfield & Co. Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWS, METAL BAND
Atkins & Co., E. C., Indianapolis, I.

SAWS, METAL CUTTING
Brown & Sharpe Mfg. Co., Providence,
Butterfield & Co., Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.
Starrett Co., L. S., Athol, Mass.

SAWS, SCREW SLOTTING
Atkins & Co., Inc., E., C., Indianapolis.
Butterfield & Co., Inc., Rock Island, Q.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canda, Ltd., Dundas, Ont.

SAWS, SCREW SLOTTING
Atkins & Co., Inc., E. C., Indianapolis.
Butterfield & Co., Inc.. Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWS, WOOD
E. C. Atkins & Co., Indianapolis, Ind.

SCALES
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Lufkin Rule Co., Windsor, Ont.

SCREENS
Dominion Engineering Works, Ltd., Montreal, Que.

SCREW DRIVERS, OPTICAL, JEWELRY AND NOVELTY
Strand & Co., N. A., Chicago, Ill.

SCREW MACHINE WORK
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Montreal, Que.

SCREW MACHINERY, WOOD AND LAG
Cook Co., Asa S., Hartford, Conn.

SCREW MACHINES
Brown & Sharpe Mfg. Co., Providence, Rhode Island.

SCREW MACHINES, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.

SCREW MACHINE PRODUCTS
National Acme Co., Montreal, Que.

SCREW PLATES
Butterfield & Co., Inc., Rock Island. Que.
Jardine & Co., A. B., Hespeler, Ont.

SCREWS, CAP AND SET
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

SCREWS, SAFETY, SET
Galt Machine Screw Co., Galt, Ont.

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SEPARATORS, MOISTURE AND OIL
Bowser, S. F., & Co., Ltd., Toronto, Canada.

SEPARATORS, OIL AND WASTE
Bowser, S. F., & Co., Ltd., Toronto.

SHAFTS, FLEXIBLE
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Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
Williams Machinery Co., A. R., Toronto.

SHAPES, COLD-DRAWN SPECIAL STEEL
Union Drawn Steel Co., Hamilton, Ont.

SHAPING MACHINES
Hendey Machine Co., Torrington, Conn.
Morton Mfg. Co., Muskegon, Mich.
Williams Machinery Co., A. R. Toronto.

SHEARS HAND
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

SHEARS, POWER
Bliss Co., E. W., Brooklyn, N. Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Stoll Co., Inc., D. H., Buffalo, N. Y.
Williams Machinery Co., A. R., Toronto, Ont.

SHEARING MACHINES, ANGLE, IRON BAR AND GATE
Bertrams Ltd., Edinburgh, Scotland.

SHEET LEAD
Canada Metal Co., Ltd., Toronto, Ont.

SHEET METAL WORKING MACHINERY
Bliss Co., E. W., Brooklyn, N. Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Stoll Co., Inc., D. H, Buffalo, N.Y.

SHEETS, NICKEL, MONEL AND FIBRE
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.

SHEETS, O.P.C.R. & B. A. AND BLUE ANNEALED
Steel Co., of Canada, Ltd., Hamilton, Ont.

SIDE FRAMES, LOCOMOTIVE
Can. Steel Foundries, Montreal, Que.

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Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
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Gisholt Machine Co., Madison, Wis.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont
National Acme Co., Cleveland, O.

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SPINNING LATHES
Prybil Machine Co., P., New York City.

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Barnes Company, Wallace, Hamilton.

SPRINGS
Barnes Company, Wallace, Hamilton.
Cleveland Wire Spring Co., Cleveland, O
Steele Ltd., James, Guelph, Ont.

SPRINGS, FLAT STEEL, BRUSH HOLDER, CLOCK, SMALL FLAT SPRINGS
Barnes Company, Wallace, Hamilton.

SPROCKETS AND CHAINS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Renold Hanson of Canada, Ltd., Montreal, Que.

SQUARES
Brown & Sharpe Mfg. Co., Providence, R.I.
Lufkin Rule Co., Windsor, Ont.
Steel Co. of Canada, Ltd., Hamilton. Ont.

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American Pulley Co., Philadelphia, Pa.
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Diamond Saw & Stamping Works, Buffalo, N. Y.
Parmenter & Bulloch Co., Gananoque, Ont.

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Diamond Saw & Stamping Works, Buffalo, N. Y.

STEEL CONCRETE REINFORCEMENT
Steel Co. of Canada, Ltd., Hamilton.

STEEL PLATE
British Empire Steel Co., Montreal, Que.

STEEL AND IRON BARS
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STEEL, COLD-ROLLED STRIP
British Empire Steel Co., Montreal, Q.
Barnes Company, Wallace, Hamilton.

STEEL, CRUCIBLE, SPRING
Barnes, Company, Wallace, Hamilton.
British Empire Steel Co., Montreal, Q

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STEEL, SHAFTING AND FREE CUTTING SCREW
Union Drawn Steel Co., Hamilton, Ont

STEEL, SHEET
British Empire Steel Co., Montreal, Q.
Rice Lewis & Son, Ltd., Toronto, Ont.

STEEL, STAINLESS
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STEEL STAIRS
Roelofson Elevator Works, Galt, Ont.

STEELS, ALLOY AND CARBON
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Can. Steel Foundries, Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton. Ont.

STEELS, HIGH-SPEED
Armstrong Bros. Tool Co., Chicago, Ill.
Atkins & Co., Ltd., Wm., Sheffield, England.
British Empire Steel Co., Montreal, Q.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton

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Standard Tube & Fence Co., Ltd., Woodstock, Ont.

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Williams & Co., Ltd., J. H., Brooklyn, N.Y.

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Galt Machine Screw Co., Galt, Ont.

STUD SETTERS, SELF OPENING
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Lufkin, Rule Co., Windsor, Ont.

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Geometric Tool Co., New Haven, Conn.
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National Acme Co., Cleveland, Ohio.
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Gisholt Machine Co Madison Wis.
Herbert, Limited, Alfred, Toronto, Ont.
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Pratt & Whitney Co. of Canada Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin

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Parmenter & Bulloch Co., Gananoque, Ontario.

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Steel Co. of Canada, Ltd., Hamilton.

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Kennedy & Sons, Wm. Owen Sound, Ontario.

WINCHES, STOPLOG
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Dominion Oxygen Co., Ltd., Toronto.

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Greening Wire Co., B., Hamilton, Ont

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Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
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WRENCHES, DROP FORGED
Armstrong Bros. Tool Co., Chicago, Ill
Canada Foundries & Forgings Co., Welland, Ont

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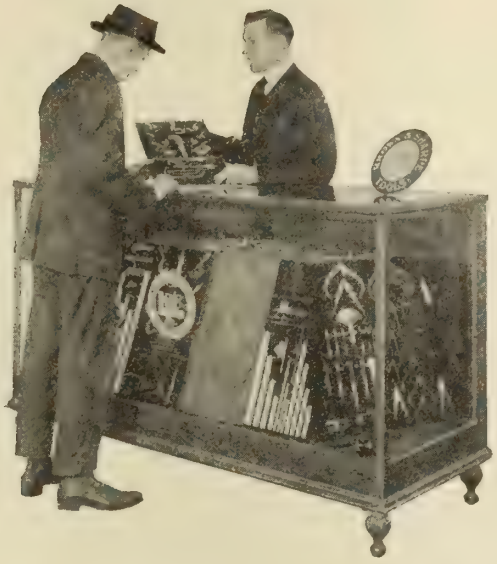

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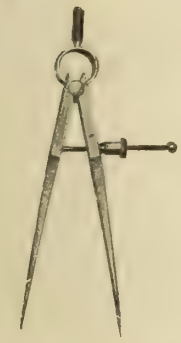

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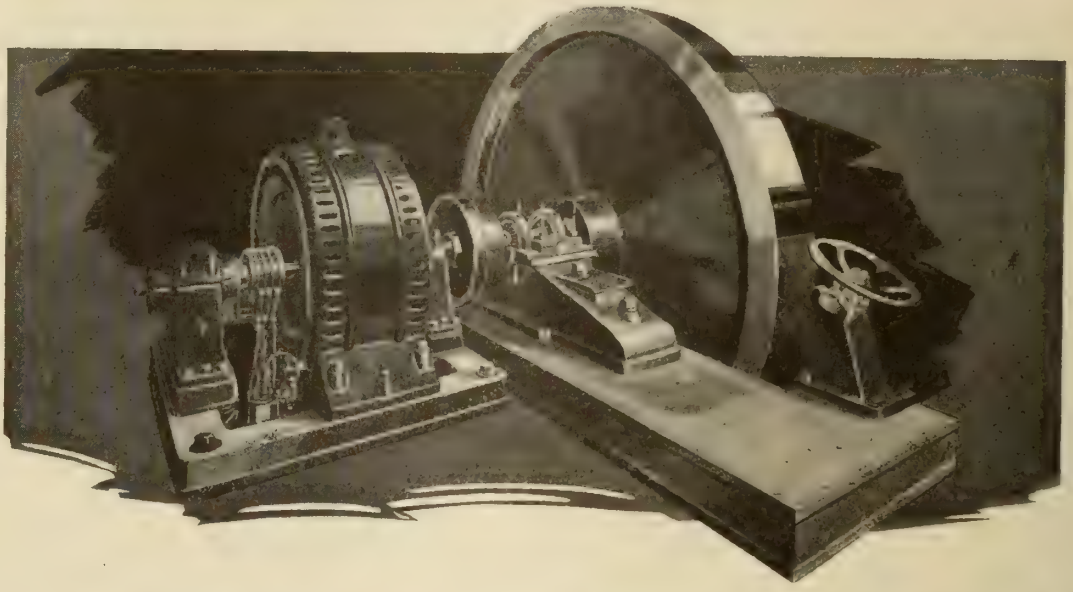

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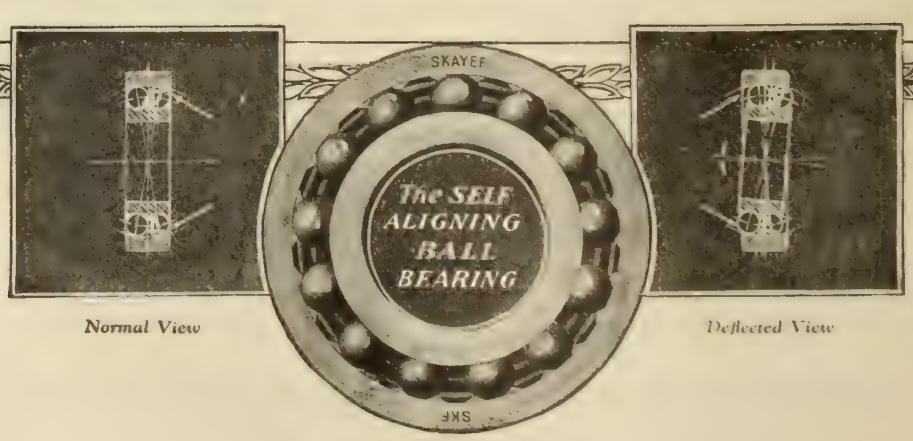

Normal View *Deflected View*

CANADIAN MACHINERY AND MANUFACTURING NEWS

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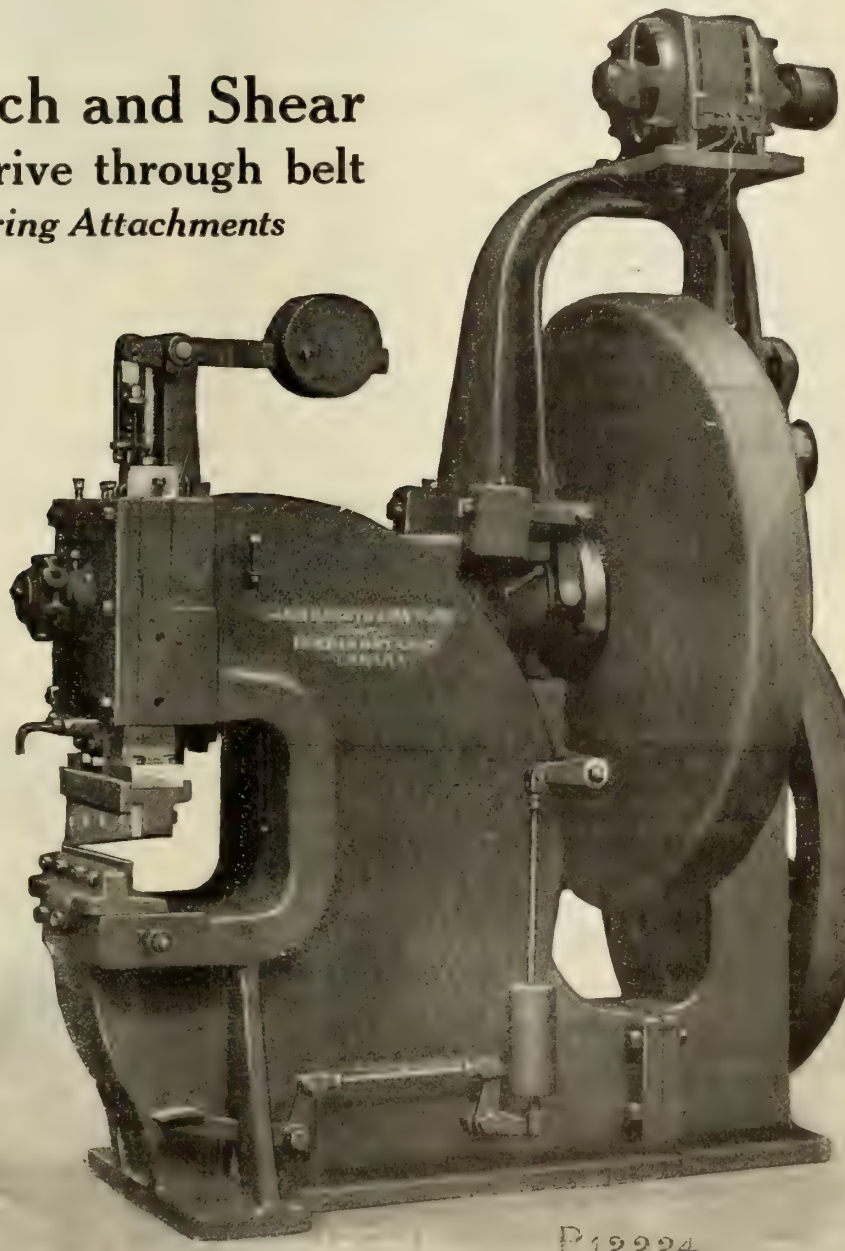

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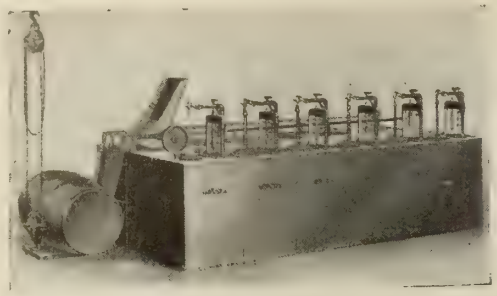

Save Money and Machinery by Correct Storage

Save labor, be sure of clean oil, eliminate fire hazards—and buy less oil—by using Bowser Piston-Type Measuring Pump for handling oils.

Accurate measurement saves oil: Bowsers are accurate. Oil-tight construction eliminates losses—Bowsers are oil-tight. Spillage means waste—Bowsers prevent spillage. And such a battery of oil tanks as is shown saves hand labor—cuts down operating costs and overhead.

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ESTABLISHED 1885
ACCURATE MEASURING PUMPS

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For Handling Gasoline and Oils Wherever Sold o Used.

Filling Station Pumps and Tanks for Gasoline.
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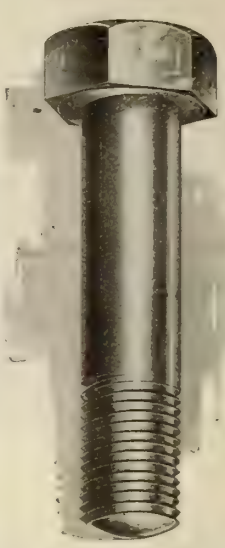
Write for Booklets



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Just now all jobbers should have a complete stock of SAE Cap Screws, Plain and Castellated Nuts and Taper Pins to meet the automobile repair trade requirements.

Your rush orders filled promptly by

The Galt Machine Screw Co., Limited
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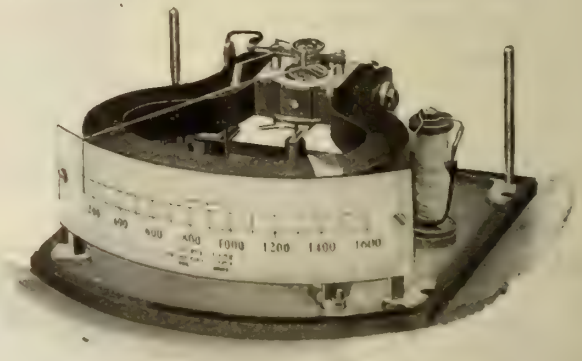
PYROMETER



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The Bristol Automatic Cold End Compensator with which our pyrometers are now equipped serves merely to increase the precision of instruments already recognized for their accuracy. This exclusive feature is a simple device located within the instrument itself which automatically compensates for any variation in the temperature of the cold end. The full details are in Catalog I-1401. Now at your service in Philadelphia.

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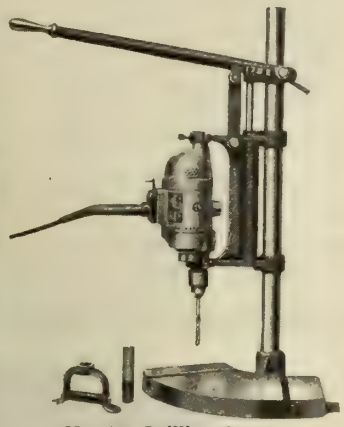

No. 1½ Drilling Stand.

drills can be mounted in a U.S. drilling stand, post stand, or radial arm to form a bench, post, or radial drill, respectively.

The cost of any of the three is low and the service will equal that of more expensive single purpose tools.

In addition they can be used as a small lathe, portable grinder, portable buffer and with a wire brush for cleaning carbon from automobile engines.

Catalogue 20L mailed upon request.

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St. John, Quebec, Montreal, Ottawa, Regina, Toronto, Hamilton, Windsor, Winnipeg, Calgary, Saskatoon, Vancouver, Victoria.

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THE UNITED STATES ELECTRICAL TOOL CO.

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Sizes 180, 160, 140, 120, 110, 100, 90, 80, 70, 60, 54, 46, 40, 36, 30, 24, 20, 18, 16, 14, 12, 10, 9, 8, hole.

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that can be depended on.

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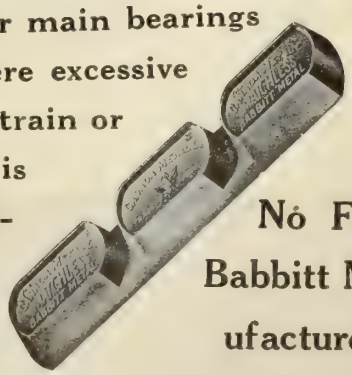
unequalled for all General Service and of such high quality that it can be employed in many cases where a Genuine Babbitt has been used

without a fault

IMPERIAL GENUINE

For your main bearings and where excessive shock, strain or friction is encountered.



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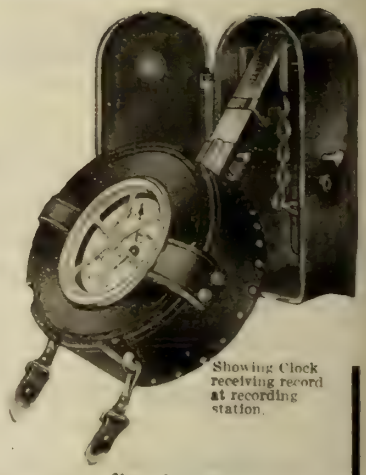

Showing Clock receiving record at recording station.

WHEN you pile into your bed every night do you ever stop to realize that you are entrusting, absolutely, the source of your income to a low-salaried watchman **without proof that he is actually "on the job"?** True, you have your fire insurance, but that is merely indemnity for buildings and material destroyed. It pays you nothing for loss of production, organization and time.

The Hardinge Alert System is your Factor of Safety. It tells you, beyond argument, whether you are getting all the protection you pay for. If your watchman is "on the job," it tells you so—if he's a slacker, it tells you so. It cannot lie, the watchman makes the record himself. By his own hand he tells you whether or not he is faithful. There's no wiring, no complicated installations to the Hardinge Alert; your workman can equip your plant in a couple of hours.

Let us send you a system for thirty days' trial.
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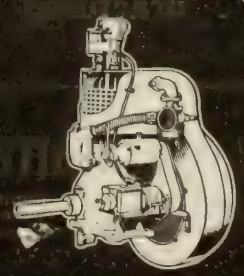
Your old conception of a gasoline engine and consider only



The Air-Cooled, Multi-Purpose "New-Way" 5 Engines in 1

THE "New-Way" Engine offers a new solution of power problems. Flexible, dependable, light-weight, and compact as an electric motor, it is especially designed for the operation of machinery — portable, semi-portable, traction and stationary.

Enlarge the Field for Your Product

The electric-motor-driven unit is limited to fixed installations where electricity is readily available. *Universalize your product* with the "New-Way" Engine and sell it to the world.

The "New-Way" Engine has variable control, 2 to 5 horsepower. Weight, ready to mount on any equipment, 248 pounds.

Our engineering staff has had wide experience in the application of power to machinery of all kinds. They will be pleased to give special attention to your power application problems.

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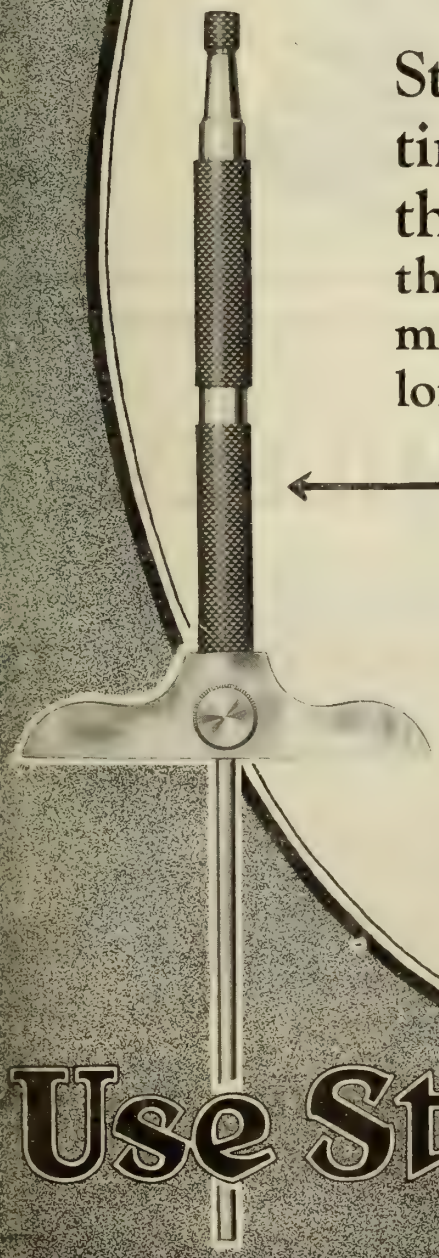

Starrett Precision Tools save time because they're handy; they save mistakes because they're accurate and they save money because they're built for long, reliable service.

This new Starrett Spring Depth Gage (No. 48) and 2100 other fine precision tools are fully described and illustrated in the Starrett Catalog No. 22'3' and Supplement. Sent free on request.

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The World's Greatest Toolmakers
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STARRETT TOOLS

STARRETT HACK SAWS CUT QUICKER LAST LONGER

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Use Starrett Tools

Buried in the Work and Broke!

Next time a tap breaks below the surface of a large casting, don't let some make-shift method of removing it injure the thread and waste half an hour of valuable production time. Instead—

Walton it Out in a Jiffy

And save the casting.

Special analysis steel fingers of the Walton Extractor drop into the flutes of the broken tap—and grip. Then a few turns of a wrench applied to the squared end of the Extractor backs out the buried tap.

Sixty-day trial offer proves the Walton Extractor pays for itself. Write.

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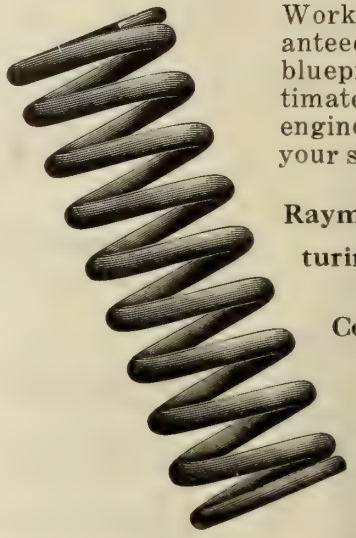
Of Every Description

In Steel, Brass, Phosphor Bronze, etc.

Workmanship guaranteed. Mail your blueprints for an estimate and write for engineering advice on your spring problems.



Raymond Manufacturing Company,
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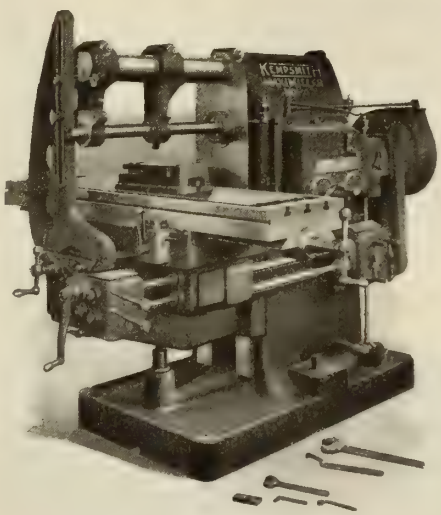
THE MAXIMILLER
FOR PERMANENT PRODUCTION PROFITS



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RIGID CONSTRUCTION!
AMPLE POWER!
POWER RAPID TRAVERSE!
(in all directions)
CENTRALIZED CONTROL!
GEARS RUN IN OIL!

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Builders of Cone-Geared Head and Production Type Milling Machines.

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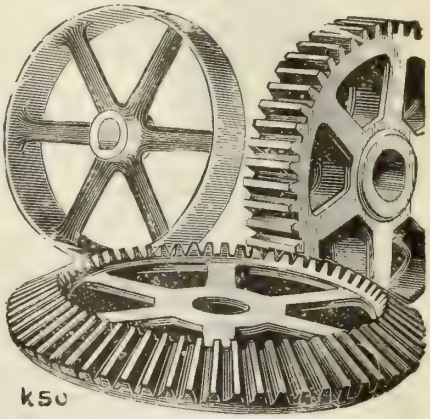
TRANSMISSION MACHINERY



Order your gears and pulleys where you have the largest range of stock patterns in Canada to choose from. Order from "Kennedy's."

Fully equipped to make gears and pulleys of every kind, any size, and of any material.

The Wm. Kennedy & Sons, Limited
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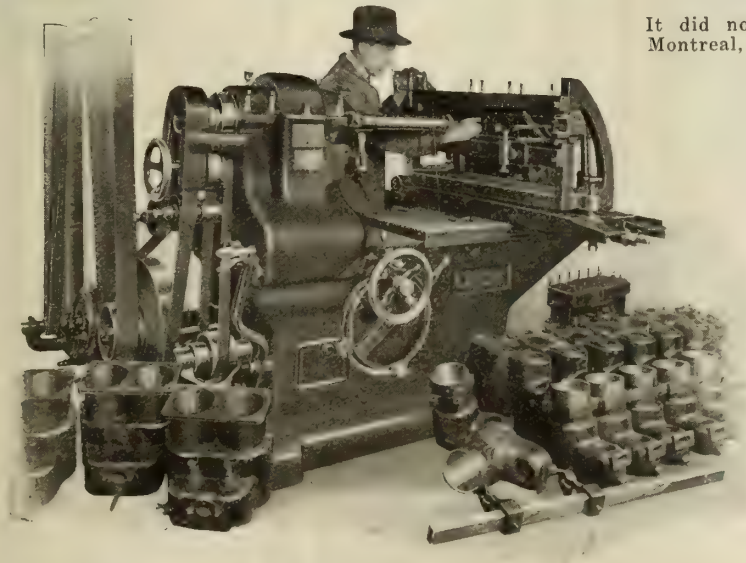
Why Not Increase Your Profits Too?



No. 5 Cylinder Grinding Machine in the plant of H. E. Bourassa, Montreal.

It did not take long to convince Mr. H. E. Bourassa, of Montreal, that this

LANDIS No.5 CYLINDER GRINDING MACHINE

is a money-maker for Garages, Repair Shops and small Machine Shops—it increased his profits right from the start.

The Landis No. 5 Cylinder Grinding Machine assures big returns from your investment. It was specially designed for rapidly and accurately regrinding motor vehicle cylinders.

Set-ups are easy and operating time is speedy. In addition, it has a range as broad as the Landis reputation in the machine tool field and will handle any type of cylinder that comes into your shop.

Send for "Interesting Facts on Regrinding"—it's free on request.

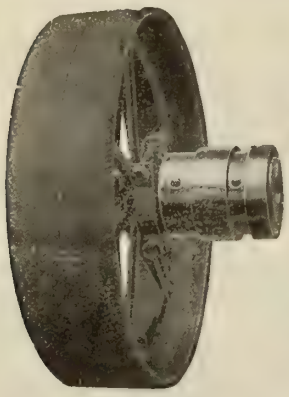
LANDIS TOOL COMPANY, Waynesboro, Pa.

CANADIAN AGENTS: A. R. Williams Machinery Co., St. John, Halifax, Winnipeg, Vancouver; Williams & Wilson, Montreal; F. F. Barber Machinery Co., Ltd., Toronto.

THE JOHNSON FRICTION CLUTCH

IS USED ON

The BERTRAM 24-Inch Crank Shaper

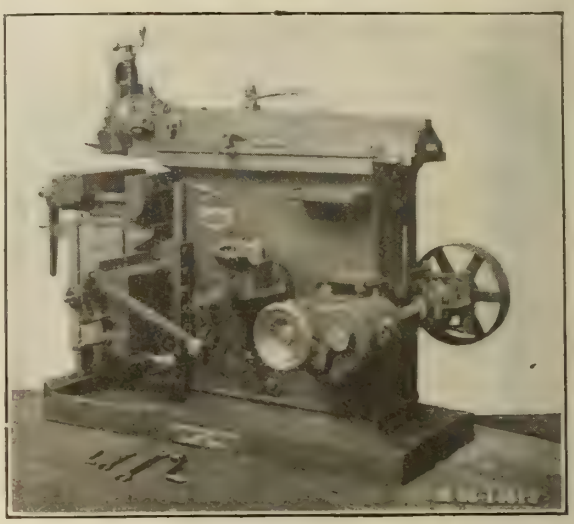


Single Clutch with Pulley.

on the Main Drive

A No. 6 Single Clutch Controls the Stopping and Starting of this Machine

No Tight and Loose Pulleys on this Machine



Courtesy: John Bertram & Sons, Ltd., Dundas, Ont., Can.

A good clutch is essential on any machine and there is none that will equal the Johnson.

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WRITE FOR YELLOW CATALOG.

THE CARLYLE JOHNSON MACHINE CO. MANCHESTER, CONN.

DROP FORGINGS
Are sometimes cheaper than castings—Always far superior.
DROP FORGINGS
One of the Largest and Best Equipped Plants anywhere.
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Quality & Service
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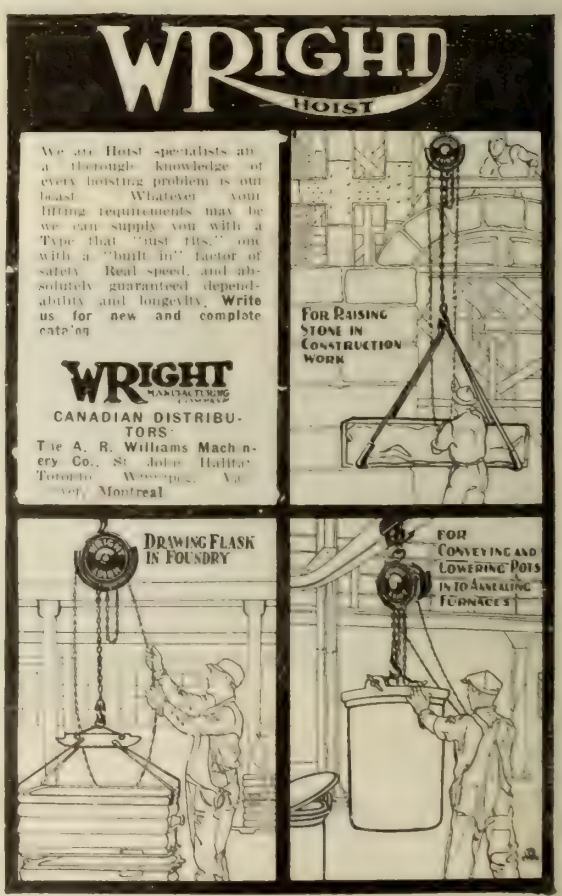
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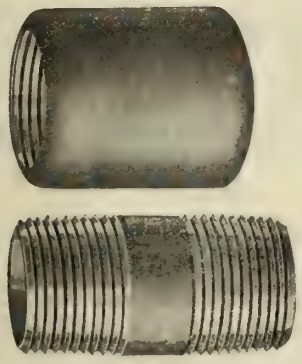
HOIST
We are Hoist specialists and a thorough knowledge of every hoisting problem is our boast. Whatever your lifting requirements may be we can supply you with a Type that "just fits," one with a "built in" factor of safety. Real speed, and absolutely guaranteed dependability and longevity. Write us for new and complete cata'og
WRIGHT MANUFACTURING COMPANY
CANADIAN DISTRIBUTORS
The A. R. Williams Machinery Co., St. John, Halifax, Toronto, Winnipeg, Vancouver, Montreal
FOR RAISING STONE IN CONSTRUCTION WORK
DRAWING FLASK IN FOUNDRY
FOR CONVEYING AND LOWERING POTS IN TO ANNEALING FURNACES

WROUGHT PIPE
COUPLINGS and NIPPLES



Each length of M.R.M. Pipe is tested to withstand a pressure of 700 pounds per square inch.

Supplied in black or galvanized.

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Largest Manufacturers in the world
of
High Speed Silent Chains

The superiority of Morse Rocker Joint Silent Chain has never been seriously questioned.
They speed up production, cut belt expense and overtime wages.

Catalogue Free.

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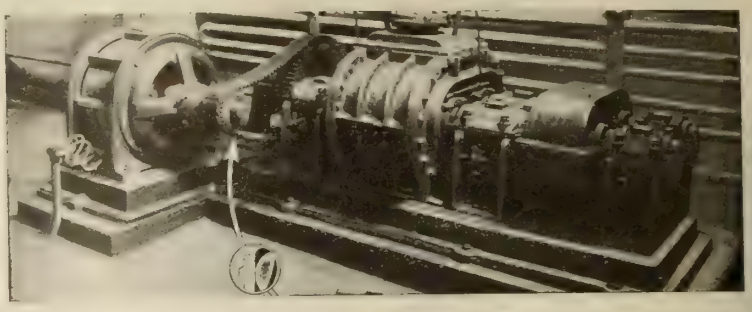

25 H.P. Morse Silent Chain to Positive Blower.

ARMSTRONG
Safety Clamp Lathe Dogs

THIS Dog is so constructed as to combine a wide range of adjustment with the convenient features of the Clamp Dog and the Simplicity and Strength of the ordinary Lathe Dog.

It is specially adapted for use on finished work which would be liable to be damaged by the set screw of a common Lathe Dog.

A distinct advantage of this Dog is that it can be applied without removing work from centres.

Ask for Catalogue B-20.

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SAFE
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WELL
BALANCED

ARMSTRONG BROS. TOOL CO.
"THE TOOL HOLDER PEOPLE"
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GISHOLT
LABOR SAVING EQUIPMENT

TURRET LATHES
Hand Operated
For Chucking and Bar Work
AUTOMATIC TURRET LATHES
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VERTICAL BORING and TURNING MILLS
UNIVERSAL TOOL GRINDERS
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With Adjustable Cutters
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For Time Recording in Factories
Separate Catalogs on each Product
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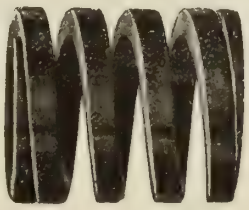

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BARNES CANADIAN SPRINGS
STEEL
HAMILTON, ONTARIO
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PRECISION SPRINGS OF HIGHEST GRADE
FOR
ENGINES, VALVES, DIES, AND SPECIAL MACHINERY
ALSO SPECIAL DESIGNS and TYPES

BROWN-BOGGS

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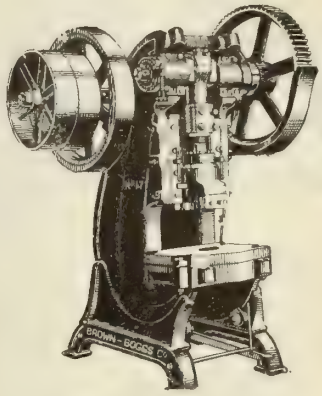
Not Sometime—

Right Now!

"B-B" Tools Mean Bigger Opportunities



No. 215—Power Press

Is it really Consistent Practice in times of retrenchment to cut down your men's wages and still retain machines and methods of practice that are out-of-date, slow and costly? If economy demands adjustments a good place to start is an investment in a machine that will cut down operating expenses.

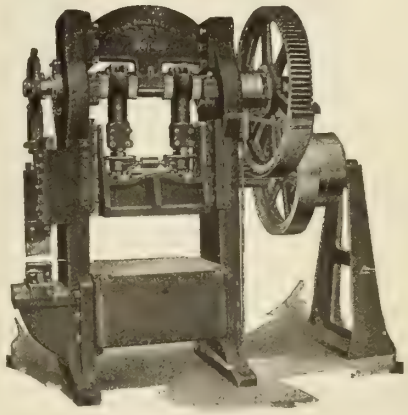
That's why we urge you at this time to investigate "B-B" Metal Working Tools.

What they will save you NOW can be approximately figured by the profits they have built up in brisker days.

Rigidly tested and guaranteed—presses, dies, shears, punches, drop hammers, and tinsmiths' tools of every description.

What our catalogue does not explain we will be glad to.

Easy-Running
Long Lasting
Sturdily Built
Greater Production



No. 140—Double Crank Trimming Press

TORONTO OFFICE:
Holbrook Building

A. B. WALKER
Representative

THE BROWN-BOGGS CO. LIMITED
HAMILTON, CANADA.

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OPEN HEARTH

ALLOY STEELS

CHROME-VANADIUM

CHROME-NICKEL

NICKEL

All of these Steels are supplied in

HOT ROLLED BARS.

We also furnish in BLOOM, BILLET AND SLAB FORM

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BLOOMS
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SLABS

STRUCTURAL STEEL

MERCHANT BARS

CONCRETE REINFORCING BARS

IRON, BRASS AND BRONZE CASTINGS

STEEL RAILS
Open Hearth Quality (All Sections from 12 lbs. to 100 lbs. per yard).

SPLICE BARS

STEEL TIE PLATES

PIG IRON
BASIC
FOUNDRY
MALLEABLE

SULPHATE OF AMMONIA

For the better convenience of customers who may find it necessary to secure rush shipments of particular items, we are keeping a large stock of all the various standard sections constantly on hand, and to this end extensive warehouse facilities are being prepared. Your enquiries and business will be appreciated.

May we have your next order?

Algoma Steel Corporation, Limited

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Sales Offices: **Montreal—606 McGill Building. Toronto—Bank of Hamilton Building**

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CANADIAN MACHINERY
AND
MANUFACTURING NEWS

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Synchronizing Screw Threads By Lead Variator

Special Lathe Grinding Attachment—Tilting the Head to Suit Angle of Helix—Obtaining Uniform Lead—Odd Pitch Threads Easily Cut—Accurately Truing of Cutting Wheel

GRINDING of screw threads provides a means of obtaining a greater degree of accuracy than is possible by any other method. Rapid progress is being made in securing the same precision on thread surfaces as has been heretofore obtained, commercially speaking, only on cylindrical, flat or spherical surfaces. A grinding unit that can be used in conjunction with any machine tool is shown in Fig. 1. It is capable of service on a variety of work and is particularly adapted for thread grinding on lathes. The device is made in two styles, one for applying to the front tool post and the other for service on the rear rest of the lathe. The construction of both models is identical in every respect with the exception that they face in opposite directions. The wheel truing arm is attached to base in such a way that the thread angle is dressed on the wheel in the same plane with the axis of work centres, thus producing a perfectly formed thread. The device may be readily located to conform to the angles for "V," W. S. S., Whitworth and Acme threads.

Construction Features

The grinding spindle is carried in five precision ball bearings, adjustable for radial wear and end-thrust play. The spindle housing is on a vertical traverse plate which is indexed with graduations for setting in any angular inclination to conform to the helix angle of the thread. Means are provided for raising and lowering the traverse plate to bring the wheel centre into alignment with the work centre.

An outstanding feature is the power transmission system which is accomplished by an endless belt. This belt has a three-point contact with both the driving and driven pulleys and then travels over a compensating two-pulley arrangement which automatically keeps it at the proper tension. Arrangements for two speeds are provided.

Setting for Thread Angle

Fig. 2 shows the machine in operation grinding a thread gauge. Fig. 3 is a view taken from the rear of the machine showing the grinder head tilted to conform to the proper angle of the helix of the thread gauge which is being ground. By using two heads in combination, when working on production grinding, large quantities of duplicate pieces may be readily ground by an accurate setting of the wheels on the first piece, as the setting of the wheels is not interfered with thereafter, but the subsequent parts are brought into lead with the wheels by means of an adjustable rotating lathe dog. Wheels are beveled on one side only. Each wheel grinds only on one side of the thread simultaneously. This is an efficient method of obtaining a sharp bottom in the "V" form of thread. There being no included angle point to wear away, wheels require redressing less frequently. The effect is similar to flat grinding with a straight wheel.

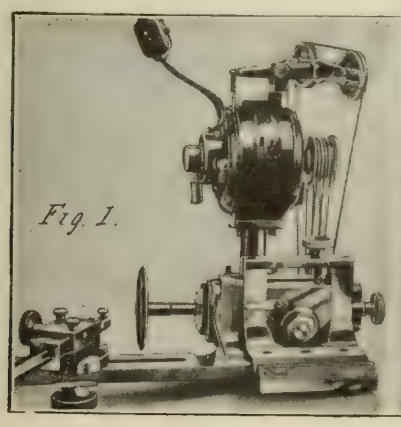

Fig. 1—General view of precision grinder.

Fig. 2—Grinding a thread gauge.

Synchronizing Thread Lead

A difficulty that is often experienced in the assembly of machinery is the working loose of studs used in supporting brackets and other parts of the machine. This trouble is largely overcome by synchronizing the two threads. Synchronized thread lead does not necessarily mean precision thread lead, but simply that both male and female threaded parts have the same lead. Under these conditions a perfect fit is assured, greater tolerances permissible on pitch diameters, for an excessive pitch diameter's error with true lead produces a continuous and safe bearing for the full length of the threaded engagement, whereas perfect pitch diameters with lead error permits of the successive shearing or stripping of threads, and to accomplish a complete entry of the stud requires a reduction of pitch diameter of stud threads. Subsequent assembly of some parts does not produce engagement of full length of threads, with the result that under work and stress, studs work loose and tear out.

Fig. 4 illustrates unsynchronized lead showing the contact on ends only, due to different leads between stud and threaded hole. Fig. 5 illustrates a thread with synchronized lead, showing the contact uniformly distributed over all the threads because the leads of stud and threaded hole are the same. Synchronized thread leads do not add expense but effect a considerable economy in production and assembly. Stock parts with synchronized thread leads match up with predetermined accuracy and result in finished products, insured against breakdown by studs working loose or tearing out.

Thread Lead Variator

Fig. 6 shows the grinder and thread lead variator installed on an engine lathe. This appliance enables a shop to produce synchronized lead by harmon-

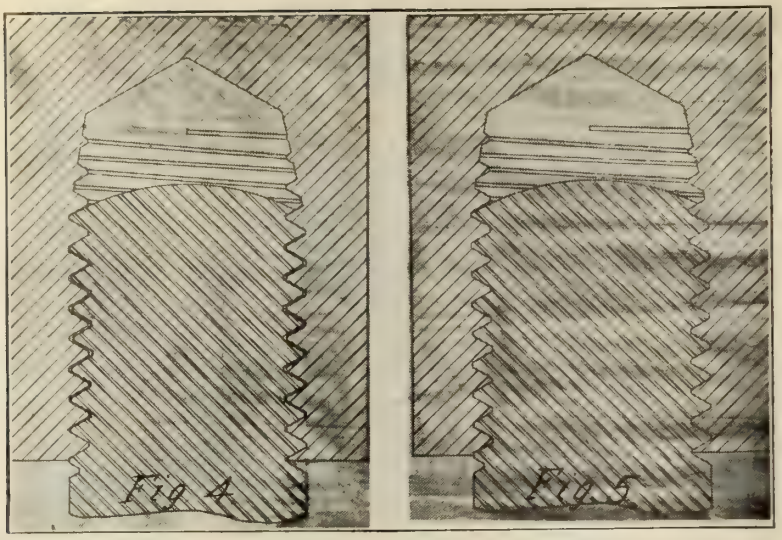

Fig. 4—Unsynchronized lead. Fig. 5—Synchronized lead showing perfect fit of thread.

izing the thread leads on existing tools. The grinder grinds taps, thread gauges, die head chasers, and all thread cutting tools. The variator gives control of the thread lead. Tools can be made to conform to stock on hand, or stock coming through can be manufactured to match taps used on the work.

The precision and thread lead variator is intended for elongating or diminishing the normal lead on lathes, and also for correcting errors in the lead of the lead screw. Likewise to elongate the lead on parts which are subsequently to be hardened, to compensate for the approximate shrinkage in lead, eliminating correction grinding in non-precision work and reducing the correction grinding necessary in accurate tool work. Metric threads, and any of odd or unusual lead, may be cut by the use of this device without requiring special or translating gears. Fig. 7 shows details of the variators.

Variator Mechanism

The stationary part of the device consists of a bracket, clamped on the ways of the lathe. This bracket is composed of two pieces, the outer frame and the ways adaptor. The outer frame is adjustable horizontally sufficiently to make the proper connection between the bracket and the mechanism carried on the lead screw. The bracket carries a swiveling rack and provision is made for vertical adjustment to bring the centre of the rack pivot in line with the centre of the lead screw. The adjustment can be locked and subsequent tilting of the rack does not disturb it. A dial is provided to show the degree of inclination of the rack.

The mechanism on the lead screw consists of a nut adjustable for size and having an extension carrying a half gear, that is free to swivel in line with the rack. The variation in the lead is obtained by the rotation of this half gear, in accordance with the angle at which the rack is set, as the nut is traversed by the action of the lead screw. Lead screw nut in the lathe carriage is not employed, but the connection is made between the variator nut and the carriage by steel cylinder. The variator nut moves the lathe carriage only during the machining operation. The return of the carriage to its initial position is obtained by a second nut, keyed in the frame of the variator nut to permit longitudinal movements independent of those making variations in the lead. A dust guard is furnished to protect the lead screw from abrasive dust, when performing grinding operations. It is recommended that the variator be positioned near the tailstock end of the lathe, as that portion of lead screw is generally but little used.

Setting the Device

In order to aid in setting the lead variator for either the normal lead of the screw or for a change of lead, a gauge block is provided. The block is used by clamping it directly upon the threaded work, it fitting all diameters up to 3 in. The block is one inch thick, so that by turning the work through the same number of turns as threads per inch required, and measuring the travel of the carriage by a dial indicator on it, adjusted to fit the block, the variation of the pitch of the lead screw can be determined. The desired pitch can be obtained by varying the angle of the swiveling rack to suit the conditions, and then locking it in place.

Deep Internal Grinding

Fig. 8 illustrates an attachment that is particularly adapted to deep internal grinding to a depth of 12 in. on holes 2 in. or greater diameter and to a depth of 6 in. on holes ½ in. in diameter. The device has a number of uses and can be mounted on machines of different types. It is shown in Fig. 8 mounted for grinding the tapered bore of a milling machine spindle. Such operations can be quickly performed so as to give perfect concentricity to the bore after it has become scored or worn. The taper of lathe spindles can be ground in the same manner with the head mounted on the tool post. Besides grinding deep holes in jigs, fixtures and other work, holes that are difficult of access because of projecting obstructions can be easily reached. The extension housing is screwed directly on the threads at the front of the spindle cap of the grinder. The extension spindle couples on the end of the regular spindle by means of a tapered joint. It is supported by double radial and end-thrust ball bearings at the extreme outer end of the housing.

Wheel Truing Head

Fig. 9 shows the wheel truing head on the multi-graduated precision grinder. The principal feature of this head is that

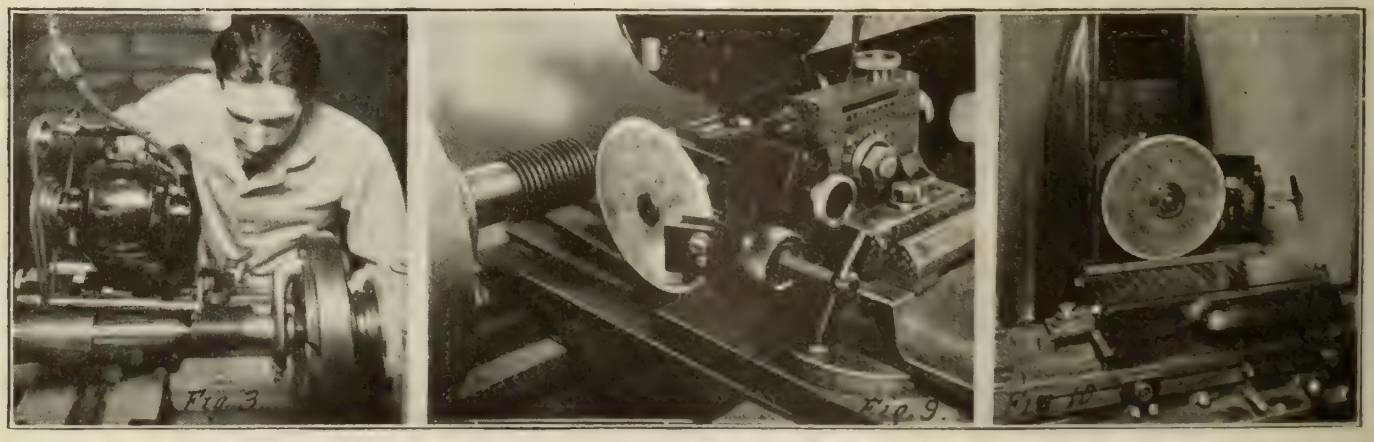

Fig. 3—Grinder tilted to conform to thread helix. Fig. 9—Wheel truing head. Fig. 10—Head in operation on B. & S. grinder.

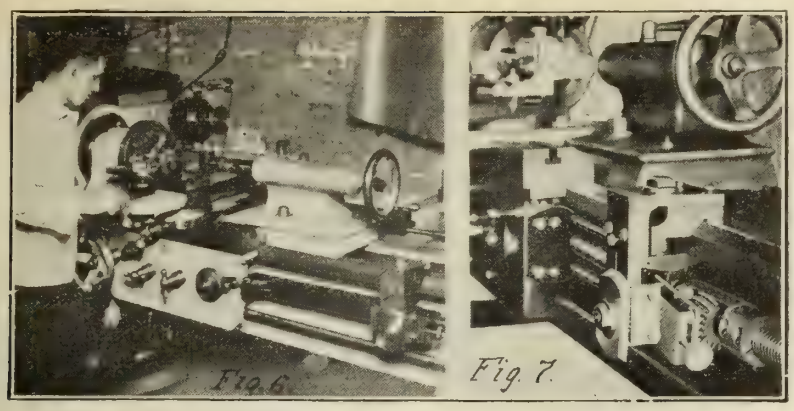

Fig. 6—Thread head variator on engine lathe. Fig. 7—Details of variator.

of keeping the wheel always in correct alignment with the lead of the thread being ground. Further, it is feasible to dress the "V" form on the wheel to a sharper point, facilitating the grinding of much finer pitch threads than usually considered practicable. Likewise there is no limit to the length of commercial thread which may be accurately ground, as the grinding wheel may be trued while grinding. The infeed for the head being graduated in thousandths of an inch, allows the grinding attachment to be fed in the same amount as the wheel diameter is reduced by wear and dressing.

Setting Diamond Dressers

The form dressed on the wheel is always in line with the axis of the work centres, as the diamond holder head is graduated in degrees corresponding to the spindle graduations on the grinder proper. For illustration, if the spindle is inclined five degrees to correspond with the helix angle of the thread being ground, the diamond holder is set at five degrees, opposite direction which brings the dressing head perfectly horizontal with the work centres. The traverse of the diamond is obtained by operating the double ended handle on the extended threaded shaft. The diamonds do not cut the wheel simultaneously but in progressive order. This is done for the reason that if one diamond should become dull it would cause the wheel to spring away and the other and sharper diamond would gouge the wheel and both diamonds would become heated. The diamonds are positioned at an angle of 10 deg. and after a slight amount of wear, can be rotated a small fraction of a turn, presenting to the wheel a new sharp point which will always be sharp, and this can be continued until the diamond is worn down to its setting. A stop is provided for regulating the return traverse of the two diamonds. This stop can be utilized for predetermining the amount of flat desired at the bottom of the thread angle, insuring the same amount of flat regardless of re-dressings and without subsequent re-gauging. By using this head it is practicable to use an 8 in. dia. wheel, reduce the grinding time proportionately and produce more accurate work with ease and certainty.

Fig. 10 shows the head in operation on a Brown and Sharpe surface grinder, using a 10 in. wheel, grinding thread chasers. An even depth of cut is maintained by lowering the regular grinder head to correspond with the reduction of wheel diameter on each truing. This combination is also applicable to grinding flat thread rolling dies.

The use of these precision thread grinding devices supersedes lapping in finishing gauges and precision threads, producing more accurate and uniform work with a better finish, at greatly reduced cost. By using the grinder on a lathe equipped with a relieving attachment, relief on hardened taps and hobs can be readily obtained. Ground taps usually have a much longer life, hold their cutting edge better, and produce more accurate work. Spindle threads of new and used lathes and milling machines can be accurately ground and this promotes concentricity of work, and is an efficient and practical method of correcting hardened spindle threads.

Article compiled from illustrations and data supplied through courtesy of Precision and Thread Grinder Mfg. Co., Philadelphia, Pa.

EFFECT OF U. S. TARIFF ON METAL PRICES

The importance of Canada as a source of mineral wealth, as yet only partially developed, and the proximity and extent of its natural market, the United States, has prompted an investigation into the possible effects the new United States tariff might have on the trade in minerals between the two countries. On certain items of the metal group the possible effect of a new tariff was discounted a week or two before the bill became law, but the full effect of the new rates has only been definitely determinable recently.

Aluminum:—From Canada during the year 1921, 3,259,893 pounds of crude aluminium were imported into the United States, on which the tariff has been increased three cents per pound to five cents. On this commodity the full increase in duty has been met by the market since the domestic aluminium producer has made two price advances on ingot aluminium totalling three cents per pound, since the law became effective.

Ferro-silicon:—During 1921 the United States imported 7,409 tons of ferro-silicon from Canada, valued at $363,702, or nearly $49 per ton. At this rate the duty-paid value, with duty at 15 per cent. ad valorem, amounted to $56.35 per ton. The new rates of duty range from two cents per pound of silicon content, where less than 60 per cent. silicon, to 8 cents per pound, so that on 50 per cent. ferro-silicon the duty amounts to $20 per ton. The price of this grade of ferro-silicon has therefore advanced from $55 before the passing of the new Act to $75 per ton, delivered with duty paid, and as a result importation of this product has practically ceased.

Zinc:—The duty on zinc was increased from 15 per cent. ad valorem to 1¾ cents per pound specific, and while this increment has stimulated production in the zinc industry of the United States, the acute shortage in Europe has caused such heavy purchases of United States zinc for export to Great Britain and the Continent that prices, both in the United States and in London, have risen to the highest levels in two years.

Lead:—The duty on pig lead was advanced from 25 per cent. ad valorem to 25 per cent. specific, and the demand in the United States has been so heavy and domestic production has gained so slowly that the entire increase in duty has been discounted, in the face of a higher world market, and supplies of Mexican lead are being imported on a large scale.

Manganese:—The heavy duty now levied on manganese ore was anticipated and heavy purchases were made prior to the signing of the bill. The market is now nominally quoted at the old price plus the duty.

Carbon ferrochrome:—Before the tariff was enacted 4 to 6 per cent. carbon ferrochrome was quoted 12 cents per pound by domestic makers and 10 cents by importers. Since the passing of the Act domestic alloy can still be bought at 12 cents, but importers have advanced their price to 12 cents duty paid.

NEW METHODS IN KNIFE MAKING

A short time ago the British Cutlery Research Association held an exhibition of modern methods as applied to the cutlery trade. The exhibits included the latest machines used in Great Britain in the manufacture of pocket knives, table knives, razors and scissors. One of the novelties shown at this exhibition was a machine which electrically welds table knive blades to steel handles. The handles are hollow and are produced and ground by machinery and are so constructed as to combine balance and lightness with durability and good appearance; above all, a low price. Still more interesting was the demonstration of the latest discovery in electro-plating. It is the method by which silver, copper, nickel, iron or steel can be plated with chromium.

Making Machine Tools and Making Money

Lack of Contact Between Business and Economics—Latter is Essentially Commercial—Should be Applied to Everyday Life—Sources of Demand Analyzed—Place for Engineer Salesmen

*By ERNEST F. DU BRUL

IT IS truly regrettable that instead of economics being recognized as the human, humane science that it really is, instead of it forming a valuable part of the business world's working knowledge, we find it considered, and for the most part still taught, as some form of esoteric mental gymnastics for college students. It is high time that both economist and business man take effective steps to bring economics into its own proper place.

In a recent address, Dr. Wesley C. Mitchell said that "engineers no doubt can and will contribute greatly to the solution of economic problems, to which they bring a special type of training which should enable them to see many things wanting or awry in the economist's conceptions. By constructive criticism they may make the economist's contribution more effective and in working with economists they may learn some things of advantage to themselves." As one working with both elements I can add a hearty "Amen" to that statement. More than that, I would appeal to both elements to give sympathetic attention to what each has to offer in the way of constructive criticism.

Lack of Contact

In puzzling out reasons for the lack of contact between business and economics, I have concluded that it is because, in sales terms, business has not been sold on economics.

To the suggestion that economic science deserved being "sold" to business, an economist of the academic type gave me the shocked response: "Why, that would commercialize the science, and destroy its cultural value in our course." To my unacademic mind, economics like engineering, is essentially commercial. I think it could be made decidedly more cultural than it is now, if more teachers taught is as a science of living humans, instead of as though it concerned an economic specimen preserved in academic embalming fluid. Far from shrinking at the fling of commercialism, I am for selling economics to the business world, as we have sold chemistry, physics, mathematics, geology, and other organized divisions of human knowledge.

Must Create Demand

We business men have learned that to procure consumer acceptance for our goods, we must hunt out, run down, coax, stimulate and manipulate our demand. We have learned that such acceptance depends

1st—On the sales effort made, its attractiveness and effectiveness.

2nd—On the service we give our customers to keep them sold after we have reached them.

3rd—On the effective utility of the goods we have to sell.

4th—And least perhaps, on the price we ask.

Perhaps the consumer acceptance of economics is so low because the sales effort has been very slight, the attractiveness and display of the goods has been poor, the service to the user has been bad, the utility has not been apparent; and perhaps all these made for a low price that was an index of inferiority.

In analyzing a sale we business men have also learned the four steps through which we must lead our customer's mind to accomplish the desired transfer of our goods to him and his money to us. These are:

1st—Attracting attention.
2nd—Arousing interest.
3rd—Creating desire.
4th—Inducing action.

Prefer Ease to Hard Work

Wherein have the purveyors of economic science failed in these? As to attracting attention, many of the best of our economists seem to prefer academic retirement and ease to the hard work necessary to popularize the science. They may have a mistaken notion that it is unscientific or unprofessional, or undignified, to make a science so popular as to effectively promote its application to every day life. If any science ought to be, and can be made popular it is economics, the one that deals with getting our living.

The opportunity of arousing interest in economics is ever present. Business men are always interested in the question "How is business?" Their wives often talk about the domestic labor supply. Working men think a lot about jobs and wages; politicians and citizens think about taxes, and the gathering and spending thereof. Even professors worry at times about the cost of living and whether the latest drive for endowments will be successful enough to increase their own salaries. It would seem very noble to do everything possible to direct this general interest toward instructive rather than destructive action.

Economists have evidently not created much desire, much appetite for economics; and Dr. Hollander, president of the American Economic Assn., gives testimony that in the great war crisis they did not induce good economic action. Perhaps it is because they have not presented their wares in an attractive, appetizing manner. Dealt out as dry, unpalatable brain fodder, economics cannot have as strong an appeal as if served in the form of a sparkling beverage to quench a human thirst for knowledge. Because it has been subjectively treated, it sems to me that the quality of the wares has been defective.

It is a fatal defect in economics to assume as true for the whole, what business experience proves to be true only for a part, or to assume as true at all times things that are actually true only a part of the time.

Must Consider Human Element

Men, of course, think only as they know, and of course they write as they think. Few writers of economic tests have had business experience. They mostly have but limited knowledge of fabrication and exchange. Their personal exchange experience is limited to purchasing the most evanescent of all goods—food, clothing, shelter. So they subjectively formulate laws of supply and demand from that consumer angle, and apply that formulation to a mere abstraction, the economic man, buying and selling goods and services in a perfect economic market. But this method takes no account of the human element swayed by caprice, and favoritism, and hampered by ignorance and folly. According to this theory the seller always extracts the last penny of profit from every sale. Every business man knows that if he tries to do that he will have to hunt so many new customers that his strictly economic selfishness will kill him off as a business factor.

Take the absurd expressions, "normal price," "normal wage," "normal profit," "normal business." The "normal price" notion leads people to chasing price-fixing rainbows, meanwhile baying the word "Profiteer." The "normal wage" notion leads unions to attempt to level up wages regardless of efficiency. The "normal profit" notion leads to envy of superior capacity that can make two healthy blades of grass grow where most competitors can only get a sickly sprout. The silly "normal business" notion leads men to run their business craft aground when the tide of demand goes out. That fallacy of a normal business has destroyed much wealth and wasted much human effort. Men have complacently considered a boom quite the normal thing only to be-

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wail the abnormality of the succeeding depression that their complacency brought on.

Striving for a fallacious simplicity of statement, economists have sacrificed clarity of thought, in formulating so called Economic Laws. The subjective method developed a formalism that led men to believe that the so called Law of Supply and Demand was something external, universal and automatic in its operation like the law of gravity, and that business simply consists of fabricating goods and making a price that takes the goods into consumption. The business world never could and never will recognize that sort of purely imaginary market.

As Applied to Flivvers

Every business man knows that fabrication is not difficult, but sale at a profit is difficult. It is not impossible to start a new automobile factory and make a better car at a lower cost than the flivver, because the limit of invention is not yet in sight, and Mr. Ford is still a human being, in spite of all attempts to deify him. Suppose such a factory were started, and its owner, counting on the automatic operation of the law of supply and demand, were to make a lower price than Ford's, and just wait for customers. Would he find Emerson right, that clamorous buyers would beat a path to his door, elbowing each other out of line to secure one of the new cars? Personally, I would bet on the Ford sales organization putting more flivvers on the road, at a higher price.

Again, the usual generalization is fatally defective when a depression comes on, when nobody wants to buy at low prices, or a boom develops, when every one wants to buy at high prices. The usual explanation of these things is, "Well, that is abnormal. It just cannot be explained by the formula." Another important fact is that the relative elasticity or inelasticity of demand in its response to price movement, is vitally different for different commodities at all times, and is different for the same commodity at different times. Economic theory has concerned itself but little with the effects of this inelasticity in different businesess.

England's leading economist, Alfred Marshall, seemed to think that only in the case of a coffin maker working for a local poor house, would it be impossible to stimulate demand by lowering prices, and that with this limited exception, the law as formulated by him is universally true. Yet manufacturers of producer goods, like industrial machinery of all kinds, whose yearly product amounts to hundreds of millions of dollars are precisely in the same boat with this coffin maker, and unless they manage their business craft according to actual facts and not by generalized errors, they are sure to lose their ventures. The whole mechanical engineering profession is largely affected by this little considered but very important characteristic of inelasticity of demand for some goods. Making plant equipment of all sorts constitutes a very large part of total production from year to year, and each year it constitutes an increasing part.

Demand From Three Sources

How many engineers recognize that such a business cannot be continuously operated according to the notion of a "normal," because of the nature of its demand? Demand for production machinery is entirely secondary, depending on the demand for the product of the machine, and becomes effective in orders, from three sources:

1st—from wear-out.

2nd—from expansion in the market for the machine's product.

3rd—from improvement of the machine reducing the cost of the product.

Unlike demand for food, there is little recurrent demand for machinery. Well-built machines are relatively long-lived so that actual wear-out is slow, and as improvement is always proceeding there is a diminishing market each year for old types of machines.

Expansion demand comes on only when the machine builder's customer is starting a new shop or is putting in additions to his capacity to take care of prospective increases in his own demand. This is done only well along in the prosperity stage of a business cycle, and it stops before the boom is over, as soon as the user sees his own temporary satiety point looming up. Obsolescence or improvement demand is largely an expansion demand, since it involves greater production per machine. Expansion demand comes on late in the cycle because most men lack both the money and the courage to expand their plants during depression. The consequence is that a machine industry's order curve would show relatively sharper peaks and wider valleys, than consumer goods demand would show. For good reasons, until the particular cycles of the machine-using industries are controlled, buyers will mostly continue to place their orders in that fashion, and will not be tempted by the low prices made in a depression to do otherwise. The machine builder and his employees can feast only as the buyer spreads the feast.

Not knowing much of the practical effects of this inelasticity, but assuming that all demand can be made to respond in the same theoretical way, to a reduction price, men like Professor Commons gravely propose an absolutely uneconomic scheme, **falsely but attractively labelled "Unemployment Insurance." It is not insurance at all, because it does not distribute the risk of unemployment over a considerable base or over a considerable time. It concentrates the risk on the last employer unfortunate enough to be compelled to lay off a workman at a time when jobs are scarce in his locality and industry.**

Certainly conditions of demand and supply for machinery are decidedly different from those for butter. So, even though this scheme which it is proposed to apply to all employers alike, might work no great hardship on a butter manufacturer, that is no good premise for a conclusion that its effect would be beneficial in the machine industry. Such sciolism is coupled with a praiseworthy desire to do a really constructive thing—to provide a reserve out of which workers can better support a business depression. But the good motive does not cure the bad logic that is being used to further this uneconomic legislation in Massachusetts and Wisconsin at this time.

Is it any wonder that business is not sold on that kind of economics? Can business be blamed for scoffing when such manifest fallacies are gravely put out for public consumption by an economist of some standing, without much, if any, criticism from his confreres? Unfortunately it is just such economic stuff-and-nonsense that attracts the attention of the unthinking mass, and arouses their interest. It is easy to create desire for something that looks so easy to get, at some one else's expense, and to induce legislative action regardless of logic and real economics. And so the sale is made—here—and in Russia. Then, when private initiative is so hampered that industry withers, the public finds—too late—that it was "sold" in the sense the bunco men use the term.

Engineer Salesmen

Good economics does need selling of the right kind, to replace the spurious goods mostly current on the market. To do that sort of selling will require men of the engineer type, who are now preferred to the superficial hand-shaking type where any project of importance is afoot. The engineer salesman with a professional, scientific background knows his goods, and their application, and knows how to engineer the sale. I believe that when the engineer takes up economics seriously, he will want to sell it to business, and he will keep business sold on economics in the proper way. As the engineer is essentially one who carries out the application of other sciences in the furtherance of human welfare, perhaps we should call this class of man, an economic engineer.

A BUSINESS EVOLUTION

Forty publishers of morning newspapers met in Chicago a couple of weeks ago and formed an association to promote the morning newspapers' interests in competition with the evening newspaper as an advertising medium. The chief method by which they say they intend to accomplish this is through announcements in the business newspapers of the United States—that is papers of the type of Canadian Machinery.

This is an interesting evolution—the recognition of the place and power of the specialized newspaper.

Factors That Influence Chain Drive Efficiency

Purpose of the Spring Cushion Wheel—Recommended Gear Ratio—Best Location of Drive—Taking Care of Slackness in Chains—Tendency to Individual Drive on Machine Tools

SPRING cushion wheels are designed for reducing the irregularities in the load on chains when driving certain classes of machinery. It is usually the driven wheel and while not occupying much more space than an ordinary wheel is considerably heavier. There is an outer toothed rim with two or more inwardly projecting vee blocks arranged equidistant. The inner portion of the wheel comprises a boss and rim with outwardly projecting vee blocks also arranged equidistant. Coil springs in partial compression are arranged between these vee blocks, one set taking driving effort and another and lighter set acting as buffer springs to neutralise the recoil when the extra compression is taken off the first set of springs. The springs are enclosed by a suitable cover plate. To keep the inverted tooth type of chain in place, guide plates may be arranged either on the outside or along the centre of the chain, though, of course when used on flanged wheels, the guide plates are unnecessary.

Recommended Gear Ratio

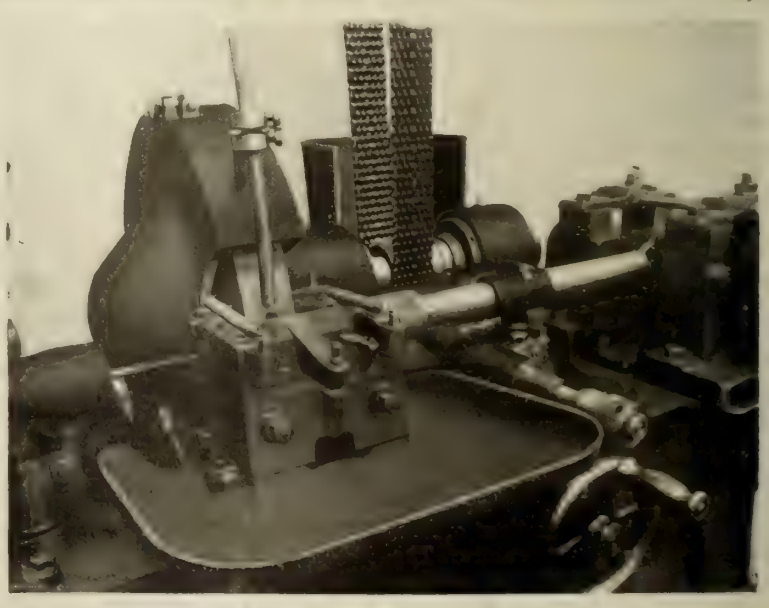
Horse powers from 1/10 to 5,000 have been satisfactorily transmitted by chains. The maximum gear ratio recommended for the roller type chain is 7 to 1 and for the inverted tooth type chain 6 to 1. For the roller type chain of ⅜ in. and ½ in. pitch the normal maximum chain speed in feet per minute is 1,000 and this is gradually decreased as the pitch increases so that for a 3 in. pitch chain 500 ft. per minute would be the normal maximum. In the inverted tooth type for ⅜ in. and ½ in. pitch 1,500 ft. per minute may be employed, and this gradually decreases to 1,200 ft. per minute for a 3 ins. pitch chain. These figures assume a sprocket pinion of not less than 19 teeth for the roller type and 21 teeth for the inverted tooth type. The desirable maximum centre distance expressed in pitches of chain for the roller type, ⅜ in. to ¾ in. is 100, 1 in. to 1¾ in. 85, 2 in. and upwards 70. For the inverted tooth type ⅜ in. to ¾ in. is 70, 1 in. to 1¾ in. 60, above 2 in. is 50. These figures apply for an ordinary horizontal drive with steady load or slightly inclined drive. The minimum centre distance should be such that the arc of contact is not less than 120 deg. between the chain and any wheel and with at least 7 teeth in engagement. Chain drives should preferably be arranged horizontal or inclined not more than 60 deg. when the large wheel is uppermost in the drive and not more than 45 deg. when the pinion is uppermost. These angles refer to the driving side of the chain and an horizontal line. It is important that the shafts should be truly parallel and horizontal.

Vertical shafts require special treatment. Wherever possible means should be provided for adjusting the shaft centres so that slackness due to a worn chain may be taken up. This prolongs the life of the chain. In electric drives, the slide rails of the motor make this provision. At least 1½ times the pitch of the chain should be allowed. If provision cannot be made, in the case of an horizontal or inclined drive, the chain may run slack until the slackness is such as to allow a link in the chain to be removed. Where the bottom side of a chain is the tight side, provision must be made to keep the two sides apart, hence the reason for large chain wheels in relation to centre distance. A chain works best with the tight or driving side uppermost and should be so arranged where a choice is possible. In all cases where there is a substantial amount of end play provision must be made to allow the chain to move laterally. Pinions should have an odd number of teeth if possible, in order to give uniform wear on the wheels and chain. Irregular loads should be corrected by the introduction of a flywheel and centre distance should also be short and the wheels as large as possible to prevent sagging. If a flywheel is impossible, the chain must be kept taut by adjusting the centres or the use of a jockey wheel or the introduction of a spring cushion wheel to absorb shock. Safety pins can be fitted in a driven wheel in the case of feed motions where damage may occur due to positive action of the chain. This shears in the event of an overload and allows the driven wheel to turn around on its shaft.

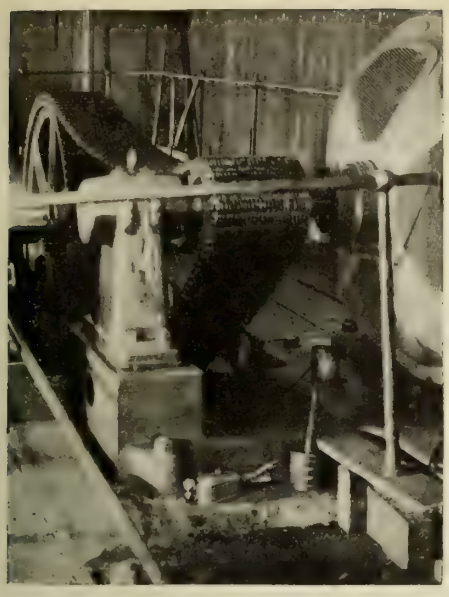
Cleaning and Lubricating

Lubrication of the working joints is essential for chain gearing. The most efficient form of lubrication is to encase the drive and pump a constant stream of oil on to the inside face of the chain from a filter pump, or the chain may be run through oil. This is essential for a chain speed exceeding 1,000 feet per minute. A drip feed lubricator may be used for slower speeds dripping on the inner face of chain, and a light or medium machine oil should be used Periodic cleaning is essential.

The drive should be thoroughly cleaned and overhauled every three months and oftener if working in damp and dirty conditions. A bath of paraffin is recommended and then a suitable lubricant, tallow or grease for roller chain, light or medium machine oils for the inverted tooth type, all wearing surfaces should be thoroughly lubricated. If the chain has not a gear case, a light screen or guard may be necessary to guard against oil splashing. When the periodical examination is made it should be seen whether the chain requires adjustment, requires clearing, whether the wheels are correctly aligned, whether undue wear is taking place or whether lubrication is satisfactory. In the chain case, the chain runs through a reservoir of oil, and the



Vertical Drive on Grinding Machine.



Heavy Main Drive.

level should be such that the lowest point of the chain will dip into the lubricant in its passing. The cases are divided, the upper half fitting inside the lower, and are dust-proof.

Necessary Conditions

When a chain is being renewed, it should be noted that where the drive is continuously in one direction a certain amount of wear will necessarily take place on the face of the wheel teeth in contact with the chain. Providing the wheel bosses are equal sided and bored parallel they should be reversed on their shafts to bring the unworn faces of the teeth into engagement with the new chain.

In addition to the numerous motor to lineshaft, lineshaft to countershaft and countershaft to machine chain drives which have been introduced in recent years both in replacement of existing drives and as new installations, almost every modern tool is now constructed so that it may be directly driven by motor. In this case the motor is self-contained with the machine, and the drive from the motor spindle to the driving spindle of the machine is very frequently by chain.

The invariable practice is to either mount the motor on a foundation plate connected to the machine or directly on the machine itself. Examples of both these methods are to be found in any modern engineering works, applying to the driving of lathes, planing, shaping, slotting, milling, drilling, gearcutting and other machines. The chain is also being developed for auxiliary drives, such as for driving the feed motion of a lathe, the power elevating gear for a planing machine, the quick power traverse of the carriage of shaping and various machines, tools etc. In some cases it is possible to displace quite a complicated arrangement of spur and bevel gears, horizontal and vertical shafts by a simple chain drive. Jockey wheels are employed to guide the chain past any desired point. The user is strongly recommended in any case of doubt to lay his information before any of the well-known makers of chain drives for their advice.

The Reason Why Belts Slip on Pulleys

IN NEARLY every plant there are some drives in use on which more or less trouble is experienced because of the belts slipping on the pulleys, and it has become quite a common practice to endeavor to overcome this by lagging the pulleys with some special covering or by use of applications which tend to hold the belts and pulleys together when they are in contact.

The results obtained by the use of these expedients can be satisfactory only to a degree for while in many cases they apparently correct the difficulty it is quite probable that a really careful investigation will bring out that the trouble which manifested itself in belt slippage has been transformed into another form which is not so evident as was the slippage and consequently is overlooked altogether. Increase in friction in bearings is one common form which this transformation takes, and the result is a decrease in the efficiency of the power unit, which not only backs up directly to the coal pile and the money box, but is a steady boarder.

It is much like trying to cure a surface manifestation of an infection by putting on a salve. You may drive it away from some particular spot, but it will show up somewhere else and will continue to do so until you remove the cause of the infection.

There are two factors which fundamentally influence slippage—one is the resistance to slip exerted between the two surfaces which are in contact, and commonly referred to as the co-efficient of friction, and the other is the pull in the belt which is the cause of the tendency to slip. Therefore, when a belt slips on a pulley, assuming that the belt is pliable and conforms readily to the face of the pulley, it may be either because the co-efficient of friction between the belt and the pulley is too low, or because the belt pull is too great.

In probably nine hundred and ninety-nine cases out of a thousand, it is because the belt pull is too great, and manifestly the logical and rational thing to do is to decrease the belt pull, not only because it constitutes the removal of the cause of the trouble, but because it decreases the wear on the belt and decreases the friction in the bearings, and as a consequence reduces the demand on the coal pile and the drain on the money box, while increasing the co-efficient of friction accomplishes none of these advantages.

The amount of power a belt transmits is calculated by multiplying the belt pull by the belt speed, so it will be seen that if the belt speed is increased the belt pull can be decreased, and the same power will result. For instance: If the belt pull is 800 lbs. and the speed 3,000 ft. per minute, the same amount of power is being transmitted as if the pull were 600 lbs. and the speed 4,000 ft. per minute, and when you stop to figure that in the transmission of power there is a tension in the belt on both the pulling and slack side when the drive is standing still, which throws a side pull on the bearings of pretty close to twice the working pull, it will be seen that cutting down the belt pull means a great deal.

In this particular illustration the total reduction in the side pull on the bearings is something like 600 lbs., while the pull tending to cause slip on the pulleys is cut down by 200 lbs., and it is all accomplished by increasing the diameters of the pulleys. The real cure for belt slippage and at the same time a profitable dividend paying investment is:

1st. See that the belts are pliable so that they conform to the faces of the pulleys, and then

2nd. Increase the pulley diameters so that efficient belt speeds are obtained, and the belt strains are brought down to within reasonable limits.

IMPROVING THE RAILWAY COUPLING

Very few among the ordinary travelers on railways realize how much their safety depends upon the piece of iron or steel which joins the carriages together. This item has become more important during late years owing to the increased weight of trains, and accordingly railway engineers in Great Britain have devoted special attention to devising an improved form of coupling which can be relied upon under the most severe conditions. Originally iron was the material generally used; and when stronger couplings were called for, the iron was made thicker. Latterly, however, steel has taken the place of iron, and an effort was made to utilize a special nickel-chrome steel, which is enormously strong. This material has, however, the disadvantage of tending to be somewhat brittle, and it is well known that constant vibration increases any tendency to brittleness. To meet this situation one of the leading British firms has applied a special form of nickel chrome steel which, while of great tensile strength, is quite free from brittleness. Railway couplings made from this material have recently been subjected to tests and show remarkably fine results. Whereas a coupling of the old type would stand a pull up to about 50 tons, one of the new couplings of a smaller diameter will easily stand over 110 tons.

Construction work on the new city hall building at Kitchener, Ont., will be in the hands of P. H. Secord & Sons Construction Co., of Brantford. The estimated cost of the structure will be about $253,000.

News From the Welding Field

Safe Practice in Handling Acetylene Generators

Best Housing Methods Under Different Conditions—Fire Hazard Requires Special Attention—Natural and Artificial Lighting of Buildings—Pressure in Pipe Line Important

IT IS ALWAYS desirable to have two workmen trained to properly operate the acetylene generator. If you only have one man in your employ who knows how to operate the generator and he should be sick or absent from other cause, you are liable to permit a man who knows absolutely nothing about the operation of the generator to attend to it, and possibly with serious results, and the chances are that your foreman or even you, yourself, have not enough knowledge about the generator to tell an unskilled man how to operate it or to judge whether he is operating it properly.

Recharging Generators

In the recharging of acetylene generators it is most important to follow the orders and instructions for consecutive operations as laid down by the manufacturer. Manufacturers of acetylene generators have endeavored, as far as seems humanly possible, to make their generators fool-proof, but the idea has never been quite accomplished. It is most important to remember when an acetylene generator is recharging that the generating chamber which contains the water and spent carbide is first of all drained or flushed out and again filled with water before any attempt is made to open or fill the hopper or container with carbide.

Supposing you have drained all the water from the generating or water chamber and that you then before refilling it with water, fill your carbide hopper, there is just the possibility that a piece of carbide may drop down through the feeding mechanism into the empty generating chamber. You must remember that the bottom of this generating chamber will probably have a coating of moist lime sludge. The moisture will attack the carbide and start to decompose. There is, however, not sufficient water to cause the decomposition to take place rapidly and, as a result, the decomposing carbide may heat up and reach a temperature where it is possible for it to ignite a mixture of acetylene and air. Remember if the carbide hopper were opened up before the generating chamber was filled with water, it would be possible for some air to have got into it.

Special attention should always be given to making sure that the hydraulic seals and backflash devices at the discharge of the generator are properly filled with water and are in proper working order. The pressure relief valves, which are commonly employed on what is known as the medium pressure type of generator, should be tested periodically in order to see that they are working freely and release at the proper pressure.

If any repairs have to be made to an acetylene generator, the whole machine should be thoroughly flooded with water to make sure that all gas has been expelled. This may seem very elementary advice, but history seems to warrant it being given as often as possible, and notwithstanding the fact that this advice is given on every possible occasion, workmen will sometimes occasionally open up an acetylene generator to make some minor repair or adjustment and then, without making sure that all gas has been expelled, start to use some metal tool and create the spark necessary to cause trouble.

In these cases where the shops are piped for oxygen supply and the oxygen is supplied from a number of cylinders manifolded together, it will probably be arranged for the same man who looks after your acetylene generator to look after the oxygen manifold and replace the exhausted cylinders with full ones when necessary. It is essential that the workman looking after this work be very carefully instructed in the matter of handling the cylinders with his hands free of grease or oil. When the empty cylinders are disconnected from the manifold and put on one side, the full ones that are to be attached should all have their valves cracked, that is to say, they should be opened very slightly for a moment to blow out any dirt or foreign matter that may have accumulated in the valve orifices during transport or storage. The cylinders should then be connected up in turn through flexible connections to the manifold and the valve on one cylinder opened up, care being taken to open the valve slowly so as not to throw a pressure of 2,000 pounds suddenly on the system. With the valve of one cylinder opened up, the manifold and all connections will contain oxygen at 2,000 pounds per sq. in.

Search for Leaks

A careful search should then be made

The cutting operator working on the outside of the casting cannot see the line of cut. The man in the picture is his helper and is guiding the cut with signals.

As recommended by the National Safety Council.

for leaks, which will be detected by a hissing sound. Connections where leaks occur should be tightened up immediately. After the operator has made sure there are no leaks in the manifolding system, the rest of the cylinders connected to the manifold can be opened up. It should be appreciated that it is necessary to open the valves on oxygen cylinders fully. If any cylinders are found that leak around the valve stem they should be disconnected and returned to the manufacturer.

Under no circumstances whatever should workmen be permitted to attempt to make any repair to the valves and valve fittings on an oxygen cylinder. All oxygen cylinders are fitted with valves having right-handed connections. Unfortunately, certain combustible gases are stored in cylinders of similar size and appearance to oxygen cylinders. Such cylinders should, in the cause of safety, be equipped with left-handed valves, but there are no laws which make it possible to enforce such a safety measure, and I regret to say that there have been one or two isolated instances where a cylinder of combustible gas has been connected up to an oxygen manifold along with oxygen cylinders and with, of course, disastrous results.

These occasions, however, have been so very rare that there is really nothing much to worry about, and even if every combustible gas cylinder were equipped with left-handed valves we would still have the man who might occasionally, by some means or other, connect a right-hand connection to a left-hand connector. As a matter of fact, cases are known where an operator endeavored to connect up a connection from an oxygen manifold to a cylinder of combustible gas, and he found he was unable to make a proper connection because the thread on the valve of the combustible gas cylinder was left-handed. This, however, did not thwart the determined worker and he went into the machine shop and got them to make up an adaptor for him so that he could make the connection. Now when instances of this sort do occur it is very clear that the workman delegated to look after cylinders, generators, etc., has not been properly instructed and cautioned.

Operation of Welding Units

It is quite needless to talk about the operation of the actual welding units, that is, the blowpipe, gas regulators, hose, and the installations using individual oxygen and acetylene cylinders where they are employed. Every manufacturer of apparatus puts out detailed instructions on how the various items of equipment are to be connected up and operated, and if users would follow these instructions, few, if any, accidents would occur. If, for some reason or other, oxygen or acetylene regulators which are employed for adjusting the pressure of the gas for delivery to the blowpipe become disarranged, do not permit your workmen to attempt to repair these themselves. Large establishments can, of course, have a department where welding equipment can be periodically overhauled, repaired and tested, and can employ in that department a man who is properly and thoroughly skilled in his work; but in the case of smaller establishments, it is advisable for defective apparatus to be returned to its manufacturer when overhaul or repair is necessary.

Testing Working Pressure

It is very important to periodically test the working pressure gauges on the regulators. These are the pressure gauges that indicate the delivery pressure of the gas from the regulator. As previously mentioned, acetylene should never be used in a blowpipe, or in a hose or piping system at pressure over 15 pounds per sq. in., and it is on this account that we emphasize the importance of making sure that the working pressure gauges, particularly those on the acetylene supply, are periodically tested to see that they register correctly. You hear occasionally of accidents where the hose supplying the gas to the blowpipes has burst. In nearly every case this can be traced down to the fact that acetylene was being supplied to the hose at a pressure in excess of 15 pounds per sq. in., either intentionally or because the working pressure gauge on the regulator did not record properly, with the result that a backfire in the blowpipe propagated through the blowpipe to the hose. Now appreciate that the backfire would not matter at all if the pressure in the hose was not above 15 pounds per sq. in. The acetylene would not even burn. But when the pressure is over 15 pounds to the sq. in. the acetylene may readily decompose and cause the hose to be ruptured, and probably disarrange the functioning of the regulator attached to the gas cylinder.

Proportions of Hose

Guard against using long lengths of hose of too small a diameter. Quite a number of blowpipes only function properly when the acetylene is delivered to the inlet to the blowpipe at pressure somewhere between 10 and 12 pounds to the sq. in. Therefore care must be taken to see that the diameter of the hose is large enough in proportion to the length to be employed to insure that the drop in pressure between the outlet of the regulator and the inlet of the blowpipe is not more than a pound or so.

It is probably advisable to say a few words about the acetylene cylinders. Some of you may not appreciate the fact that an acetylene cylinder is not merely an empty shell containing compressed gas the same as an oxygen cylinder. The interior of an acetylene cylinder is completely filled with a porous material such as asbestos, or a concrete made up of charcoal instead of crushed stone. This porous mass has a porosity of about 75 to 80%, and is being employed for the following reason:

It is found that if acetylene is compressed into a porous substance, and where the porosity does not exceed 80%, and acetylene cannot be exploded or ignition propagated when the pressure is over 15 pounds per square inch, as it could be if the cylinder contained no porous mass. Therefore, a cylinder properly constructed and containing the proper porous mass can be safely used for the storage of acetylene at over 15 pounds pressure per square inch. Cylinders commercially used today, in addition to containing the porous mass, also have in them a solvent, which will dissolve many times its own volume in acetylene, thus making it possible to store in the cylinders large quantities of gas at comparatively low pressure. A charged cylinder of compressed acetylene contains practically no free gas. All the gas that is in the cylinder is in solution in the liquid solvent, which liquid solvent is in turn absorbed in the porous mass in the same manner that a sponge absorbs water. When the valve of the cylinder is opened and pressure released, the acetylene gas comes off from the solvent in the same manner that CO_2 bubbles up through the water in a seltzer water syphon when the valve is opened. Acetylene cylinders should always be stored and used standing upright.

Safety Fusible Plugs

As mentioned previously, the safety devices in acetylene cylinders consist of fusible plugs which melt at a temperature of 212° F. It will therefore be seen that care must be taken not to let any flame come in contact with the fusible plugs. Otherwise they will melt instantly and release the full charge of gas in the cylinder.

Make a point of insisting that all welding operators wear suitable goggles. When securing suitable goggles it is advisable to have them comply with the specifications for goggles of the National Head, Eye and Ear Code for acetylene workers. Welders employed on heavy work should be supplied with fireproof gauntlets and aprons as a protection against radiated heat, and it is considered advisable where welding is being performed in the interior of some structures to insist that all outer clothing be fireproof.

Get The Safety Habit

It is sincerely hoped that some of the recommendations may help to steer you clear of accidents which need not occur, but don't forget that safety practice does not end with proper operation of your welding equipment. Welding must only be used for work where welding can be considered good and safe practice for construction or repair. Some users become over-enthusiastic and attempt to employ welding on certain work where it should never be attempted and consequently fall down badly, with the result that it tends to give welding a

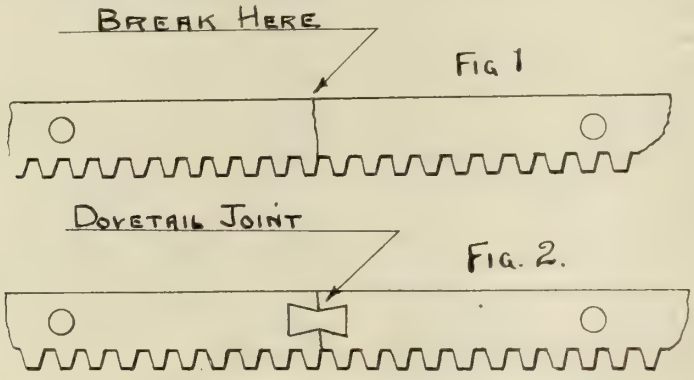
(Continued on page 29)

Practical Ideas From Practical Men

"REPAIRING A BROKEN RACK"

By G. Blake

This was a small mild steel rack, which had broken as shown in Fig. 1. As it was not possible to cut another, the writer repaired the broken one as shown in Fig. 2. Two dovetail slots were cut, one in each of the broken ends, and a dovetail wedge piece was snugly fitted. The slots were given a slight taper or bevel so that when the rack was brazed the molten metal would flow into the bevelled slots and make a solid joint. Regarding the brazing, it may be mentioned that to ensure the rack being straight, and to prevent any warping it was supported on a cast iron slab on two thin parallels near to the joint and held in that position by two small clamps during the brazing operation. This repair turned out entirely successful, and much time was thereby saved by repairing the broken rack, as to get another from the makers would have taken nearly a week.



Repairs to Machine Rack.

SQUEEZE LIGHTLY ON MACHINE VISES

By D. A. H.

Flat vises are used in vast numbers on milling machines and, to some extent, other tools. And besides these, there are many special fixtures used in manufacturing that follow the same gripping principle built into a design that adapts itself to high production on a particular job. Mechanics often complain at the short handled wrenches that come with these vises; they do more than complain—unless a foreman is right on the job—they hammer the handles unmercifully in gripping a piece of work or they substitute an ordinary wrench reinforced by a length of pipe. "They are going to get the vise tight—that's what."

But do they hold the work tighter by such heroic measures? Vises are built with parallel jaws, which will remain so for long years if not abused and if an hour or two is spent in that time in adjusting gibs for natural wear in the slides. With reasonable pressure on the screw, vise jaws will remain parallel, on any vise that is kept in good physical condition.

Work pieces must be held in the top half of the vise (for the bottom half is the base or "backbone" of the vise) and frequently they are thin pieces that catch the jaws only on their top half. Consequently, the result of gripping is to spring the vise if pressure enough is applied to the handle; the body of the vise usually has the same depth vertically as the jaws and that depth is not sufficient to render the vise proof against all kinds of stresses. In practice, the ignorant workman bends the body of the vise when he puts too much pressure on the handle.

As the vise is ordinarily clamped at the two ends, the centre springs up when so much pressure is applied and this defeats the very end the workman sought to attain, that of holding the work tighter. In bending up, the jaws bend also with the top edges spreading apart—this done the work is gripped only near the bottom. The result is a far poorer grip than one when but half the pressure is applied to the handle. A vise with non-parallel jaws never holds.

An instance of vise abuse and intelligent correction will be told. A new foreman in the milling machine department had set up a machine for cutting off six bars at a time of ¼in. x ½in. cold drawn steel. These were placed in an ordinary vise having an end stop arranged and with a parallel under the bars. The foreman ran two loads through, telling the operator to watch how he did it and giving other verbal instructions. Then he went about other work, leaving the operator alone as he had done similar work before.

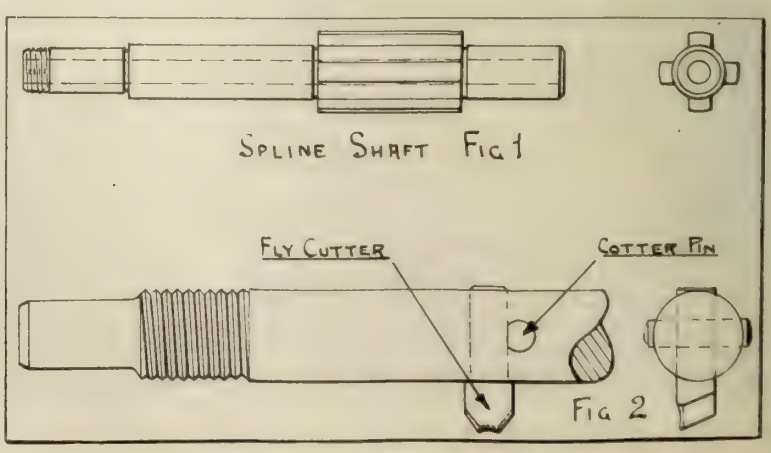
Fifteen minutes later, the operator hunted up the foreman to tell that "the vise had broken." Investigation showed that as soon as the foreman had gone, the workman had dug up a piece of pipe and slipped over the vise handle "so he could hold the bars tight" but "that wasn't what broke the vise because they always used the pipe."

The new foreman had been brought up in a school that taught one to reason things out. He showed the man how too much pressure actually lessened the grip and why he had gotten along so nicely on the first two cuts with only normal pressure on the short wrench. A new vise was obtained and the subdued workman proved for himself that it was not necessary to abuse it in order to make it do its proper work.

MAKING A SMALL SPLINE SHAFT

By G. B.

In the small shop one is often faced with the problem of making the small order pay, particularly so in the case where special tools have to be made and the cost of the same to be spread over a comparatively small quantity. We experienced something of this when making 50 of the spline shafts as shown in Fig. 1. We had no formed spline milling cutter and the method of taking three cuts with an ordinary milling cutter did not appeal to the writer as, after the



Milling machine arbor with fly cutter.

milling, it would have been necessary to trim up the radius with a file. A fly cutter was made and fixed in the milling machine arbor as shown in Fig. 2; this cutter was first turned on the shank then filed up to suit the profile of the sample spline shaft, it was next backed off by hand, hardened and touched up on the grinder. A hole was drilled in the milling machine arbor so that the shank of the cutter fitted snugly. The cutter, it will be noted, was held in position with a steel cotter pin. The milling of the spline was performed in the usual way, holding the shaft between centres on the dividing head. By taking a fairly light feed the splines were cut as accurately as if they had been done with the usual formed circular cutter.

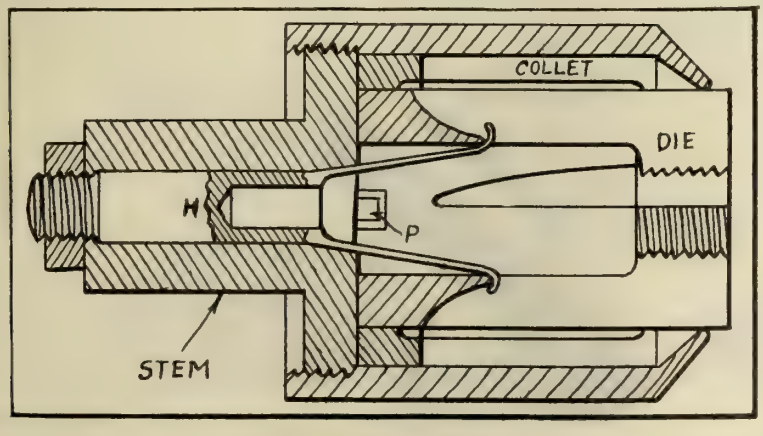
IMPROVEMENT FOR COLLET DIE

By D. A. H.

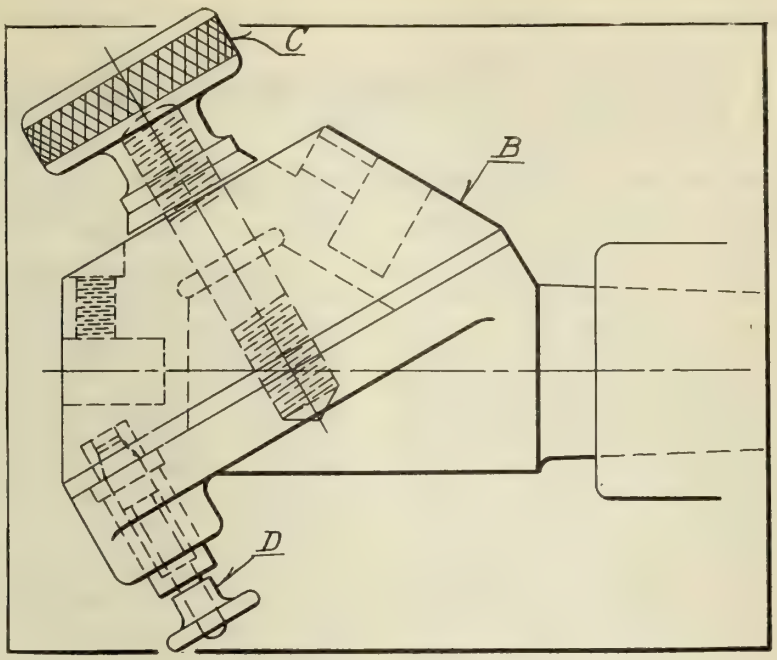
On small work, the round die known variously as a button, acorn, spring, or collet die, has come to be the tool most widely used on automatics. It is low in cost and it possesses an adjustable feature that permits of a limited range of fits to be made with it. Of these, the spring die that is made to go in a collet style of holder is undoubtedly the best. This holder closes equally on all prongs of the die, causing them to cut equally and keeping the die centred with the work spindle.

Driving pins in the holder (P in the drawing) relieve the outside shell from the thrust of the cut. But when it is desired to cut a thread of the larger size, the collet must be opened up sufficiently to allow the prongs to spring out their limit; there is not much grip on the die then and they keep pulling out of the holder as they are backed off the screw. This has led to some condemnation of this type of holder.

The drawing shows a way of avoiding this trouble when the screws are of a length that does not pass through the shank. The shank is enlarged and through it is placed a piece of steel H which has a thin nut on its inner end bearing against the shank. The outer end of this piece was drilled, then filed through leaving two fingers which could be spread apart and bent. The hook-shaped ends of the two fingers engage the slots, or flutes in the die and effectually prevent the die's pulling out as it backs off.



Improvements to collet die.



Small turret for engine lathe.

MACHINING SMALL LOTS

By J. H. D.

In almost every machine shop there is always some unfortunate soul picked out to do the thousand and one details in the way of small turned pieces. There are numerous parts to be machined in lots of a dozen or so which makes it a tantalizing proposition from the standpoint of production at low cost. Herewith is a drawing of a miniature turret to be used in conjunction with the engine lathe. It is made with a taper shank to fit the tail stock spindle; in all other details it resembles a regular turret. The revolving part B is inclined at an angle of thirty degrees and is locked in position by the knurled nut C. This turret can be made with four or six stations. The spring plunger D locks the turret in its position. Tools are held in place by Allan headless set screws. Holders for the different tools such as drills, hollow drills, hollow mills, taps and so forth can be made up for use with this attachment. Where ever much work of a duplicate nature is done on a small scale, it will pay to provide such a tool for the shop.

USE RECORDS

Records that are never used are worse than useless. The time and the effort required to keep them has been wasted. Using records spells progress. Failing to use them means falling short of the greatest ultimate success. Records are guidebooks to future action. Their use makes it possible to escape pitfalls, to prevent waste, to avoid mistakes.

CATALOGUES

Canadian Ingersoll-Rand Company, Montreal, with factories at Sherbrooke, Que., have just published a new catalogue K-602-A, illustrating and describing "Circo" direct vertical lift air hoists, the development of which has been carried to such a point that they might be called reciprocating air hoists. They are now built in their entirety at the Sherbrooke works and stocked in all standard sizes. The catalogue shows the different usefulnesses to which the hoists can be put, not the least of which is the foundry, where some concerns supply each molder with one for lifting copes, drawing patterns, etc. One of their chief uses is in connection with the molding machine floor. Further description of the hoist is unnecessary, since it is fully described in the catalogue, which can be had for the asking.

Duraloy can be welded by either the oxy-acetylene or electric arc methods, although it cannot be hammer welded. Preheating is found advantageous, particularly in the case of castings. Since the metal does not oxidize, it cannot well be cut by the oxy-acetylene cutting torch.

New Things in Shop Equipment

GASOLINE INDUSTRIAL TRACTOR

A gasoline driven industrial tractor intended for general use in machine shops and engineering works has been placed on the market recently. A notable feature of the machine is the small turning radius which may be as small as 5 ft. 3 in. Wheels are of the cast steel disc type fitted with Timkin bearings. Rear driving wheels are 22 x 3½ in. and the front steering wheels 16 x 3½ in., all tires of solid rubber. Power is supplied by a four-cylinder, four-cycle motor, rated at 23 b.h.p. at 2,000 r.p.m. The battery is mounted under the truck. The 6-gal. gasoline supply tank is located in front of the driver and fuel feeds by gravity. Fabric universal joints are fitted between the transmission and the rear axle, which is of the internal-gear type, full-floating and operating on Timkin bearings at a speed reduction of 8 to 1. Internal-expanding brakes are fitted on the rear wheels. Machine may be operated at a speed of from one to eight miles per hour. Special bumper is provided at front and rear. Machine has a length of 72 in., width of 40 in., and weighs about 2,900 lbs. It is made by the Toromotor Co., Cleveland, Ohio.

CUTTING-OFF MACHINE

Improvements in the design of the "Modern" cutting-off machine have been announced. The chief changes are in the method of handling the stock and the location of the operating levers. The larger machines are now equipped with double live roller feed for feeding the stock through the spindle. The automatic stop, for gauging length of stock, is operated from the tool block. The arrangement is so designed that the tool-block moves out to clear the tool after the cut. This movement brings the stock stop in a position for gauging the length of the next piece. The stop is pulled back by means of a spring, so that it is not in contact with the work during the cutting-off process. The speed of the roller feed is automatically regulated by the speed of the machine. Feed rolls run continuously but are only in contact with the stock when the collet is open, the lever that operates the latter being also connected to the roll feed mechanism. The convenient location of the two operating levers, the left-hand one for controlling the collet and feed, and the right-hand one for moving tool block and gauge stop, facilitates production and relieves the operator of considerable effort. These machines are made by the Modern Machine Tool Co., Jackson, Mich.

BOX RAILS AND STEEL STRINGERS

What is designated as box rails and stringers, made in the form of rolled steel sections, especially designed to facilitate the erection of lineshafting and similar equipment, has recently been developed and placed on the market. The box rails are a kind of continuous socket insert, the cross-sectional area being generally greater to give added strength. They are primarily intended to be built into the concrete ceilings at time of construction. The surface slot permits of inserting the head of a bolt at any point, which is anchored by giving it a quarter turn. This system of anchorage may be adapted for a wide variety of uses, such as monorail conveyors, on the side walls for supporting brackets for crane rails, and in floors for securing machinery, etc. Motors may be hung on these stringers so that adjustment along the length of slot provides facilities for taking up slack of belt. These box rails may be secured in any length. The feature of the system is claimed to be its flexibility, as adjustment of substringers may be made to any desired position. This equipment is manufactured by the Midwest Steel and Supply Co., New York.

TOOLHOLDER WITH INTERCHANGEABLE CUTTERS

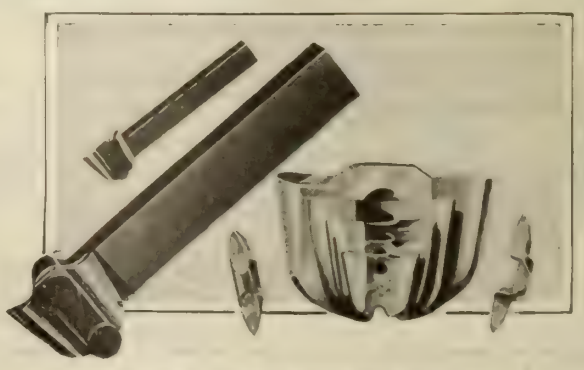
A toolholder with interchangeable cutters of various shapes that can be adapted to any class of work where toolholders may be used, has just been placed on the market. The holders are made of chrome-nickel steel and have two projecting portions at the cutter end in which the clamping bolts are inserted. The holes are offset unequally from the centre of the shank and the height of the tool cutting edge may be altered by changing the blade to the other side. The special feature is the construction of the high-speed steel blades, as each blade has two cutting edges and can be turned to use either one of them. The cutter has exceptional depth which gives added strength to the tool. The various shapes provide for turning, cutting-off, threading and facing and their construction is such that any one can be used in the same holder. Side and front rake are always the same as these are formed in the making of the cutter. Sharpening is accomplished by grinding the top slope. It is claimed that the design provides for very heavy cutting and that the rigidity is similar to a solid forged tool. The tool can be used on any machine where toolholders are in service. Twelve sizes ranging from blades of ⅛ to 1⅛ in. in thickness are made. These toolholders are manufactured by the Morris Tool Co., New York.

"SPEED-UP" GARAGE TOOLS

A number of time-saving devices for service about the garage in the repairing of automotive engines have been offered to the trade recently. These include a reseating tool by which valves of all 45-deg. removable head motors can be reseated regardless of their size. Work on different sizes of values can be carried on without any change of pilots. The pilot is made in one piece with four steps of sizes to suit stems of 5/16, ⅜, 7/16 and ½ in. dia. A snug fit of pilot is assured by a slight taper on each step. The pilot telescopes into the handle and is forced outward by means of a coil spring. The two diameters of the 45-deg. cutter are 1⅛ and 3 in.

Another serviceable device for the garage is a special vise for holding pistons, ball bearings, universal joints, etc. The jaws provide four points of contact for holding the work, the gripping surfaces being lined with lead. The fixed jaw is bolted to the base while the movable jaw slides along a smooth surface by means of a screw and hand wheel. The vise has a capacity for work up to 5 in. in dia., with an overall length of 10½ in.

Still another device is a sleeve for fit-



Tool-holder with high-speed steel cutters.

ting rings to pistons without injury to the latter. The sleeves can also be used when slipping assembled pistons into the cylinder block. The device keeps the rings compressed and the ring joints properly spaced. The sleeve is split and made of tempered steel in five sizes ranging from 2⅝ to 5⅛ in. in dia. These several devices are manufactured by Stevens and Co., 375 Broadway, New York.

UNIVERSAL SAW BENCH

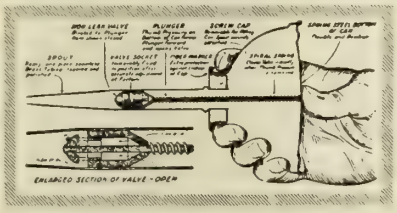
A fully universal bevel and miter saw bench fitted with tilting arbor and sliding table, and which may be quickly adjusted for performing different classes of work, has been placed on the market recently. The wheel spindle may be raised or lowered vertically by means of a wheel at the front of machine; this feature is especially serviceable for grooving and rabbeting. Saw spindle can be tilted to an angle of 45 deg. Frame is lightly but rigidly constructed, allowing ready access to all parts of the mechanism. Left-hand portion of table is movable sideways and adjustable to saw position. It can be swung back out of the way if desired. The right-hand section of table operates on rolls fitted to the track, and may be adjusted sideways to permit of using a dado head in place of the saw. Saw arbor yoke is carried in a circular groove, and saw may be raised or lowered when adjusted to an angular position. End thrust of saw arbor is taken on ball thrust bearings. Ball bearings may be provided on the spindle in place of the babbitt usually employed. Machine has a capacity of sawing material 6½ in. thick, when using maximum diameter of 18 in. saw. Saw arbor operates at a speed of 3,600 r.p.m., with countershaft running at 1 200 r.p.m. Machine is fitted with all necessary work gauges. A floor space 72 x 58 in. is required. Belt-driven and motor machines have a net weight of 1,100 lbs. and 1,350 lbs respectively. They are made by the Hooker Manufacturing Corp., St. Johnsbury, Vt.

DRAW-CUT HACK SAW

A portable motor-driven draw-cut hacksawing machine, with a capacity for work 6 in. by 6 in. on long stroke, and 8 in. by 8 in. on short stroke, has been placed on the market recently. The motor is located at the rear of the machine and the drive to the crankshaft is by means of a silent chain. The drive gears operate in oil and are entirely enclosed. Provision is made for connection to a convenient lighting socket wherever the machine may be placed. The feature of the machine is the self-contained drive, which makes it particularly valuable in structural steel and ornamental iron works, as it may be moved to any desired position with very little trouble. The starting and stopping of the machine is similar to the belt-driven type, the movement of a handle controlling the operation of the electric switch. No clutch is used. The saw frame automatically trips the lever when a cut is completed. The floor space required is 52 by 18 in. Machine weighs about 350 lbs. It is made by the Armstrong-Blum Manufacturing Co., Chicago, Ill.

NON-LEAK OIL CAN

An oil can that is constructed to prevent the dripping of oil from the spout except when pressure is applied to the spring bottom has recently been placed on the market. The valve socket is located in the spout of the can and rigidly fixed in a definite position after accurate adjustment at the factory. The valve



O-No-Drip Oil Can.

that regulates the flow of oil from the can is riveted to the plunger that extends from the valve to the spring bottom of the can. Pressure on the can bottom forces the plunger outwards and opens the valve in the spout. A small spiral spring surrounding the plunger causes the valve to close instantly when thumb pressure is removed. The spout is drawn from the best quality brass and will not bend, turn or split. The can is made of rolled steel, copperized inside and out. The screw cap is particularly large and a fibre washer provides extra protection against leakage. All cans are tested at 110 lbs. air pressure. They are known as the "O-NO-DRIP" and are made by Arthur S. Harding Co., Boston, Mass.

ALUMINUM LINE LEVEL

An extremely light level made of aluminum and weighing only ½ oz., eliminating any appreciable sag when used on a line, has just been placed on the market by the L. S. Starrett Co., Athol, Mass. It is 3 in. in length and made from ⅜-in. hexagon stock so that it may be used effectively as a surface level. It may be conveniently carried in the pocket. A luminous level glass with a yellowish fluid is used for the vial. The slots on the protruding pieces are carefully constructed so that the part of the slot which comes in contact with the line

Aluminum line bevel.

is true in relation to the level. The design of the slots prevents the level from dropping off the line when in use. Carpenters, masons and contractors will find this line level especially useful in laying foundations, tile pipe, cement and brick walls, working ditches, determining grades, building roads, aligning ditches, shafting, machines, etc.

MARINE BOILERS FOR LAND STATIONS

During the war many important advances were made in the design of the boilers fitted to British men-of-war. The exraordinarily severe service demanded from naval boilers stimulated invention in many directions. The reduction since the war in naval programmes of all nations has accordingly restricted the demand for such boilers, and the makers are turning their attention to other fields. They have found a very promising one in the electric pump station. The marine type of boiler has the advantage of taking up comparatively little space and of being able to give a very rapid increase in steaming power, when, for example, a sudden load comes on the station. In one large British electrical station two of these boilers are being fitted with oil burners, and excellent results are expected to follow.

IMPROVED FORM OF PULLEY

No kind of equipment is more familiar to the engineer than a shaft carrying pulleys; and in most cases it retains a primitive simplicity which makes it adaptable to a wide range of conditions. There are, however, cases where a departure from the traditional form is likely to be advantageous. For example, the development of ball bearings, to which keen attention is being given in Great Britain, is regarded as an important source of economy in running. Another feature is the use of a split pulley where it is necessary to add pulleys to a line of shafting. Quite a new form of split pulley, claiming many advantages, has been introduced by a British firm, and it is so simple in construction that one person can easily mount it on a pulley within a minute. The pulley is made in two parts, one forming more than three-quarters of the circle and carrying two projections against which the other piece is fitted. The adjustment of one screw tightens up the pulley and keeps it in straight alignment. No side-holding screws are employed, so that the pulley can be fitted close up to another pulley. This and its other advantages make it peculiarly well suited for experimental work where pulleys have to be put on and taken off with the least possible interruption of other work.

Charter is being applied for at Ottawa on behalf of the Buffalo and Fort Erie Bridge Co., who propose to build and operate a bridge across the Niagara between Fort Erie and Buffalo.

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Present Ills and the Remedy

IN THE numerous annual reports and reviews that are being issued at the present time, it is interesting to note the various diagnosis of present industrial ailments, and the remedies that are proposed.

A machine tool manufacturer observes that the "only means of overcoming the high cost of production, and the only way to attract capital is to secure and to show improved methods of production in factories now established." A manufacturer of a commodity extensively used in building and engineering operations, remarks that "Canada is primarily an agricultural country, and as long as this basic industry is carried on in a way that does not give a fair return to the farmer for his efforts, there cannot be any great measure of prosperity in this country." Another observer refers to difficulties "where the local market is only a fraction of that necessary to consume the supply."

These statements having established the fact that Canada has production capacity but serious market limitation, there is great significance in the conclusion of a financier noted for his practical, common sense in matters pertaining to industrial economics. It is that there is urgent need at the present time for high standard immigration, the building up of the population and the necessity for broad national emphasis upon the importance of thrift, industry and independence. So long as production is confined to restricted markets, costs will be high. Only in the development of volume operations and of the means of easy and profitable absorption can there emerge a solution of the difficulties referred to.

Economists See Buying Wave

THAT A BUYING wave is gathering force, and that the inspiration of mounting prices is taking possession of the business world, is the observation of economic investigations in the United States. Trade reviews are roseate. Signs point to higher prices. It is claimed that when the buying community realizes this the buying wave is bound to start; in fact, it is said to have already started.

There is another side. What is described as "our great senseless, useless over-supply of gold is increasing the cost of living inevitably." It is responsible for high temporary peaks in business, and in time, for descent to low, uncomfortable valleys. Economists do not all seem to see an unmixed blessing in the development of internal trade at the expense of trade with other nations, many of whom are heavy debtors, unable to pay except in goods against which there is a tariff barrier. They feel their country is in the same position as the millionaire referred to by the California banker who claimed he would rather have 30 cents and feel like a millionaire, than be a millionaire and feel like thirty cents.

Further, while business in the Eastern States is having wonderful records, there are internal sore spots and famished areas. Though crops have been good, farmers are said to be dissatisfied with returns and in some sections there are decreased acreages. Farmers have gone to work in factories. Wages in many lines are such that a scarcity of common labor has developed. It is claimed to be proving unwise to fix, by law, wages, rates, prices, etc., that should be allowed to take a natural course. A wave of radicalism is feared by some.

Meanwhile, Canada occupies the position of innocent bystander. There has not been the same sensational industrial recovery here, nor the same basic economic condition. Proximity, however, will exert certain influences. The steel industry will be the first to reflect the tendency, but restricted market may curtail widespread results. Most serious of all will be the effect upon available labor. Shortage in United States has always had the effect of serious inroads upon Canadian forces. The high wage becomes an imperative proposition. These are times when industry must have courage. When influences from without have to be solved as best they may, in relation to conditions within. Steady, well-established industrial growth, such as is apparent, is not easily unseated.

To Study Export Trade

SHORT COURSES in export trade are to open Jan. 15th in Toronto University, and Jan. 29th in McGill University, Montreal, in co-operation with the Department of Trade and Commerce, Ottawa. The courses will consider the principles of international trade, economic geography, transportation, trade currents and cycles. There will be discussions and demonstrations on special trade topics.

The course is calculated to better equip all those interested in shipping to size up commercial conditions and prospects in different countries. It will portray the many sides of international trading, and will enable students to apply increased knowledge and understanding to the work.

Canada has ambitions as an exporting nation. This course seems appropriately timed, for there is a feeling that the period is approaching when expansion in world trade will develop unusual opportunities. It is well that manufacturers should be schooled in the sound principles of this phase of business. It is an important step and no doubt many firms will be represented in the enrollment. Through their co-operation the courses will be successful.

Dollar Advance in Pig Finds Strong Market

Foundries Covering for First Quarter as Coal Strike Looms—Radiator Plants Taking Good Tonnages—Pittsburgh Reports Many Additional Blast Furnaces Being Blown In—Inventory Season

MACHINE TOOL MEN REPORT BETTER SALES

THAT THE steel industry is running largely on the momentum acquired not so much from fresh buying as from the volume of old orders that accumulated and have to be filled, is a statement made by an observer, writing from Pittsburgh. Predictions made six weeks ago that there would be a decided falling off in production in December will have to set their dates still farther ahead into January. Many new blast furnaces are being blown in. Business men, including bankers, are of the opinion that trade activity will keep up for several months in the new year. The steel trade, unless a coal strike upsets all calculations, may be expected to move in harmony with the general condition.

Pig iron markets are developing strength. Larger buyers are now covering for the entire first quarter. Pittsburgh reports that the valley basis was $25 a ton, but, as the buying progressed, the price moved up to $26 and this was firmly held. It is stated that foundry iron may easily go above that price by the end of the year.

After a series of declines, the Toronto pig iron market staged an advance of $1 a ton to $31.80, effective December 20. There is greater activity in the market than for some time. Foundries are better employed and, with prices where they are, practically $1.50 a ton lower than Buffalo, are covering in good quantities for first quarter requirements. Algoma Steel Corporation report that they are selling some iron to foundries in Northern Michigan at points where shipment may be received from the Soo at advantage. Radiator plants and other concerns in contact with the building industry are taking large quantities. On the whole there is a feeling in evidence that, at present prices and with prospect of labor troubles, pig iron is an attractive buy. Steel Co. of Canada may blow in their second furnace before the year ends.

Machine tool dealers report that during the past three months they have had some pretty fair bookings although, on the whole, the year will not show improvement over last year. Canadian National Railways have issued another list of tools on which they are asking for tenders, returnable Dec. 28.

Toronto

December 20.

IT IS THE inventory season, and manufacturers and dealers are estimating in terms of dollars and cents the results of the year's business. In many respects the finish has been good and it is felt that, as far as the material is concerned, the coming year should see marked improvement. Some reports will show a gain over last year, but on the whole there is consolation in the fact that results were developed wherever there was aggressive sales organization. In machine trades the past three months have seen some satisfactory business.

Railroads have made some purchases, and there is at present a list out for a considerable quantity of equipment for the Canadian National Railways. This list includes woodworking machinery, wheel lathe, electric welding outfits, lathes, bolt-turning machine, and considerable miscellaneous machinery. Tenders are returnable Dec. 28. In addition to this, the National is placing orders for large quantities of track and rolling stock requirements to cover their visible needs for the coming year. This will mean more normal operations in many plants that have had machinery lying idle.

The prospects are said to be bright for the early operation of the Algoma Steel Corporation on a much larger scale than for the past six months, in which little more has been done than to take care of pig iron requirements by the use of one furnace. The Steel Company of Canada will also begin the new year with their second furnace available for foundry pig iron.

Iron and Steel.—An easing off that is characteristic of the year end has set in, and the market is without notable feature. Some business is being booked for first-quarter delivery at prevailing warehouse prices which, it is claimed, do not fully reflect conditions at the base of supply. It is pointed out that with bars at $2 in Pittsburgh there should be added about $1.65 to make a reasonably profitable Toronto price, but the dealers are still quoting $3.25 to $3.40. Blue annealed sheets, it is pointed out further, while quoted at $4.25, are bringing out some quotations at below $4, a price which, it is claimed, is absolutely out of line with present conditions.

Some dealers are inclined to deplore a lack of confidence among Toronto dealers in the matter of stabilizing prices. There is said to be a lack of cooperation and that Toronto market is always a buyers' market because there seems to be no factor making for steady prices. Buyers interviewed in the matter were not all agreed that by peddling a contract it was always possible to get some firm to undersell. While they admitted that, although it was always possible to get a range of 5 to 15 cents, the market was inclined to be firm at a certain point. Prices ruling on the Toronto market are as follows:

Iron bars	3 25	3 40
Steel bars	3 25	3 40
Reinforcing bars	3 15	3 25
Steel hoops		4 75
Tire Steel		3 50
Spring steel	7 00	14 00
Band steel, No. 10 gauge and 3-16 in base		3 90
Small shapes		3 50
Sheets, black, No. 28		4 60
Sheets, blue, ann., No. 10		4 25
Canada plates, dull, 52 sheets		4 90
Canada plates, all bright		5 40
Galvanized Sheets, No. 28		6 00

Pig Iron.—The week has brought an increase of $1 per ton, to $31.80, in pig iron. There is a much steadier tone in the market and some very good orders have been placed. Taking the trend of the American market into consideration, it would seem that, at $30, the bottom of the decline had been reached. Apprehension as to a coal strike next spring will undoubtedly bring out business as a matter of preparedness. Buffalo reports that pig iron at $26 is in a stronger position than for some time. As an indication of building prospects next spring, it is stated that orders aggregating 150,000 tons have been placed by radiator interests in the past three weeks. Furnace operators are reported as saying that they have no further cause for worry as to a further decline in price. Prospect of an advance early in the new year is said to be not unlikely by Canadian furnace interests. The new price is about $1.50 below Buffalo.

Old Materials.—December has been an exceedingly quiet month in the scrap iron market. Transactions are not showing any volume and reports from American centres also show things to be at a temporary standstill. It is reported that large operators are exceedingly optimistic as to the outlook. Steel mills are steadily increasing their production and it is said that most of them have orders on their books to run at present capacity for some months. While it might be expected that the rise and fall of pig iron would be reflected in the scrap market, it is pointed out that the movement in pig iron was largely the result

of artificial conditions which could not effect pig iron markets very materially. Dealers' average buying prices:

Copper, light	9 00
Copper, crucible	11 25
Copper, heavy	11 00
Copper wire	11 00
No. 1 composition	9 00
New brass cuttings	7 00
Red brass turnings	7 00
Yellow brass turnings	5 25
Light brass	4 50
Medium brass	6 00
Scrap zinc	3 50
Heavy lead	4 50
Tea lead	3 00
Aluminum	11 00
Boiler plate, per gross ton.	9 00
Heavy melting steel	10 00
Axles (wrought iron)	20 00
Rails (scrap)	11 00
Malleable	10 00
No. 1 machine cast iron	18 00
Pipe, wrought	7 00

Non-Ferrous Metals. — Business is good but the majority of firms are doing business in a very conservative way, is the report from a large dealer. The railways were not a heavy factor as yet. Their purchases were largely in babbitt metals. Prices are firm. Tin prices in London have fluctuated considerably but it is felt that the rise in sterling may have the effect of forcing prices down somewhat in order to bring buyers into the market. Great activity has developed in copper. The 14-cent level is holding steady and it is stated that consumers in the States took five million pounds last week. Demand is strong and from a lethargic condition copper has moved into the upward-moving list.

Lead remains at fairly stable levels, while zinc is said to be holding fairly well with little notable business moving. Zinc in London showed a decline.

Dealers in the non-ferrous metal markets are in communication with the Customs department looking to some adjustment of sales taxes on ingot metals subject to re-sale. They claim they are losing much business by reason of the fact that large manufacturers may import direct with tax of 3¾%, whereas a dealer importing for re-sale must not only allow for the 3¾% but include an additional 2¼% in his re-sale price. A plan is proposed whereby sales made by manufacturers and wholesalers holding sales tax licenses for re-sale should not be subject to sales tax. In connection with this there is a suggestion that consumers pay 4½%, the idea being to provide some revenue in view of the sales tax that would be lost in case the wholesalers were not assessed.

Prices in Toronto market:

Lake copper	17 25
Electrolytic copper	17 00
Castings, Copper	16 50
Tin	41 00
Lead	7 50
Spelter	9 50
Antimony	8 50
Aluminum	22 00

Montreal

INVENTORY season dullness has settled upon the market and outside of an advance of $1 in the price of pig iron, there is no outstanding movement. The year closes with a fairly good showing of business.

Pig Iron.—Recent reduction of $2 a ton in the price of pig iron has been followed by an advance of $1, to $34.15. At this the Canadian price is below the level of U. S. competition throughout Ontario, and even in Montreal district the price is now down to a basis where Canadian-made pig iron can successfully compete with imported iron. There has been considerable inquiry, more particularly for special grades, and fairly heavy purchases have been put through, consumers evidently being of the opinion that present prices are about, if not quite, at the bottom and that there may be an upward tendency in the near future. Demand for steel is fair, more especially for bars, wire, wire nails.

Algoma, No. 1, car lots on Tracks, nominal quotation		34 15
Summerlee, 30-ton lots, dock	35 00	....
Carron, 30 ton lots	35 00	....
Do., 5 ton lots, ex. warehouse	40 50	....

Non-Ferrous Metals.—Commenting on the situation in non-ferrous metals, the British Metal Corporation have issued a letter pointing out that in copper a firmer tone has been noticeable, U. S. prices now being quoted 14⅛ to 14¼c. Export business has been on a larger scale and domestic orders for the first quarter of the new year have been freely booked. From the number of foreign enquiries that are being received in the U. S. A. for electrical locomotives it would appear that electrification of railroads is going ahead; how soon the effect of these orders will make itself felt in the copper market it is difficult to say, as the orders, whilst of a varied nature and from many sources are not of great magnitude, lead one to suppose that they are more for experimental purposes. In the meanwhile, it must not be forgotten that production is exceeding consumption, last month's excess amounting to 3,000,000 pounds.

The London electro market closes unchanged, the advance in price on this side being counteracted by the rise in sterling. Considerably more interest has been taken in standard and prices close £1 higher. The turnover of 7,100 tons is the highest since May and consisted almost entirely of future transactions.

In tin, continued upward movement of sterling has been accompanied by heavy fluctuations and made trading in New York very difficult. Indeed the entire decline on the London market has been offset by the appreciation of sterling and New York prices close higher on the week.

Some tin has been sold in U. S. for reshipment to England, dealers taking every advantage of the exchange, and while this should have the effect of depressing the London market, the phase may only be a temporary one, and the greatest gainers the shipping companies, who, in all likelihood, will eventually be called upon to ship the tin back again to this side.

U. S. supplies of lead are freer with a corresponding effect on values. This increase in stocks, combined with a decline in prices, should tend to alleviate the tightness of the European position.

As in lead, though not to the same effect, stocks of zinc are increasing. The market has a weaker tone, but demands for brass goods and galvanized sheets are good and no great recession in prices is looked for. Montreal prices:

Lake Copper	17 50
Electrolytic Copper	17 25
Castings, Copper	17 00
Tin	45 00
Lead	8 00
Spelter	9 50
Antimony	7 50
Aluminum	22 00

Pittsburgh

December 20.

OPERATIONS at steel mills reflect various conditions as to order books. Some subsidiaries of the Steel Corporation have reduced operations in the past week or ten days, while others have increased. The Carnegie Steel Company has put on several additional blast furnaces, while the National Tube Company now has the Riverside plant, in the Wheeling district, in practically full operation. Several independents have decreased operations.

Steel ingot production was at a rate of about 40,000,000 tons a year in both October and November, and in the first week or ten days of this month was probably at a rate distinctly above this, but with the decreasing operations already seen at some points and with the curtailments that are likely over the holidays, this month's total output may show a reduction.

There is a heavy pressure for production of wire nails and of merchant steel pipe, while other lines are under no particular pressure.

Operations are being watched for the indication they may furnish as to business conditions next year. Movements just now as to production are not particularly significant, however, on account of the near approach of the annual inventory date. Normally buyers like to have reduced shipments at this time to lighten inventory, even though they may need much more material later. To illustrate, production of ingots last December was 15 per cent. less than the average of October and November and 20 per cent. under the average of January and February.

Fear of Coal Strike

There is increased ground for suspicion that part of the demand for steel shipments at this time is due to fear on the part of buyers that there will be another coal strike April 1. Opinion on this subject is divided. Nearly half the people in the trade think the balance of probability is that there will be a strike, and nearly half think the balance is the other way. Whether the chances are six in ten, five in ten or four in ten is merely a detail. Everyone recognizes that there is a possibility, hence there is a contingency to be provided for.

The steel industry is running largely on momentum. Operations are sustained not so much by fresh buying as by the

old orders that are left to be filled. Much the same condition exists with the customers of the industry. They may not be selling a great deal just now but they have old orders to fill. In some lines, such as builders' hardware, stocks are abnormally light and need to be brought up to the normal.

Those who were predicting a month and six weeks ago that there would be a decided falling off in steel production and shipments this month have now modified their prediction and expect the decrease to occur in January. The coal strike may loom more prominently then and make the predictions prove wrong even though they were well based as to general trade conditions. Others, however, perhaps the majority, have not expected any material decrease in steel movement for several months. Opinion among business men and bankers seems to be crystallizing now on the idea that general trade activity is marked to keep up for several months in the new year, and even to increase somewhat, with a decrease in activity about the middle of the year. If these predictions are right, the steel trade may be expected to move in harmony with the general condition.

Steel Prices

Finished steel prices are unchanged. Merchant pipe at 66 per cent. basing discount and wire nails at $2.70 are very strong. Sheets are fairly steady at 3.35c for common black, with only one or two mills shading. Tin plate is firm on the general basis of $4.75, with concessions for large orders smaller than usual. Bars, shapes and plates are moderately steady at 2.00c as an open quotation for small lots, with concessions for large lots as for some time past.

Buying Movement in Foundry Iron

In the past week the buying movement in foundry iron went farther. Large consumers, who at first were disposed to cover for only a portion, say a third or a half of their first-quarter requirements, later decided they had better cover for the remainder also, and went into the market again. All told, the business has been heavy, both in this district and elsewhere. Approximately all the consumers with definitely known requirements in foundry iron for first quarter have covered, while the furnaces seem to be correspondingly well sold. In the local market the business was done at precisely $25, valley basis. Furnaces would not concede a particle from this figure nor would buyers pay any more. Gradually the furnaces began to withdraw the $25 price in favor of $26 and the last has now done so, $26 being not merely an asking price but a firmly-held price. The foundry iron market has scored to square advance of $1 a ton.

Conditions in basic iron were different. The steel works that buy their iron did not have much steel sold for first quarter and therefore were indisposed to buy largely as they had little to cover, while there was another factor that, while in foundry iron the production is limited, in basic iron there are several steel works with surplus blast furnace capacity and some are quite ready to sell iron. There has been some buying of basic iron at $24.75 or $25, but not a great deal. Basic iron may decline from $25 whereas foundry iron may easily go above $26 by the end of the year. Bessemer is off 50 cents, being offered at $27.50, valley.

New Turn in Coke

Connellsville coke, which had been softening and softening as production increased and consumption experienced little change, has suddenly had a new condition thrust upon it, a heavy inquiry from the East for coke as domestic fuel. Dealers have been in the market for lots of 10 cars, 25 cars or more, ready to buy anything so it is "coke." The point is that the East had an exaggerated impression of the importance of the lake movement in anthracite, and expected a large increase in offerings when lake navigation should close. When it was found that this made little difference they turned to coke with a rush. Whether the movement will amount to much depends on the attitude of domestic consumers, to whom coke may or may not appeal. If it does, the coke market will be taken out of the hands of the furnaces by a greater factor being in the market.

That is, production of anthracite has been running at over 2,000,000 tons a week, while merchant production of Connellsville coke has been only at say 75,000 tons a week. A single per cent. of the anthracite business, therefore, turned into the coke market would mean more than 25 per cent. of the present production, which is almost all taken up by existing furnace contracts. Connellsville furnace coke opened last week easy at $6.50 and ended the week stiff at $7.50 to $8, and the $7.50 price was obtainable for descriptions of coke that blast furnaces would not accept. Foundry coke was $7 to $7.50 and advanced to $8 to $8.50, all according to brand. As to contract, a producer making a particularly good brand quotes $8.50 for the first quarter and $7.50 for the first half.

Pig iron at Buffalo has advanced to $27, furnace, or $1 above the valley level, an unusual divergence.

The furnaces that use purchased coke have not covered for first quarter and presumably expected to do $6 or perhaps less. Now there are chances they may have to pay much more, in which case the pig iron market will be stiffened.

SAFE PRACTICE IN HANDLING ACETYLENE GENERATORS

(Continued from page 21)

bad name and creates a feeling of insecurity about the process in the minds of those who are considering its use.

Those of you who are intimately acquainted with welding work know that perfectly sound and safe welds can be made in almost any class of work, but such safe, sound welds can only be secured when properly trained and skilled operators are permitted to work. In the ends of safety it is just as much your duty to assure yourselves that the men employed in welding in your establishments make sound welds, as it is for you to see that they work under safe conditions.

METAL-DURALUMIN

Bausch Metal-Duralumin is an aluminum alloy, which has the strength of mild steel, with a two-thirds saving in weight for sections of the same size. At the metals division plant of the Bausch Tool Co. this new alloy is rolled into sheets, forged, fabricated and heat treated the same as steel and the product is used for a large variety of purposes. During the recent development of metal-duralumin in the United States and Canada, applications have been found for its use in over one hundred different industries, and there is hardly a place where iron, brass, steel or copper is used that does not have at the same time economic openings for the use of this metal.

At the National Automobile Show in New York the exhibit will show connecting rods made of Bausch metal, such as are now being adopted by various manufacturers of automobiles, also demountable rims, timing gears, etc. The use of this metal in the making of connecting rods has a remarkable effect in the reduction of vibration and increase of motor power; demountable rims used on automobile wheels save from 40 to 80 pounds of weight per set, improves riding comfort, facilitates tire changing, because of non-rusting qualities, makes driving easier and prolongs tire life.

The metal is especially adapted for use in reciprocating and moving parts and promises in the near future to be as widely used as steel, brass or copper.

Metal-Duralumin takes a remarkable polish and does not require nickel plating, and for this reason is used by automobile manufacturers for automobile body trim.

Speaking at a meeting recently in St. John, N.B., Sir Henry Thornton, president of the C. N. R., stated that "the possession of the Grand Trunk lines over the border is not fundamentally connected with the railway problem with regard to Portland and that portion of the road passing through American territory. If we amputate these lines, somebody will get them; it would be better to have them at least on friendly terms with the C.N.R. than to let them fall into hostile hands. It would not be well for us to remove our nose for the edification of our face."

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Toronto price:—

Silicon, 2.25% to 2.75%	$31 80
Algoma, No. 1, Montreal	34 15
Summerlee, Scotch, Montreal dock	35 00
Carron, Montreal docks	35 00
Grey forge, Pittsburgh	26 77
Lake Superior, charcoal. Chicago	36 15
Standard low phos., Philadelphia	37 00
Bessemer, Pittsburgh	29 27
Basic, valley furnace	25 00

METALS

	Montreal	Toronto
Lake copper	$17 50	$17 25
Electrolytic copper	17 25	17 00
Castings, copper	17 00	17 00
Tin	45 00	41 00
Spelter	9 50	9 50
Lead	8 00	7 50
Antimony	7 50	9 00
Aluminum	22 00	22 00

Prices per 100 lbs.

BILLETS

F. O. B. Pittsburgh

	Per gross ton
Bessemer billets, 4 in. x 4 in. and larger	$36 50
Open hearth billets	36 50
O. H. sheet bars	36 50
Forging billets	45 00
Bessemer rods	46 50

IRON AND STEEL

Per 100 lbs. to large buyers

Iron bars, base, Toronto	$3 25	3 40
Steel bars, base, Toronto	3 25	3 40
Small shapes, base		3 50
Iron bars, base, Montreal	3 15	3 25
Steel bars, base, Montreal	3 15	3 25
Reinforcing bars, base	3 15	3 40
Steel hoops		4 50
Tire steel, base		3 50
Spring steel	7 00	14 00
Band steel, No. 10 gauge and 3-16 in. base		3 90
Chequered floor plate ¼" and heavier	6 25	7 00
Chequered plates ¼-in. and heavier, sunken diamond		5 40
Bessemer rails heavy at mill		2 35

PITTSBURGH MILL

Steel bars	2 00
Tank plates	2 00
Structural shapes	2 00
Steel hoops	2 75 to 2 90

F. O. B. Chicago Warehouse

Steel bars	2 80
Structural shapes	2 90
Plates	2 90
Small shapes under 3-in.	2 75 to 2 90

PLATES

Plates 3-16 in.	$3.85	$3 60
Plates, ¼ up	3 50	3 40

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$4 60	$5 10
Sheets, blue ann., No. 10	3 85	4 25
Canada plates, dull, 52 sheets	5 00	4 90
Can. plates, all bright	6 50	6 00
Galvanized sheets, No. 28	6 75	6 25
Queen's Head, 28 B.W.G.	7 25	
Fleur de Lis, 28 B.W.G.	7 00	
Gorbal's best, No. 28, U. S. G.	6 10	
Colborne's Grown, No. 28		
Premier 28	6 10	6 35
Premier 10¾ oz.	6 80	6 75
Zinc sheets	10 25	11 50	11 00

FREIGHT RATES

Pittsburgh to Following Points	Per 100 lbs. C.L.	L.C.L.
Montreal	52	65½
St. John, N. B.	76	96
Halifax	77½	97
Toronto	34	48½
Guelph	34	48½
London	34	48½
Windsor	31½	45½
Kingston	48½	61

OLD MATERIAL

Dealers' Average Buying Prices

	Montreal Per Ton	Toronto Gross
Boiler plate	$ 9 00	$ 9 00
Heavy Melting Steel	10 00	11 00
Axles (wrought iron)	20 00	16 00
Rails (scrap)	11 00	11 00
Malleable scrap	10 00	11 00
No. 1 Machine cast iron	22 00	18 00
Pipe, wrought	7 00	6 00
Car wheel	17 00	16 00
Steel axles	15 00	15 00
Mach. shop turnings	6 00	6 00
Stove plate	16 00	14 00
Cast boring	6 00	6 00
Copper, light	9 00	9 00
Copper, crucible	11 50	11 25
Copper heavy	11 25	11 00
Copper, wire	11 25	11 00
No. 1 machine composition	9 00	9 00
New brass cuttings	7 00	7 00
Red brass turnings	7 25	7 00
Yellow brass turnings	5 25	4 85
Light brass	4 50	3 50
Medium brass	6 00	4 50
Scrap zinc	4 50	4 00
Heavy lead	4 50	4 50
Tea lead	3 00	3 00
Aluminum	11 00	11 00

COLD ROLLED STEEL

(At Warehouse)

Rounds and squares	$4 25 base
Hexagon and flats	5 25 base
Cumberland ground shafting, base	5 15 base

COPPER PRODUCTS

Prices per lb.

	Montreal	Toronto
Copper bars, 1¼ to 2 in.	28-31	.28
Plain sheets, 16 oz. in. 30 x 72 hot rolled	.31 00	.29
Copper sheet, tinned, 16 oz.	34 00	.36
Copper sheet, planished, 16 oz. base	39 00	.46
Braziers', in sheets, 6 x 4 base	30	.29
Copper tubing, seamless		.33

LEAD SHEETS

Roll Lot Prices

	Montreal	Toronto
Sheets, 3 lbs., sq. ft.	$10 35	$10 50
Sheets, 3½ lbs., sq. ft.	10 25	10 50
Sheets 4 to 6 lbs. sq. ft.	10 10	9 50
Cut sheets, ¾c. per lb. extra		
Cut sheets to size, 1c. per lb. extra		

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in.	22
Brass sheets, 24 gauge and heavier base	23
Brass tubing, seamless	30

STANDARD BUTTWELD PIPE S/C

Per 100 feet.

Price List No. 57. November 2, 1922.

	Steel Blk.	Steel Galv.	Gen. Wrot. Iron Blk.	Gen. Wrot. Iron Galv.
⅛ in.	6 00	8 00	....	....
¼ in.	3 96	6 00	7 20	9 30
⅜ in.	3 96	6 00	7 20	9 30
½ in.	5 02	6 55	7 31	8 93
¾ in.	6 10	7 82	8 86	10 70
1 in.	8 67	11 22	12 75	15 47
1¼ in.	11 73	15 18	17 25	20 93
1½ in.	14 03	18 15	20 63	25 03
2 in.	18 87	24 42	27 75	33 67
2½ in.	29 84	38 61	....	....
3 in.	39 02	50 49	....	....
3½ in.	50 60	64 40	....	....
4 in.	59 95	76 30	....	....

STANDARD LAPWELD PIPE

Per 100 feet.

Below dividing line—price per foot.

	Steel Blk.	Steel Galv.	Gen. Wrot. Iron Blk.	Gen. Wrot. Iron Galv.
2	22 20	27 75	31 08	37 00
2½	32 76	41 54	46 80	56 16
3	42 84	54 32	61 20	73 44
3½	51 52	65 32	73 60	88 32
4	61 04	77 39	87 20	104 64
4½	71 12	90 17	1 07	1 27
5	82 88	105 08	1 24	1 48
6	1 08	1 36	1 61	1 92
7	1 40	1 79	2 07	2 50
8L	1 48	1 88	2 18	2 63
8	1 70	2 16	2 51	3 02
9	2 07	2 62	....	....
10L	1 92	2 43	2 82	3 63
10	2 47	3 13	3 63	4 37

Prices—Ontario, Quebec and Maritime Provinces.
Terms—2% Cash discount if paid within 30 days.
Provinces

WROUGHT NIPPLES

4-in. and under, close and short, 55 per cent.

4½-in. and larger, close and short, 45 per cent.

4-in. and under running thread, 35%.

Standard couplings 4-in. and under 25%.

Do., 4½-in. and larger 5 per cent.

MALLEABLE FITTING LIST

1 in. elbow	.32	.53
2 in. elbow	1.05	1.70
1 in. tee	.43	.70
2 in. tee	1.45	2.40
1 in. coupling R. & L.	.33	.53
1 in. locknut R. & L.	.15	.23

Discount to dealers—70 per cent.

BOILER TUBES

Sizes	Seamless Lapw'ld Toronto		Seaml's Lapw'ld Montreal	
1 in.	20 00	....	23.80	...
1¼ in.	22.00	....	23.80	...
1½ in.	24.00	...	28.80	...
1¾ in.	24.00	....	24.50	24.00
2 in.	22.00	19.00	21.00	19.75
2¼ in.	24.00	21.50	24.00	22.25
2½ in.	27.00	23.50	27.00	26.25
3 in.	34.00	28.50	34.00	29.50
3½ in.	36.00	....	36.00	...
3½ in.	38.00	33.00	38.00	34.25
4 in.	50.00	42.00	49.00	43.50

Prices per 100 ft., Montreal and Toron

BOLTS, NUTS AND SCREWS

Per Cent.

Carriage bolts, 7-16 and up 30
Carriage bolts, ⅜ in. and smaller 6 in. and shorter 40
Coach and lag screws 45
Stove bolts 72½
Wrought Washers 60
Do., corru. head 60
Machine bolts, 7-16 and over 35
Machine bolts, ⅜-in. and less 35
Blank bolts 35
Bolt ends 35
Machine screws, fl. and rd. hd., steel cut thread .....37½ & 10
Machine screws, o. and fil. hd., steel cut thread 30
Machine screws, o, and fil. hd., brass cut thread 15
Standard couplings, 4-in. and under,30%
brass cut thread 30
Nuts, square, blank off net list $1.00
Nuts, square, tapped off net list 50c.
Nuts, hex., blank off net list .... 50c.
Nuts, hex., tapped net list
Copper rivets and burrs, list less 32c.
Burrs only, list plus 10%
Iron rivets and burrs..... 47%
Boiler rivets, base ¾ in and larger $5.75
Structural rivets, as above 5 65
Wood screws, O. & R., bright .. 80
Wood screws, flat, bright 82½
Wood screws, flat brass 77½
Wood screws, O. & R., brass .. 75
Wood screws, flat, bronze 72½
Wood screws, O. & R., bronze .. 70

NAILS AND SPIKES

Wire nails, base $3 65
Cut nails, base 4 35
Miscellaneous wire nails 72½%

MILLED PRODUCTS

(Prices on unbroken packages)

Set screws 65
Square and hexagon head cap screws 60
Round head cap screws 20
Fillister head cap screws 35
Flat head screws 25
Button head cap screws 20
Studs 45
Semi-finished nuts up to and including 9/16 in. 70
Semi-finished nuts ⅝ to 1¼ in. 65
Semi-finished nuts 1⅜ to 2 in 35
Coupling bolts 35
Taper pins, up to and including No. 5 65
Taper pin No. 6 and over 55
Planer bolts without fillet 10
Planer bolts with fillet ..... Net
Patch bolts ..... Plus 10%
Hollow set screws 20
Thumb screws 50
Thumb nuts 70

CARBON DRILLS AND REAMERS

Discount.

S. S. drills, wire size 60
Can. carbon cutters ..... plus 10
Standard drills, all sizes 60
3-fluted drills, plus 10
Jobbers and letter sizes 60
Bit stock 50
Ratchet drills 25
S. S. drills for wood 10
Wood boring brace drills 50
Electricians' bits 30
Sockets 50
Sleeves 30
Taper pin reamers 20
Drills and countersinks 20
Bridge reamers, carbon 30
Centre reamers ..... Net
Taps, machine screw ..... 55 to 60
Taps, hand, ¼ in. to ⅜ in ....40 to 45
7/16 in. to. ⅝ in. .....40 to 50
11/16 in. to 1 in. .....35 to 45
Chucking reamers ..... 20 off
Hand reamers 20
High speed drills, list 40
Can. high speed cutters..... plus 10
American ..... plus 40

FILES AND RASPS

Globe 60/5
Vulcan 50
P. H. and Imperial 60
Nicholson 35/5
Black Diamond 35/5
Heller 40
Jowitts ..... net
J. Barton Smith, Eagle 55
McClelland, Globe 50
Delta Files 20
Disston 40
Disston 50
Great Western-American 50
Kearney & Foote, Arcade 60/5

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive 8½
Grits, 80 and finer 6

PROOF COIL CHAIN

B. B. B. CHAIN

⅜ in., $16.45; 7-16 in., $14.00; ½ in., $12.95; 5-8 in., $13.15; ¾ in., $12.75; ⅞ in., $12.25; 1 in., $11.85; 1⅛ and 1¼ in., $10.55. Fire weld chain same sizes respectively are $14.00; $11.50; $10.40; $10.55; $10.15; $9.75; $9.35; and $8.25.

ELECTRIC WELD COIL CHAIN B.B.B.

⅛ in. $20.00; 3-16 in. $16.50; ¼ in. $15.50; 5-16 in. $12.70.

BELTING—No. 1 OAK TANNED

Extra heavy, single and double .. 30%
Standard .....30 and 10%
Cut leather lacing, No. 1 ..... 1.60
Leather in side, (Lacing) 1.50

RUBBER BELTING

Standard 36 ....28% Best grades 28%

TAPES

Chesterman Metallic, 50 ft. $5 00
Lufkin Metallic, 603, 50 ft. 3 17
Admiral Steel Tape, 50 ft..... 3 00
Admiral Steel Tape, 100 ft. 4 50
Major Jun. Steel Tape, 50 ft..... 3 75
Rival Steel Tape, 50 ft. 4 40
Rival Steel Tape, 100 ft..... 8 75
Reliable Jun. Steel Tape, 50 ft. 5 25

PLUMBING SUPPLIES

Plumbers' oakum, per cwt. ....$ 6 40
Navy oakum, cwt. 13 00
Solder, strictly 0 25
Solder, guaranteed 0 26½
Soldering coppers, lb. 0 62½
White lead, pure, cwt 13 20
Red dry lead, 100-lb. kegs, per cwt. 9 75
Wood alcohol, per gal. 1 75
Whiting, plain, per 100 lbs. ... 3 00

ROPE AND PACKING

Packing, square braided 0 38
Packing, No. 1 Italian 0 31
Packing, No. 2 Italian 0 24
Pure Manila rope ¾ and larger, base 0 20
British Manila rope 18
New Zealand hemp 0 18
Jute packing, fine 15c
Jute packing, coarse 11c

OILS AND COMPOUNDS

Castor Machine Oil, per lb. 34½
Royalite, per gal. bulk 21
Machine oil, per gal. 39
Black oil, per gal. (Summer) 19
Cylinder oil, Capital 69½
Turp., single bbls., gal. 2 20
Linseed oil, raw, single bbls. ... 1 13
Premier gasoline 29 00
Fuel oil, bbls., gal. 10 80

WASTE

XXX Extra .... 17 Atlas 18
Peerless ..... 21 X Empire ... 13½
XX Grand ..... 16 Ideal 18
Superior ..... 20 X Press 12
X L C R 15

Colored

Lion ..... 12½ Fancy 12
Standard .... 11 Popular 9½
No. 1 ..... 13 Keen 8

Wool Packing

Arrow .....24 Anvil 16
Axle 20

Washed Wipers

Select White ...18 Dark colored. 13
Mixed Colored ..14

This list subject to trade discount

PLATING SUPPLIES

Polishing wheels, felt $3 25
Polishing wheels, bull-neck 1 60
Emerey in kegs, Turkish 7½
Pumice, ground ..... 3 to 4½
Emery glue 18
Tripoli composition ..... 6 to 8
Crocus composition 12
Emery composition 11
Rouge, silver powder ..... .60
Rouge, powder, nickel 35

Prices per lb.

ANODES

Nickel .....40 to .45
Copper 22to 24
Zinc ..... 14 to 14½

PLATING CHEMICALS

Acid boracic ..... .20
Acid, hydrochloric ..... .03¾
Acid, nitric ..... .10¼
Acid, sulphuric ..... .03¾
Ammonia, aqua ..... .20
Ammonium, Carbonate ..... .15
Ammonium, chloride ..... .13
Ammonium, hydrosulphuret ..... .75
Ammonium, sulphate ..... .10
Arsenic, white ..... .18
Copper carbonate, anhy. ..... .26
Copper, sulphate ..... 8 to 10
Cobalt, sulphate ..... .20
Iron perchloride ..... .62
Lead acetate ..... .30
Nickel ammonium sulphate ..... .14
Nickel carbonate ..... .32
Nickel sulphate ..... .14
Potassium sulphide (substitute) .40
Silver chloride (per oz.) ..... .85
Silver nitrate (per oz.) ..... .70
Sodium bisulphate ..... .13
Sodium carbonate crystals ..... .04
Sodium evanide, 127-130% ..... .31
Sodium hyposulphite ..... .08
Sodium phosphate ..... .10
Tin chloride ..... .50
Zinc chloride, C. P. ..... .30
Zinc sulphate ..... .06

Prices per lb. unless otherwise stated

News From the Industrial Field

Alterations costing $100,000 will be made to the factory of Monk, Manhard & Dawson at Three Rivers, Que.

Development of electrical power in South Africa is creating an active market for electrical equipment there.

In operating at about 75% of the present capacity, the U. S. steel industry is running at more than 100% of pre-war production.

Vancouver, B. C.—Forty thousand tons of wheat were loaded this week at Vancouver for United Kingdom and continental ports.

The construction of a $900,000 terminal elevator at Port Arthur will soon be commenced by C. D. Howe & Co. for the N. Bawlf Grain Co. of Winnipeg.

McIlroy Belting and Hose Co., of Hammond, Ind., are now considering the erection of a plant at Brampton, Ont., the cost of which will approximate $20,000.

Owen Sound may install an asphalt plant in carrying out a proposed paving program. A movement is on foot looking to expenditure of $125,000 on harbor improvement.

Hamilton Bridge and Iron Works have been awarded the steel contract for the erection of an addition to the factory of the Zimmerman-Reliance Co. of Hamilton. Steel sash work goes to the Trussed Concrete Steel Co., Toronto.

The Bank of Montreal are having plans made for the erection of a branch bank at Vancouver, B. C. Plans are being prepared by K. G. Rea, Montreal. Cost of structure will be approximately $500,000.

Niagara Falls.—Dominion Insulator Co., Portage Road, expect to have their new plant completed by the end of the year, and machinery installed for a start early in 1923. This concern is a branch of the Ohio Brass Company, Mansfield, Ohio.

A deputation from Sault Ste. Marie recently waited on the Acting Minister of Railways at Ottawa and urged the granting of contracts for steel rails to the steel works at the Soo. The matter will probably be referred to the National railways directors.

Victoria.—During the past week, 153 mills reporting to the West Coast Lumberman's Association manufactured 109,604,102 feet of lumber, sold 78 738 343 feet, and shipped 71,089 558 feet. Thirty-nine per cent. of the week's lumber shipments, or 27,619 558, went by water, and rail shipments amounted to 1,449 cars.

Montreal, Que.—It is estimated by the Montreal Grain Clearance Board that about 155,000,000 bushels will be sent out in ocean bottoms from this port before the close of navigation. This compares very favorably with the previous season when approximately 138,000,000 bushels were shipped from this port, and a record was created.

Montreal, Que.—Approximately 100,000 sailors passed through the port of Montreal during the past season of navigation. Eighteen nationalities were represented, including Malays, Danish, English, Irish, Swedish, Norwegian, Chinese, Serbian, Arab, French, Russian, Jugo-Slavian, Italian and Esthonian.

At a banquet at Niagara Falls, Sir Adam Beck stated that engineers were already working out designs for another power canal looking to the development of a half million horsepower. He stated that the demand for power exceeds the capacity of the present Chippawa canal even when the fifth unit is installed.

Thompson Bros., Ltd., Liverpool, N. S., whose machine shop, with valuable equipment, was burned out recently, are again operating. A foundry, garage and pattern shop have been erected, 157 x 51 feet, and blacksmith and boiler shop 25 x 50 feet.

Trade commissioners' reports from South Africa say the corner of the trade depression had been definitely turned. Wool prices were practically double those of the pre-war period. Other agricultural operations have improved. Mines show increased output.

For eleven months ending November, imports of anthracite coal into Canada amounted to 2,012,169 tons as against 4,165,290 tons, the average for each of three preceding years and bituminous imports were 7,963,445 tons as against 10,639,745 for each of the three preceding years.

K. D. Marratt, retiring chairman of the Tanners Section, Toronto Board of Trade, stated that 1922 had shown a large turnover in leather for the Canadian trade, but that exports to Europe had been disappointing. Hides advanced from a low point fully 80 per cent. during the year, while leather did not advance more than about 20 per cent.

Sault Ste. Marie.—W. C. Franz, president of the Algoma Steel Corporation, states that while no new rail orders have been booked recently, the prospects are bright. The plant was being arranged and placed in a position to effectively handle new business when it actually materialized. He stated that the Corporation had quoted on a large order for the Canadian National Railways, and that if the bid were successful the mill would commence operations as soon as the order was received. The coal situation is improving. Two months ago he had despaired of getting in sufficient coal, but during the last few weeks a continuous stream of black diamonds has been arriving at the steel plant docks, and it is estimated that 200,000 tons have been unloaded. This will keep the mill running four months. The arrival of coal has taken a great load off the minds of the steel plant Executive, and they will now be able to go ahead and seek orders knowing full well that they will be able to make delivery when required.

Port Arthur, Ont.—With the construction of two new elevators during the coming year, storage capacity at the head of the lakes will be brought up to 61,000,000 bushels for the 1923 season. The Bawlf Grain Company announces that it will erect a terminal elevator with a storage capacity of 1,500,000 bushels at Port Arthur.

On his inspection trip of the Canadian National lines, Sir Henry Thornton recently visited the plant of the British Empire Steel Corporation at Sydney, where he saw rails in process of manufacture for the G. T. R. He inspected terminals and industries at Sydney mines. The C. N. R.'s new president was ready for work at 7 o'clock on the morning of his inspection.

House of Commons, London, Eng., recently voted a million pounds for unemployment relief. Officials of the Canadian Employment Service stated recently that they had received numerous demands from recently arrived immigrants for unemployment assistance, rent payment and other considerations. All they could offer was work, which, in some cases, was unacceptable.

Montreal, Que.—Wheat and flour exports from the port of Montreal continue active. A cargo of over forty thousand sacks of Canadian flour left here for Egypt recently, while large quantities were shipped to other foreign countries. Shipments to date are far in excess of those of the corresponding period a year ago.

Vancouver, B. C.—A special dispatch received here says the Dominion Government has decided to hand over control of the big grain elevator here to the Harbor Board. The financing of extensions will be left for the Harbor Board to carry out and will be financed by the Government under the same system as at Montreal, according to the dispatch.

Victoria, B. C.—The Argentine Republic forms an important market for British Columbia lumber, according to F. K. Vigor, an electrical engineer in La Plata, who has arrived in Victoria. In view of the fact that there is no native softwood in the Argentine, and only a limited quantity of hardwood, there is a great demand for lumber from Canada.

Winnipeg.—A terminal elevator with a capacity of 1,500,000 bushels will, it is reported, be erected at Port Arthur by James Stewart, president of the Maple Leaf Flour Mills, according to authoritative information obtained here. The cost will approximate $850,000 and construction will be commenced during the forthcoming winter. The site selected is near Thunder Bay elevator.

Vancouver, B. C.—During the week, the first lot of wheat to leave the Pacific coast for South America was loaded and several thousand bushels were consigned to this market. It is believed that a substantial trade will be developed in this line, whilst the recent earthquakes on the Chilean coast will, it is anticipated, result in increased demands for lumber, lime, and cement from British Columbia.

Vancouver, B. C.—The outstanding feature of the metal production of Canada during the first six months of the present year was the gain made in gold output by the two important producing provinces, Ontario and British Columbia, amounting to an increase of some 42 per cent. over the first six months of 1921. The higher prevailing prices and more active markets for silver and lead have been reflected in gains in production of these metals.

St. John's Nfld.—According to report, the British Treasury has signed a guarantee for $10,000,000 recommendation of the Trades Facilities Commission for the establishment of pulp and paper mills at Humber, Newfoundland. The Newfoundland Government has guaranteed the contractors, Armstrong Whitworth Company, a similar amount. The initial work has already begun.

St. Catharines, Ont.—Work on Welland Canal will be continued during the winter, except in very severe weather, according to an announcement by Chief Engineer Grant. There are about two thousand men engaged in the work. A few men have been laid off on sections No. 1 and 2, but work on sections 3 and 4 will be maintained up to normal point.

Canadian exports for November amounted to $132,000,000, a record for the year. It is expected that the total trade for 1922 will exceed that for 1921 by about $80,000,000. The Canadian railways have been in shape to expedite crop shipments this fall and this has helped materially to produce the record, which is higher than that attained by any other country of comparable population.

Toronto.—The British-American Oil Company is enlarging its Toronto refinery by adding a new process building which contains the latest machinery for the production of certain lubricating oils. This plant will enable it to manufacture oils at present in demand which heretofore it has not made in large quantities. The company has also established six new branches in Ontario and Quebec, each of which has large tank storage accommodation as well as warehouse and office facilities.

Fort William.—Movement of the crop east from Fort William by the railway this season has totalled 3,598,971 bushels, compared with less than 1 000,000 for each of the years 1915 and 1912. By boat this year, there have been shipped from Canadian Pacific tracks 82,923,908 bushels, against 68,168,553 bushels in 1915, and 52,043,000 bushels in 1912. Total shipments from the head of the lakes have amounted to 86,522,897 bushels this season, compared with 52,991,845 bushels for 1915 and 68,683,557 for 1921.

Vancouver, B. C.—Application is reported to have been made to the Dominion Government by the Marconi Wireless Telegraph Co. of Canada for a license to erect and operate in the vicinity of Vancouver a continuous wave wireless station costing approximately $2,000,000, and capable of communicating direct with Great Britain, Australia and the Orient. It is said that the company will erect other stations situated at Montreal, Toronto and Winnipeg. A total expenditure of $5,000,000 is planned by this company.

Montreal, Que.—A total of 21,530 head of cattle were shipped from the port of Montreal during the past season of navigation, as compared with 31,217 head for the season 1921, a decrease of 9,687 head. Of the above total shipped in 1922 there were 7,615 head from the United States, so that the total number of Canadian cattle that went forward to the British markets from this point was only 13,915 head. There was no export business done in sheep during the past season, while during the preceding year shipments amounted to 4,064 head.

Whitby will vote, at the municipal elections, on a by-law to grant certain concessions to a factory described in the daily press as "utilizing the products of the Imperial Steel Corporation at Collingwood." It will employ a hundred hands and spend $75,000 on factory equipment. The town is asked to guarantee $50,000 of the company's bonds are given fived assessment. Samuel Jeffrey & Son, harness manufacturers, recently burnt out in Port Perry, may also locate in Whitby. Concessions in taxation and free light and water are proposed.

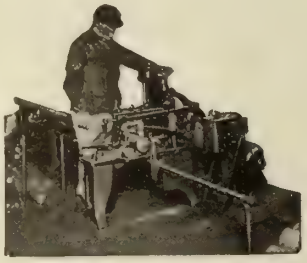
Vancouver, B. C.—The herring hauls of the Pacific Coast may yet rival the North Sea. According to Gosse-Millerd, there have been some very large catches of herring made off the coast of British Columbia. In fact, the firm says that they themselves have caught as much as 200 tons of herring in one day, which would probably mean one and a half million fish. Their total catch during the last season, which begins about the middle of October and ends about the middle of February, was in the neighborhood of 50,000 tons—about 400,000,000 fish.

Vancouver, B. C.—November saw a new record established in the movement of Western Canadian grain through the port of Vancouver. Approximately 3,700,000 bushels, or considerably more than half of last year's total shipments, have passed through the local elevator during the month. December, it is stated, will be another big month for grain shipments, about 4,000,000 bushels being due to move from Vancouver for the United Kingdom and the Orient. Total grain booked and shiped of the 1922 crop, for the United Kingdom and the Orient, now amounts to about 10,000,000 bushels.

Ottawa.—A further amelioration of economic conditions is indicated in the report of the labor situation of the Dominion Government for the month of October. The price movement was downward, both the index number of wholesale prices and the weekly budget being slightly lower. The time lost due to industrial disputes showed a decrease from the previous month and unemployment was lower. The cost of a family weekly budget of 29 staple foods in some 60 cities was $10.23 in October as compared with $10.28 in September, $11.48 in October, 1921, and $15.83 in October, 1920, and $7.99 for October, 1914.

Manufacturers interested in shipping via Panama Canal to British Columbia or other Pacific ports, are considering whether regular steamship service from Canadian Atlantic ports would be warranted. It is pointed out by the Canadian Manufacturers' Association that various factors would have to be considered, such as rates from shipping point to Montreal or St. John and terminal charges. Rates from New York are quoted ranging from 30 cents per 100 pounds on heavy iron and steel goods, and as high as $2 per cwt. on small lots of highly manufactured goods. The element of time also has to be considered. It is understood that from New York to Vancouver shipments are made in approximately thirty-five days.

With reference to the forthcoming Empire Trade Conference, Arthur Balfour, one of the leading figures in the British steel trade, in an interview, says if the conference results in nothing further being accomplished than placing emigration on a sound basis it certainly will be warranted. As to the export trade with the Dominions, Mr. Balfour says the only way it can be improved is to "give the Dominions exactly the kind of goods they require, instead of forcing on them goods which we think they want, as we have done in the past."



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EXTENSION COURSES IN EXPORT TRADE

At the suggestion of, and in co-operation with the Department of Trade and Commerce, extension courses in export trade will be given at Toronto University, Jan. 15 to 27, and at McGill Univeristy, Montreal, Jan. 29 to Feb. 10. The course is intended primarily for export managers, and all those engaged in export trade, but others interested may enrol. It is an intensive course of two weeks' duration and the instruction has the two-fold purpose of introducing business men to the underlying principles of export trade and of making them familiar with the practical details of management. The course will proceed under the following heads:—Principles of International Trade; Economic Geography; Transportation; Trade Currents and Cycles. Under these heads consideration will be given to conditions determining volume, diversity, and direction of a country's trade; survey of the geographical background (climate and geologic) of the development of modern trade; railroad freight rates; railroad facilities in export trade; a study of economic changes from the standpoint of the trades.

Special trade discussions and demonstrations will be conducted by Lieut.-Col. L. M. Cosgrove, D. S. O., and R. S. O'Meara, B. Com., of the Commercial Intelligence Service, Ottawa. These will deal with Government Services and their Relation to Foreign Trade; Documentation; Packing for Egypt; Foreign Correspondence and Representation and Salesmanship Abroad.

TROUBLES OF GERMAN STEEL INDUSTRY

Handicapped by the difficulty of obtaining foreign credits, the German steel industry is finding it hard to cover with foreign ores and scrap the loss of the iron-ore resources of the Lorraine basin. (It is estimated that the consumption of foreign iron ore, much of which is imported from Newfoundland, and scrap is now about 1,000,000 tons and 100,000 tons per month, respectively.) The progressive fall in the purchasing power of the mark has seriously affected the actual value of matured and outstanding credits and has interposed obstacles in respect of producers' replenishment costs. This can readily be understood when it is remembered that the normal basis of payment gives as a minimum 15 days' and as a maximum 6 weeks' credit, within which periods recently the internal value of the mark has fallen rapidly. Forward covering of exchange has become both troublesome and expensive and even at times quite impossible.

MAY CURTAIL COAL SHIPMENTS

C. A. Magrath, Chairman of the Federal Advisory Fuel Committee at Ottawa, was informed to-day by C. E. Spens, Federal Fuel Distributor, that, because of the acute shortage of anthracite in the United States, "there is no immediate prospect, if any at all, of equalizing the deficit existing on December 1 in Canada's allotment," amounting to 50 per cent. of last season's imports. "Rationing and compulsory mixing of steam with domestic sizes have been inaugurated in our most populous districts, which have heretofore been accustomed to using only domestic anthracite," Mr. Spens declared. "Other substitutes are also being employed. We have no information that similar drastic steps have been adopted in Canada."

FAVOR OF SAVING WAGE

Defending child labor laws and advocating strict immigration laws, in order to lessen materially the ranks of three million unemployed in U. S., James J. Davies, Secretary of Labor, further claims that strikes could be averted early by mutual understanding between capital and labor.

"Strikes might easily be averted," said he, "if the committees representing both labor and capital would meet around council tables sixty days before a strike, instead of waiting sixty days after.

"There is no one who will question the right of labor to organize. It has the same right as capital to organize.

"The man who advocates cheap labor is not much of an American, to my notion of thinking.

"I am opposed with all my heart and soul to the so-called living wage. It is not American for a man to receive just enough for his toil to pay all of the bills on Saturday night. I say it is all wrong in our land. I am against the living wage and in favor of the saving wage. There should be enough in the envelope each week so that the American family may live as human beings. There should be enough so that the children may be educated. There should be enough so the things in life worth living for will not be crowded out.

"We want the American laborer paid so his children may be kept in the home with their mother instead of being sent to factories. Eighty per cent. of our criminals come from neglected children. And neglected childhood comes from the father receiving an insufficient wage."

Mr. Davis said the Department of Labor had taken a firm stand on the "3 per cent." law regulating the immigrants to the United States.

"We have 3,000 000 men out of work right now in the United States," he said. "Why should we allow foreigners to come to add to the burden?"

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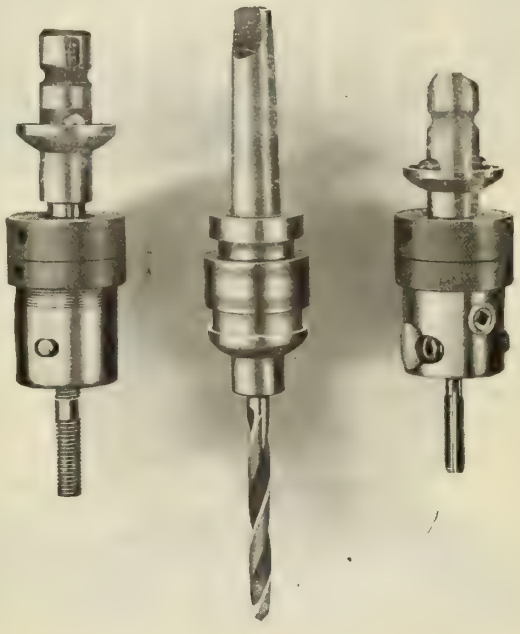

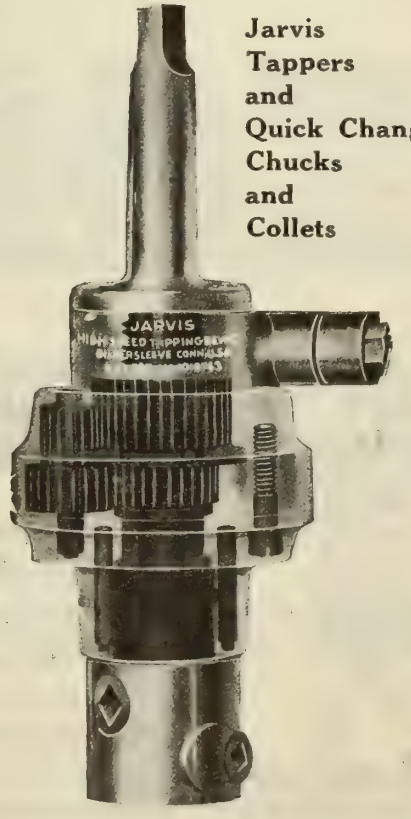

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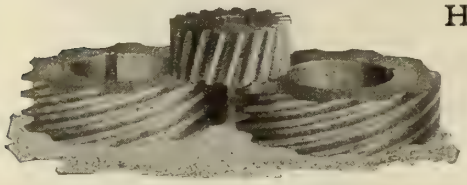

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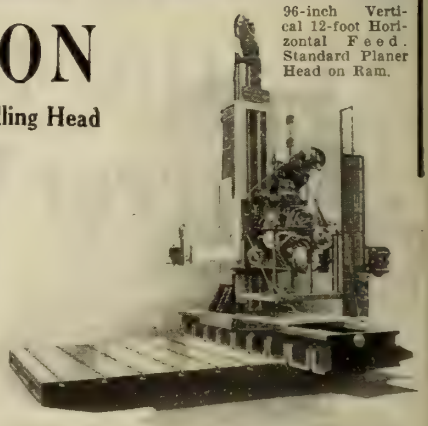

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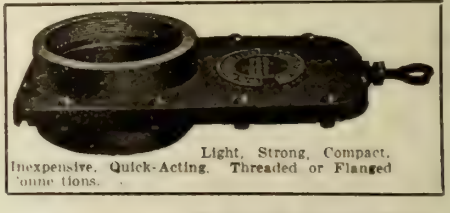

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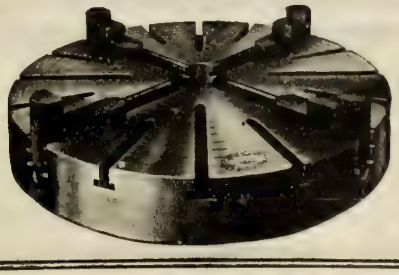

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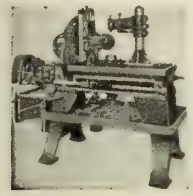

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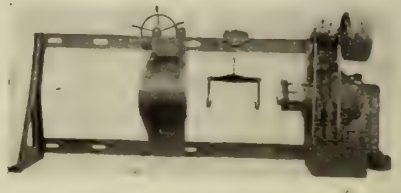

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Grey Iron, Semi-Steel, Brass, Aluminum.

William Kennedy & Sons, Ltd.
OWEN SOUND, ONT.
Steel, Malleable and Heavy Grey Iron.
See Advertisement Page 7

Machinery & Foundries, Ltd.
BROCKVILLE, ONT.
Light and Medium Grey Iron.

A. F. McCulloch
OSHAWA, ONT.
Brass, Alum. Castings—Wood, Metal Patterns.

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International Malleable Iron Company, Limited
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Malleable.

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Canadian Machinery & Mfg. News
153 University Ave., Toronto.

Canadian Machinery BUYERS DIRECTORY

If what you want is not here, write us, and we will tell you where to get it. Let us suggest that you consult also the advertisers' index— last page of book, after having secured advertisers' names from this directory. The information you desire may be found in the advertising pages. This department is maintained for the benefit and convenience of our readers. The insertion of our advertisers' names undr proper headings is gladly undertaken, but does not become part of an advertising contract.

ABRASIVE DISCS
Lion Grinding Wheels, Limited, Montreal, Que
Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John, London, S.E., Eng.

ABRASIVE MATERIALS
Lion Grinding Wheels, Limited, Montreal, Que.
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Dominion Oxygen Co., Toronto.
Liquide Air Company, Toronto.

ANCHOR BELTS
Steel Co. of Can. Ltd., Hamilton, Ont

ANGLE BARS
Steel Co. of Can. Ltd., Hamilton, Ont.

ANVILS
Atkins & Co., Inc., E.C., Indianapolis, I.

ANCHOR BOLTS
Steel Co. of Can., Ltd., Hamilton, Ont.

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Atkins & Co., Inc., E. C., Indianapolis,
Brown & Sharpe Mfg.Co., Providence,R.I.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.

BELLS, BRASS, BRONZE and STEEL
Canada Foundries & Forgings Co., Welland, Ont.
Canadian SKF Co., Toronto, Ont.

BARS, BORING
Armstrong Bros. Tool Co., Chicago, Ill.
Bertram & Son Co., td., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

BARS, BORING, PORTABLE
Underwood Corp., H. B., Philadelphia.

BARS, STEEL
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
British Empire Steel Corporation, Montreal, Que.

BEARINGS, BALL
Canadian SKF Co., Toronto, Ont.
Corman Engineering Co., Toronto, Ont.

BEARINGS, ROLLER
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

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D. K. McLaren, Limited, Montreal,
McLaren Belting Co., J. C., Montreal, Que.

BELT DRESSINGS AND FILLERS
Dom. Belting Co., Ltd., Hamilton, Ont.
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Bristol Company, Waterbury, Conn.
D. K. McLaren, Limited, Montreal,
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BELT LACING, STEEL
Bristol Company, Waterbury, Conn.

BELT LACING MACHINES
D. K. McLaren, Limited, Montreal,
McLaren Belting Co., J. C., Montreal, Que.

BELTING, CHAIN
Can. Link-Belt Co., Toronto, Ont.
Fittings, Limited, Oshawa, Ont.
Jones & Glassco, Montreal, Que.
real, Que.
Renold (Hans) of Canada, Ltd., Montreal, Que.

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D. K. McLaren, Limited, Montreal,
McLaren Belting Co., J. C., Montreal, Que.

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Can. Fairbanks-Morse Ltd., Montreal, Q.
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Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bertrams Ltd., Edinburgh, Scotland.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

BILLETS, BLOOMS and SLABS
Steel Co., of Can. Ltd., Hamilton, Ont.

BLAST GATES
Rockwell Co. W. S., New York, N. Y.

BLOCKS
Wright Mfg. Co., Lisbon, Ohio.

BORING TOOLS
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.

BUCKET CARRIERS, Pivoted
Can. Link-Belt Co., Toronto, Ont.

BUFFERS
Pryibil Machine Co., New York, N.Y

BUFFING OR POLISHING MACHINES (See Polishing and Buffing Machines)
Blount Co., J. G., Everett, Mass.
Herbert, Limited, Alfred, Toronto, Ont.
Pryibil Machine Co., New York, N.Y.
U. S. Electrical Tool Co., Cincinnati, O.

BUILDING MATERIALS
Bertram & Son Co., Ltd., The John Dundas, Ont.

BURNERS, OIL AND GAS
Rockwell Co., W.S., New York City.

BURRS
Steel Co. of Can. Ltd., Hamilton Ont

CABINETS, OIL
S. F. Bowser & Co., Ltd., Toronto, Ont

CALIPERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Starrett Co., L. S., Athol, Mass.

For list of Dealers see the last page of This Buyers Directory

BLOCKS, CHAIN (See Hoists, Hand)
Can Fairbanks-Morse Co., Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

BLOCKS, DIE
Canada Foundries & Forgings Co., Welland, Ont.

BLOCKS, PILLOW
Can Link-Belt Co., Toronto, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

BLOWERS
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Flexible Shaft Co., Ltd., Toronto, Ont

BOLT AND NUT MACHINERY
Acme Machinery Co., Cleveland, Ohio
Bertram & Son Co., Ltd., The John Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Montreal, Que

BOLT AND NUT MACHINERY, Automatic
National Acme Co., Cleveland, Ohio

BOLTS AND NUTS
British Empire Steel Corporation, Montreal, Que.
National Acme Co., Montreal, Que

BOLT THREADING DIE HEADS
Landis Machine Co., Inc., Waynesboro Pa.

BOLTS, TRACK
Steel Co. of Canada, Ltd., Hamilton, Ont.

BORING and TURNING MILLS, Vertical
Bertram & Sons Co., Ltd., The John Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

BORING, DRILLING and MILLING MACHINES, Horizontal.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
Herbert, Limited, Alfred, Toronto, Ont
Landis Tool Co., Waynesboro, Pa
Vertical
Can Fairbanks-Morse Co., Ltd Montreal, Que.

CAMS
Canada Foundries & Forgings Co., Welland, Ont.

CAN-MAKING MACHINERY (See Sheet Metal Working Machinery)
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Bliss Co., E. W., Brooklyn, N. Y.
Smooth Mfg. Co., Jersey City, N. J.

CARBONIZING AND HARDENING
Corman Engineering Co., Toronto, Ont

CEMENTS, IRON CENTERING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.

CHAINS (See Sprockets and Chains)
Reynold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

CARD CLOTHING
D. K. McLaren, Limited, Montreal.

CASTINGS, ALUMINUM, BRASS, BRONZE, COPPER, DIE-MOLDED, FERRO-ALLOY, IRON, SEMI-STEEL, STEEL.
See "Where to buy your castings" Section Page number may be found by turning to Advertisers' Index

CHAINS, DRIVING
Can Link-Belt Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont
Jones & Glassco, Montreal, Que.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

CHASERS
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, a.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CHUCKING MACHINES
Acme Machine Tool Co., Cincinnati, O
Brown & Sharpe Mfg. Co., Providence, R. I.
Gisholt Machine Co., Madison, Wis
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

CHUCKS, DRILL AND TAP
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Canadian SKF Co., Toronto, Ont.
Cushman Chuck Co., Hartford, Conn.
Geometric Tool Co., New Haven, Conn.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn
Union Mfg., New Britain, Conn.

CHUCKS, LATHE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Cushman Chuck Co., Hartford, Conn
Geometric Tool Co., New Haven, Conn
Gisholt Machine Co., Madison, Wis.
Herbert, Limited, Alfred, Toronto, Ont
Ker & Goodwin Machine Co., Brantford Ont.
Pryibil Machine Co., New York, N.Y.
Skinner Chuck Co., New Britain, Conn
Union Mfg. Co., New Britain, Conn.

CHUCKS, MAGNETIC
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

CHUCKS, PLANER
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cushman Chuck Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn
Union Mfg. Co., New Britain, Conn.

CHUCKS, TAPPING
William L. Procunier, Chicago, Ill.

CHUCKS, VERTICAL BORING MILL
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Skinner Chuck Co., New Britain, Conn
Union Mfg. Co., New Britain, Conn

CLAMPS, MACHINISTS'
Brown & Sharpe Mfg. Co., Providence,
Starrett Co., L. S., Athol, Mass.

CLEANERS, METAL, WASTE, GENERAL
Oakley Chemical Co., New York, N. Y

CLOCKS
Chicago Watchman's Clock Co., Chicago.
Hardinge Bros., Limited, Toronto, Ont.

CLOCKS, TIME
Gisholt Machine Co., Madison, Wis.

CLOCKS, WATCHMEN'S
Chicago Watchman's Clock Co., Chicago, Ill.
Hardinge Bros., Limited, Toronto, Ont.

CLUTCHES, FRICTION
Can.-Link-Belt Co., Toronto, Ont
Johnson Machine Co., Carlyle, Manchester, Conn.

COAL AND ASH HANDLING MACHINERY
Can.-Link Belt Co., Toronto, Ont
Roelofson Elevator Works, Galt, Ont

COAL-STORAGE SYSTEMS
Can. Link-Belt Co., Toronto, Ont.

COLLARS, SHAFT OR SET
Canada Foundries & Forgings Co., Welland, Ont
Can Link-Belt Co., Toronto, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont

COLLETS
Butterfield & Co., Inc., Rock Island, Que.
Geometric Tool Co., New Haven, Conn.
Hardinge Bros., Inc., Chicago, Ill.
Hendley Machine Co., Torrington Conn
Kearney & Trecker Co., Milwaukee, Wis
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

COMPOUNDS, CLEANING
Oakley Chemical Co., New York, N.Y.

BUYERS' DIRECTORY

COMPOUNDS—CUTTING, DRILLING, GRINDING, SCREW CUTTING
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Oakley Chemical Co., New York, N.Y.

COMPRESSORS, AIR AND GAS
Can. Fairbanks-Morse Co., Ltd., Montreal.

CONES, FRICTION
Norton Co., of Can. Ltd., Hamilton, Ont.

CONNECTING RODS AND STRAPS
Canada Foundries & Forgings Co., Welland, Ont.

CONTRACT WORK
Dominion Engineering Works, Limited, Montreal, Que.
Victoria Foundry Co., Ltd., Ottawa, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

CONVEYORS AND ELEVATORS (SEE ELEVATORS)
Jones & Glassco, Montreal, Que.

COTTERS
Steel Co. of Canada, Ltd., Hamilton, Ont.

COUNTERBORES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

COUNTERS, REVOLUTION
Starrett Co., L. S., Athol, Mass.

COUNTERSHAFTS
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Johnson Machine Co., Carlyle, Man.
Kempsmith Mfg. Co., Milwaukee, Wis.

COUNTERSINKS
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

COUPLERS, CAR AND LOCOMOTIVE
Can. Steel Foundries, Montreal, Que.

COUPLINGS
Steel Co. of Canada, Ltd., Hamilton, Ont.

COUPLINGS, SHAFT
Can. Link-Belt Co., Toronto, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

CRANES, ELECTRIC
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can.-Link-Belt Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Northern Crane Works, Walkerville, Ont.
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.

CRANES, LOCOMOTIVE
Can. Link-Belt Co., Toronto, Ont.

Bertram & Son Co., td., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Northern Crane Works, Walkerville, Ont.

CRANK PIN TURNING MACHINE
Underwood Corp., H.B., Philadelphia, Pa.

CUTTERS, GEAR
Brown & Sharpe Mfg. Co., Providence, R. I.

Butterfield & Co., Inc., Rock Island, Q. Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CUTTERS, HIGH SPEED
Atkins & Co., Inc., E. C., Indianapolis.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CUTTERS, MILLING
Brown & Sharpe Mfg. Co., Providence, R. I.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.

CUTTERS, STAY BOLT
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.

CUTTING-OFF MACHINE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Starrett Co., L. S., Athol, Mass.

CUTTING OFF MACHINES, PIPE (SEE PIPE-CUTTING AND THREADING MACHINES)
Landis Machine Co., Inc., Waynesboro, Pa.

CUTTING-OFF TOOLS
Armstrong Bros. Tool Co., Chicago, Ill.

CUTTING OIL FILTERS (SEE OIL FILTERING SYSTEMS
Bowser, S. F. & Co., Ltd., Toronto.

CUTTING, OXY-HYDROGEN
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

CYLINDER GRINDING
Corman Engineering Co., Toronto, Ont.

DETACHABLE CHAIN
International Malleable Iron Co., Guelph, Ont.

DIAMONDS, BLACK AND ROUGH
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

DIAMOND TOOLS
Can. Desmond-Stephan Co., Hamilton.
Wheel Trueing Tool Co., Windsor, Ont.

DIAMOND CROSSINGS
Can. Steel Foundries, Montreal, Que.

DIAMONDS, IMPORTERS
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Co., Windsor, Ont.

DIES, SCREW AND THREAD CUTTING
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.

DIES, SHEET-METAL AND SUB-PRESS (See Tool Work)
Brown, Boggs & Co., Ltd., Hamilton, Ont.

DIES, FORGING
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

DIES, SCREW AND THREAD CUTTING
Morse Twist Drill & Machine Co., New Bedford, Mass.

DIES, SELF-OPENING, ADJUSTABLE
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Landis Machine Co., Inc., Waynesboro, National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DIES, THREADING-OPENING
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DIVIDING HEADS
Burke Machine Tool Co., Conneaut, Ohio.
Hendey Machine Co., Torrington, Conn.
Kearney & Treacker Co., Milwaukee, Wis.

DOGS, LATHE AND MILLING MACHINE
Armstrong Bros. Tool Co., Chicago, Ill.

DRAFTING MATERIALS
American Lead Pencil Co., New York City, N.Y.

DRESSERS, GRINDING WHEEL
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ont.
Norton Co., of Can., Ltd., Hamilton.
Wheel Trueing Co., Windsor, Ont.

DRESSING TOOLS
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Co., Windsor, Ont.

DRILL HOLDERS
Armstrong Bros. Tool Co., Chicago, Ill.

DRILLING MACHINES, BENCH
Burke Machine Tool Co., Conneaut, Ohio.
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Hardinge Bros., Inc., Chicago, Ill.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, ELECTRIC AND HAND
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler Ont.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, GANG
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

DRILLING MACHINES, HEAVY DUTY
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
Herbert, Limited, Alfred, Toronto, Ont.

BORING, DRILLING AND MILLING MACHINES, (HORIZONTAL.)
Gisholt Machine Co., Madison, Wis.
Herbert, Limited, Alfred, Toronto, Ont.

DRILLING MACHINES, Multiple Spindle
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
National Acme Co., Cleveland, Ohio.

DRILLING MACHINES, Pneumatic
Cleveland Pneumatic Tool Co., Toronto. Ont.

DRILLING MACHINES, PORTABLE
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, RADIAL
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Herbert, Limited, Alfred, Toronto, Ont.
Williams Machinery Co., A. R., Toronto.

DRILLING MACHINES, SENSITIVE
Burke Machine Tool Co., Conneaut, O
Herbert, Limited, Alfred, Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont.
Williams Machinery Co., A. R., Toronto.
Wisconsin Electric Co., Racine, Wis

DRILLING MACHINES, TURRET
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wisconsin
Williams Machinery Co., A. R., Toronto.

DRILLING MACHINES, VERTICAL
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Herbert, Limited, Alfred, Toronto, Ont.

DRILLS, CENTRE
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DRILLS, ELECTRIC
U. S. Electrical Tool Co., Cincinnati, Ohio
Black & Decker Mfg. Co., Ltd., Montreal, Que.

DRILLS, HIGH SPEED TWIST
Butterfield & Co., Inc., Rock Island, Que
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Cleveland Twist Drill Co., Cleveland, O.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DRILLS, RATCHET
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

DRILLS, TWIST AND FLAT
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont

DROP FORGINGS
Steel Co. of Canada, Ltd., Hamilton

DUMB WAITERS
Roelofson Elevator Works, Galt, Ont.

DUST HANDLING EQUIPMENT
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

ELECTRIC DRILLS AND GRINDERS
Black & Decker Mfg. Co., Ltd., Montreal, Que.
U. S. Electrical Tool Co., Cincinnati, Ohio.

ELECTRIC STEAM GENERATORS
Dominion Engineering Works, Limited. Montreal, Que.

ELECTRICAL INSTRUMENTS
Bristol Co., Waterbury, Conn.

ELECTRICAL SUPPLIES
Atkins & Co., Inc., E. C., Indianapolis
Diamond State Fibre Co., Toronto, Ont

ELECTRIC TOOLS
U. S. Electrical Tool Co., Cincinnati, Ohio.

ELEVATING TRUCKS
Corman Engineering Co., Toronto, Ont.

ELEVATORS AND CONVEYORS
Can. Link-Belt C., Toronto, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q

ELEVATORS, FREIGHT AND PASSENGER
Roelofson Elevator Works, Galt, Ont.

EQUIPMENT, ELEVATOR SAFETY
Jones & Glassco, Montreal, Que.

EMERY WHEELS (See Grinding Wheels)
Lion Grinding Wheels, Limited, Montreal, Que.
Atkins & Co., E. C., Indianapolis, I.
Norton Co., of Canada., Ltd., Hamilton.

ENGINES, CAPSTAN
Kennedy & Sons, Wm., Owen Sound, Ont.

ENGINEERS, MECHANICAL
Dominion Engineering Works, Limited. Montreal, Que.
Gisholt Machine Co., Madison, Wis.
Hamilton Gear & Machine Co., Toronto.

EXPANDERS, TUBE
Jardine & Co., A. B., Hespeler, Ont

FANS, ELECTRIC
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

FANS, EXHAUST
Can. Blower & Forge Co., Ltd., Kitchner, Ont.

FANS, VENTILATING
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

FIBRE
Diamond State Fibre Co., of Can. Ltd. Toronto, Ont.

FILES AND RASPS
Nicholson File Co., Port Hope, Ont.
Simmons Canada Saw Co., Montreal, Que.

FILLER, IRON (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J.

FIRE ESCAPES
Roelofson Elevator Co., Galt, Ont.

FITTINGS, PIPE
International Malleable Iron Co., Guelph
Fittings, Limited, Oshawa, Ont.

FLEXIBLE SHAFTS
Flexible Shaft Co., Ltd., Toronto, Ont
Strand & Co., N. A., Chicago, Ill

FLUXES, WELDING
Dominion Oxygen Co., Ltd, Toronto
Liquide Air Company, Toronto, Ont.

FORGES
Flexible Shaft Co., Ltd., Toronto, Ont

FORGING MACHINERY
Acme Machinery Co., Cleveland, Ohio
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown Boggs & Co., Ltd., Montreal
National Machinery Co., Tiffin, Ohio.
Steel Co. of Canada, Ltd., Hamilton

FORGINGS, DROP
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Ltd., Toronto, Ont.

FORGINGS, HAMMER
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Hepburn Ltd., John T., Toronto, Ont.

FOUNDRY EQUIPMENT
Rice Lewis & Son, Ltd., Toronto, Ont.

FOUNDRY SUPPLIES
Rice Lewis & Son, Ltd., Toronto, Ont.

FROGS, SPRING OR RIGID
Can. Steel Foundries, Montreal, Que.

FURNACES, ELECTRIC
Rockwell Co., W. S. New York City.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

FURNACES, HEAT TREATING COAL
Rockwell Co., W. S., New York City.

FURNACES, HEAT TREATING OIL AND GAS
Bellevue Industrial Furnace Co., Detroit, Michigan.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Flexible Shaft Co., Ltd., Toronto, Ont
Rockwell Co. W. S., New York, N. Y.

FURNACES TEMPERING AND ANNEALING
Bellevue Industrial Furnace Co., Detriot, Mich.
Brown & Sharpe Mfg., Co., Providence R. I.
Flexible Shaft Co., Ltd., Toronto, Ont
Rockwell Co., W. S., New York City.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

FURNACES AND OVENS, ELECTRIC
Rockwell Co. W. S., New York, N. Y.
Starrett Co., L. S., Athol, Mass.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

BUYERS' DIRECTORY

GAGES, MEASURING (See Tool Work)
Brown & Sharpe Mfg. Co., Providence, R. I.
Greenfield Tap & Die Corp., Galt, Ont.
Lufkin Rule Co., Windsor, Ont.
Starrett Co., L. S., Athol, Mass.

GAGES, RECORDING
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GAGES, SPECIAL MEASURING
(See Tool Work)
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GAGES, THREAD
Brown & Sharpe Mfg. Co., Providence R. I.
Herbert, Limited, Alfred, Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

GALVANIZING
Fittings, Limited, Oshawa, Ont.

GAS, COAL COMPRESSED
L'Air Liquid Society, Toronto, Ont.

GAS, COMPRESSED
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

GASKETS
Diamond State Fibre Co. of Ca., Ltd., Toronto, Ont.
Smooth Mfg Co., Jersey City, N. J.

GAUGES VACUUM AND PRESSURE
Taylor Instrument Co., Toronto, Ont.

GEAR BLANKS
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.
Dominion Engineering Works, Limited, Montreal, Que.

GEAR COUNTERS
Hart Mfg. Co., R. A., Battle Creek, Michigan.

GEAR CUTTING MACHINES
Bertram & Sons Co., Ltd., The John, Dundas, Ont.

Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Fellows Gear Shaper Co., Springfield, Vt.
Whiton Machine Co., D. E., New London, Conn.

GEAR TESTING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.

GEARS, CAST
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Hull Iron & Steel Foundries, Hull, Que.
Dominion Engineering Works, Limited, Montreal, Que.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

GEARS, CUT
Brown & Sharpe Mfg. Co., Providence, R. I.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Gardner & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

GEARS, DRESSED
Kennedy & Sons, Wm., Owen Sound, Ontario.

GEARS, FORGED
Canada Foundries & Forgings Co., Welland, Ont.

GEARS, HERRINGBONE
Hamilton Gear & Machine Co., Toronto, Ont.

GEARS, RAWHIDE (See Gears, Cut)
Hamilton Gear & Machine Co., Toronto.

GEAR, SILENT CHAIN
Gardner & Son, Robt., Montreal, Que.
Can. Link-Belt Co., Ltd., Toronto, Can
Hans Renold of Canada, Ltd., Montreal, Quebec.

GEARS, WORM
Hamilton Gear & Machine Co., Toronto.

GENERAL ENGINEERING SERVICE
Corman Engineering Co., Toronto, Ont.

GENERATORS ACETYLENE
L'Air Liquide Society, Toronto, Ont.

GOGGLES, SAFETY
Dominion Oxygen Co., Ltd., Toronto
Liquide Air Company, Toronto.

GRAB BUCKETS
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Cleveland Twist Drill Co., Cleveland, O.

GREASE CUPS, PRESSED STEEL AND BRASS
Can. Winkley Co., Ltd., Windsor, Ont.

GREASES, LUBRICATING
Canadian SKF Co., Toronto, Ont.

GRINDERS, ELECTRIC
Black & Decker Mfg. Co., Ltd., Montreal, Que.
U. S. Electrical Tool Co., Cincinnati, Ohio.

GRINDERS TOOL POST
U. S. Electrical Tool Co., Cincinnati, Ohio.

GRINDING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Norton Co., of Canada, Ltd., Hamilton

GRINDING MACHINES, ABRASIVE BELT
Norton Co. of Can. Ltd., Hamilton, Ont

GRINDING MACHINES, AUTOMATIC
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, BENCH
Blount Co., J. G., Everett, Mass.
Geometric Tool Co., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co. of Canada, Ltd., Hamilton, Ont.
Pratt & Whitney Co. of Canada, Ltd.

GRINDING MACHINES, CENTER
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES, CUTTER AND REAMER
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, CYLINDRICAL
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.
Norton Co., of Canada, Ltd., Hamilton.

GRINDING MACHINES, DIE
Geometric Tool Co., New Haven, Conn.
National Acme Co., Cleveland, O.
National Machinery Co., Tiffin, Ohio.

GRINDING MACHINES, DRILL
Bellevue Industrial Furnace Co., Detroit, Mich.
Bertram & Son Co., Ltd., The John, Dundas, Ont.

GRINDING MACHINES, ELECTRIC
Strand & Co., N. A., Chicago, Ill.

GRINDING MACHINES, FLOOR AND TOOL
Blount Co., J. G., Everett, Mass.
Herbert, Limited, Alfred, Toronto, Ont.
National Acme Co., Cleveland, Ohio
Norton Co. of Canada, Ltd., Hamilton, Ontario.
Greenfield Tap & Die Corp., Galt, Ont.
U. S. Electrical Tool Co., Cincinnati, Ohio.

GRINDING MACHINES, INTERNAL
Garlock Machinery Ltd., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Cleveland Pneumatic Tool Co., Toronto Ont.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES PORTABLE
Strand & Co., N. A., Chicago, Ill.

GRINDING MACHINES, SNAGGING
Blount Co., J. G., Everett, Mass.
Norton Co., of Can. Ltd., Hamilton Ont.
U. S. Electrical Tool Co., Cincinnati, Ohio.

GRINDING MACHINES, SURFACE
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, THREAD
Pratt & Whitney Co., of Canada, Ltd., Sound, Ont.

GRINDING MACHINERY, TOOL POST
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES, UNIVERSAL
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Herbert, Limited, Alfred, Toronto, Ont.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co., of Canada, Ltd., Hamilton Ontario.

GRINDING WHEELS
Lion Grinding Wheels, Limited, Montreal, Que.
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Norton Co. of Can., Ltd., Hamilton, Ont.

GUN-BARREL MACHINERY
Steinle Turret Machine Co., Madison, Wisconsin.

HACK SAWS, POWER
Atkins & Co., Inc., E.C., Indianapolis, Indiana.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.

HAMMERS, CHIPPING
Cleveland Pneumatic Tool Co., Toronto, Ont
High Speed Hammer Co., Rochester.

HAMMERS, DROP
Bertram & Son Co., Ltd., The John Dundas, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

HAMMERS, ELECTRIC
Brown, Boggs & Co., Ltd., Hamilton, Ont

HAMMERS, PNEUMATIC
Can. Steel Foundries, Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto Ont.

HANGERS, SHAFTING
Canadian SKF Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R. I.
Hamilton Gear & Machine Co., Toronto.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

HOBBING MACHINES
Shore Instrument Co., Jamaica, N.Y.

HARDENING, CASE-HARDENING AND TEMPERING
Barnes Company, Wallace, Hamilton.
Gisholt Machine Co., Madison, Wis.
Cleveland Pneumatic Tool Co., Toronto Ont.

HAMMERS, POWER
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Jardine & Co., A. P., Hespeler, Ont.

HOBS
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

HOISTS, ELECTRIC
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Northern Crane Works, Walkerville, Ont.
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.

HOISTS, HAND
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg Co., Lisbon, Ohio

HOISTS, PNEUMATIC
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

HOLDERS-ON, PNEUMATIC
Cleveland Pneumatic Tool Co., Toronto Ont.

HYDRAULIC MACHINERY
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Kennedy & Sons, Ltd., Wm. Owen

IGNITERS, GAS ENGINE
Canada Foundries & Forgings Co., Welland, Ont.
Burke Machine Tool Co., Conneaut, O

INDICATORS, SPEED AND TEST
Brown & Sharpe Mfg. Co., Providence, R.I.

INSULATION
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.

IRON BARS
Steel Co. of Canada, Ltd., Hamilton, Ont.

JACKS, HYDRAULIC
Norton, A. O., Boston, Mass.

JACKS, PLANER
Armstrong Bros. Tool Co., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

JAPANNING AND VARNISHING OVENS
Brantford Oven & Rack Co., Brantford, Ont.

JIGS AND FIXTURES (SEE TOOL WORK)
Fisher Motor Co., Ltd., Orillia, Ont.
Gisholt Machine Co., Madison, Wis.

JOB MACHINE AND GRINDING
Corman Engineering Co., Toronto, Ont.

KEYSEATING MACHINES
Morton Mfg. Co., Muskegon, Mich.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

KEYS, MACHINE
Can. Drawn Steel Co., Hamilton, Ont
Morton Mfg. Co., Muskegon, Mich.

KNIVES, MACHINE
Atkins & Co., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

KNURL HOLDERS
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

LATHE ATTACHMENTS
Hendey Machine Co., Torrington, Conn

LATHE TOOLS
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn

LATHES, AUTOMATIC AND SEMI-AUTOMATIC
Gisholt Machine Co., Madison, Wis.
Herbert, Limited, Alfred, Toronto, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, BENCH
Hardinge Bros., Inc., Chicago, Ill.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

LATHES, BORING
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison Wisconsin.

LATHES, CHUCKING (SEE LATHES, HORIZONTAL TURRET, AND LATHES, VERTICAL TURRET)
Acme Machine Tool Co., Cincinnati, O
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
Herbert, Limited, Alfred, Toronto, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, ENGINE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hendey Machine Co., Torrington, Conn
Herbert, Limited, Alfred, Toronto, Ont

LATHES, EXTENSION AND GAP
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis
Herbert, Limited, Alfred, Toronto, Ont
National Acme Co., Cleveland, O
Steinle Turret Machine Co., Madison, Wis.

LATHES, PRECISION
Hardinge Bros., Chicago.

LATHES, RELIEVING
Hendey Machine Co., Torrington, Conn

BUYERS' DIRECTORY

LATHE, UNIVERSAL HAND
Brown & Sharpe Mfg. Co., Providence, Rhode Island.

LATHE, SPEED AND HAND
Blount Co., J. G., Everett, Mass.

LATHES, SPINNING
Pryibil Machine Co., Torrington, Conn.

LATHES, VERTICAL TURRET
Bertram & Son, Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

LATHES, WOOD TURNING
Blount, Co., J. G., Everett, Mass.
Can. Fairbanks-Morse Co., Ltd., Montreal.

LEAD PIPE
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

LEATHER FILLET
D. K. McLaren, Limited, Montreal.

LINOLEUM MILL MACHINERY
Bertrams, Ltd., Edinburgh, Scotland.

LIQUID AIR PLANTS
L'Air Liquide Society, Toronto, Ont.

LOCKERS, CLOTHES
Dennis Wire and Iron Works, London, Ont.

LUBRICANTS
Oakley Chemical Co., New York, N.Y.

LUBRICATING SYSTEMS
Bowser, S. F., & Co., Ltd., Toronto, Canada.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Ltd., Welland, Ont.
Ker & Goodwin Machine Co., Brantford, Ont
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R. Toronto Ont.

MANGANESE STEEL
Can. Steel Foundries, Montreal, Que.

MANDRELS, EXPANDING
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont.

MANDRELS, SOLID
Greenfield Tap & Die Corp., Galt, Ont.
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Pratt & Whitney Co. of Canada. Ltd., Dundas, Ont.

MEASURING MACHINES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MECHANICS' FINE TOOLS
Lufkin Rule Co., Windsor, Ont.

METALS, ALLOY
Canada Metal Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.

METAL WORKERS
Parker Co., Charles, Meriden, Conn.

MICROMETER CALIPERS
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Rice Lewis & Son, Ltd., Toronto, Ont.

MILLING ATTACHMENTS
Burke Machine Tool Co., Conneaut, O.
Hendey Machine Co., Torrington, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.

MILLING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Burke Machine Tool Co., Conneaut, O

MILLING MACHINES, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence, R. I.
Hardinge Bros., Inc., Chicago, Ill.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

MILLING MACHINES, BENCH
Burke Machine Tool Co., Conneaut, O.
Hardinge Bros., Inc., Chicago, Ill.

MILLING MACHINES, HAND
Brown & Sharpe Mfg. Co., Providence
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MILLING MACHINES, HORIZONTAL PLANER TYPE.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Kearney & Trecker Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto.

MILLING MACHINES, PLAIN
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, O.
Hendey Machine Co., Torrington, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.

MILLING MACHINES, THREAD
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MILLING MACHINES, UNIVERSAL
Brown & Sharpe Mfg. Co., Providence,
Hendey Machine Co., Torrington, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.

MILLING MACHINES, VERTICAL
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, O
Herbert, Limited, Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis
Williams Machinery Co., A. R., Toronto.

MILLING TOOLS, ADJUSTABLE HOLLOW
Geometric Tool Co., New Haven, Conn.

MOTORS, ELECTRIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Roelofson Elevator Co., Galt, Ont
Williams Machinery Co., A R., Toronto.
Wisconsin Electric Co., Racine Wis.

NAILS AND STAPLES
Canada Metal Co., Ltd., Toronto, Ont.

NIPPLES
Canada Metal Co., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton

NITROGEN
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

NUT TAPPERS
(See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
National Acme Co., Cleveland, Ohio.

NUTS, FINISHED and SEMI-FINISHED
Galt Macine Screw Co., Galt, Ont.
National Acme Co., Montreal, ue.

NUTS (Up to 4-in.)
Steel Co. of Canada, Ltd., Hamilton.

NUTS, S.A.E., PLAIN AND CASTELLATED
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

OIL FILTERING AND STORAGE SYSTEMS
Bowser, S. F., & Co., Ltd., Toronto,

OIL STORAGE ENGINEERS
Bowser, S. F., & Co., Ltd., Toronto

OIL HOLE COVERS
Can. Whitney Co., Ltd., Windsor, Ont.

OILS, SOLUABLE
Brantford Oven & Rack Co., Brantford, Ontario

ORNAMENTAL IRON AND WIRE WORKS
Roelofson Elevator Works, Galt, Ont.

OXYGEN
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

OXY-ACETYLENE APPARATUS
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Atlas Press Co., Kalamazoo, Mich.

PAPER MILL CONVEYORS
Bertram Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd., Montreal, Que

PAPER MILL MACHINERY
Dominion Engineering Works, Limited, Montreal, Que.

PATENTS AND INVENTION WORK
Corman Engineering Co., Toronto, Ont.

PATTERNS, WOOD AND METAL
Fittings, Limited, Oshawa, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.
Victoria Foundry Co., Ltd., Ottawa.

PHOSPHOR TIN
Canada Metal Co., Ltd., Toronto, Ont.

PHOTOGRAPHIC DUPLICATING MACHINES
Photostat Corp., Providence, R. I.

PIPE BENDING MACHINES
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Underwood Corp., H. R., Philadelphia, Pa.
Williams Machinery Co., A. R., Toronto.

PIPE CUTTING AND THREADING MACHINES
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.

PIPE
Canada Metal Co., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.

PIPE FITTINGS
Canada Metal Co., Toronto, Ont.
International Malleable Iron Co., Guelph Ont.

PIPE AND NIPPLE THREADING MACHINES
Landis Machine Co., Inc., Waynesboro, Pa.

PIPE FITTERS' TOOLS
Rice Lewis & Son, Ltd., Toronto, Ont.

PIPE THREADING DIE HEADS
Landis Machine Co., Inc., Waynesboro, Pa.

PISTON-RING MACHINES
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

PLANING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Williams Machinery Co., A. R., Toronto.

PLANING MACHINES, ROTARY
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Herbert, Limited, Alfred, Toronto, Ont.

PLATE ROLLS
Bertram & Son Co., Ltd., The John, Dundas, Ont.

PNEUMATIC TOOLS
Cleveland Pneumatic Tool Co., Toronto

POLISHING AND BUFFING MACHINES
Lion Grinding Wheels, Limited, Montreal, Que
Blount Co., J. G. Everett, Mass.
Brown & Sharpe Mfg. Co., Providence.
Pryibil Machine Co., New York, N.Y.

PRESSED STEEL PARTS
American Pulley Co., Philadelphia, Pa.

PRESSES, ARBOR
Atlas Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que

PRESSES, DROP AND FORGING
Brown, Boggs & Co., Ltd., Hamilton.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

PRESSES, FOOT AND HAND
Brown, Boggs & Co., Ltd., Hamilton

PRESSES, HYDRAULIC
Bertram & Son Co., Ltd., The John Dunldas, Ont.
Cleveland Twist Drill Co., Cleveland, O
Perrin Ltd., W. R., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

PRESSES, POWER
Bliss Co., E. W., Prooklyn, N. Y.
Brown, Boggs, & Co. Ltd., Hamilton
Hepburn Ltd., John T., Toronto, Ont.
Stoll Co., Inc., D. H., Buffalo, N.Y

PRESSES, SCREW
Brown, Boggs & Co., Ltd., Hamilton.

PROFILING MACHINES
Prtt & Whitney Co., of Canada, Ltd. Dundas, Ont.

PROTRACTORS
Brown & Sharpe Mfg. Co., Providence
Lufkin Rule Co., Windsor, Ont.

PROPELLERS
Kennedy & Sons, Wm., Owen Sound Ontario.

PULLEYS, CORK INSERT
American Pulley Co., Philadelphia, Pa

PULLEYS, METAL AND FIBRE
American Pulley Co., Philadelphia, Pa.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.
D. K. McLaren Co., Limited Montreal, Que.

PULP AND PAPER MILL EQUIPMENT
Dominion Engineering Works, Ltd., Montreal, Que.

PUMPS, HYDRAULIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Dominion Engineering Works, Ltd. Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont

PUMPS, LUBRICANT AND OIL
Bowser, S. F., & Co., Ltd., Toronto.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Hepburn Ltd., John T., Toronto, Ont.

PUMPS, POWER
Bowser, S. F., & Co., Ltd., Toronto.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hepburn Ltd., John T., Toronto, Ont.

PUNCHES, CENTER
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

PUNCHES, HAND
Brown Boggs & Co., Ltd., Hamilton.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Jardine & Co., A. B., Hespeler, Ont.

PUNCHES, POWER
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

PUNCHING MACHINES, HORIZONTAL
Bertrams Ltd., Edinburgh, Scotland.

PYROMETERS, ELECTRIC
Bristol Co., Waterbury, Conn.
Flexible Shaft Co., Ltd., Toronto, Ont.
Taylor Instrument Co., Toronto, Ont.
Hiram Walker & Sons Metal Products Co., Walkerville, Ont.

RACKS, CUT
Hamilton Gear & Machine Co., Toronto.

RACKS, STORAGE
(See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ontario.

REAMER HOLDERS
Simonds Canada Saw Co., Montreal, Q.

REAMERS, ELECTRIC
U. S. Electrical Tool Co., Cincinnati, Ohio.

REAMERS, EXPANDING
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

REAMERS, SOLID
Butterfield & Co., Inc., Rock Island, Q.
Morse Twist Drill & Machine Co., New Bedford, Mass.

REAMERS, TAPER
Brown & Sharpe Mfg. Co., Providence, R. I.
Butterfield & Co., Inc., Rock Island, Q.
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canad, Ltd., Dundas, Ont.

RECORDERS, TEMPERATURE
Taylor Instrument Co., Rochester, N. Y.

RECORDERS, TIME
Gisholt Machine Co., Rochester, N. Y.
Taylor Instrument Co., Toronto, Ont.

REGULATORS, TEMPERATURE
Taylor Instrument Co., Toronto, Ont.

RIVETS AND BURRS
Parmenter & Bulloch Co., Gananoque, Ont.
Steel Co., of Canada, Ltd., Hamilton.

RIVET-MAKING MACHINERY
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

BUYERS' DIRECTORY

RIVETING MACHINES
Can. Fairbanks-Morse Ltd., Montreal Q
High Speed Hammer Co., Rochester, N.Y
Parmenter & Bulloch Co., Gananoque Ont.

RUDDER FRAMES, STEEL
Can. Steel Foundries, Montreal, Que

RUBBER MILL MACHINERY
Bertram Ltd., Edinburgh, Scotland.

RUBBER MOULDS
Corman Engineering Co., Toronto, Ont.

RULES, STEEL AND WOOD
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Windsor, Ont.

RUST PREVENTATIVES
Oakley Chemical Co., New York, N. Y.

SAND EQUIPMENT
Can. Link-Belt Co., Toronto, Ont.

SAND RAMMERS, PNEUMATIC
Pneumatic Tool Co., Toronto.

SAW FRAMES AND BLADES, HACK
Atkins & Co., Inc., E. C., Indianapolis.
Diamond Saw & Stamping Works, Buffalo, N. Y.
Rice Lewis & Sons, Ltd., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWING MACHINES, POWER HACK
Atkins & Co., Inc., E. C., Indianapolis.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

SAW SHARPENING MACHINES
Atkins & Co., Inc., E. C., Indianapolis.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

SAWS, CIRCULAR METAL
Atkins & Co., Inc., E. C., Indianapolis.
Pryibil Machine Co., New York, N. Y.
Gisholt Machine Co., Madison, Wis.

SAWS, HAND
Atkins & Co., Inc., E. C., Indianapolis
Simonds Canada Saw Co., Montreal, Q.

SAWS, HOT AND COLD
Atkins & Co., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Q.

SAWS, HIGH SPEED STEEL
Atkins & Co., Inc., E.C., Indianapolis, I.
Butterfield & Co. Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWS, METAL BAND
Atkins & Co., E. C., Indianapolis, I.

SAWS, METAL CUTTING
Brown & Sharpe Mfg. Co., Providence.
Butterfield & Co., Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.
Starrett Co., L. S., Athol, Mass.

SAWS, SCREW SLOTTING
Atkins & Co., Inc., E., C., Indianapolis.
Butterfield & Co., Inc., Rock Island, Q.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canda, Ltd., Dundas, Ont.

SAWS, SCREW SLOTTING
Atkins & Co., Inc., E. C., Indianapolis.
Butterfield & Co., Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWS, WOOD
E. C. Atkins & Co., Indianapolis, Ind.

SCALES
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Lufkin Rule Co., Windsor, Ont.

SCREENS
Dominion Engineering Works, Ltd., Montreal, Que.

SCREW DRIVERS, OPTICAL, JEWELRY AND NOVELTY
Strand & Co., N. A., Chicago, Ill

SCREW MACHINE WORK
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Montreal, Que.

SCREW MACHINERY, WOOD AND LAG
Cook Co., Asa S., Hartford, Conn.

SCREW MACHINES
Brown & Sharpe Mfg. Co., Providence, Rhode Island.

SCREW MACHINES, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.

SCREW MACHINE PRODUCTS
National Acme Co., Montreal, Que.

SCREW PLATES
Butterfield & Co., Inc., Rock Island. Que.
Jardine & Co., A. B., Hespeler, Ont.

SCREWS, CAP AND SET
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

SCREWS, SAFETY, SET
Galt Machine Screw Co., Galt, Ont.

SECOND-HAND MACHINERY
See last page of directory.

SEPARATORS, MOISTURE AND OIL
Bowser, S. F., & Co., Ltd., Toronto, Canada.

SEPARATORS, OIL AND WASTE
Bowser, S. F., & Co., Ltd., Toronto.

SHAFTS, FLEXIBLE
Strand & Co., N. A., Chicago, Ill.

SHAFTING
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
Williams Machinery Co., A. R., Toronto.

SHAPES, COLD-DRAWN SPECIAL STEEL
Union Drawn Steel Co., Hamilton, Ont

SHAPING MACHINES
Hendey Machine Co., Torrington, Conn.
Morton Mfg. Co., Muskegon, Mich.
Williams Machinery Co., A. R. Toronto.

SHEARS HAND
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

SHEARS, POWER
Bliss Co., E. W., Brooklyn, N. Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Stoll Co., Inc., D. H., Buffalo, N. Y.
Williams Machinery Co., A. R., Toronto, Ont.

SHEARING MACHINES, ANGLE, IRON BAR AND GATE
Bertrams Ltd., Edinburgh, Scotland.

SHEET LEAD
Canada Metal Co., Ltd., Toronto, Ont.

SHEET METAL WORKING MACHINERY
Bliss Co., E. W., Brooklyn, N. Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Stoll Co., Inc., D. H, Buffalo, N.Y.

SHEETS, NICKEL, MONEL AND FIBRE
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.

SHEETS, O.P.C.R. & B. A. AND BLUE ANNEALED
Steel Co., of Canada, Ltd., Hamilton, Ont.

SIDE FRAMES, LOCOMOTIVE
Can. Steel Foundries, Montreal, Que.

SLOTTING ATTACHMENTS
Brown & Sharpe Mfg. Co., Providence, R.I.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

SLOTTING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.

SOLDERS
Canada Metal Co., Ltd., Toronto, Ont.

SPECIAL MACHINERY AND TOOLS
Brown Engineering Corp., Ltd., Toronto.
Gisholt Machine Co., Madison, Wis.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont
National Acme Co., Cleveland, O.

SPIKES, RAILWAY AND PRESSED
Steel Co. of Canada, Ltd., Hamilton, Ont.

SPINNING LATHES
Pryibil Machine Co., P., New York City.

SPRING, MILLED
Barnes & Co., Wallace, Hamilton, Ont.

SPRINGS, SMALL SPIRAL HELICAL, COMPRESSION, EXTENSION, TORSION AND SPECIAL
Barnes Company, Wallace, Hamilton.

SPRINGS
Barnes Company, Wallace, Hamilton.
Cleveland Wire Spring Co., Clevleand, O
Steele Ltd., James, Guelph, Ont.

SPRINGS, FLAT STEEL, BRUSH HOLDER, CLOCK, SMALL FLAT SPRINGS
Barnes Company, Wallace, Hamilton.

SPROCKETS AND CHAINS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Renold Hanson of Canada, Ltd., Montreal, Que.

SQUARES
Brown & Sharpe Mfg. Co., Providence, R.I.
Lufkin Rule Co., Windsor, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

STAMPING, METAL
American Pulley Co., Philadelphia, Pa
Barnes Company, Wallace, Hamilton.
Diamond Saw & Stamping Works, Buffalo, N. Y.
Parmenter & Bulloch Co., Gananoque, Ont.

STAMPS, STEEL
Diamond Saw & Stamping Works, Buffalo, N. Y.

STEEL CONCRETE REINFORCEMENT
Steel Co. of Canada, Ltd., Hamilton.

STEEL PLATE
British Empire Steel Co., Montreal, Que

STEEL AND IRON BARS
Steel Co. of Canada, Ltd., Hamilton.

STEELS TOOL
British Empire Steel Co. Montreal Q.

STEEL, COLD-ROLLED STRIP
British Empire Steel Co., Montreal, Q.
Barnes Company, Wallace, Hamilton.

STEEL, CRUCIBLE, SPRING
Barnes, Company, Wallace, Hamilton
British Empire Steel Co., Montreal, Q.

SHEETS, OPEN HEARTH STEEL
Steel Co., of Canada, Ltd., Hamilton

STEEL, SHAFTING AND FREE CUTTING SCREW
Union Drawn Steel Co., Hamilton, Ont.

STEEL, SHEET
British Empire Steel Co., Montreal, Q.
Rice Lewis & Son, Ltd., Toronto, Ont.

STEEL, STAINLESS
Steel Co., of Can. Ltd., Hamilton, Ont.

STEEL STAIRS
Roelofson Elevator Works, Galt, Ont

STEELS, ALLOY AND CARBON
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Can. Steel Foundries, Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton, Ont.

STEELS, HIGH-SPEED
Armstrong Bros. Tool Co., Chicago, Ill.
Atkins & Co., Ltd., Wm., Sheffield, England.
British Empire Steel Co., Montreal, Q.
Rice Lewis & Son, Ltd., Toronto, Ont
Steel Co., of Canada, Ltd., Hamilton

STEEL TUBING, CLOSE JOINT AND WELDED
Standard Tube & Fence Co., Ltd., Woodstock, Ont.

STERN FRAMES, CAST STEEL
Can. Steel Foundries, Montreal, Que

STRAIGHTENING MACHINERY
Bertram Ltd., Edinburgh, Scotland.
Williams & Co., Ltd., J. H., Brooklyn, N.Y.

STUDS
Galt Machine Screw Co., Galt, Ont.

STUD SETTERS, SELF OPENING
Geometric Tool Co., New Haven, Conn.

SWAGING MACHINES
Atkins & Co., Inc., E. C., Indianapolis, Indiana.

SWITCHES, RAILWAY
Can. Steel Foundries, Montreal, Que.

TACHOMETERS
Bristol Co., Waterbury, Conn.

TANKS AND PUMPS, OIL
Bowser, S. F., & Co., Ltd., Toronto.

TAP HOLDERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
William L. Procunier, Chicago, Ill.

TAPER PINS
Galt Machine Screw Co., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

TAPES, MEASURING
Starrett Co., L. S., Athol, Mass.
Lufkin, Rule Co., Windsor, Ont.

TAPPING MACHINES AND ATTACHMENTS
Burke Machine Tool Co., Canneaut, O.
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.
Wm. L. Procunier, Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

TAPS AND DIES
Butterfield & Co., Inc., Rock Island, Q.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Herbert, Limited, Alfred, Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

TAPS, COLLAPSING
Geometric Tool Co., New Haven, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.

TEETH, DREDGE BUCKET
Kennedy & Sons, W., Owen Sound, Ont.

THERMOMETERS
Bristol Co., Waterbury, Conn.
Flexible Shaft Co., Ltd., Toronto, Ont
Taylor Instrument Co., Toronto, Ont.
Greenfield Tap and Die Corp., Galt, Ontario.

THREAD-CUTTING TOOLS
Butterfield & Co., Inc., Rock Island, Q.
Greenfield Tap and Die Corp., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

THREAD CUTTING MACHINES
Landis Machine Co., Inc., Waynesboro, Pa.

THREADING MACHINES
Acme Machinery Co., Cleveland, Ohio.
Geometric Tool Co., New Haven, Conn.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Williams Tool Corp., of Can. Ltd., Brantford, Ont.

THREAD LEAD TESTING MACHINES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

THREAD-ROLLING MACHINES
Bliss Co., E. W., Brooklyn, N. Y.

TIE PLATES
Steel Co. of Canada, Ltd., Hamilton.

TIME RECORDERS
International Business Machine Co., Ltd., Toronto, Ont.

TONGS
Hepburn Ltd., John T., Toronto, Ont.

TOOL CASES
Rice Lewis & Son, Ltd., Toronto, Ont.

TOOL HOLDERS
Armstrong Bros., Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Bertrams Ltd., Edinburgh, Scotland.

TOOL POSTS, LATHE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Williams & Co., Ltd., J. H., Brooklyn, N.Y.

TOOLS, SMALL
(See Machinists' Small Tools)
Armstrong Bros. Tool Co., Chicago, Ill.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Lufkin Rule Co., Windsor, Ont.
National Machine Tool Co., Racine, Wis.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S. Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A.R., Toronto.

TOOL WORK
Brown Engineering Corp., Ltd., Toronto, Ontario.

TOOLS AND DIES
Corman Engineering Co., Toronto, Ont

TORCHES, BLOW
Rice Lewis & Son, Ltd., Toronto, Ont.

TRACKWORK, RAILWAY
Can. Steel Foundries, Montreal, Que.

TRACKWORK, MANGANESE STEEL
Can. Steel Foundries, Montreal, Que.

TRANSMISSION EQUIPMENT
Corman Engineering Co., Toronto, Ont

TRANSMISSION MACHINERY
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound.
Renold, (Hans) of Canada, Ltd., Montreal, Que.

TROLLEYS AND TRAMWAYS
Can. Link-Belt Co., Toronto, Ont.
Northern Crane Works, Walkerville, Ont.
Wright Mfg. Co., Lisbon, Ohio.

TROLLEY WHEELS
Langley & Austin, Galt, Ont.

TROWELS, PLASTERING
E. C. Atkins & Co. Indianapolis, Ind.

WRENCHES, MACHINISTS'
Armstrong Bros. Tool Co., Chicago, Ill.

TRUCKS
Can. Fairbanks-Morse Ltd., Montreal, Q.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.

BUYERS' DIRECTORY

TUBING, SEAMLESS STEEL, BRASS AND COPPER AND FIBRE
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.

TURRET HEADS
Bertram & Son Co., Ltd., The John Dundas, Ont.

TURRET MACHINES
(See Lathes, Horizontal Turret)
Acme Machine Tool Co., Cincinnati, O.
Cook Co., Asa S., Hartford, Conn.
Gisholt Machine Co. Madison Wis.
Herbert, Limited, Alfred, Toronto, Ont.
National Acme Co. Cleveland O.
Pratt & Whitney Co. of Canada Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin

TURRETS, TOOL POST
Gisholt Machine Co. Madison, Wis.

UNIONS, PIPE
Fittings, Limited, Oshawa, Ont.

VALVES
Canada Metal Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Mon-
Dominion Engineering Works, Limited. Montreal, Que.

VISES, DRILLING MACHINE
Burke Machine Tool Co., Conneaut, Ohio.
Charles Parker Co., Meriden, Conn.
Cleveland Pneumatic Tool Co., Toronto, Ontario.
Kempsmith Mfg Co., Milwaukee, Wis.

VISES, PIPE
Charles Parker Co., Meriden, Conn.

VISES, PLANER AND SHAPER
Bertram & Son Co., Ltd., The John Dundas, Ont.
Philip Gies Foundry, Kitchener, Ont.
Hendley Machine Co., Torrington, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.

VISES, WOOD WORKERS'
Charles Parker Co., Meriden, Conn.
Parmenter & Bulloch Co., Gananoque, Ontario.

VOLTMETERS
Bristol Co., Waterbury, Conn.

WAGON LEADERS
Can. Link-Belt Co., Toronto, Ont.

WASHERS, LOCK, SPLIT AND SPRING
Barnes Company, Wallace, Hamilton.

WATER POWER PLANTS
Dominion Engineering Works, Limited, Montreal, Que.

WELDING APPARATUS, OXY-ACETYLENE
L'Air Liquide Society, Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto, Ont.

WELDING APPARATUS
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.

WELDING, ELECTRIC, ARC, SPOT AND BUTT
International Malleable Iron Co., Guelph, Ont.

WELDING MACHINES, OXY-ACETYLENE
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.

WELDING, ELECTRIC
McLaren Belting Co., J. C., Montreal, Que.
Steel Co. of Canada, Ltd., Hamilton.

WELDING ROD, TOBIN, MANGANESE, BRONZE AND ALUMINUM
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto, Ont.

WELDING SUPPLIES
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.

WHEELS, INDUSTRIAL
American Pulley Co., Philadelphia, Pa.
Hull Iron & Steel Foundries, Hull, Que.
Kennedy & Sons, Wm., Owen Sound, Ontario.

WINCHES, HEADGATE
Kennedy & Sons, Wm. Owen Sound, Ontario.

WINCHES, STOPLOG
Kennedy & Sons, Wm., Owen Sound. Ontario.

IPING PRODUCTS
Sanitary Wiping Products Co., Toronto, Ont.

WIRE
Barnes Company, Wallace, Hamilton.
Canada Metal Co., Ltd., Toronto, Ont
Dennis Wire & Iron Works, London, Ontario.
Greening Wire Co., B., Hamilton, Ont
Hiram Walker & Sons Metal Products Ltd., Walkerville, Ont.

WIRE, BLACK TEMPERED, MUSIC PHOSPHOR BRONZE AND PREMIER
Barnes Company, Wallace, Hamilton

WIRE, COPPER AND BRASS, FINE AND HEAVY
Steel Co., of Canada, Ltd., Hamilton, Ontario.

WIRE STRAIGHTENING AND CUTTING MACHINERY
Brown, Boggs & Co., Ltd., Hamilton, Ontario.

WIRE, WELDING
L'Air Liquide Society, Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.

WIRES, SPECIAL
Dennis Wire & Iron Works, London, Ontario.
Greening Wire Co., B., Hamilton, Ont

WOODWORKING MACHINERY
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Williams Machinery Co., A. R., Toronto, Ontario.

WRENCHES, DROP FORGED
Armstrong Bros. Tool Co., Chicago, Ill
Canada Foundries & Forgings Co., Welland, Ont.

Why Don't You Write?

HARDLY a week passes that Canadian Machinery does not receive copies of this paper returned by the postal authorities because of the change in firm names or the address of some whose names are on the mailing list. Sometimes complaints reach us of the non-delivery of mail matter. It is not till the receipt of such complaints or the return of the paper, as the case may be, that we obtain any knowledge of the changes or removals of persons or firms. The adoption of the co-operative spirit on your part by notifying changes would make things a good deal more pleasant for both parties. The MacLean Publishing Co. want their mailing list to be in such shape that they will be able to render the perfect service to their subscribers. There is a lot of valuable trade matter mailed by this company and if you don't receive it—well, the fault is entirely yours.

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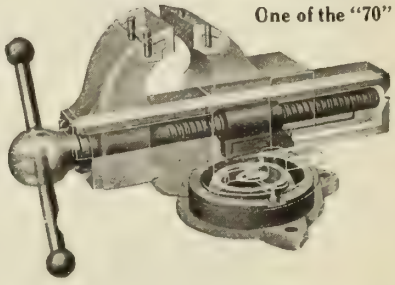
SEND FOR BULLETIN NO. U.13. SPRINGFIELD, OHIO.

The Handle STAYS Where You Leave It


One of the "70"

The set screw and tension spring at which the arrow points prevent the handle from sliding down its full length every time the mechanic lets go of it; a feature that saves a good deal of time in the course of a day. This is one of *seven Special Features* that make Parker Vises unusually serviceable. For eighty years they have been standard tooling equipment in the biggest shops of the United States and Canada.

Send for Catalog No. 57-C.

The Charles Parker Co. (*Master Vise Makers*)
Meriden, Conn., U.S.A.

PARKER VISES
Grip Like a Grizzly

When answering advertisements kindly mention Canadian Machinery

DIRECTORY OF DEALERS

THE Buyers' Directory of CANADIAN MACHINERY was originally intended to contain information regarding lines actually manufactured by our advertisers. We now carry the advertising of leading machinery dealers, some of whom represent scores of manufacturers in addition to being manufacturers themselves in some cases. We recommend, therefore, if our subscribers cannot find what they want in our Directory that they communicate with the dealers whose names appear herewith.

MACHINE TOOLS, ETC.

Bertram & Sons, Ltd., John, Dundas, Ont.
The Canadian Fairbanks-Morse Co., Montreal, Que.
Garlock Machinery Ltd., Toronto.
Herbert Ltd., Alfred, Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

SHOP and FACTORY SUPPLIES

The Canadian Fairbanks-Morse Co., Montreal, Que.

Garlock Machinery Ltd., Toronto.
Herbert Ltd., Alfred, Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

POWER EQUIPMENT, ETC.

The Canadian Fairbanks-Morse Co., Montreal, Que.
Herbert Ltd., Alfred, Toronto, Ont.

WOODWORKING MACHINERY

The Canadian Fairbanks-Morse Co., Montreal, Que.

Garlock Machinery Ltd., Toronto.
Herbert Ltd., Alfred, Toronto, Ont.

A. R. Williams Machinery Co. Toronto, Ont.

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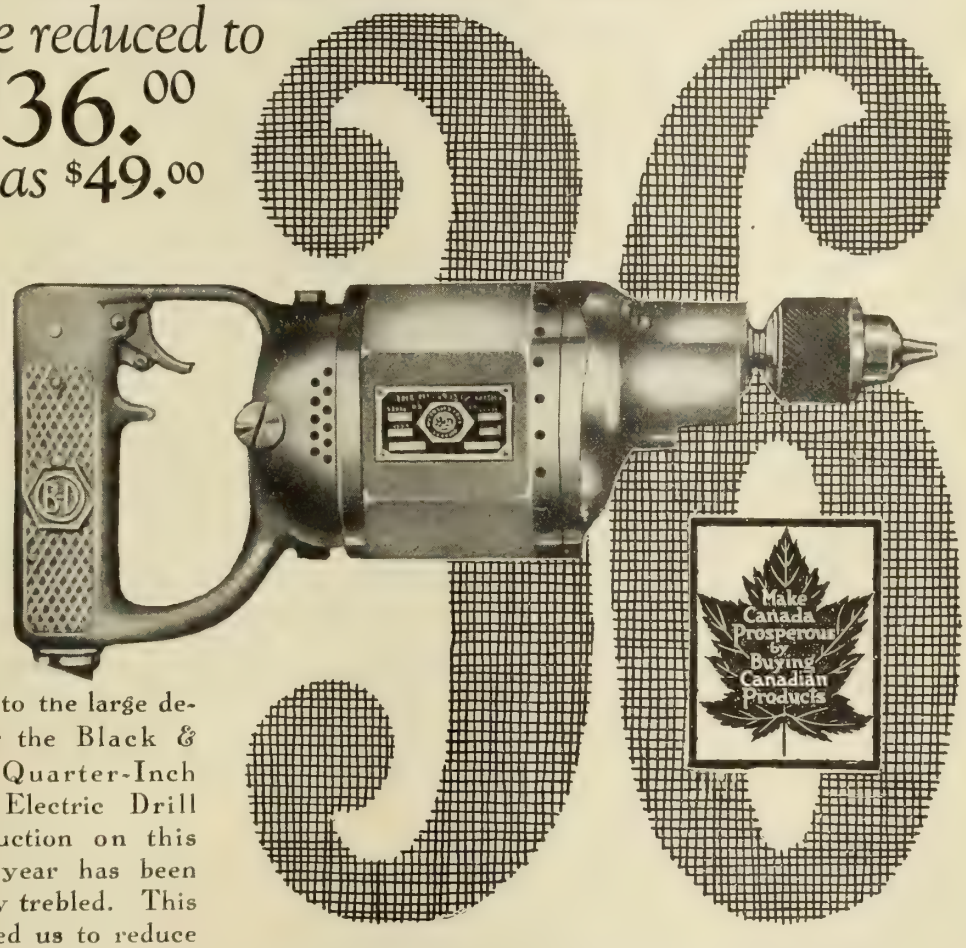
BLACK & DECKER

¼ inch PORTABLE ELECTRIC DRILL

"With the Pistol Grip and Trigger Switch"

Price reduced to
$36.00
was $49.00



Owing to the large demand for the Black & Decker Quarter-Inch Portable Electric Drill our production on this unit this year has been practically trebled. This has enabled us to reduce our manufacturing costs, and in accordance with our established policy we are passing the saving on to you.

This is the standard Black & Decker Quarter-Inch Drill, exactly the same as has previously been sold for $49.00 except that it has been improved by the addition of a geared-nut chuck instead of a hand operated chuck.

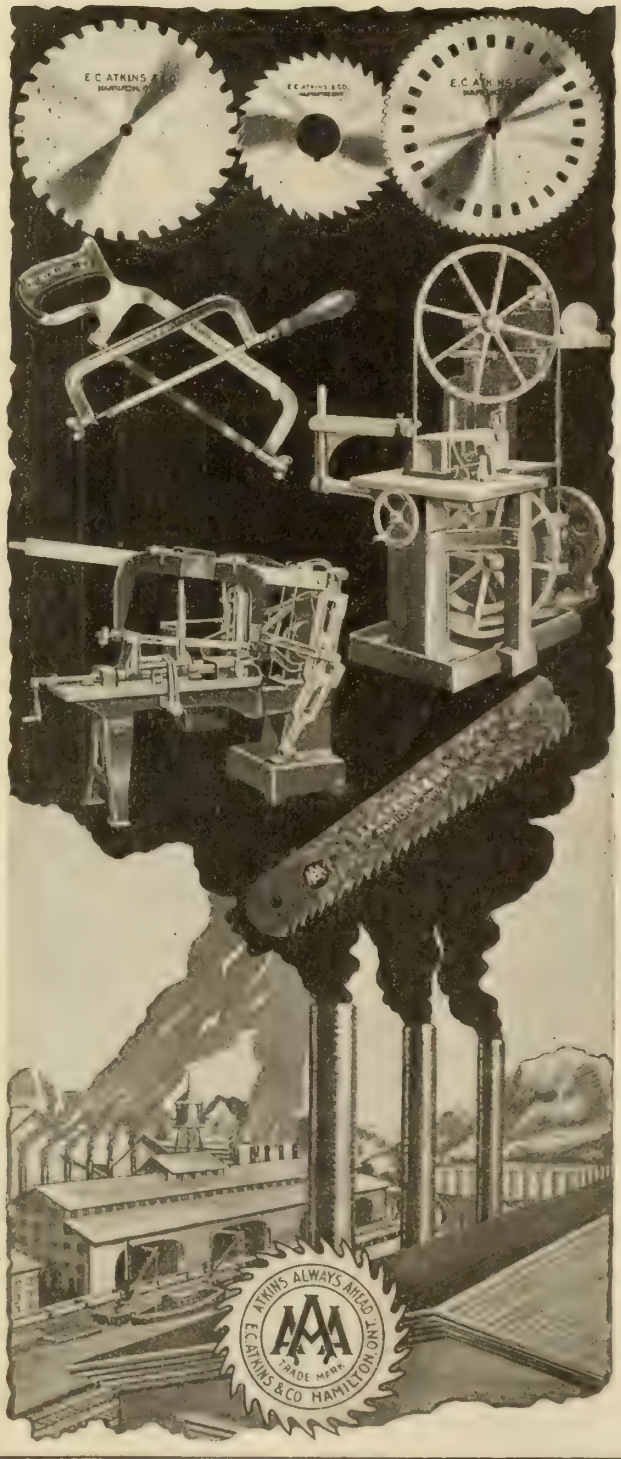
A new folder describing this unit in detail, INCLUDING SPECIFICATIONS, is yours for the asking.

Guaranteed by
THE BLACK & DECKER MFG. CO.
LIMITED
344 St. James Street
Montreal, P. Q.
A. J. HOPKINS, Manager

"The Well-Equipped Shop Gets the Business"

ATKINS

METAL CUTTING SAWS



WE SPECIALIZE in the manufacture of circular metal cutting saws. The steel which we use is made for us exclusively.

They possess the essentials which make metal cutting operations effective and economical.

In addition to Metal Cutting Saws, AAA Hack Saw Blades and Frames we make Kwik-Kut Power Hack Saw and Metal Band Saw Machines. To assure metal cutting accuracy, speed, economy of operation and maximum production, order by name,

ATKINS—

Non-Breakable Hack Saw Blades
Power Hack Saw Blades
AAA Hack Saw Frames
Kwik-Kut and Metal Band Saw Machines
Metal Cutting Circular Saws

Send for our new book,
"Atkins Saws in the Shop"

MADE IN CANADA

E. C. ATKINS & CO.

Est. 1857

"The Sterling Quality Saw People"

Home Office and Factory, Indianapolis, Indiana

Canadian Factory: HAMILTON, Ont.

Branch carrying complete stock, VANCOUVER, B.C.

Vol. XXVIII No. 26

CANADIAN MACHINERY

AND MANUFACTURING NEWS

Annual Review and Directory Number

TORONTO, Dec. 28th 1922

GROWTH

BERTRAM
MACHINE TOOLS

The John Bertram and Sons Co, Limited, Dundas, Ont.

HALIFAX MONTREAL TORONTO WALKERVILLE WINNIPEG VANCOUVER

The MacLean Publishing Company, Limited, Toronto, Montreal, Winnipeg, Vancouver, London, New York, Boston, Chicago, Cleveland.

PRATT & WHITNEY

MILLING CUTTERS

High-Speed Steel Milling Cutters, Reamers and End Mills in all standard forms can be supplied from stock and special cutters made to customers' requirements at the shortest notice.

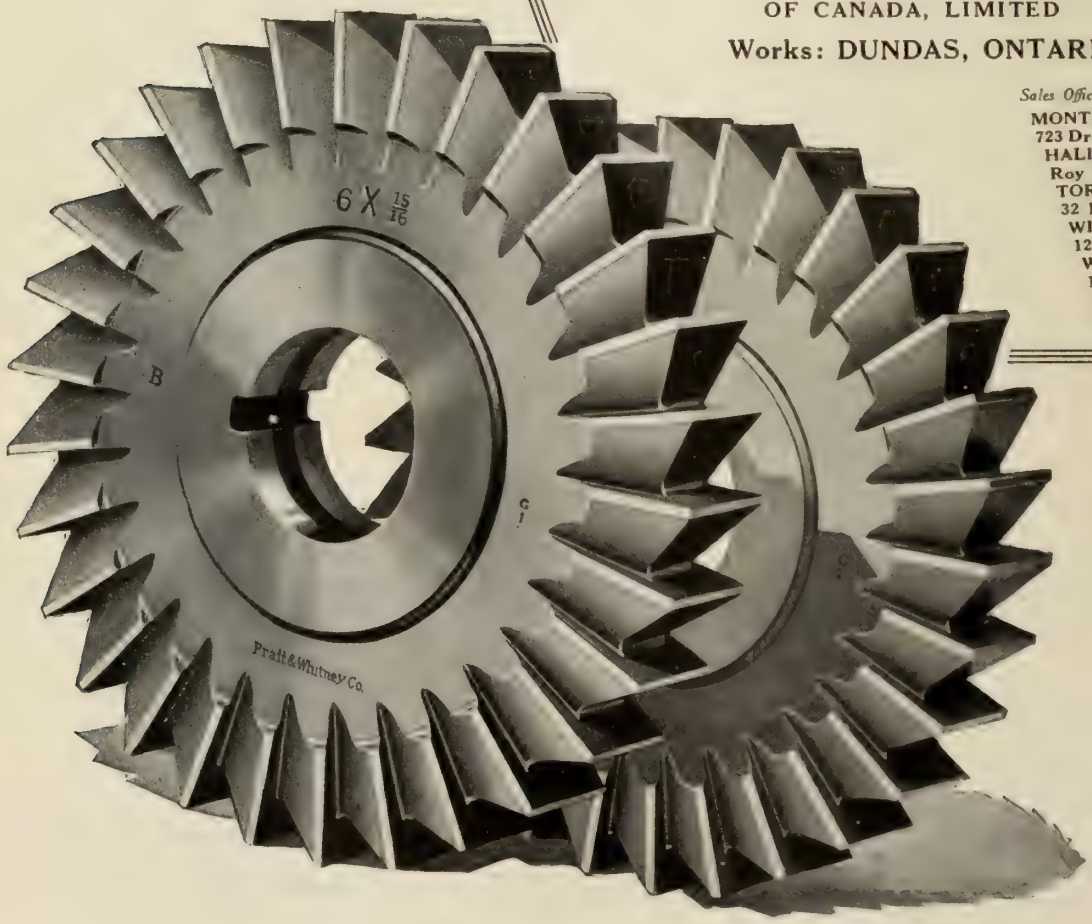
Our "Curvex Cutters"—new formed milling cutters that are spiral fluted and eccentrically relieved—allow the use of a maximum feed and will increase production on form milling from 50 to 100 per cent.

--for better production

Write to our nearest office for catalogues and prices

PRATT & WHITNEY CO.
OF CANADA, LIMITED
Works: DUNDAS, ONTARIO

Sales Offices in:
MONTREAL
723 Drummond Bldg.
HALIFAX
Roy Building
TORONTO
32 Front St. West
WINNIPEG
1205 McArthur Bldg.
WALKERVILLE
103½ Sandwich St.
VANCOUVER
B.C. Equipment Co.

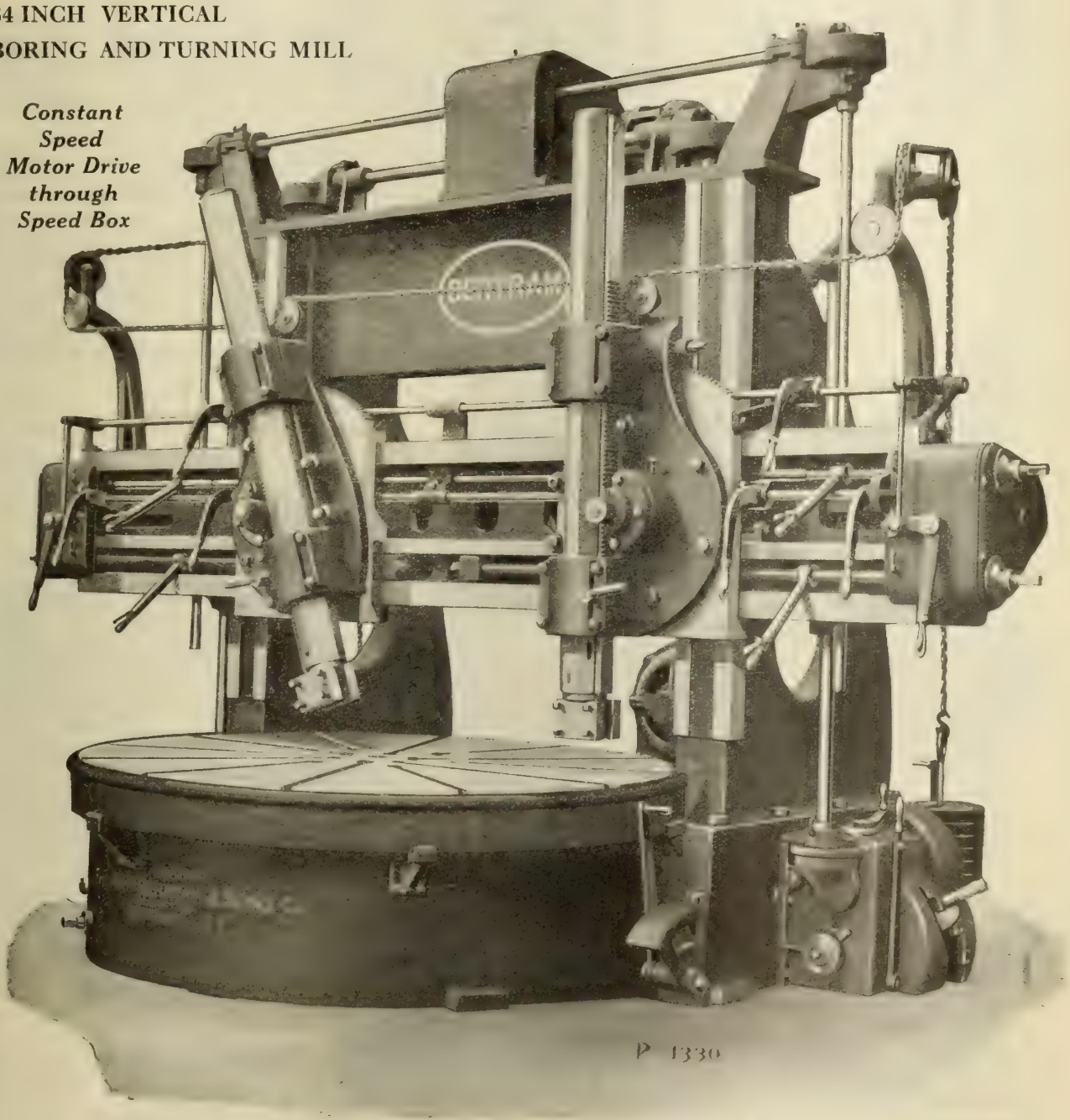


HIGH GRADE MACHINE TOOLS

Lathes - Boring Mills - Wheel Turning Lathes
Planers - Hammers - Punches - Shears - Shapers
and other machine tools.

84 INCH VERTICAL
BORING AND TURNING MILL

Constant Speed Motor Drive through Speed Box

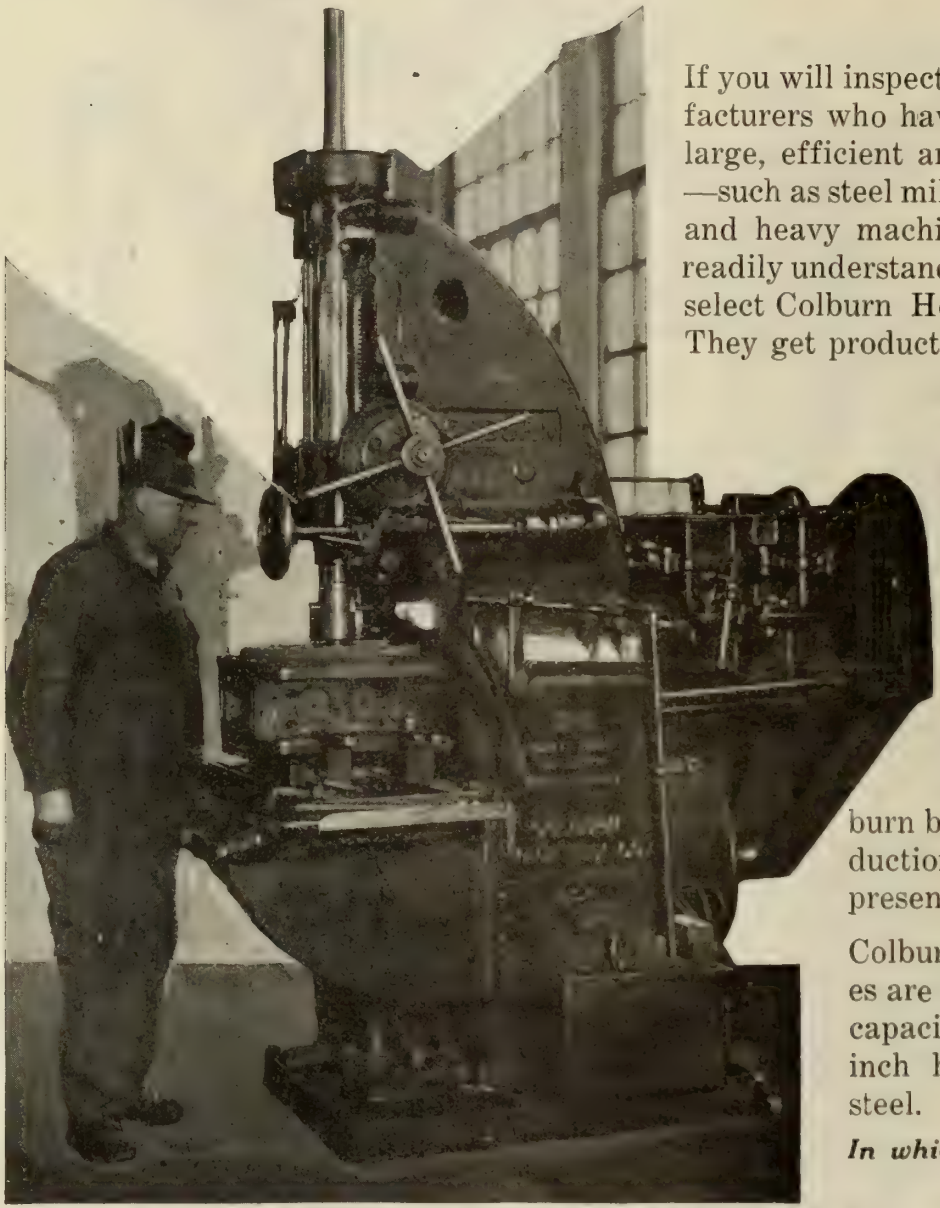


THE JOHN BERTRAM & SONS COMPANY LIMITED
DUNDAS - ONTARIO - CANADA

HALIFAX Roy Bldg. | MONTREAL 723 Drummond Bldg. | TORONTO 32 Front St. W. | WALKERVILLE 103½ Sandwich St. | VANCOUVER 609 Bank of Ottawa Bldg. | WINNIPEG 1205 McArthur Bldg.

COLBURN

Heavy Duty Drill Press



If you will inspect the plants of those manu facturers who have established a name fo large, efficient and economical productio —such as steel mills, car shops, engine shop and heavy machine tool shops—you wi readily understand why these manufacture select Colburn Heavy Duty Drill Presse They get production!

Work that would ordina ily necessitate the use of lathe or boring mill done far more econom cally with the Colbu Heavy Duty Drill Press.

If your work consists drilling, reaming, tappi or some similar operatio of an exceptionally heav character, there is a Co burn built to do it—and at a pr duction cost greatly below yo present figures.

Colburn Heavy Duty Drill Pres es are built in several styles wit capacities up to the limit of inch high speed drill in soli steel.

In which style are you interested? Send for Bulletin.

COLBURN MACHINE TOOL PLANT
of
CONSOLIDATED MACHINE
of

BETTS MACHINE PLANT, Rochester, N.Y. COLBURN MACHINE TOOL PLANT, Cleveland, Ohio. HILLES & JONE PLA

GENERAL OFFICE, 17 East 42nd Street, New York *District Sales Office*

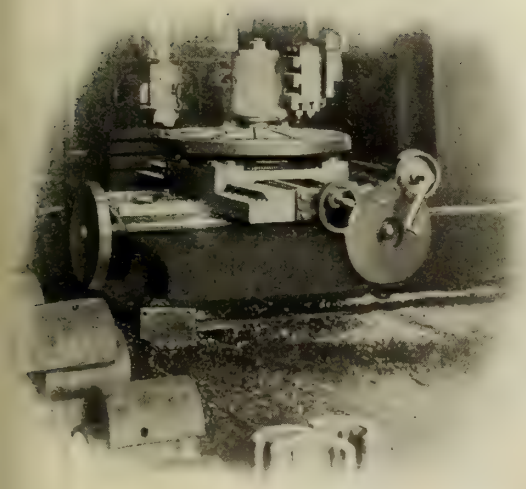
NEWTON

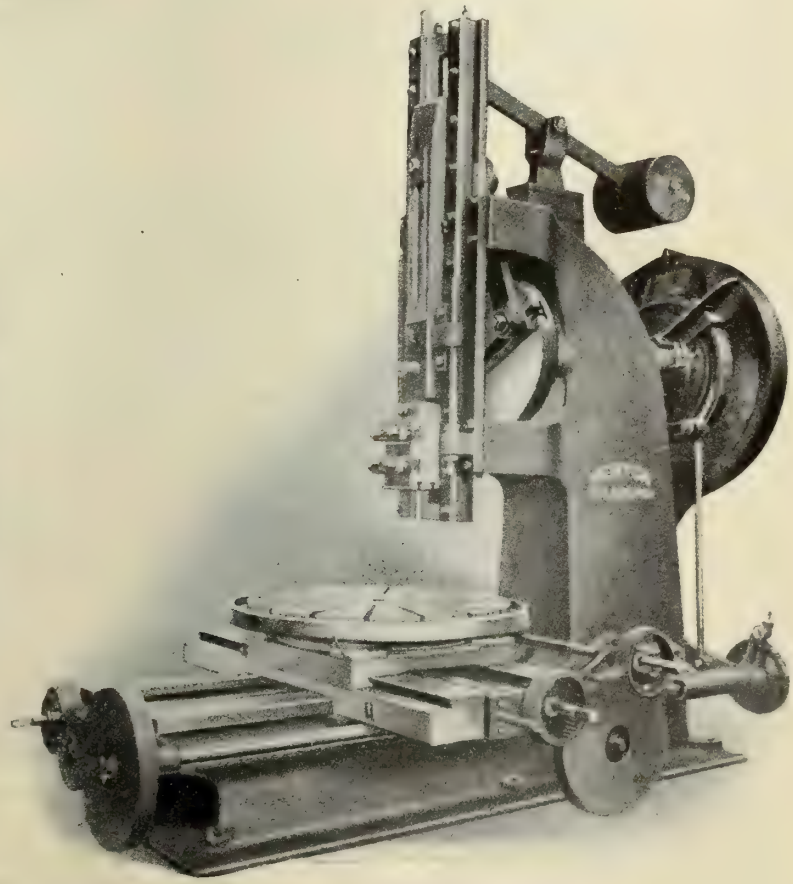
(REGISTERED TRADE MARK)

On Driving Box Work

Boring and chamfering Locomotive Driving Boxes is an interesting example of the wide range of work handled by Colburn Heavy Duty Drill Presses. This versatility of operation keeps them always busy—your shops will charge no "dead time" against a Colburn. Drilling, reaming, boring and tapping jobs on car and locomotive parts are handled with equal dispatch—making the Colburn Heavy Duty Drill Press a machine of continuous efficiency.

For odd jobs or quantity production, Colburn Drill Presses mean lower costs per operation—investigate Colburn possibilities in **your** shop.





Standard Design, 12" to 30" Strokes, inclusive.

NEWTON MACHINE TOOL PLANT

of

TOOL CORPORATION

America

Wilmington, Del. MODERN TOOL PLANT, Erie, Pa. NEWTON MACHINE TOOL PLANT, Philadelphia, Pa.

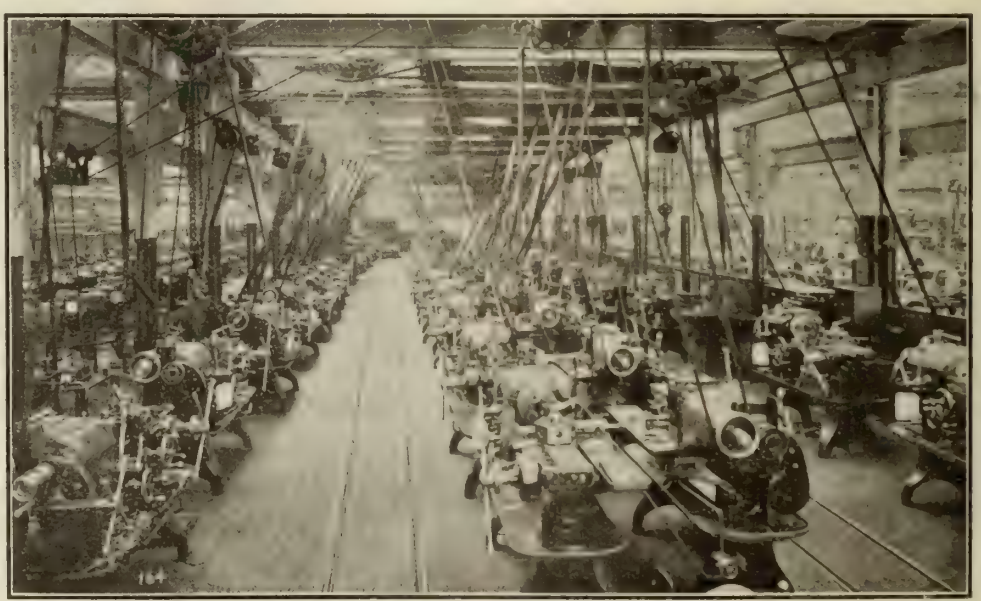
in New York, Philadelphia, Pittsburgh, Chicago, St. Louis, Cleveland, Detroit

The Business of

ALFRED HERBERT, LTD.

consists of two main divisions: viz., the "Manufacturing" and the "Factored." The first consists of two well-equipped, self-contained shops comprising Laboratories, Foundries, Machine and Erecting Shops, employing upward of 3,000 men in the production of Automatic and Turret Lathes, Milling and Drilling Machines. The second or "Factored" Division acts as sole selling agents in various countries for leading British and American makers of machine tools.

The combined result is an organization able to quote on the most suitable machines for any given work and to deliver them tooled up with all the necessary tools and fixtures. Complete Plants can also be quoted on for the production of complete units when desired.



A View of our Head Works Test Bay at Coventry, England

ALFRED HERBERT, LTD.

Head Office and Works: Coventry, England

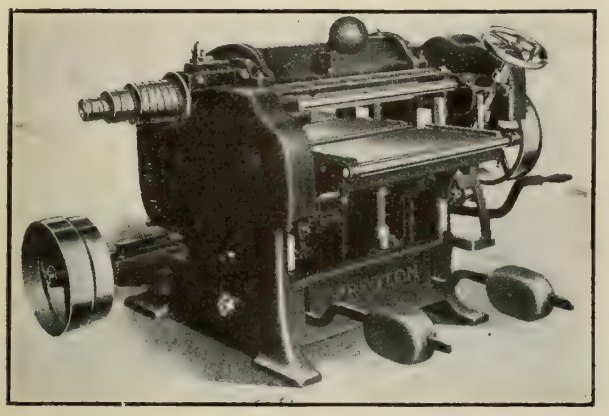
1-3 Jarvis St., Toronto **Phone No. 4409 Adelaide**

Agents for Quebec:

Standard Machinery & Supplies, Limited, Montreal

Vancouver Machinery Depot, Ltd., Vancouver

"Service and Satisfaction to the Customer"



from the use of

PRESTON
WOODWORKING MACHINERY

is the idea of more importance to us than anything else in this world. We put into a machine the best material we can and all the ability we have and then we stand behind it until **absolute satisfaction** results.

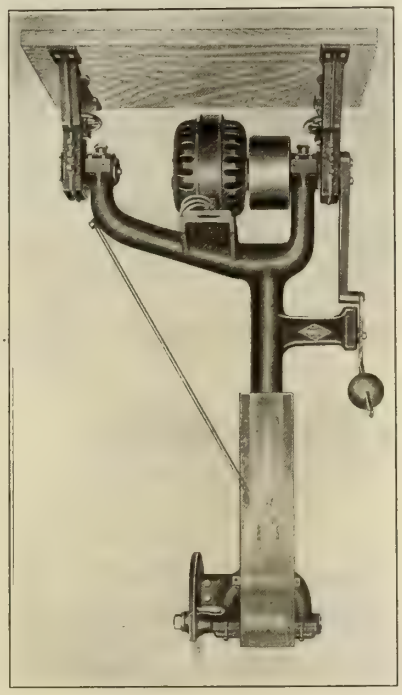
No. 121 "Preston" Heavy Pony Planer

This cut shows standard machine. Can be built with:

(1) Straight roll or divided rolls or sectional roll and chipbreaker.

(2) Square cylinder or round 4 knife cylinder.

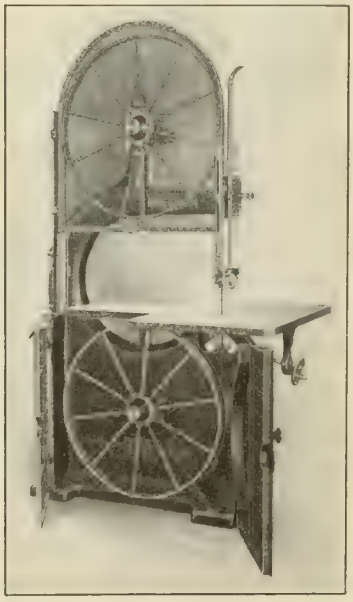
(3) Babbitt Bearings or S.K.F. Ball Bearings.



No. 132 "Preston" 36" Band Saw

We guarantee that breaking of saws will be reduced to a minimum on this machine by reason of our almost perfect tension device and style and guide.

Made with or without guards. Wheels are all steel, covered with ¼" solid rubber bands. Supplied with 3 H.P. motor for individual drive if desired.



No. 152 "Preston" Motor Driven Swing Cut Off Saw

Embodies every requirement of a swing cut-off saw. Note the belt guard. Built with special arrangement providing for use of an endless belt.

Larger Output at Lower Expense—How?

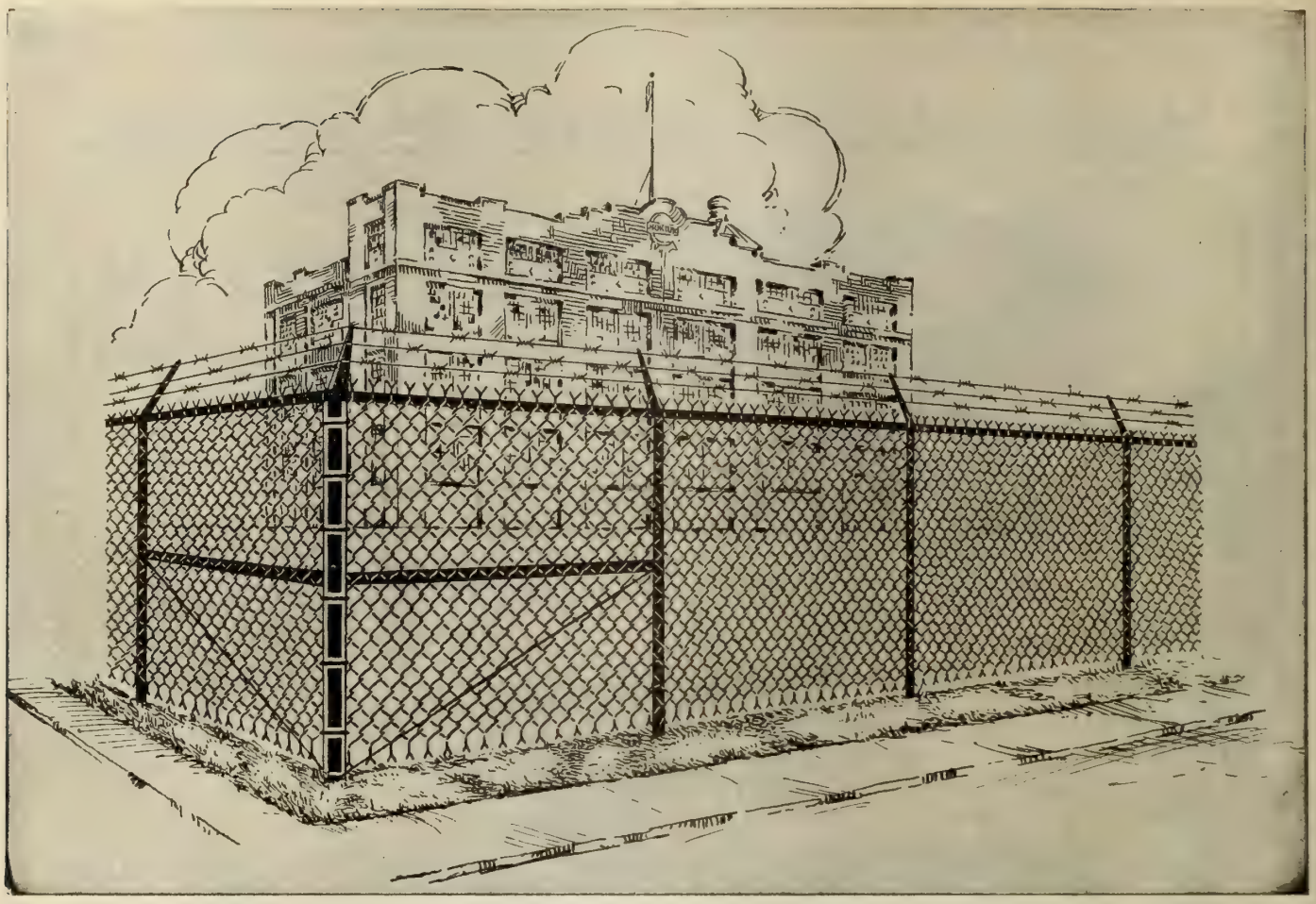
Efficient equipment is the only answer to this problem. We can supply this **efficient equipment** because we have been unceasing in our efforts toward keeping our line thoroughly modern and up-to-date.

Let Us Send You Illustrated Bulletins of Our Line!

The Preston Woodworking Machinery Company, Limited

PRESTON, ONTARIO, CANADA

SPECIALISTS IN BALL BEARING WOODWORKING MACHINERY



How the Norton Company of Hamilton Protect their New Plant

Property Losses are as Unnecessary as they are Expensive

Of all the factors which contribute to "overhead" that of Property Loss (including petty thefts and damage to property, etc.) should really have no part. It is an unwarranted charge because it is absolutely unnecessary.

A Frost Non-Climbable Property Protection Fence around your property limits not only will eliminate these Property Losses but will considerably lessen your watchman service costs by lightening the work.

There's another feature too—the surrounding grounds can be utilized for additional storage with perfect safety. Besides keeping out all undesirable trespassers—day and night—it will centralize your workmen's entrance and exit.

Let us send a Representative to plan and quote on Property Protection Fence for your plant.

A Few of the Properties Protected by Frost Fence

British-American Oil (13 plants)
Proctor-Gamble, Hamilton.
Moffatts, Limited, Weston.
Congoleum Company, Montreal.
Colgate & Company, Montreal.
Libby-Owen Sheet Glass, Hamilton.
Lang Tanning Co., Kitchener.
Gillies Mfg. Co. Toronto.
Sunbeam Lamp Co., Toronto.
St. Lawrence Starch Co., Port Credit.
The Barrett Company, Toronto.
Canadian National Carbon Co., Toronto.
Warren Bituminous Paving Co., Toronto.
Canadian Steel Tire & Wheel Co., Montreal.
Imperial Tobacco Co., Montreal.
McClary Mfg. Co., London.
Fittings, Limited, Oshawa.
Pedlar People, Oshawa.
Hull Iron & Steel Co., Hull.
Steel Co., of Canada, Hamilton.
Hamilton Bridge Works, Hamilton.
Canadian Shovel & Tool Co., Hamilton.
Dominion Glass Co., Hamilton.
Norton Company, Hamilton.
F. W. Bird & Son, Hamilton.
Imperial Cotton Co., Hamilton.
International Malleable Iron Co., Guelph.
Empire Cotton Co., Welland.
White's, Limited, Collingwood.
St. Maurice Paper Co., Three Rivers, Que.
Slingsby Mfg. Co., Brantford, Ont.

FROST STEEL & WIRE COMPANY, LIMITED

HAMILTON - CANADA

If interested, tear out this page and place with letters to be answered

Hannifin Production Tools

In the manufacture of automobile hubs, Hannifin Equipment plays an important part.

(1) Hannifin Air Operated Chucks grip the hubs quickly, simply and rigidly.

(2) Hannifin Adjustable Boring Bars bore the hubs continuously and rapidly.

(3) Hannifin Adjustable Block Type Floating Reamers ream the hubs to size rapidly and accurately.

(4) Hannifin Air Operated Wheel Bearing Arbor Presses press the bearings into the finished hubs simply, quickly and accurately.

Can our equipment be applied to your job? Put it up to our engineers.

Hannifin Mfg. Co.

621 S. Kolmar Ave. Chicago, Ill.

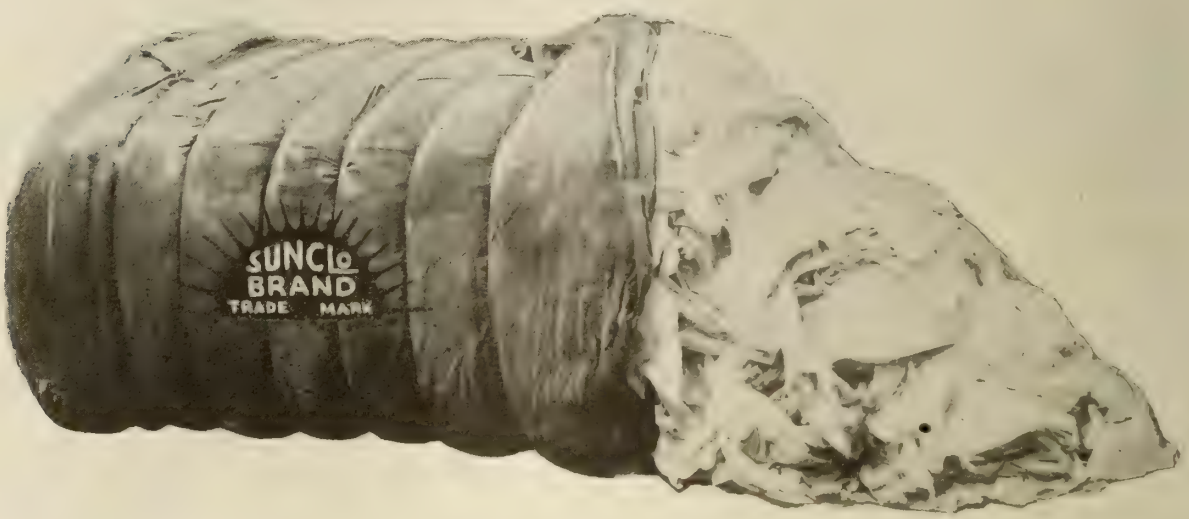
HANNIFIN

SUNCLO WIPING CLOTHS

Thoroughly Washed and Sterilized

USABLE SIZE PIECES BUTTONS, SEAMS REMOVED

100% Wiping Cloth Efficiency



Sunclo have solved wiping cloth troubles in scores of Canadian factories. Why not get away from your difficulties by their use. Made from carefully selected cotton materials, they are soft, absorbent, and will not scratch or mar the most delicate surface. Packed in neat compressed bales.

When entering your next order for Wiping Cloths specify SUNCLO

Contracts may be made for your requirements for the year 1923.

Samples and Price List on application.

SUNCLO
TRADE MARK
A WIPING CLOTH OF MERIT
PREPARED BY
THE LEVI'S
TORONTO CANADA

THE LEVI'S
98 John Street
TORONTO

If interested tear out this page and place with letters to be answered.

"Do It Ten Times Faster"

with the

"WODACK"

Portable Electric

DRILLS, GRINDERS & BUFFERS

with the automatic-stop-switch control

"Wodack" Portable Grinder saves a man a day

Day in and day out, under constant heavy duty, the "Wodack" will stand the gaff. It has been our endeavour to make them so they will never ask for "time off" or an expensive vacation in the repair shop. Our rugged, hardy motors will stand up under the most trying strain a practical man would subject a tool—it will meet the most severe test of every day service. Our motors have been stalled for three minutes at a time without injury. The automatic swith cuts out the needless expenditure of motor rewinding.

"Wodack" Electric Tools are made in various sizes ana types (52) *ranging from ⅛ in. to 1¼ in. capacities for drilling—and three to six inches for grinding.*

"Wodack" Combination Portable Electric Drill and Grinder

Two Tools in One

This new "Wodack" Combination Drill and Grinder fills a long-felt want in those shops and factories where hand drilling and grinding operations are performed, yet not enough to warrant the purchase of two separate machines. The illustration shows the "Wodack" when used as a portable electric drill and also when used as a portable electric grinder. One motor gives a satisfactory speed for both drilling and grinding. The only tool of its kind that grinds as efficiently as it drills.

This is the lightest and most powerful ⅜" drill in the world to-day. It's a popular drill for general production purposes in metal and woodworking plants. Complete weight, 8 lbs.

Here is a two-speed ⅝" drill that is a crackerjack for general all around drilling and adapted to repair work in machine shops, garages, metal and woodworking plants.

Write for our latest booklet, "Electric Drill Facts"

It contains valuable information

Dealers Attention—We still have some territory open—Write for our proposition

Wodack Electric Tool Corporation

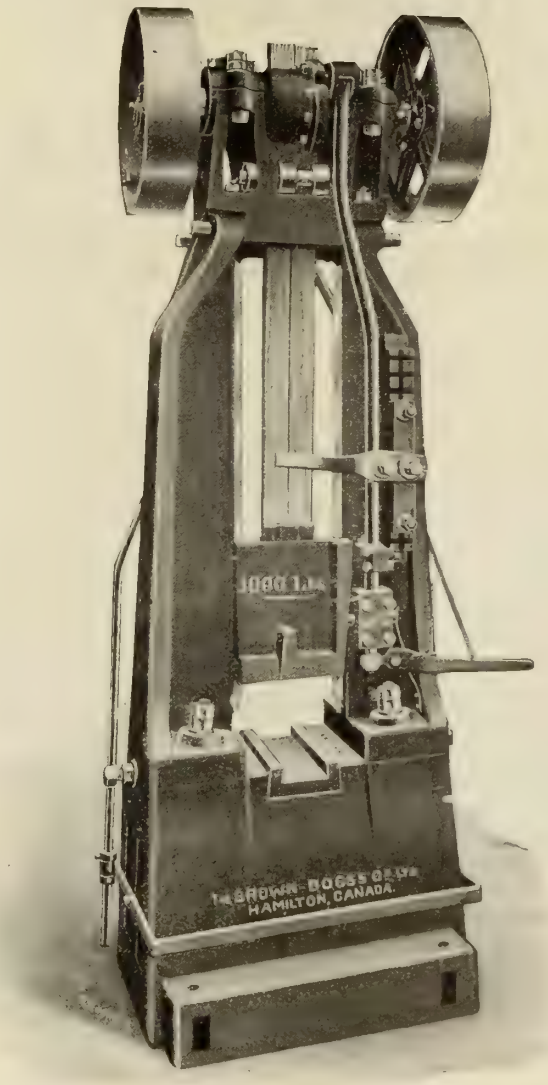
47 So. Jefferson Street

CHICAGO - ILLINOIS

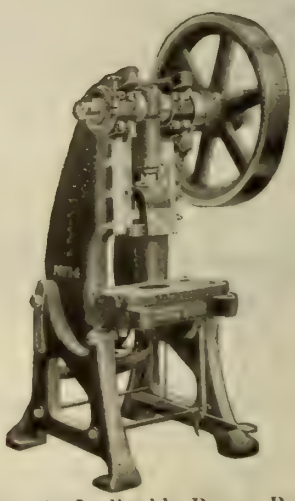
Cable Address—"WODAK-Chicago"
(Bentley's Code)

Bro

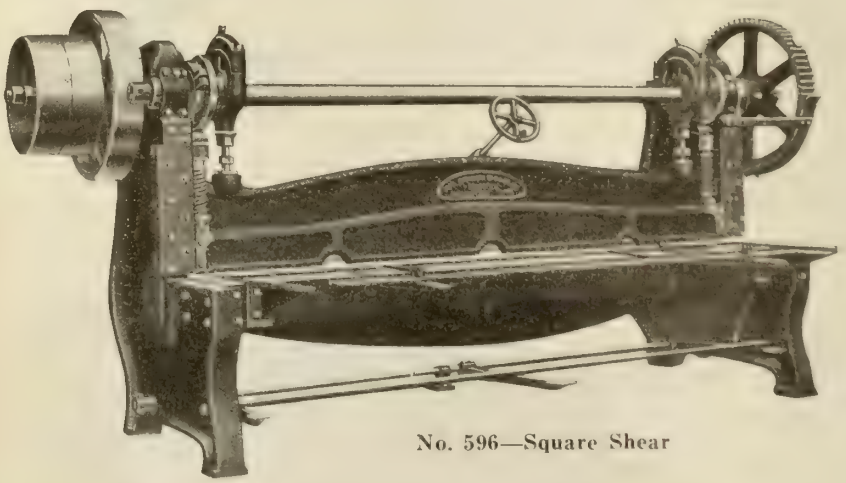
Sheet



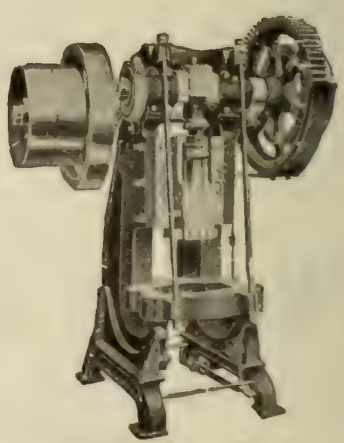
1,000-lb. Board Lift Drop Hammer



No. 14—Inclinable Power Press



No. 596—Square Shear



No. 17—Power Press

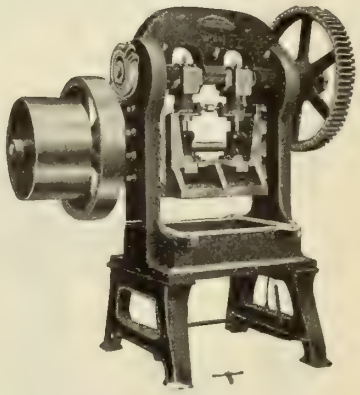
If interested, tear out this page and place with letters to be answered

wn-Boggs

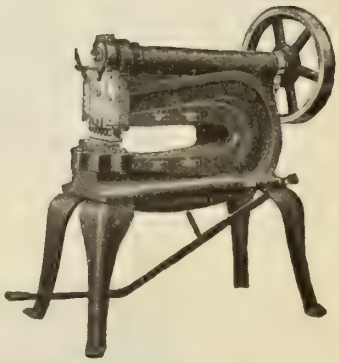
Metal Workers' Tools

"BEST TO BUY"

SHEET Metal Workers of Canada buy "B-B" equipment because they may be sure of their performance; sure of freedom from trouble, sure of every quality that results in quick and accurate production. Slogans are often meaningless but the slogan "Best to Buy" as applied to "B-B" Sheet Metal Workers' Tools carries more than a grain of truth.



No. 20½—Power Press



No. 126—Deep Throat Power Punch

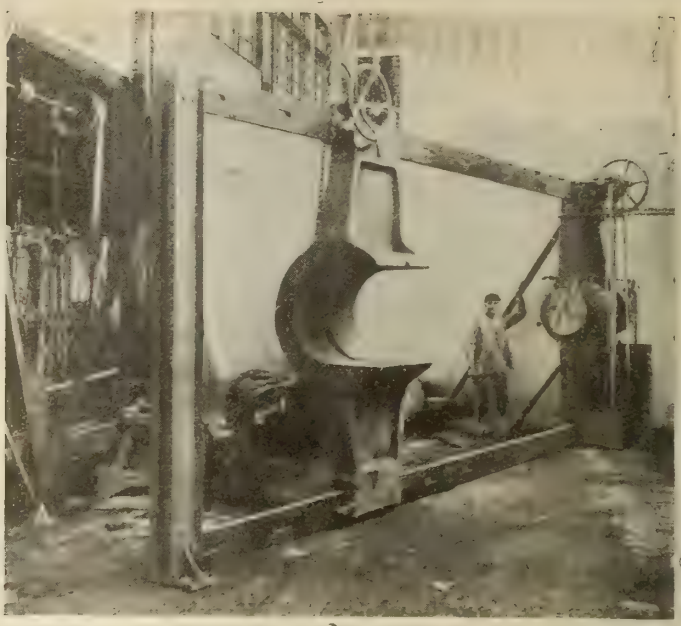
"B-B" line includes tinsmith's small tools and machinery; presses, dies, shears, punches, drop hammer and special machinery.

The Brown, Boggs Co., Limited

Hamilton, Ont.

B B Co Ltd

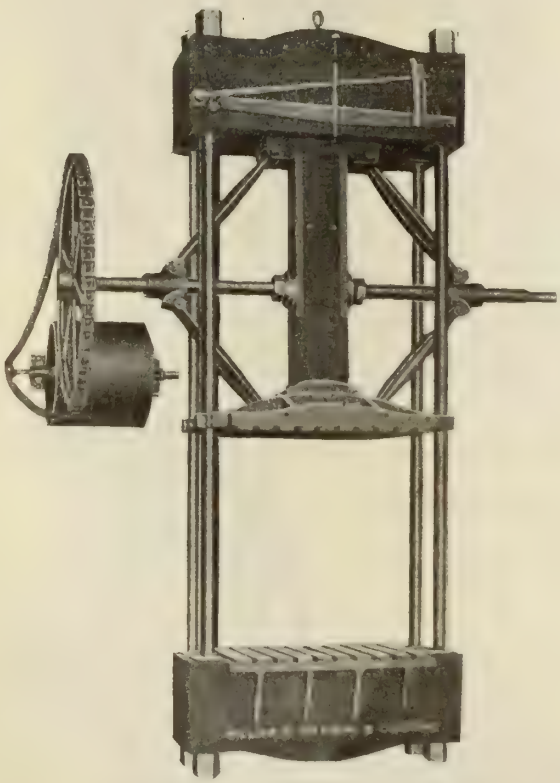
HYDRAULIC FILTER AND KNUCKLE-JOINT PRESSES



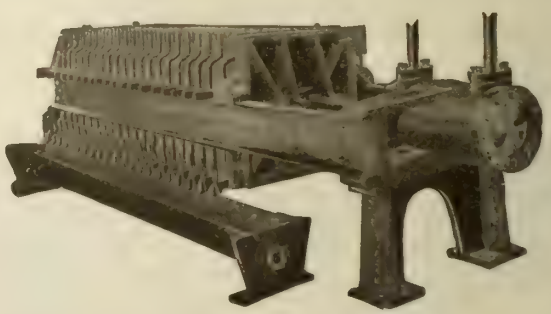
Hydraulic Wheel Press used for locomotive wheels or shipyard work.

All types can be made to customer's requirements. We also manufacture Hydraulic Pumps and Accumulators.

MADE IN CANADA



Knuckle Joint Press for pressing oils and for general work.



Filter Press for filtering Paints, Soaps, Oils, Sugar, Gold, Silver, Slimes, Starch, etc.

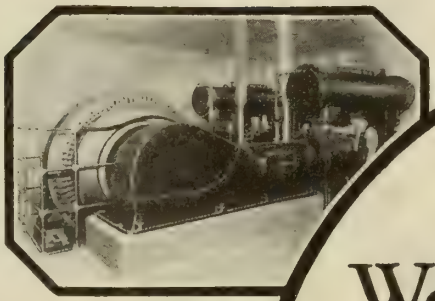
William R. Perrin, Limited

TORONTO, ONTARIO

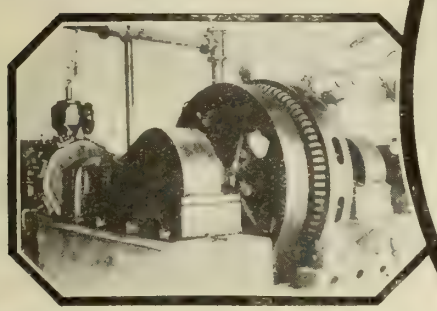
If interested, tear out this page and place with letters to be answered

1200hp. Westinghouse Synchronous Motors driving Norberg Compressors.

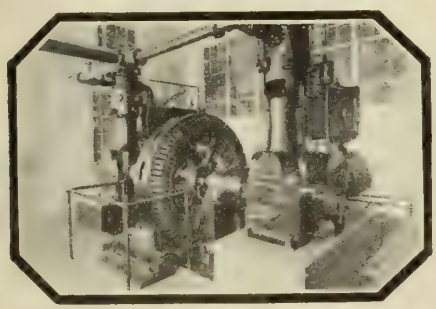
600hp., 200rpm. Westinghouse Motor driving Chicago Pneumatic Tool Compressor.



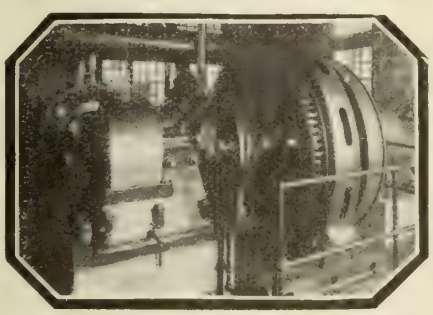
Westinghouse Builds Synchronous Motors for Every Size and Type of Compressor



200hp. 225rpm. Westinghouse Synchronous Motor driving Worthington Compressor.



400hp. 200rpm. Westinghouse Synchronous Motor driving Sullivan Compressor



187hp. 150rpm. Westinghouse Synchronous Motor driving Ingersol-Rand Compressor

An Important Feature:

Low Cost of Operation

In low cost of operation lies one of the main secrets of profitable manufacturing today. Low cost of operation is one of the outstanding features of the Westinghouse Synchronous Motor on compressor drive. A second feature is compactness; a third high efficiency at full load, and its ability to operate for long periods with little or no attention.

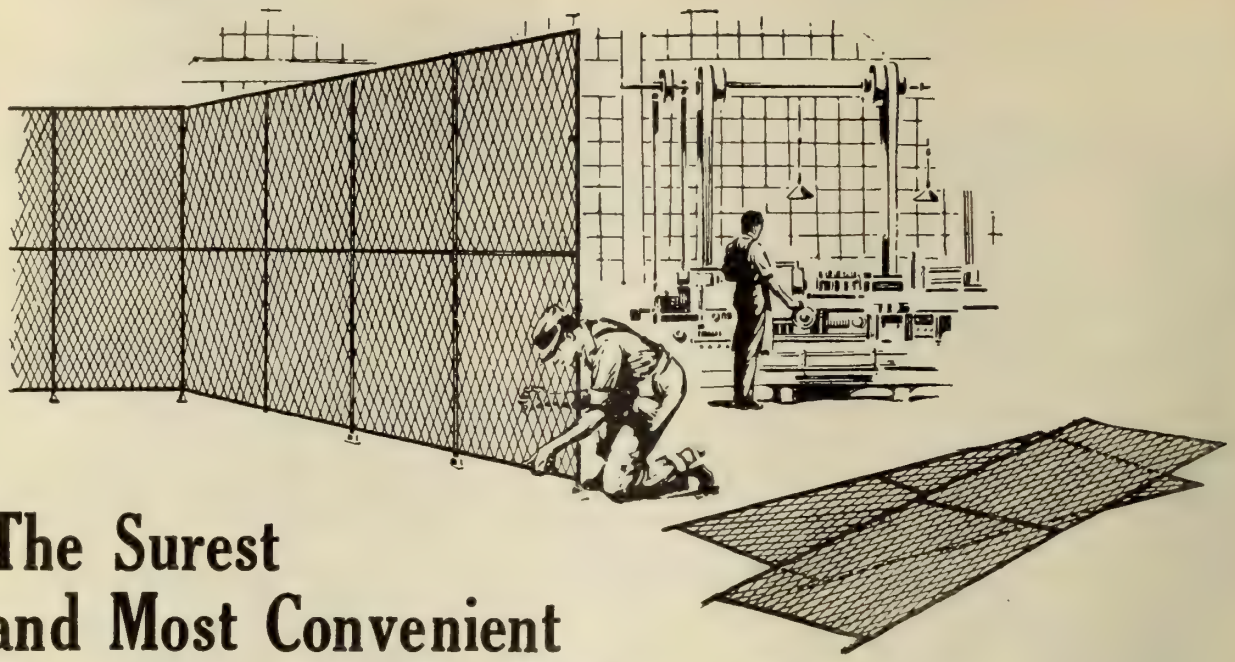
In addition to these advantages, Westinghouse offers a standard synchronous motor built in many sizes and styles for all types of compressors. This self-starting motor is compact, built of tested materials and has been designed by expert electrical engineers.

Canadian Westinghouse Co., Limited, Hamilton, Ont.

Toronto	Montreal	Ottawa	Halifax	Ft. William	Winnipeg	Edmonton	Calgary	Vancouver
Bank of Hamilton Bldg.	285 Beaver Hall Hill.	Ahearn & Soper Ltd.	105 Hollis Street.	Cuthbertson Block.	158 Portage Avenue E.	211 McLeod Bldg	Canada Life Bldg	Bank of Nova Scotia Bldg

WESTINGHOUSE REPAIR SHOPS

MONTREAL—113 Dagenais St. WINNIPEG—158 Portage Avenue E.
TORONTO—366 Adelaide W. VANCOUVER—1090 Mainland Street. CALGARY—316 3rd Avenue E.

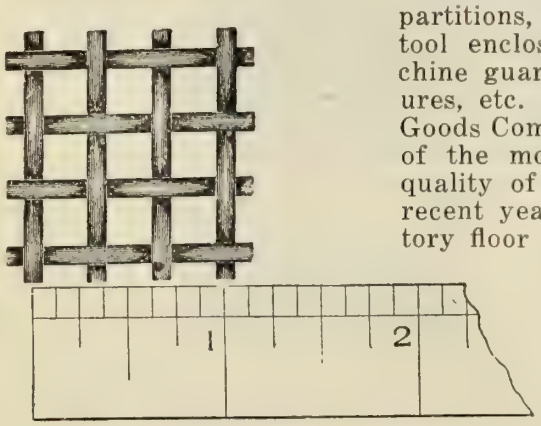


The Surest and Most Convenient Protection for the Machine Shop

PLANT executives in leading plants all over Canada have been quick to appreciate the convenience and protection of partitions of wire and iron work.

Sturdily effective yet not cumbersome, they are a positive protection for tools or stock of any kind. They do not obstruct light, and are fireproof and always look neat. Their erection is a simple matter and they can be put up or taken down quickly.

Wire and Iron work has many uses in manufacturing plants, including partitions, built in unit form, for tool enclosures, stock rooms, machine guards, window screens, guards, elevator enclosures, etc. The products of the Canada Wire and Iron Goods Company have successfully met every requirement of the modern plant. Unmistakable evidence of the quality of our work is shown in the fact that during recent years we have been forced to increase our factory floor space more than 200 per cent.



Showing how to measure the mesh

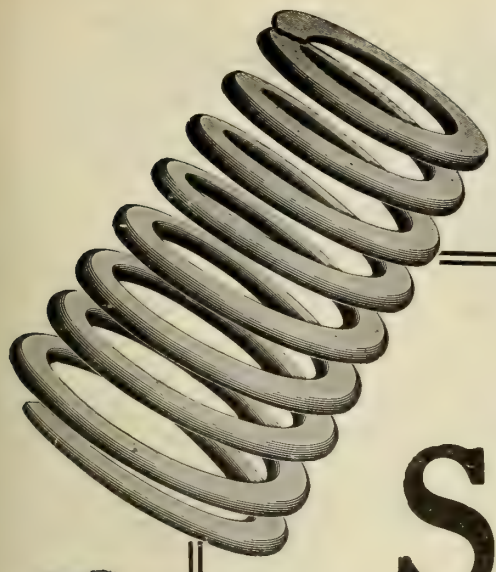
Write for Descriptive Catalogue

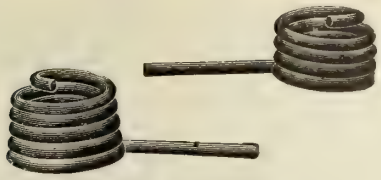
Note illustration of our Crimped Wire and Window Guards with round iron frames, and how wire is secured to them. Note also how to properly measure wire mesh.

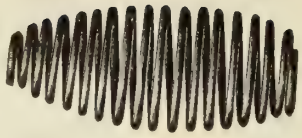
Canada Wire & Iron Goods Company

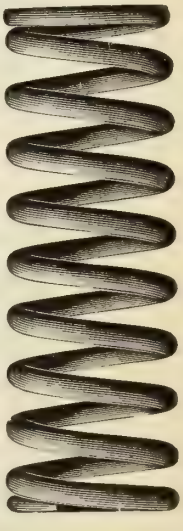
Hamilton, Ontario

If interested tear out this page and place with letters to be answered.









SPRINGS

No matter what kind of Spring you need—no matter how unusual your requirements—no matter, even, if you don't know exactly just what you need—we've got a staff of expert engineers who can handle your problem to your entire satisfaction. That's our business—

We're Spring Specialists

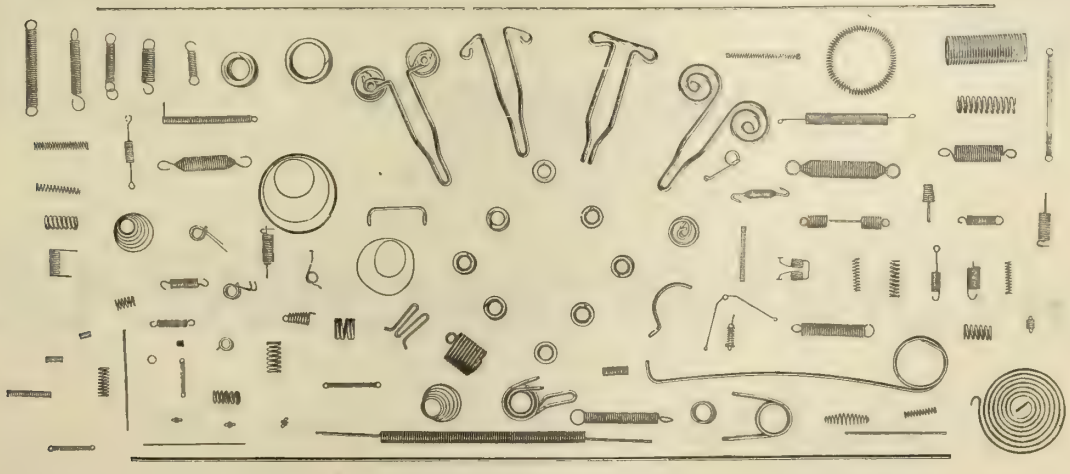
and to back up our long experience in the design and manufacture of Springs from the simplest to the most difficult, we have heat-treating, testing and other facilities that are unsurpassed.

It's natural, of course, that all workmanship and material are fully guaranteed.

Consult us freely—we can help you.

Raymond Manufacturing Company, Ltd.

Corry, Penna.



"International Machine Tools"

—GARVIN—

IN

CANADA

Especially has it been our pleasure to serve industry with evident satisfaction—

We are to-day better prepared than ever to meet the production requirements of

Canadian Industry

The machine shop operator in practically every country knows

GARVIN TOOLS

Here is the List:

Milling Machines:

Universal, Plain, Vertical, Index, Duplex, Hand, Spline, Production.

Profiling Machines,
Cam Cutting Machines,
Tapping Machines:
Automatic, Horizontal and Vertical.

Duplex Horizontal Drills,
Screw Machines,
Screw Slotters,
Die Slotters,
Bench Cutter Grinders,
Universal Cutter Grinders
Surface Grinders
Bright Internal Grinders

"ASK GARVIN"

The GARVIN MACHINE CO.

Spring & Varick Sts., New York City

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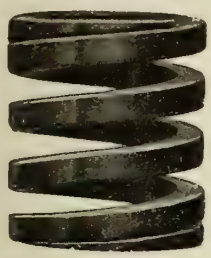
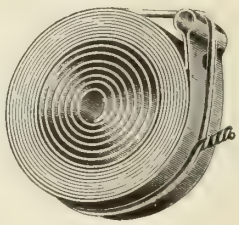
SPRINGS

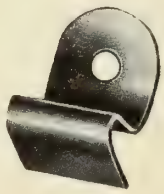


"Barnes-Made" Quality



The wide diversity of springs required in to-day's mechanisms—and there is virtually no mechanism which, somewhere in its make-up, does not rely upon a spring for successful operation—has necessitated a great accumulation of facilities for their manufacture.

Through years of specialization on this line of manufacture, the Wallace Barnes Company has been called upon to produce practically every kind of spring in operation. Its facilities have extended accordingly, so that to-day these cover the entire range of production of high-grade springs.



Quality, which includes both accuracy in dimension and superior finish, is never found wanting in "BARNES CANADIAN SPRINGS"; each operation being carefully watched to ensure that the customer's interests are looked out for throughout the various processes of manufacture.

"Barnes Canadian Springs" are made only to customers' specifications by Canadian workmen. Your enquiries are solicited. Consult us freely on your spring problems.

THE WALLACE BARNES CO. LIMITED
WIRE
BARNES CANADIAN SPRINGS
STEEL
HAMILTON, ONTARIO
CANADA

$50,000,000
In Industrial Buildings

30% of Them Repeat Orders—Comprising:

Factories
Foundries
Power Plants

Old Plants Revamped
Machine Shops
Extensions

Advisory Reports on Future Changes, Expansion Programs, Mechanical Equipment, etc.

There must be a difference

between the plant which is just so much floor space under roof and the one which has been designed to make possible the lowest production costs.

We Regard a Plant as a Machine on a Large Scale

You can employ any one of a hundred firms to make plans or build BUT you engage us for the larger purpose of obtaining the plant which is the most profitable from the standpoint of first cost and operating costs. SUCH A PLANT COSTS NO MORE, often less, and can be built with whatever speed you specify.

A Study of Your Conditions by Practical Engineers will bring a fresh viewpoint and may result in improvements which have never occurred to you.

A Critical Survey of what you are doing and a report embodying a program of practical improvements which are advisable only because they will more than pay for themselves, will enable you to wisely decide what is necessary to meet conditions, whether they be increased competition intensified by reduced demand or need for additional space.

Our Booklets and a Discussion of your problems will cost you nothing

Geo. H. Archibald
400 McKinnon Bldg. - Toronto
Canadian Representative

FRANK D. CHASE Inc.
ENGINEERS and ARCHITECTS
CHICAGO, U.S.A.

Representative Clients:

American Seating Co.
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Wilder Tanning Co.

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FLEXILITE

Doubles Daylight—and Night Lights

BEFORE painting with FLEXILITE

AFTER painting with FLEXILITE

Daylight is Free Why Not Use It?

FLEXILITE Means Increased Efficiency — Cleanliness and Sanitation—Fewer Accidents — Contented Workmen. Lessened Light Bills.

The benefits derived from finishing interiors of plants with **Flexilite** are demonstrated in the actual photographs shown above. The well diffused light that results leaves no shadows. It enables each workman to handle his tools, and operate his machine with a sureness and precision that will reflect itself in increased production and a substantial decrease in spoiled jobs.

It means also fewer accidents. Careful investigation has clearly shown that the curve of fatal accidents in factories very closely parallels the curves of "hours of light" and "cloudy days." It is well nigh self-evident that the remedy is in better lighting.

After painting with Flexilite it will be found that greatly increased light has resulted and that the number of hours during which artificial light is used, can be materially decreased with a corresponding reduction in lighting bills.

FLINT

Flint Varnish & Color Works

of Canada, Limited

Owned and operated by Canadian Explosives, Limited

MONTREAL - CANADA

Our staff of industrial chemists is ready to analyze your paint and varnish problems—solve them—make recommendations and prove their practical worth.

AN IMMENSE STOCK OF MACHINE TOOLS

for Metal Working and Wood Working

New Machinery—Rebuilt Machinery—Used Machinery

Our new machines are of the latest, labor-saving, efficient types; and our rebuilt and used machines are warranted to give first-class service. You can choose from this immense stock just the tool you need—and at the lowest possible price.

In Stock Now for Your Inspection

Drills, Tapping Machines, Rivetters, Hacksaws, Milling Machines, Arbor Presses, Lathes, Pumps, Furnaces, Punches, Grinders, Screw Machines, Turret Lathes, Rich Drill Bits, Hacksaw Blades, and also a complete line of Wood-Working Machinery.

GARLOCK MACHINERY LIMITED

WOOD WORKING AND METAL WORKING MACHINERY

163 DUFFERIN ST. TORONTO TELEPHONE, PARKDALE 7855

See Us About All Your Machinery Needs

If interested tear out this page and place with letters to be answered.

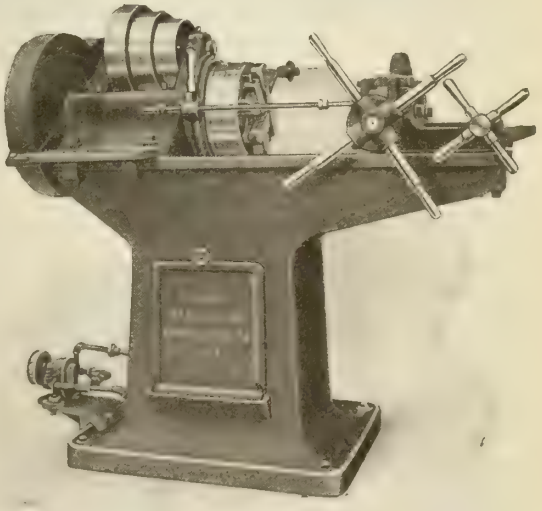
ROUND THE WORLD WITH LANDIS THREADING MACHINES

In the Plant of a Flour Mill Builder—Barcelona

Their world-wide distribution is an unmistakable indication of the worth of Landis Threading Machines.

In historic Barcelona, the ancient port of Spain, Landis Machines are well represented. The accompanying photograph was taken in the plant of Jose Pane, S. en C., manufacturer of Flour Mills in that city, and shows a 1½-in. Landis Threading Machine which has been 6½ years in operation there without repairs. Work shown is threading ¾-in. Siemens steel rods at each end a length of 20-in., operator having no difficulty in getting a production of 30 pieces per hour.

Investigate the Landis die, learn of the tangential disposition of chaser to work; interchangeability of chasers, and many other distinctive features.



LANDIS

May we send you catalogue?

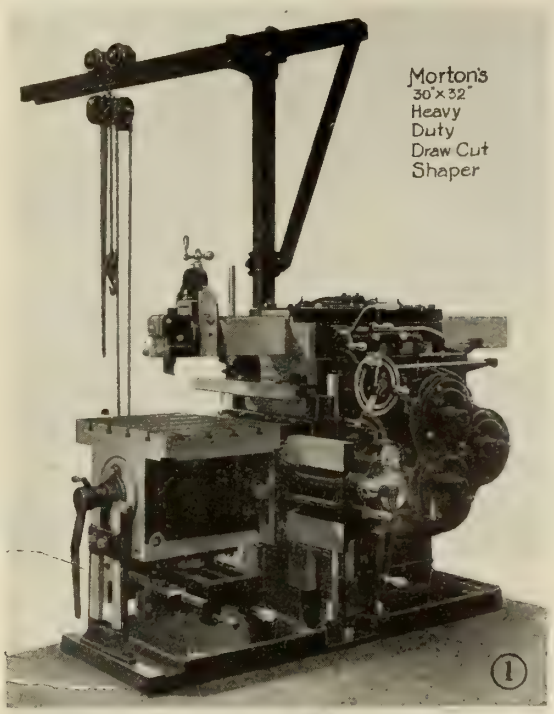
LANDIS MACHINE COMPANY, Incorporated

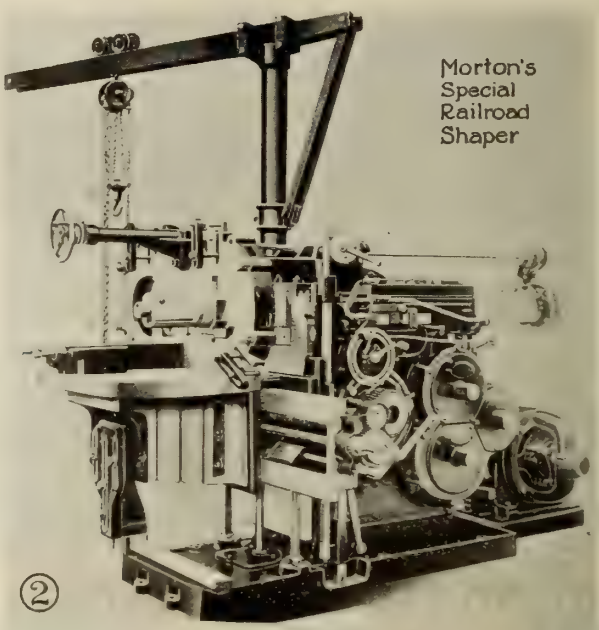
Waynesboro, Pa., U.S.A.

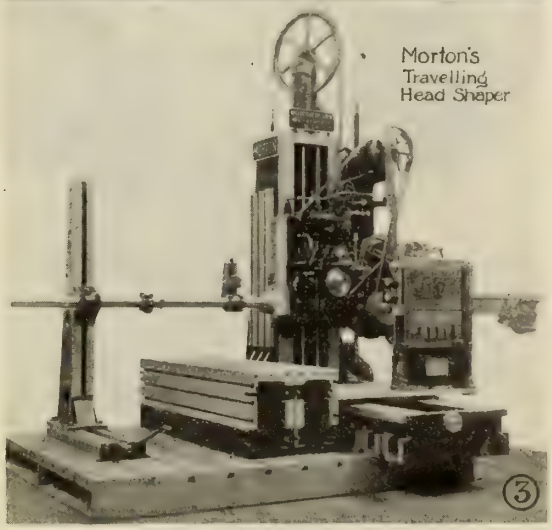
DOMESTIC AGENTS: Marshall & Huschart Machinery Co., Chicago Ill.; Marshall & Huschart Machinery Co., of Indiana, Indianapolis, Ind.; Colcord-Wright Machinery & Supply Co., St. Louis, Mo.; R. B. Whitacre & Co., St. Paul, Minn.; Hamilton, Machinery Co., Chattanooga, Tenn.; Seeger Machine Tool Co. Atlanta, Ga.; Young & Vann Supply Co., Birmingham, Ala.; Woodward, Wight & Co., New Orleans, La.; Jos. T. Ryerson & Son, Houston, Texas; Hendrie & Bolthoff Mfg. and Supply Co., Denver, Colo; Salt Lake Hardware Co., Salt Lake City, Utah; Eccles & Smith Co., San Francisco Calif.; Los Angeles, Calif.; Portland, Ore.; Hallidie Machy Co., Seattle Wash.; Hallidie Co., Spokane, Wash. CANADIAN AGENTS: Canadian Fairbanks Morse Co., Toronto and Montreal. FOREIGN AGENTS: Burton Griffiths Co., London, Eng.; Calcutta, India and Yokohama Japan; Allied Machinery Co., Barcelona, Spain, Turin, Italy; Zurich, Switzerland and Tientsin, China. R. S. Stokvis & Zoon, Rotterdam, Holland; Lindeteves-Stokvis, Dutch East Indies; D. Dura & Co., Johannesburg, South Africa; Benson Brothers, Sydney, Australia.

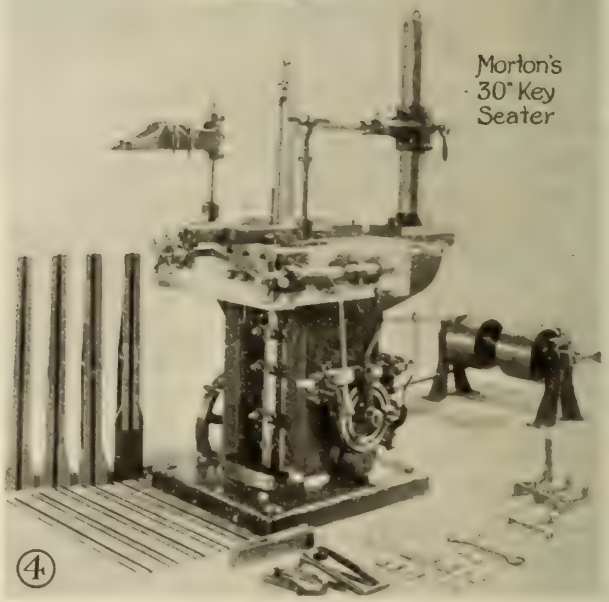
MORTON

DRAW-CUT SHAPERS AND KEY SEATER









Morton Machine Tools are necessities of large shops. Size and weight of work are no obstacles to the efficient and economical performance of the machines illustrated above—they include: (1) Morton's 30" x 32" Heavy Duty Draw Cut Shaper; (2) Morton's Special Railroad Shaper, showing the machine as arranged for machining locomotive axle boxes; (3) Morton's Travelling Head Planer, machine arranged with boring bar, outboard bearing and two-piece work table; (4) Morton's 30" Key Seater, right side view, showing belt-drive countershaft.

Would you care for a complete description of these machines? Full information promptly furnished.

MORTON MANUFACTURING CO.

MUSKEGON HEIGHTS, MICHIGAN

If interested tear out this page and place with letters to be answered.

The Marshalltown - Line

OF

THROATLESS SHEARS - BEVEL SHEARS
SPLITTING SHEARS - FLUE WELDERS

Cutting costs are materially reduced with the Marshalltown Line. Marshalltown Throatless Shears will take sheets and plates of unlimited width and cut curves of small radius in any direction. They have no equal for cutting in and out curves, straight or irregular shearing and circule work, etc. The Throatless feature allows any size material to be used—or cut from. Brief descriptions of these, together with our Bevel Shears, Splitting Shears and Flue Welders, are shown below:

No. 18 Throatless Shear—18 gauge, cuts to 1¾" radius. Hand power.

No. 18-P Throatless Shear—For hand or belt power. 70 revolutions of belt pulley per minute cuts 9 feet.

No. 18-M Throatless Shear—Motor drive; equipped with ⅛ h.p Motor.

No. 16 Throatless Shear—Cuts to 3" radius, 16-gauge material and lighter. ¼ H.P. Motor.

No. 16-BH Throatless Shear—Cuts to 3" radius up to gauge. Hand power with bench base.

No. 12 Throatless Shear—Cuts to 4" radius on material up to 12-gauge. ½ H. P. Motor.

No. 12-BH Throatless Shear—Cuts to 4" radius—up to 12 gauge material. ½ H. P. Motor.

No. 10-P Throatless Shear—Cuts to 4½" radius 10 gauge and lighter. 1 H.P. Motor.

No. 114-M Throatless Shear—For ¼" and lighter; cuts 5½" radius. Equipped with motor drive.

No. 112 Throatless Shear—½" and lighter; cuts to 10" radius. Cutters 10" x 1-⅞". 5 H. P. Motor.

No. 138 Throatless Shear—Capacity ⅜" and lighter. Cuts to 9" radius. 3 H.P. Motor.

No. 138 Rotary Bevel Shear—Will bevel plates up to ⅜" thick. A strong high class machine that will bevel plates in much less time than chipping. 3 H.P. Motor.

No. 34 Rotary Bevel Shear—¾" material and lighter. 7½ H.P. motor. For beveling edges of straight or irregular plates.

The Marshalltown-Schaefer Flue Welder was designed by an experienced Tool Maker who had years of experience in welding locomotive and super-heater flues.

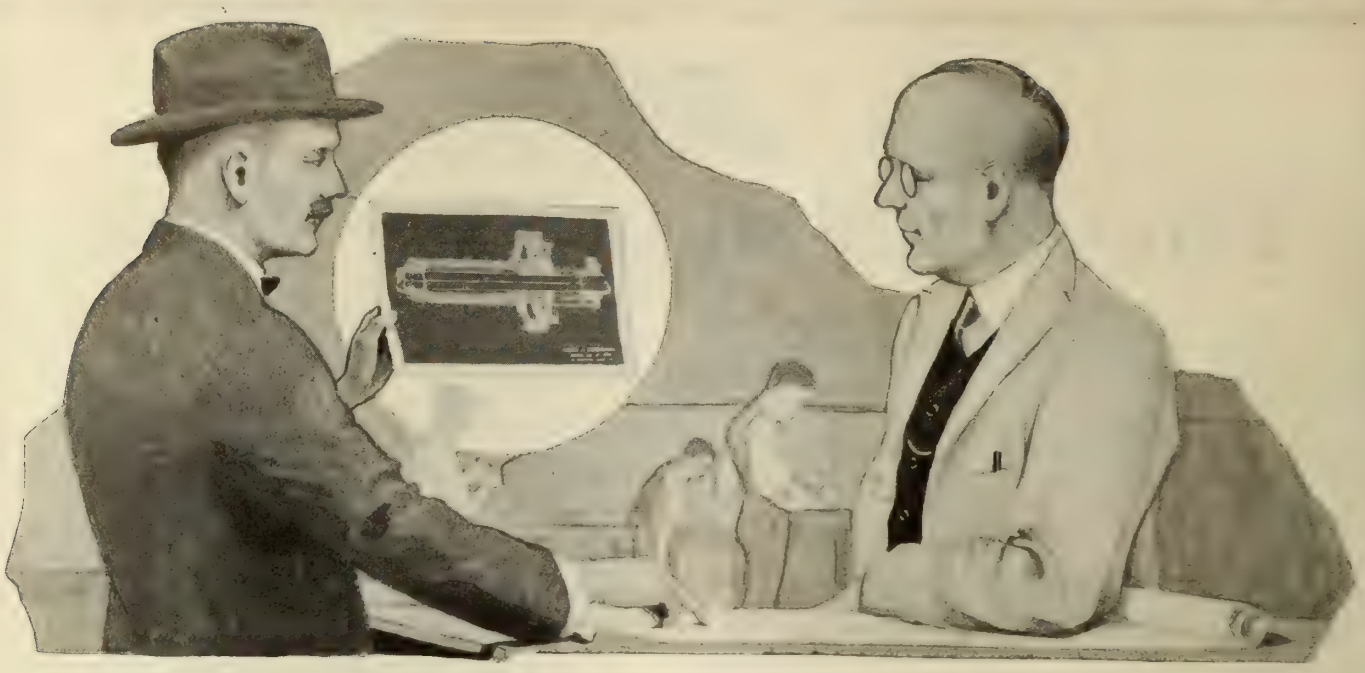
A distinctive feature is that the weld is made between two revolving rolls, welding both the in and the outside of the flue in such a manner that both sides are left in condition so that it is almost impossible to locate the place welded.

Flues from two inches to six inches in diameter can be welded by changing the rolls. Three sizes of rolls being furnished with each machine. Pieces up to nine inches in length can be welded on to the flue.

Marshalltown Flue Lathe—This is a heavy duty Lathe designed especially for cutting and chamfering safe ends and for cutting all lengths and sizes of flues up to six inches. Hollow spindle type, equipped with a three jaw Universal Chuck. Tool Carriage is equipped with two tools; one for cutting off the flues and the other for chamfering the ends of same. Made with an adjustable gage for safe ends up to nine inches in length.

Let us send catalogue fully describing the Marshalltown Line

MARSHALLTOWN MANUFACTURING CO.
MARSHALLTOWN, IOWA



A PHOTOSTAT Would Have Prevented Such A Mistake

LAYING the blame on the drafting room doesn't help us. Theoretically they should have noticed those transposed figures when they checked the tracing, but the fact remains that the error crept in in spite of the checking.

"And what is the result? It will cost us our entire profit on the job to correct the results of that mistake. And we could have bought several PHOTOSTATS with what we will lose.

"That mistake **couldn't** have occurred if we had made PHOTOSTAT copies of the blueprint instead of tracing it. The PHOTOSTAT makes photographic facsimiles so you don't even have to check them.

"And compare the time it takes to make PHOTOSTAT copies against the time it took our drafting room to trace that blueprint and to make additional blueprints. Why, it's a matter of minutes against hours. By copying blueprints, pencil sketches, drawings and orders with the PHOTOSTAT we can get all our work into the shop days earlier than we do now.

"I tell you, no matter from what angle you look at it, everything is in favor of the PHOTOSTAT.

"The PHOTOSTAT copies directly on sensitized paper and the cost per print is not over 25 cents.

"And we have any quantity of other kinds of work for the PHOTOSTAT. It will relieve our stenographers of a lot of copying—do it in far less time and with absolute accuracy. We can copy catalog pages, work sheets, contracts, production charts, letters, specifications, legal documents, and advertising layouts. The machine will more than pay for itself inside of six months."

Without obligation ask us for **"The Photostat and What It Will Do."**

PHOTOSTAT CORPORATION

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429 Monadnock Bldg., San Francisco.
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Executive Office: Providence, R. I.

PHOTOSTAT

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CANADA'S PREMIER MACHINERY HOUSE

MR. H. W. PETRIE, SR.

THROUGH half a century of industrial expansion, through wars and rumors of wars, through financial panics and trade depressions, the H. W. Petrie Limited, has stood, and stands to-day in unchallenged supremacy, the acknowledged machinery headquarters for Canada—the firm with a national reputation for quality, service and fair dealing.

The policy of Efficiency in Service is one of the sterling qualities that have built up and sustained the public confidence in the H. W. Petrie Limited, for fifty years.

In Toronto alone we possess 130,000 square feet of floor space for the storage of modern machinery. This, and the excellence of our buying and selling connections, enables us to handle a contract of **any** size in the quickest possible time and at most reasonable prices.

Our facilities for repair work of every description (stationary and marine) are magnificent.

H. W. PETRIE LIMITED TORONTO

FORD-SMITH

Grinding and Polishing Equipment

Floor, Bench, Swing, Water Tool, Disc and Special Grinders---Polishers and Buffers

Ford-Smith Grinders have established a reputation for Quality. They have proven their ability to do quicker, better, more satisfactory work, at the same time keeping costs down to the minimum. There's a size of Ford-Smith Grinder to meet every grinding need.

Suitable grinding equipment will save you a considerable sum in production costs every year. You can feel sure, when purchasing a Ford-Smith Grinder that you are getting the very best. When installing new Grinding Equipment, decide to have Ford-Smith machines, and no other.

A large portion of our plant is devoted to the production of special machinery dies, gear cutting, jobbing work, etc. We have an expert engineering staff which can handle any planning work for you, and our modern tool equipment guarantees you a good machine carefully and accurately built.

SPECIAL MACHINERY

DIES, JOBBING WORK, ETC.

Many of Canada's largest firms have been satisfactorily served by us, for we can take your design or blueprints and build the machine or fixture to your requirements. We have made dies as large as 8 tons, and can make any style of die required. Send us your blueprints and let us quote you.

We also make a line of Milling Machines that have already established a reputation. When in need of a Miller you can't do better than install a Ford-Smith Miller.

The Ford-Smith Machine Co., Limited

HAMILTON, ONTARIO, CANADA

Foreign Agent: W. E. Storey, London, Eng.

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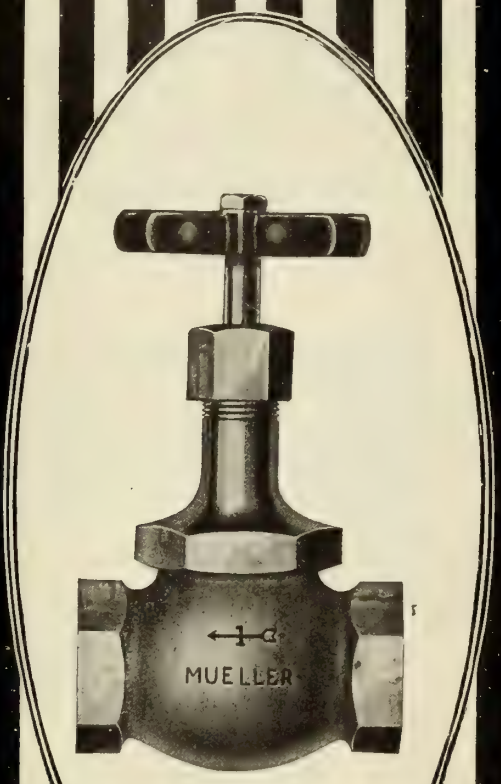
Designed To Withstand High Pressure

The Mueller Composition Disc Globe Valve is built for the hardest kind of steam line service. Thickness and weight come where strength is most needed.

The threads are full length and tapered. The Mueller Composition Disc used in this valve enables it to withstand high pressure and high temperature. This valve is so constructed that it can be repacked without shutting off the steam.

Scientifically designed by engineers with years of experience and manufactured from the finest materials by expert workmen, Mueller "Globe A-3006" will give years of efficient and economical service. Send for a sample.



A-3006

H. Mueller Mfg. Co., Limited
Sarnia, Ontario

Water, Plumbing and Gas Brass Goods and Tools

American Factory at Decatur, Illinois, U.S.A.

Branches—New York and San Francisco

Mueller Metals Co., Port Huron, Mich., Makers of "Red Tip" Brass Rod; Brass and Copper Tubing; Forgings and Castings in Brass, Bronze and Aluminum; also Screw Machined Products.

SERVICE-SALES
High-Grade Machine Tools

OUR ambition is to so conduct our business through efficient service and fair dealing as to thoroughly maintain the established prestige of the lines we represent.

REPRESENTING EXCLUSIVELY IN ONTARIO:—

KEARNEY & TRECKER CORP'N.
Milwaukee Milling Machines,
(Manufacturing, Plain, Universal and Vertical Types)
Continuous Milling Methods.

THE WARNER & SWASEY CO.
Turret Lathes & Screw Machines.
Hollow Hexagon Turret Lathes.
Universal Turret Lathes.
Brass Finishing Lathes.

LANDIS TOOL COMPANY
Plain Self-Contained Grinders.
Universal Grinders.
Cylinder Grinders.
Crank, Cam, and Roll Grinders.
Internal & Ball-Race Grinders.

TOLEDO MACHINE & TOOL CO.
Punching, Blanking, Drawing and Forming Equipment.

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Ball Bearing Radial Drills.

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High-Power Vertical Surface Grinders,
No. 10 and No. 16 Rotary Types.
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GOULD & EBERHARDT
"High Duty" & "Invincible" Shaper.
Gear Hobbing Machines.
Gear Cutting Machines.
Multiple Spindle Gear Cutting and Hobbing Machines.
Gear Cutting Grinders.

LUCAS MACHINE TOOL CO.
"Precision" Horizontal Boring, Drilling and Milling Machines.
Power Forcing Presses,
(Standard and Special Types.)

BULLARD MACHINE TOOL CO.
Vertical Turret Lathes, 24″ to 54″.
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LAPOINTE MACHINE TOOL CO.
Broaching Machines and Broaches,
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Broaching Tools of all Kinds.

LELAND-GIFFORD CO.
High Speed Drilling Equipment.
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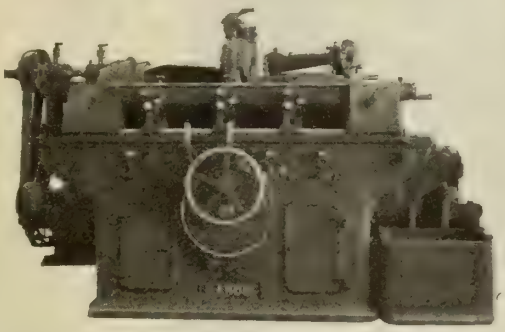
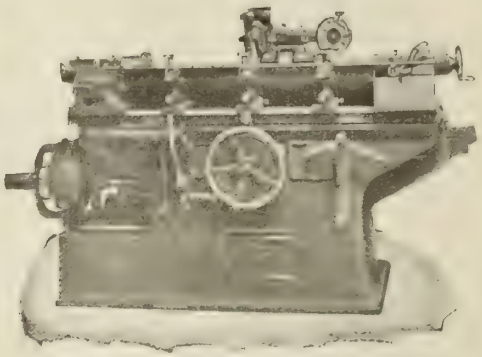
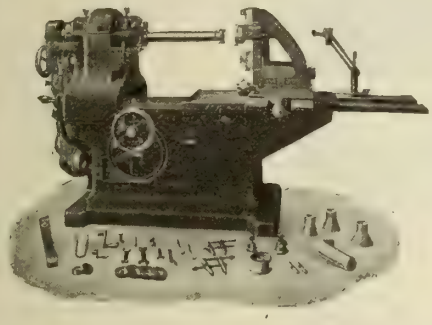
LANDIS



Plain Grinding Machines are strictly manufacturing machines for straight or taper, formed wheel or wide wheel grinding. They can be furnished with 6″, 10″, 12″, 18″ and up to 50″ swing.



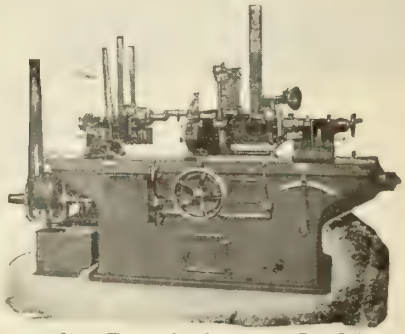
Universal Grinding Machines are adaptable for general manufacturing and tool room grinding of such parts as dies, reamers, gages, cutters, etc. They can be furnished in 10″, 12″ and 16″ swing.



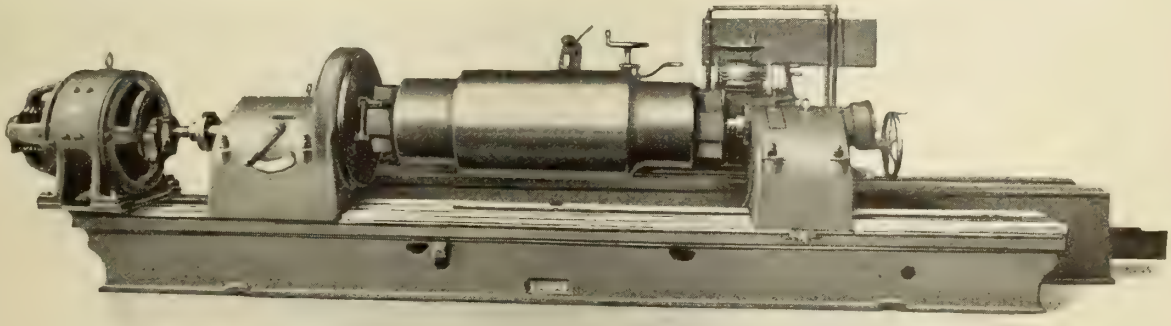
Cylinder Grinding Machines are designed particularly for use in garages and repair shops. They will accommodate any size or type of cylinder blocks.

REPRESENTATIVE "LANDIS" GRINDING MACHINES

Correct Design, Superior Workmanship and Constant Service —points of advantage which maintain leadership for Landis grinding machines.



Crankshaft Regrinding Machines are practically invaluable in service stations, repair shops and garages for all classes of grinding—pistons, piston pins, transmission gears, crankshafts and valves.

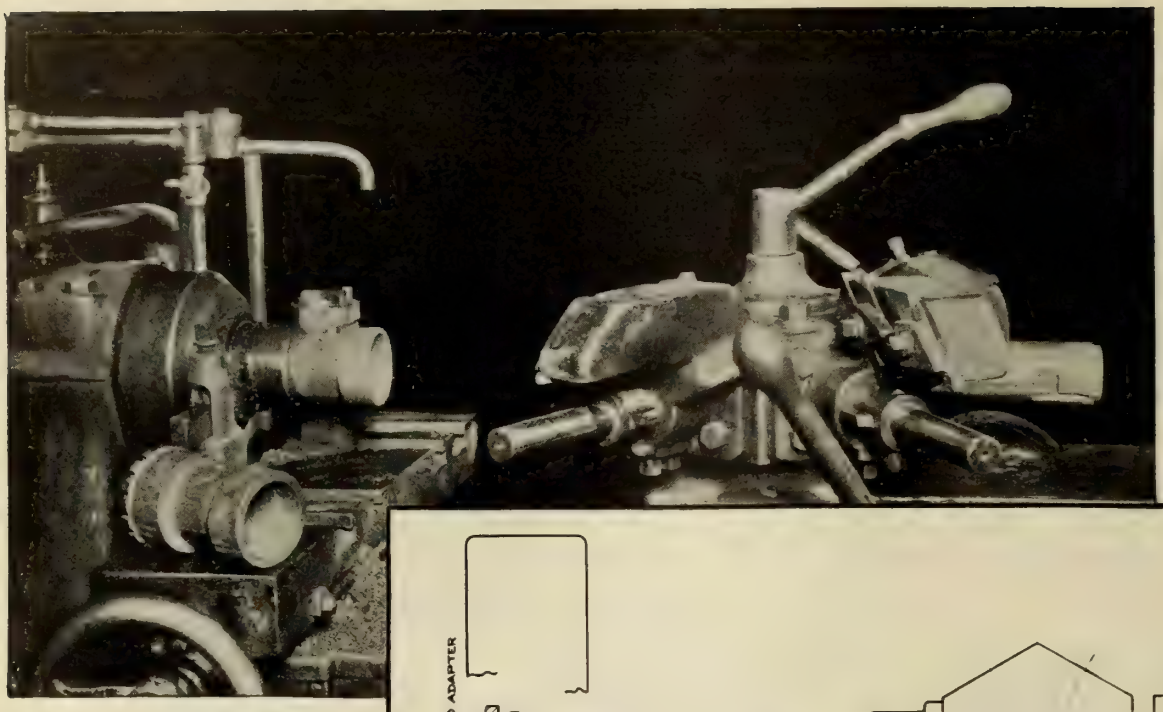


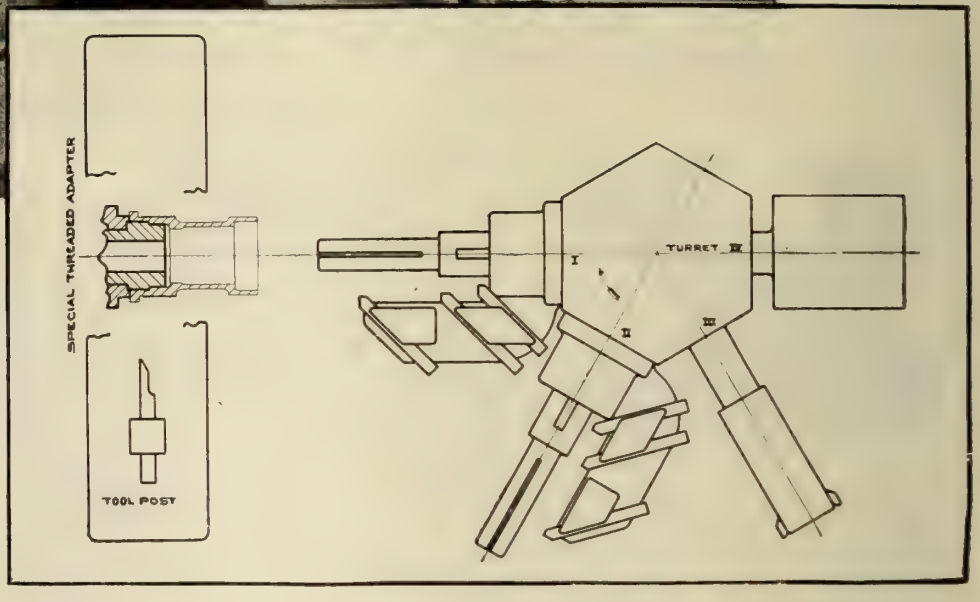
Heavy Roll Grinding Machines have a capacity for grinding rolls varying in weight from 500 to 50,000 pounds. The principle feature is the crowning mechanism for grinding either convex, concave, straight or taper.

Landis Tool Company, Waynesboro, Pa.

NEW YORK OFFICE: 51 CHAMBERS STREET

CANADIAN AGENTS: F. F. Barber Machinery Co., Ltd., Toronto; Williams & Wilson, Ltd., Montreal; A. R. Williams Machinery Co., Ltd., Halifax, St. John, Winnipeg and Vancouver.





The solution of an engineering problem of a prominent automobile builder.

Use Warner and Swasey Engineering Service for more and better production on your Turret Lathes

For the convenience of our Canadian friends Warner & Swasey engineers are stationed at our Branch Office in **Detroit,** 5928 Second Boulevard, and in the Iroquois Building in **Buffalo**, also in the offices of our **Canadian Agencies:**

F. F. BARBER MACHINERY COMPANY, 32 Front Street W., Toronto.
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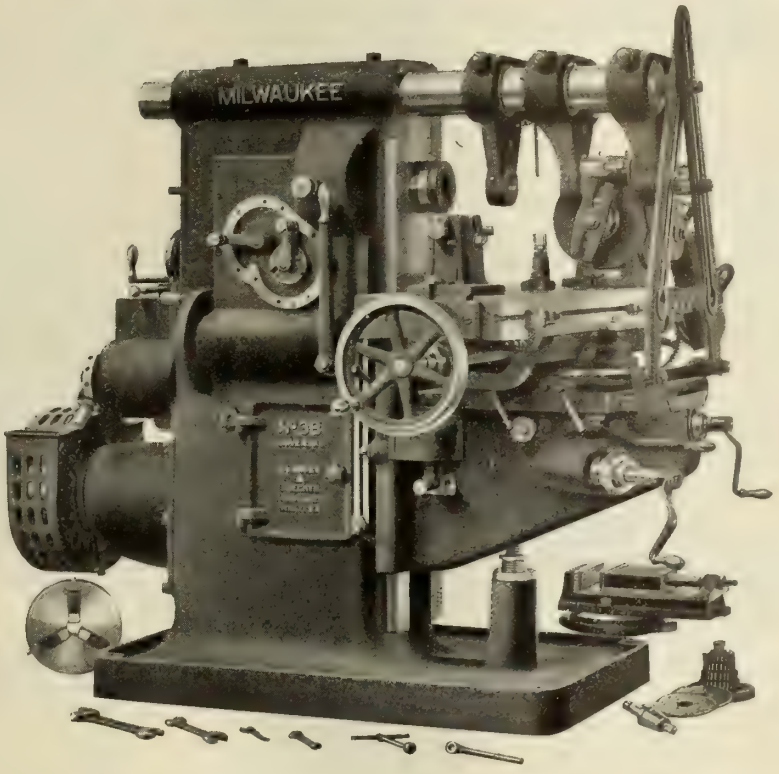
The Warner & Swasey Company

Cleveland, U.S.A.

MILWAUKEE MILLING MACHINES



You Don't Buy a Milwaukee--- Instead, you Invest in it for Profitable Returns

Milwaukee Milling Machines are built in a variety of types and sizes to meet various requirements, being designed and constructed to give maximum service over a long period. They are cost reducing machines and are in use throughout the world in all industries where metal is machined, proving their value in quality and quantity production, ease of operation and low upkeep.

Manufacturing Type

	Range	Net Wt.
No. 1A Mfg.	22″x 8″x19″	2950 lbs.
No. 1½A Spec. Mfg.	28″x10″x19″	3550 lbs.
No. 2A Mfg.	28″x10″x19″	4500 lbs.

Universal Type

	Range	Net Wt.
No. 1B Universal	22″x 8″x18″	3300 lbs.
No. 1½B Spec. Univ.	28″x10″x18″	3800 lbs.
No. 2B Universal	28″x10″x18″	5100 lbs.
No. 3B Universal	34″x12″x19″	7000 lbs.

Plain Type

	Range	Net Wt.
No. 1B Plain	22″x 8″x19″	3050 lbs.
No. 1½B Spec. Plain	28″x10″x19″	3600 lbs.
No. 2B Plain	28″x10″x19″	4600 lbs.
No. 3B Plain	34″x12″x20″	6600 lbs.
No. 4B Plain	42″x14″x20″	9700 lbs.

Vertical Type

	Range	Net Wt.
No. 1½B Vertical	30″x12 x18½″	3700 lbs.
No. 2½B Vertical	36″x15″x20½″	5200 lbs.
No. 4B Vertical	42″x15″x19″	9450 lbs.

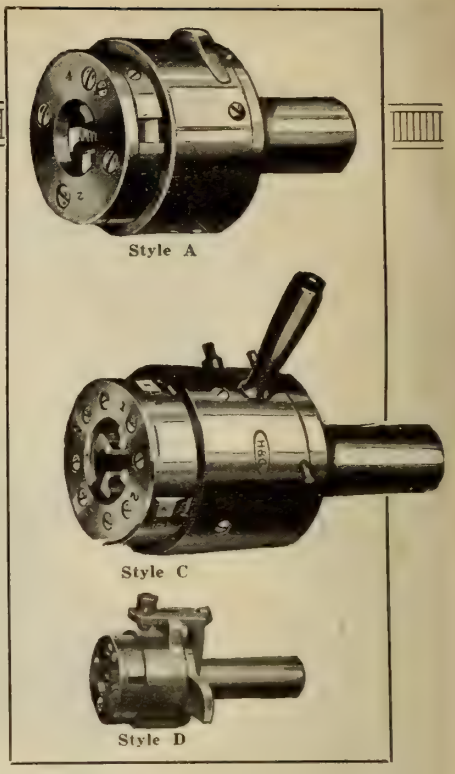
KEARNEY & TRECKER CORPORATION

Milwaukee Wis., U.S.A.

Canadian Agents

Williams & Wilson, Ltd., Montreal.
F. F. Barber Machinery Co., Ltd., Toronto.
A. R. Williams Machinery Co., Ltd., Winnipeg.
A. R. Williams Machinery Co., Ltd., Vancouver.

H&G



—the name of the Die-Head that has REVOLUTIONIZED THREAD-CUTTING throughout the world

Approximately 75% of the threads cut in the automotive industry are cut with H. & G. Die Heads. This has been accomplished within the short period of a few years, with a class of executives who are influenced only by these two requirements in their purchase of tools:

1. *Most efficient production*
2. *Highest degree of accuracy possible*

This record is silent tribute to the mechanical superiority of the tool and to the policy of the organization which produces it.

If you do any thread-cutting, H & G Die Heads will reduce your costs and give you better threads.

Our new ninety-six page catalog contains much valuable information gathered from original sources and presented for constant reference by operators.

You are invited to send for a copy.

H & G Die Heads are made in three standard styles and several sizes and are adaptable to all machines on which threading is done.

Style A is for Automatic Screw Machines like the Cone, Gridley, National Acme, and threading machines and bolt cutters in which the die head ROTATES.

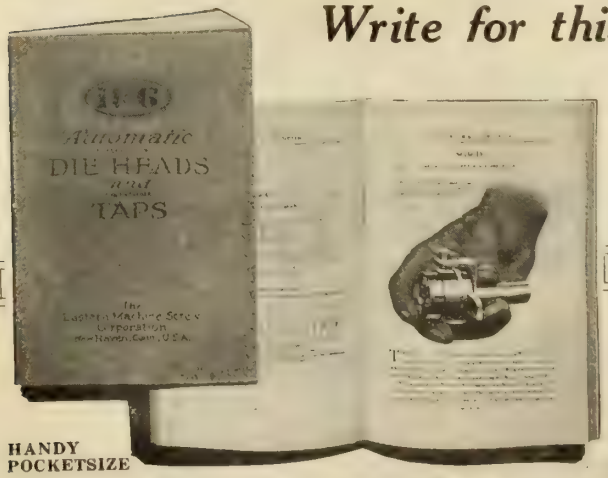
Style C is for turret lathes, hand screw machines and similar machines in which the die head is held stationary. Style CC is for Cleveland Automatics.

Style D is a recent development and has met with great success. It is especially designed for Brown & Sharpe automatics but can be used on other machines cutting small work.

The Eastern Machine Screw Corporation

28-48 Barclay Street, New Haven, Conn.

Write for this new 96 page H & G Book



HANDY POCKETSIZE

The new H & G Book is more than a catalog, it contains many valuable tables and much other information of interest to screw machine operators. Fill out this coupon and the book will be sent without obligation.

Name .....

Address .....

Firm Name .....

Position .....

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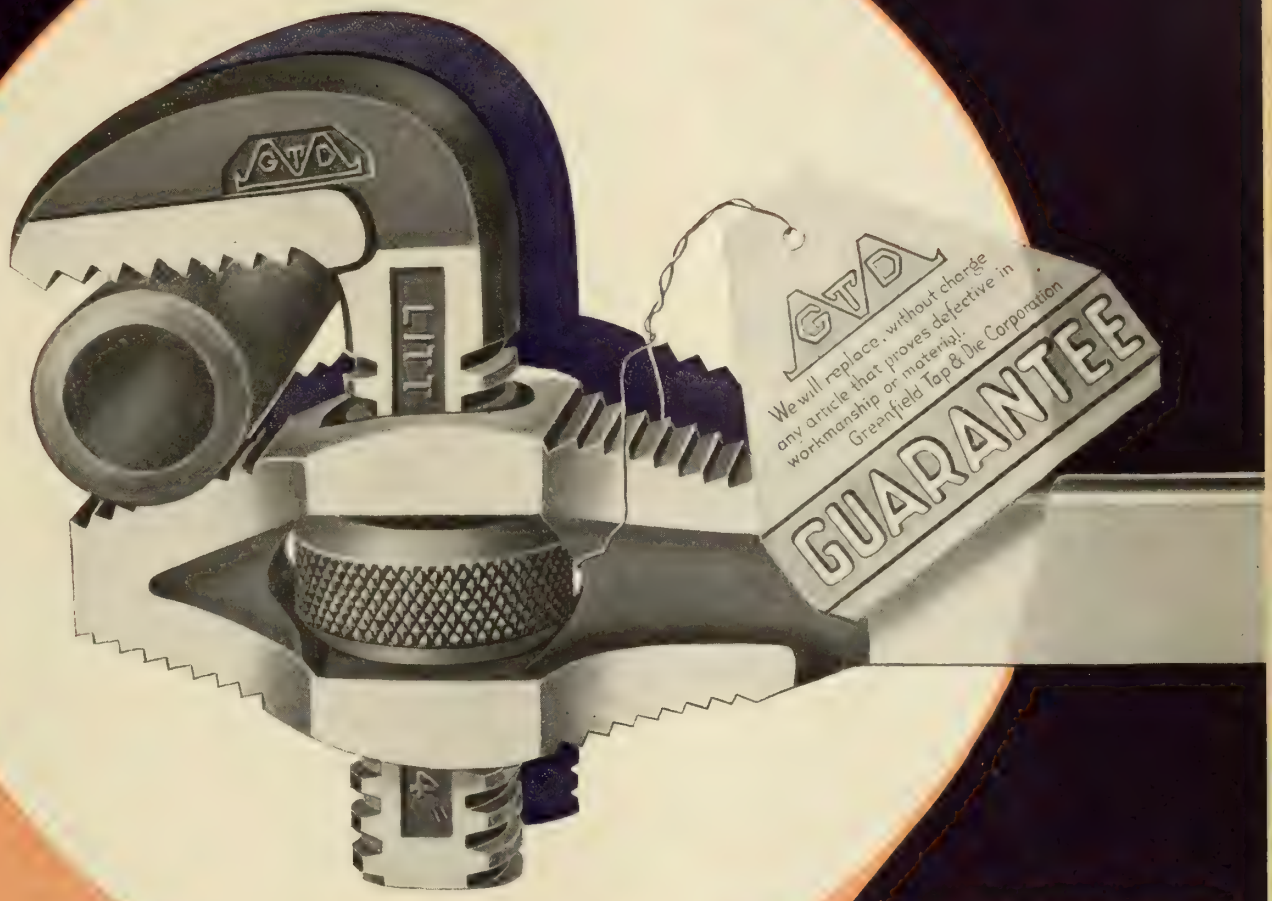


REG. U.S. PAT. OFF.

GTD

SIMPLER
STRONGER
LASTS LONGER
ONLY 3 PARTS

THE NEW *Little Giant* PIPE WRENCH

(TURN THE SHEET)

GTD

Introducing the — *Little Giant* PIPE WRENCH

On the Job

It gets into the holes and corners that the conventional pipe wrench can't touch. Look at the *end opening* jaws. They reach into cramped places just like a pair of pliers. They grip instantly and independently of springs.

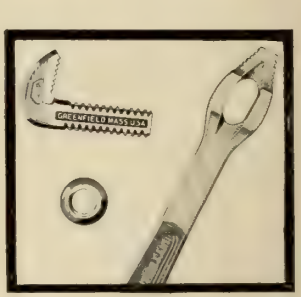
This *"Little Giant"* Wrench *takes hold* and *lets go* quicker than any other wrench you ever used, and we can guarantee that.

The Wrench Itself

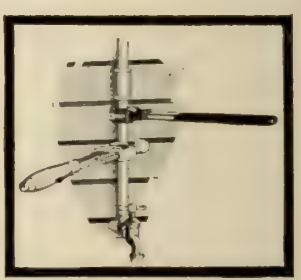
It has just three parts. Two powerful drop forged jaws and a nut, all three carefully heat treated. No cumbersome frame, no springs, no rivets. The new patented design gives extreme strength. (The 14 inch size, for example, has repeatedly withstood stresses in excess of 4700 inch pounds—2800 is Uncle Sam's test.) Finally, it has *double* the life of an ordinary wrench, because the moveable jaw can be engaged with teeth on both sides of the solid jaw. (See illustration)

The *"Little Giant"* Wrench will be made in 8", 10", 14", 18", and 24" sizes. The three smaller sizes are now in stock for immediate delivery. Hundreds of users are daily expressing their satisfaction with this new wrench.

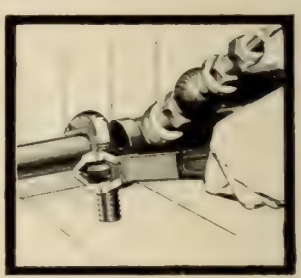
Let us tell you more about it.



ONLY THREE PARTS
Practically Indestructible
(Note teeth on both sides of jaw)



Showing the greater effective swing of the *"Little Giant"* Wrench when pipe is close to wall.



The *"Little Giant"* Wrench being used in a corner.

Mr. Reader:—
This is not a "trick" wrench. Hundreds of users have written us that it is the best pipe wrench they ever handled—from every point of view.

You want to know about a tool that lasts twice as long, and takes twice as much punishment—and we want to tell you.

[illegible] your letter head will bring you [illegible] and prices by return mail.

GTD GREENFIELD TAP AND DIE CORPORATION
OF CANADA, LIMITED. GALT, ONTARIO.

GTD SCREW PLATES, TAPS, DIES, TWIST DRILLS REAMERS, GAGES, PIPE TOOLS, MACHINE TOOLS

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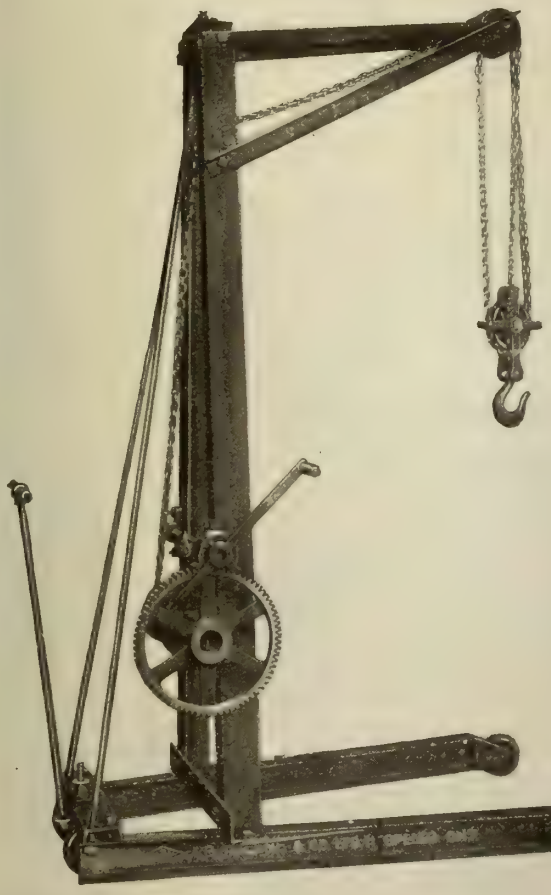
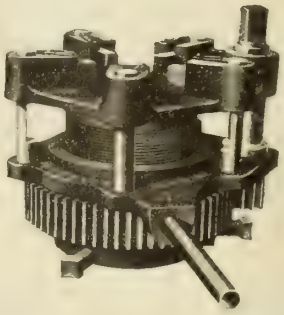
"JARDINE"

Machinists,' Blacksmiths,' Boiler Makers,' Pipe Fitters' Tools and Machinery, and Garage Equipment.



Perfect Threads, One Cut.

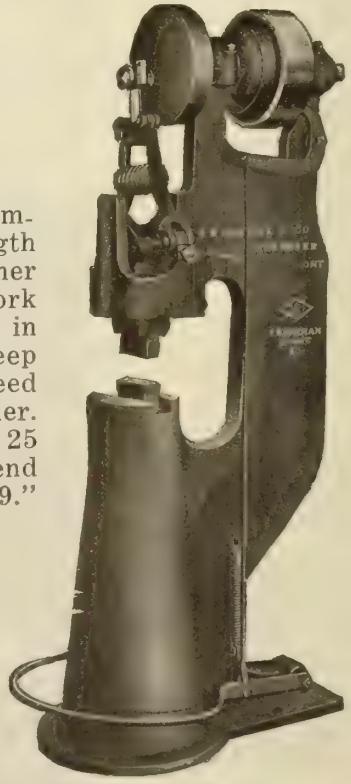
"Jardine" and "Toledo" Pipe Threading Tools are well known as the best Hand Pipe Threading Tools made. Easy to handle, cut perfect threads. One man can easily cut any thread 1/8" to 12" at one cut. Send for catalogue "P-3."



No. 2 Toledo Geared Threading Tool, capacity 2½" to 4"

"Jardine" Power Hammers

If you need a Power Hammer of uncommon strength throughout. A hammer constructed to deliver work of surpassing quality in great quantity, and to keep everlastingly at it. You need a "Jardine" Power Hammer. Made in two sizes No. 25 and No. 50. Send for catalogue "B-19."



"Jardine" Floor Cranes are ideal for Machine Shop Use

Have a wide margin of safety for overload. One man can easily lift and handle any load within the capacity of the crane. Automatic device to lock crane to floor when handle is raised.

No. 52, Capacity 4,000 lbs.
No. 51, Capacity 2,000 lbs.
No. 50, Capacity 1,000 lbs.
Send for catalogue "G-22"

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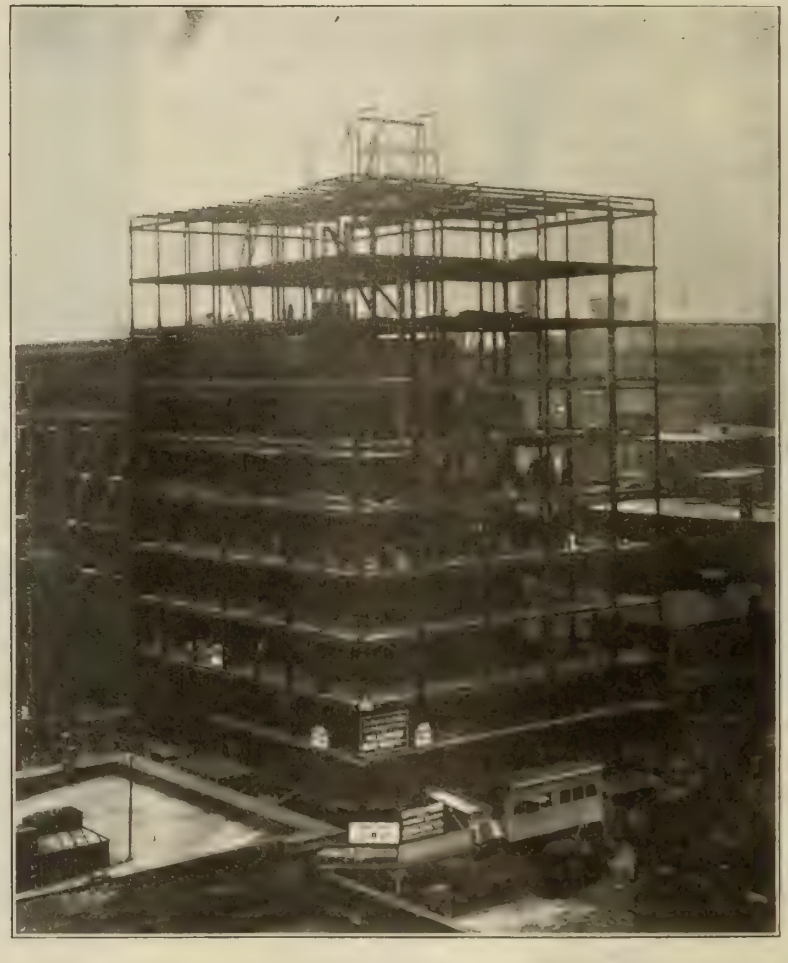
The Hamilton Bridge Works

COMPANY, LIMITED

Hamilton, - Canada

Structural Steel, and Steel Bridges



We carry a large stock of Structural Shapes and your requirements can be immediately filled. Our shops, with a capacity of 36,000 tons annually, enable us to turn out whatever you require, from the largest building to a few beams, in a surprisingly short time.

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A Year of Promise
A Year of Opportunity
Put Your House in Order!

AMERICAN metal working industries are promised a year of sound prosperity.

Business once again rides on an even keel.

Let us, one and all, steer our business craft into wider markets "full steam ahead!"

Let every metal working plant replace old equipment with new—wisely but fearlessly—in preparation for a long period of steadily-improving business!

Let old methods of cleaning metal surfaces give way to the modern, the better, way—**"Flint Shotting"**—the most advanced method of sand-blasting.

"Preparedness for Prosperity"
is a mighty fine watchword for '23.

We have prepared
We are prepared

Betterments in our plant have nearly **doubled** our capacity for producing Flint Shot Sand Blast Abrasive.

Send in your orders and we'll take care of you

UNITED STATES SILICA CO.
122 South Michigan Ave. Chicago

THE TILTED TURRET

A CLEAR TRACK FOR THE STOCK

Wood Turret Machine Co.
Brazil, Ind., U.S.A.

THE ACCURACY OF THE TILTED TURRET IS NOT AFFECTED BY YEARS OF CONSTANT USE

Realizing the conditions to be met, THE TILTED TURRET was designed to fulfill the exacting requirements and by its continuous developments has set a new standard for ACCURACY—PRODUCTION—EASE OF OPERATION—LONG LIFE and STABILITY.

OUR NEW UNIVERSAL ELECTRIC DRIVE IS WORTH KNOWING ABOUT.
WATCH TRADE PAPERS — SEND FOR CIRCULAR

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TOOLS OF EVERY DESCRIPTION

CRUCIBLE, ELECTRICAL, SIEMENS-MARTIN

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CHAS. L. BAILEY.
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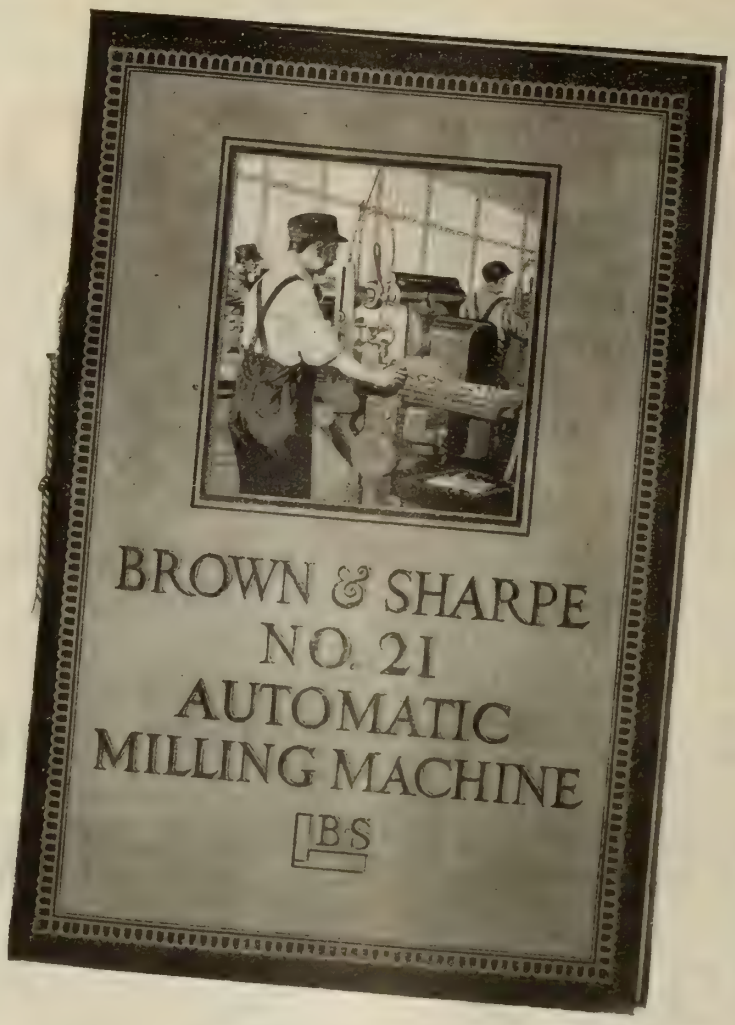

Save Money by Saving Minutes

This Book shows you how

The minutes saved by automatic milling will save money on your production work. This 40-page book on the Brown & Sharpe No. 21 Automatic Milling Machine includes descriptions of several jobs with detailed production figures which may suggest how this machine will save time, and money, on similar work in your plant.

Write for this book today

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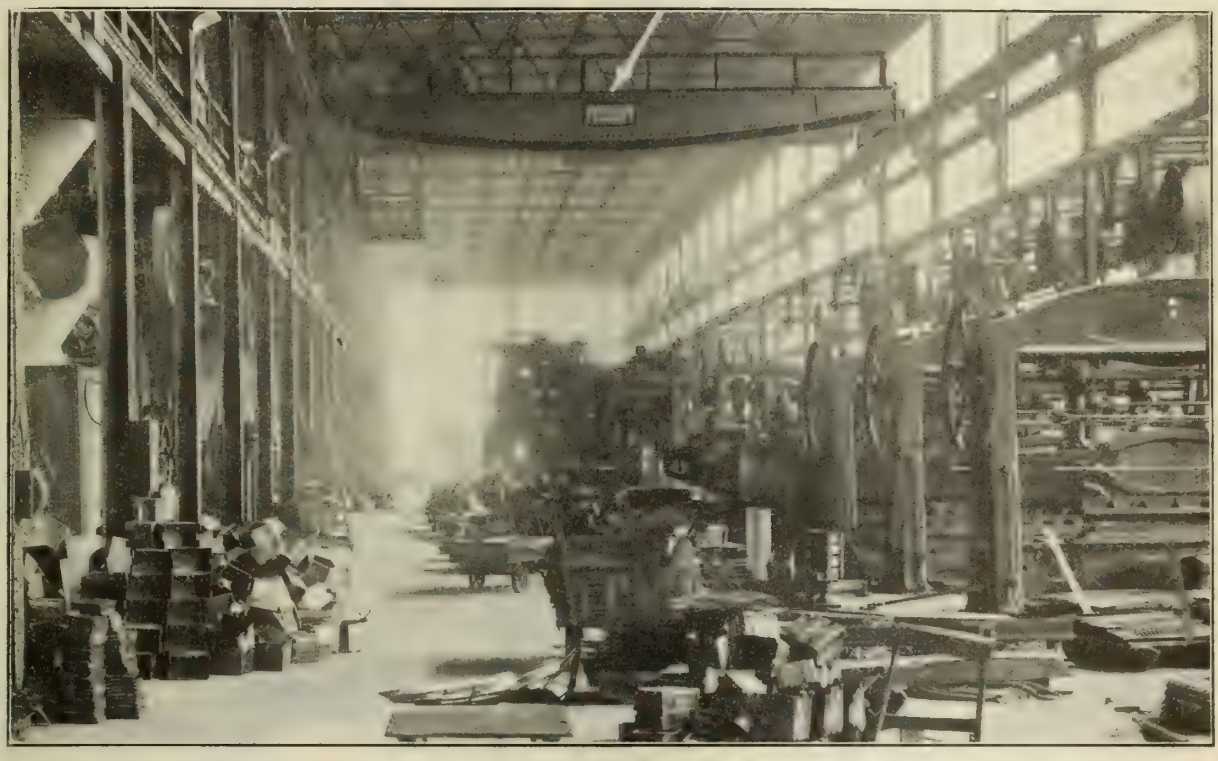
NORTHERN CRANE WORKS LIMITED
WALKERVILLE, ONTARIO

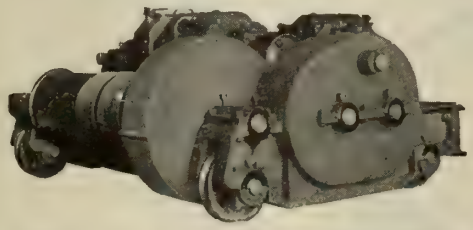


A Northern Crane at the Works of The Pedlar People, Oshawa, Ont.

Why Buy Imported Cranes?

For many years we have been meeting the definite requirements of Canadian manufacturers in the manufacture of reliable Cranes and Hoists for all purposes. ½ to 150 tons capacity.
Our Modern Crane plant at Walkerville can take care of your needs.

Type D. Electric Hoists —¼ to 10 Tons.



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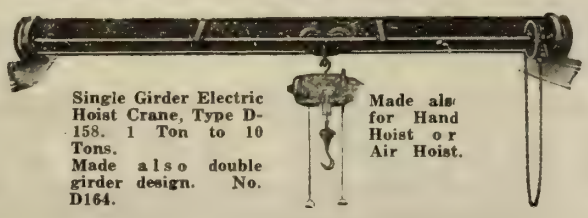
Northern Cranes are designed and made by men of long experience and are modern in every detail. Our line includes:

Electric and Hand Cranes, Electric Hoists, Air Hoists, and Foundry Equipment of all kinds—all "Canadian Made."



Single Girder Electric Hoist Crane, Type D-158. 1 Ton to 10 Tons. Made also double girder design. No. D164.

Made also for Hand Hoist or Air Hoist.

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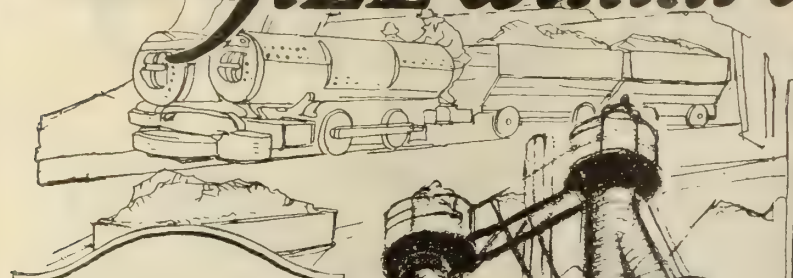
Walkerville, Ont.

From Ore to finished product —ALL within the Empire



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by reason of the magnitude of the operations of its constituent companies, is able to render a wholly unique service to the industrial organizations of the world—and of Canada in particular.

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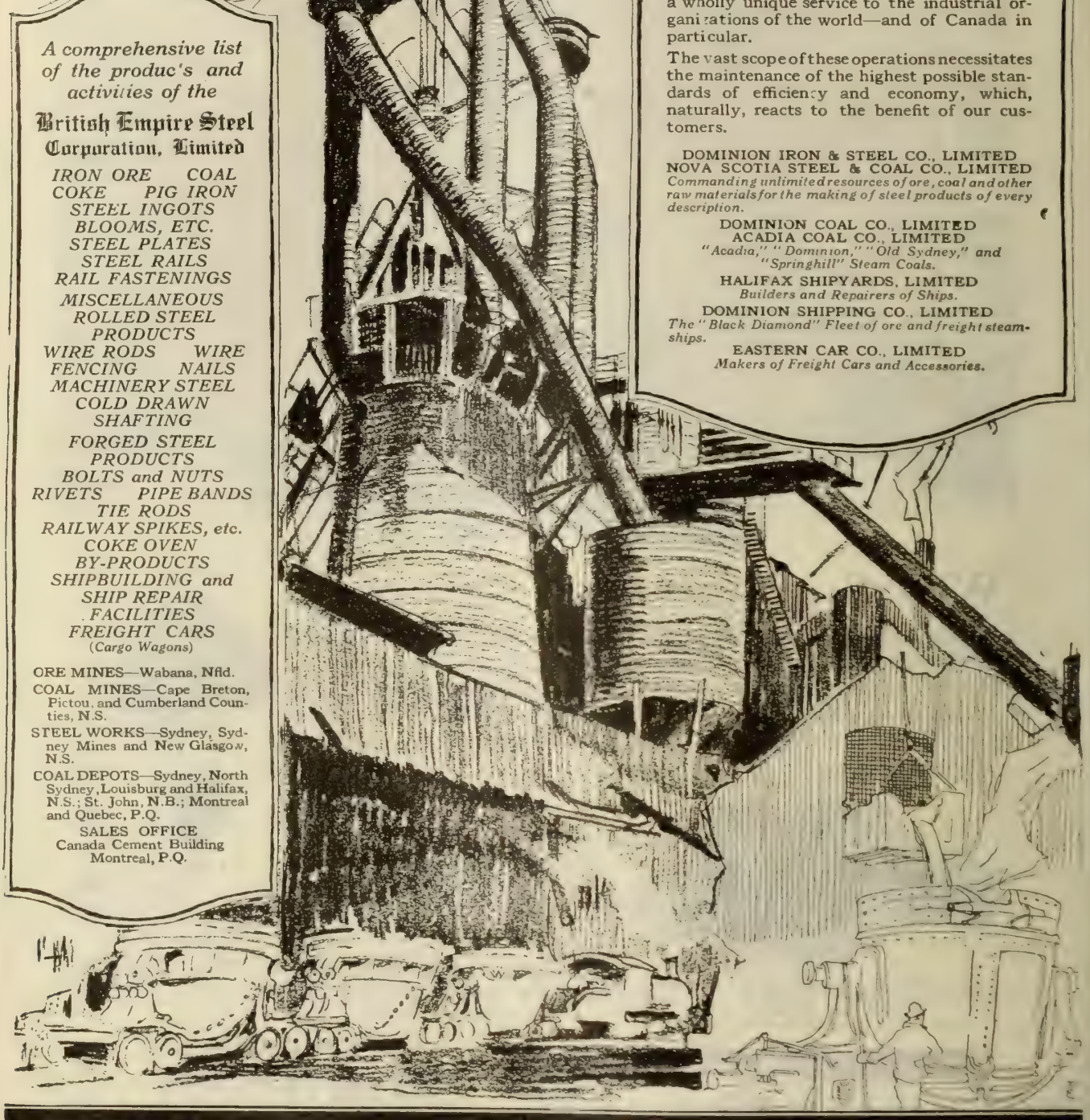

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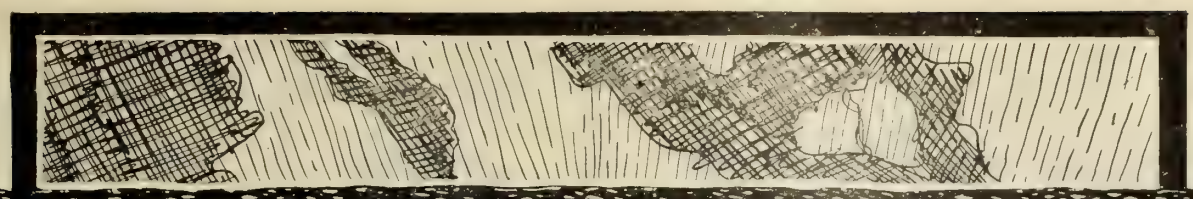

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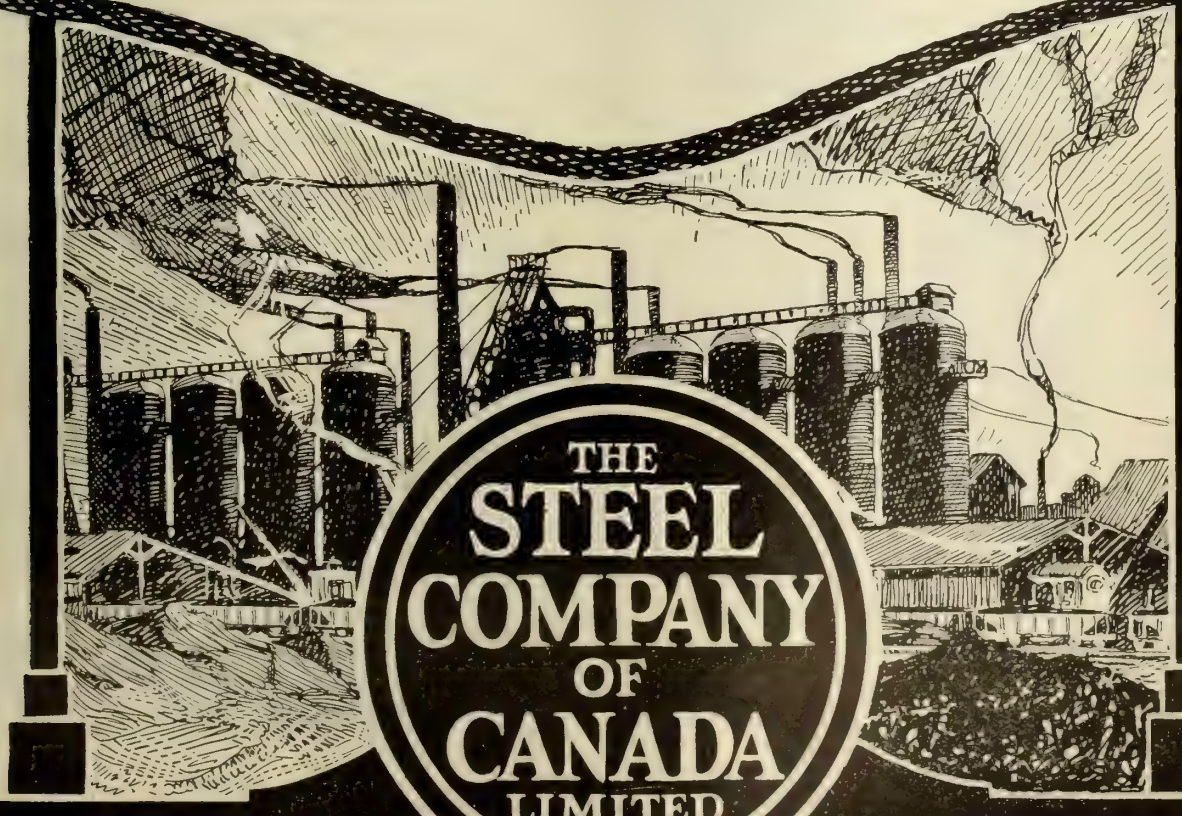

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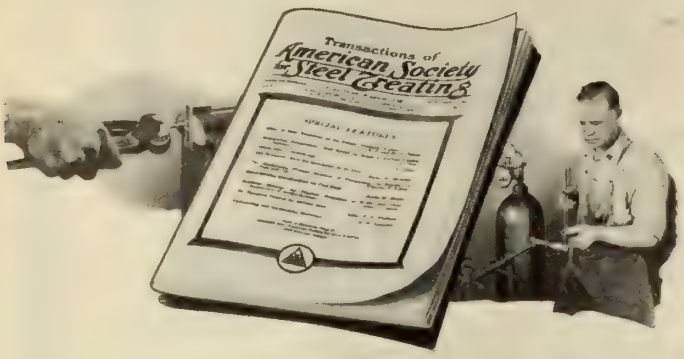

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From the Standpoint of The User*

"A pyrometer system arranged so that couples can be made up at the plant is probably more economical in operation than the one in which the couples can be purchased, must be purchased, completely assembled. The different parts, including the time of the operator to make up and check the new couples, do not cost nearly as much as new couples—and new couples must be checked also. The 'heads' can be used repeatedly and then, again, the couples can be shortened a few inches when the ends become burned off."

**From Trans. of Am. Soc'y for Steel Treating, August 1921. From Canadian Machinery, Vol. XXVIII, No. 16, October 1922.*

WHEN Mr. Armitage wrote the above he probably was thinking about Hoskins Chromel-Alumel couple alloys. We asked him his opinion about their accuracy and durability and he said: "Certainly the Chromel-Alumel Couple is accurate or we would not use it. As for durability, I personally think that the Chromel-Alumel couple will stand up in hard service longer than any other base metal couple that I have used."

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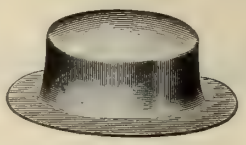

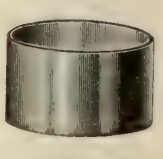

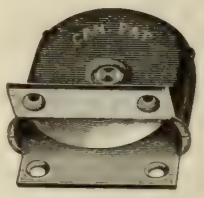

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Send us your blueprints or sample of parts. We will then let you know if it would be to your advantage to make a change. Reliable advice given promptly.

We not only make Sheet Metal Stampings, but Dies and Tools for completing such work.

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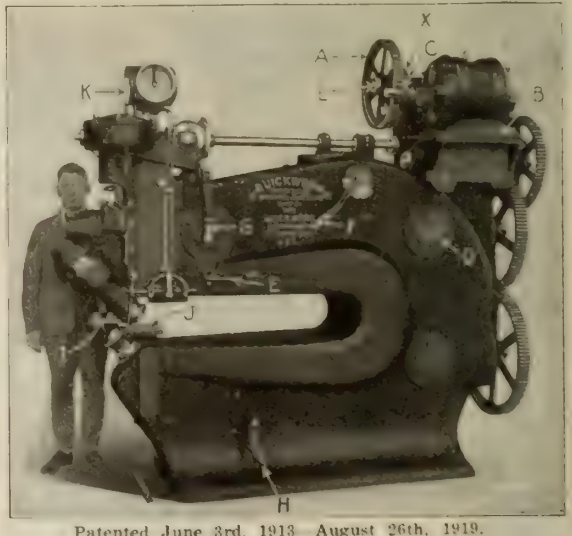

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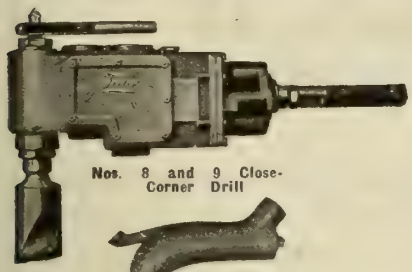

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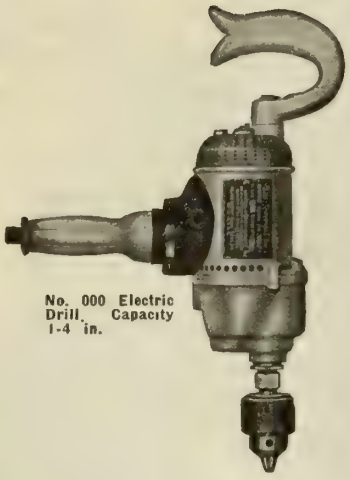

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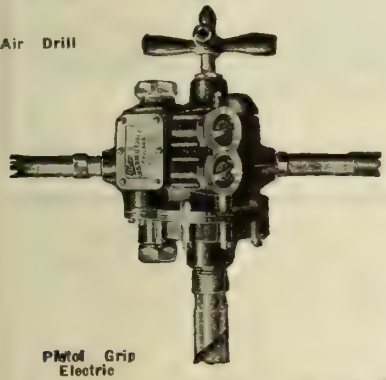

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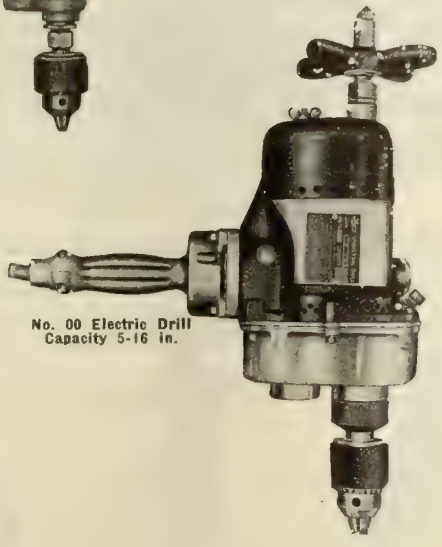

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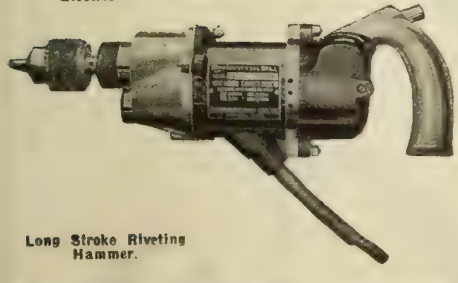
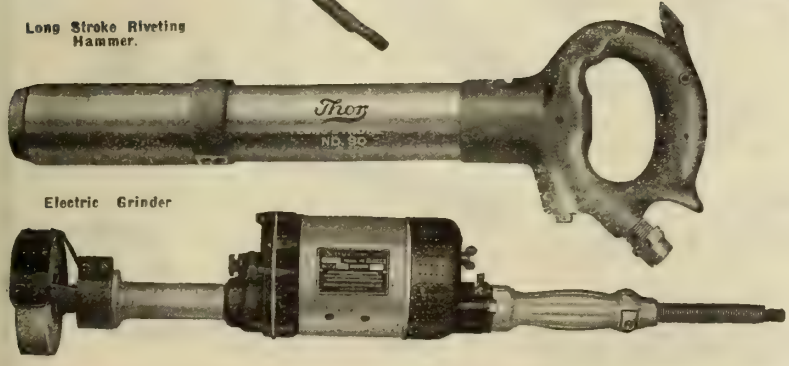


Pistol Grip Electric



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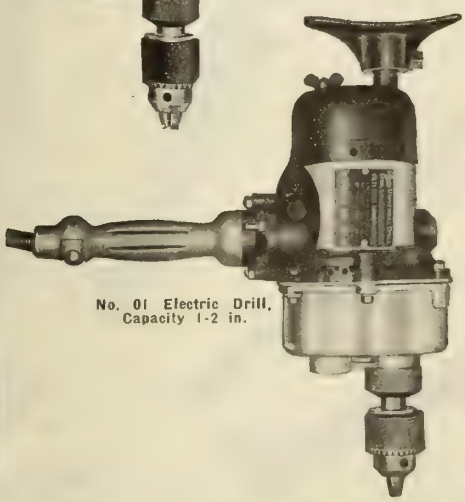

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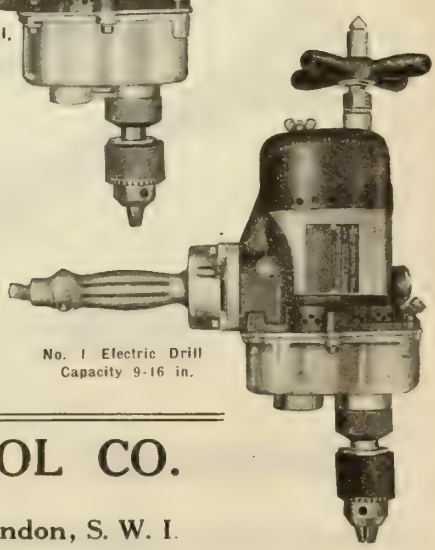

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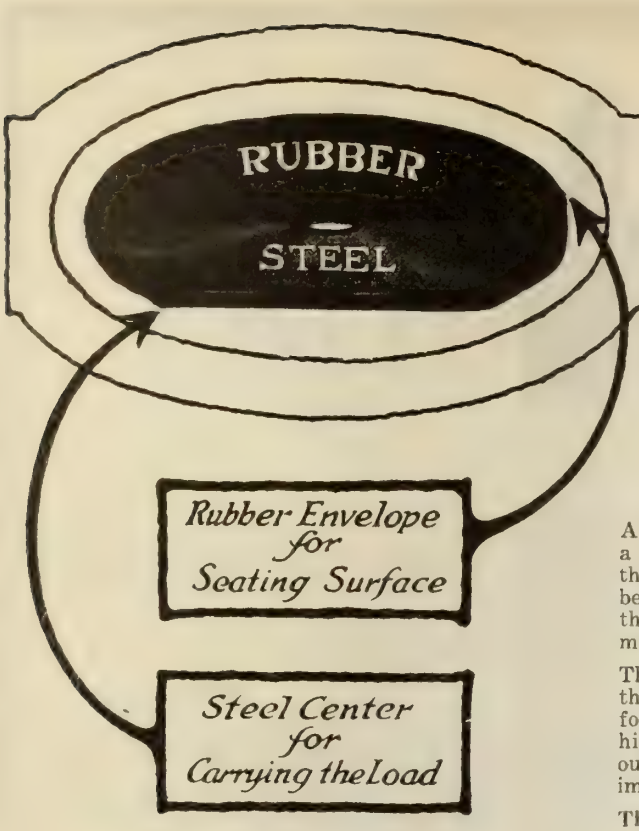

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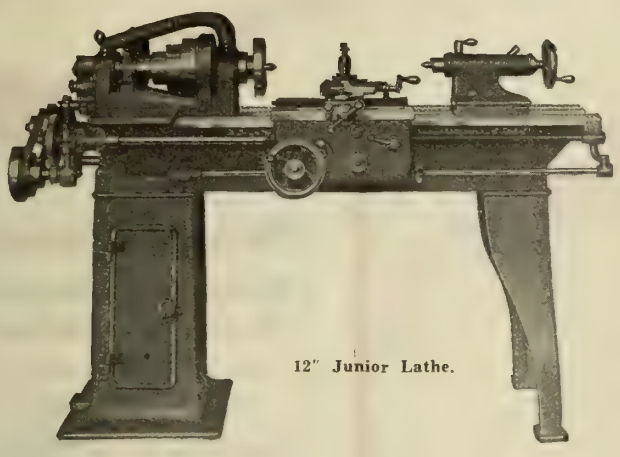

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For Light Manufacturing,
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Having what a Heavy Crank Shaper should have:—

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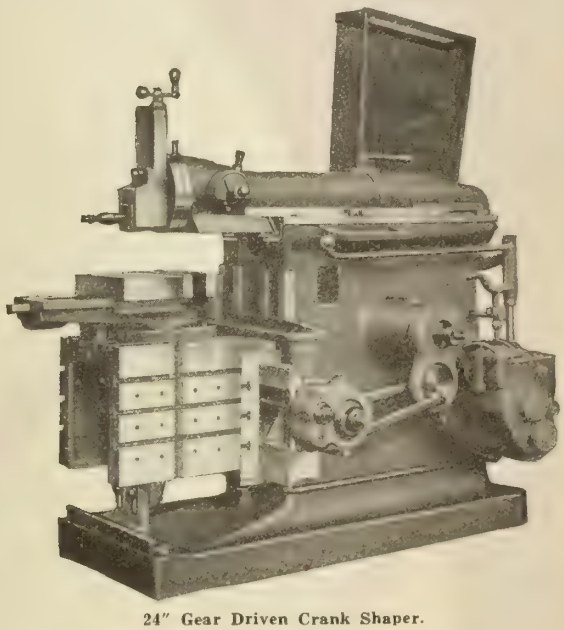
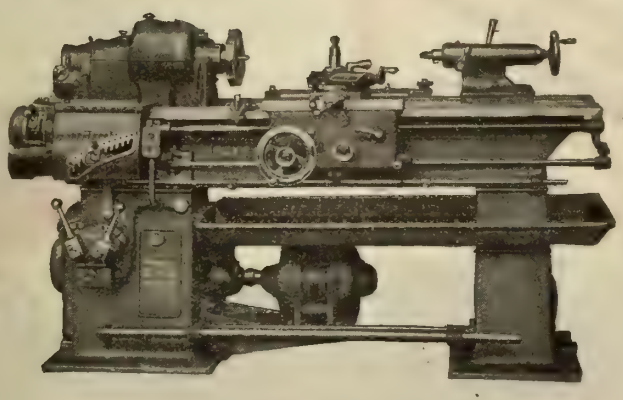


24" Gear Driven Crank Shaper.



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Ample power,
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Unit construction,
Enclosed belt drive to spindle with downward pull.

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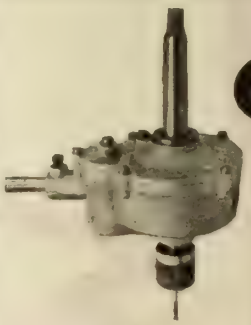

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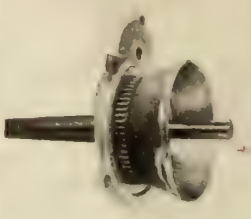

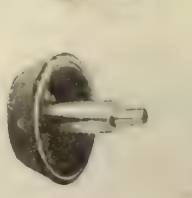

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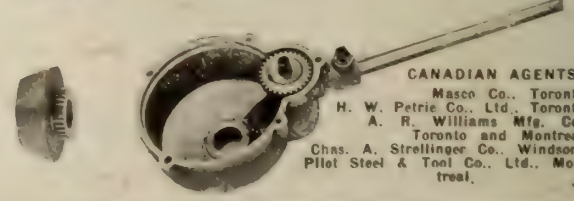
Eastern Tube & Tool Co., Inc.
594 Johnson Avenue, Brooklyn, N. Y.



CANADIAN AGENTS:
Masco Co., Toronto.
H. W. Petrie Co., Ltd., Toronto.
A. R. Williams Mfg. Co., Toronto and Montreal.
Chas. A. Strellinger Co., Windsor.
Pilot Steel & Tool Co., Ltd., Montreal.

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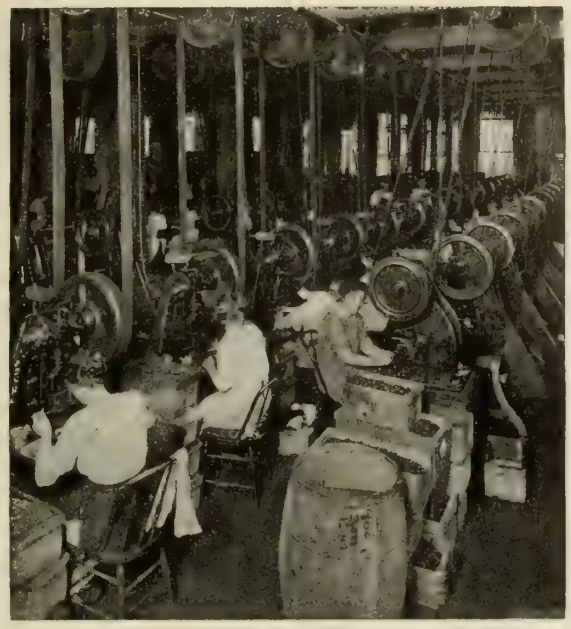
A Better Product at a Lower Cost —

The result of Bliss Presses in making Electric Fixtures



THIS BATTERY of BLISS Presses shown above means only one thing—that BLISS equipment has unquestionably earned its position as a primary production factor in this shop.

These BLISS Presses turn out electric light fixtures by the thousand, all accurate, uniform, interchangeable, and perfectly formed—at a cost far lower than by any other method.

Look over *your* list of sheet metal operations. You may consider that they are being done as economically as possible, but it's worth while consulting us to make sure.

Bliss for Machinery

E. W. BLISS CO. BROOKLYN N. Y., U. S. A.

Factories: BROOKLYN, N. Y. HASTINGS, MICH. CLEVELAND, O. SALEM, O.
Sales Offices: DETROIT CLEVELAND CHICAGO PITTSBURGH ST. LOUIS BUFFALO CINCINNATI NEW HAVEN ROCHESTER
Foreign Factories & Offices: LONDON, ENG. TURIN, ITALY PARIS, FRANCE

BLISS

No. 365

Some sheet metal products made by Bliss Presses

Agricultural Implements
Aluminum Ware
Armature Disks and Segments
Automobile Parts
Bicycle Parts
Bird Cages
Bottle Caps and Capsules
Brass Goods
Brittania Ware
Buckles
Burners
Butter Tins
Cash Registers
Cigarette Boxes
Clocks
Coal Hods
Collapsible Tubes
Cooking Utensils
Cornice Work
Cuspidors
Cutlery
Dental Instruments
Dinner Pails
Drip Pans
Door Knobs
Drop Forgings
Druggists' Tinware
Dust Pans
Electrical Goods
Elevator Buckets
Enamel Ware
Expanded Metal Lath
Fish Cans
Forks
Fruit Cans
Fry Pans
Furniture (Metal)
Gas Fixtures
Gas Ranges
Gun Parts
Hammers
Hardware
Harness Trimmings
Hinges
Horse Shoes
Jewelry
Kitchen Boilers
Kitchen Utensils
Lamps
Lanterns
Lard Pails
Locks
Match Boxes
Meat Cans
Medals
Metallic Ceilings
Metal Lath
Metal Radiators
Musical Instruments
Oil Cans
Oil Stoves
Perforated Metal
Paint Cans
Paint Tubes
Petroleum Cans
Pick-eyes
Pieced Tinware
Plated Ware
Playing Cards (Cutting)
Powder Kegs
Range Boilers
Range Parts
Reflectors
Refrigerators
Roofing
Satchel Frames
Silver Ware
Sheet Steel Sinks
Shingles (Metal)
Shovels
Spoons
Sheet Steel Stoves
Steel Barrels
Stove Trimmings
Tin Boxes and Cans
Tobacco Boxes
Toys
Trunk Trimmings
Typewriters
Vapor Stoves
Varnish Cans
Vegetable Cans
Water Coolers
Water Pails
Watches
Wash Tubs
Zinc Work

BLISS

Since 1857

BUSINESS ON THE

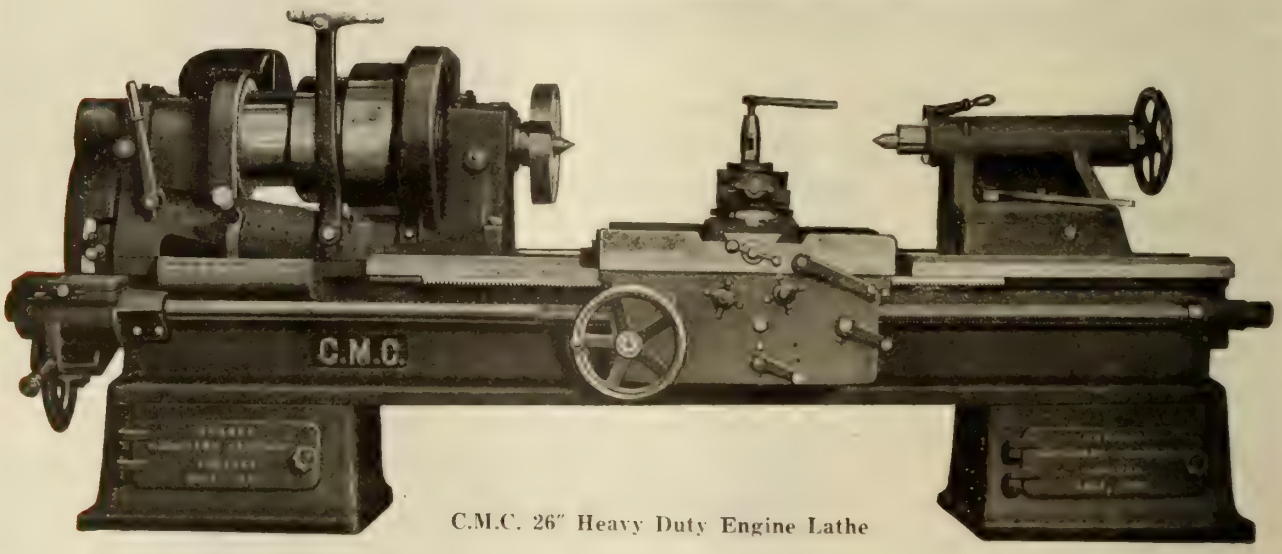
Business is coming back—not with any great momentum but a gradual improvement is evident. Inquiries are more numerous than for some time past which indicates a general revival in trade conditions.

If others are finding a need for more new equipment no doubt you will share in the coming activity. If so, we would ask you to bear in mind that we are prepared to serve you as heretofore and to furnish you with such machine tool requirements as may be called for.

C.M.C. Machine Tools are of the most modern design constructed from the highest grade material by skilled workmen. The three essentials that have made them the Standard of Quality.

We manufacture: ENGINE LATHES, GAP LATHES, BREAK LATHES, EXTENSION BED LATHES, RADIAL DRILLS, PLANERS, CRANK SHAPERS, TRAVERSING HEADSHAPERS, SLOTTERS, PUNCHES AND SHEARS.

If interested we would be pleased to send you one of our catalogs or furnish you with information on any machine in particular.



C.M.C. 26" Heavy Duty Engine Lathe

CANADA MACHINERY

GALT,

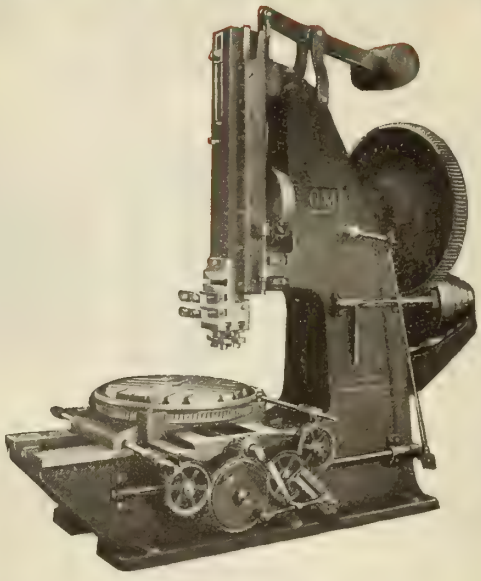
Toronto sales office

UPTURN

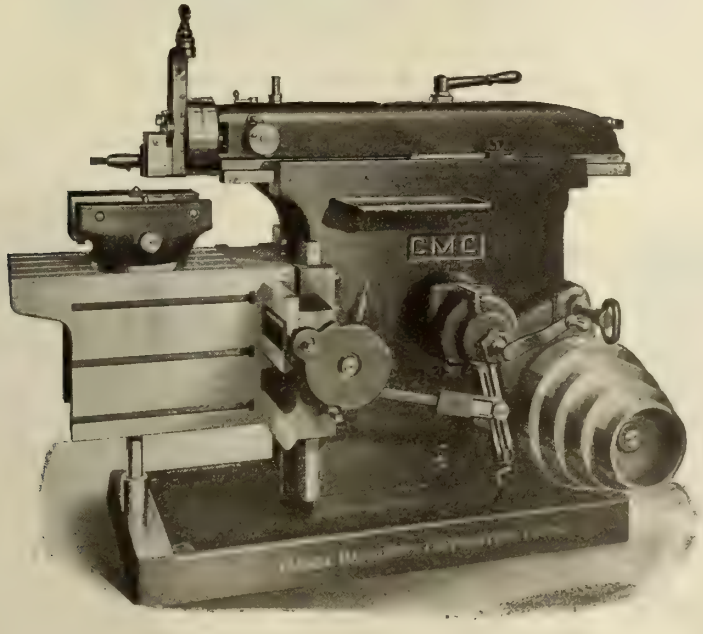
C.M.C.

A Guarantee

This registered trade mark appears on all machine tools for wood or iron-working manufactured by us and is a guarantee that the quality and workmanship are of the highest standard.



C.M.C. 18″ Slotter



C.M.C. 26″ Shaper

CORPORATION LIMITED

ONTARIO

721 Bank of Hamilton Bldg.

DENNISTEEL

Compartments for Lavatories and Showers

We cannot get ALL the orders – but all the orders we do fill are of a higher quality

Write for folders

THE DENNIS WIRE AND IRON WORKS CO. LIMITED
LONDON CANADA

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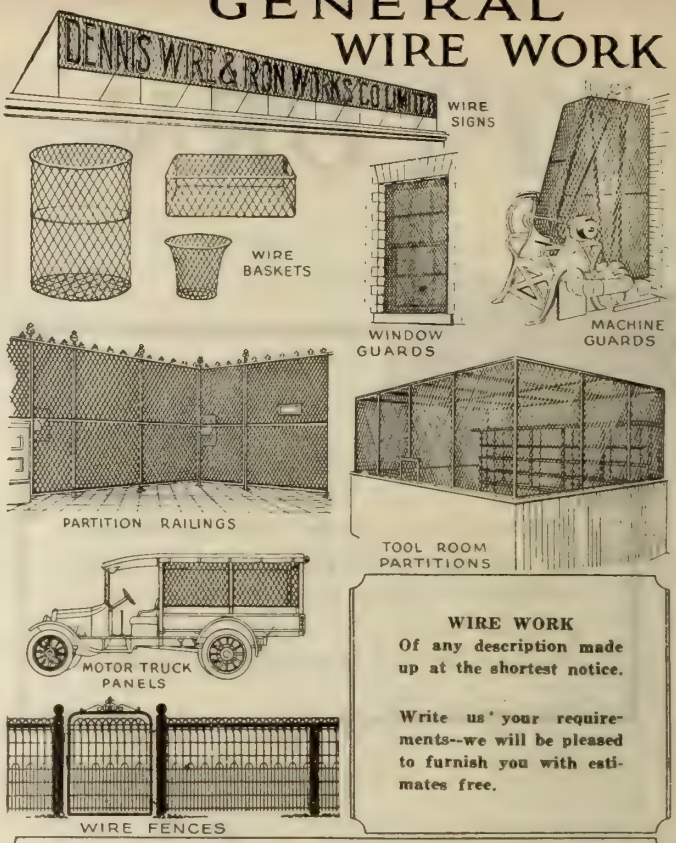

WIRE WORK
Of any description made up at the shortest notice.

Write us your requirements--we will be pleased to furnish you with estimates free.

THE DENNIS WIRE AND IRON WORKS CO. LIMITED
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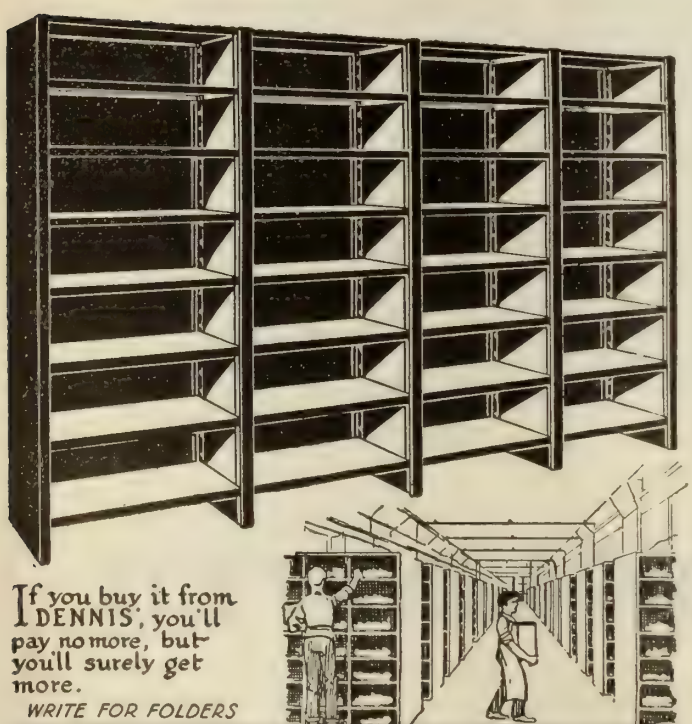

If you buy it from DENNIS', you'll pay no more, but you'll surely get more.

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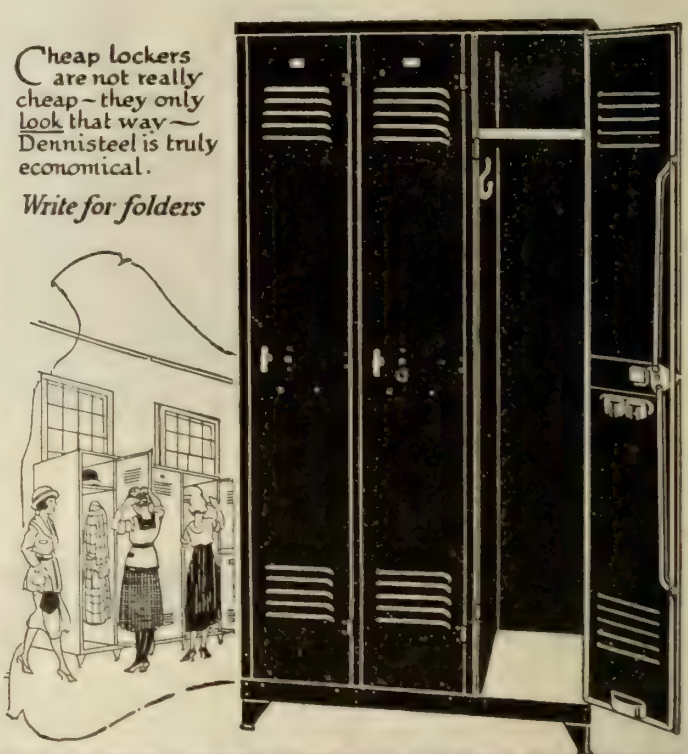
DENNISTEEL
Steel Shelving

THE DENNIS WIRE AND IRON WORKS CO. LIMITED
LONDON CANADA

Cheap lockers are not really cheap – they only look that way – Dennisteel is truly economical.

Write for folders



DENNISTEEL
LOCKERS

THE DENNIS WIRE AND IRON WORKS CO. LIMITED
LONDON CANADA

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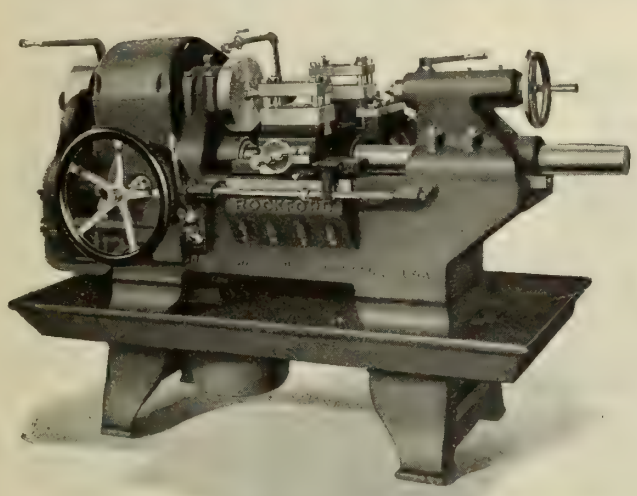
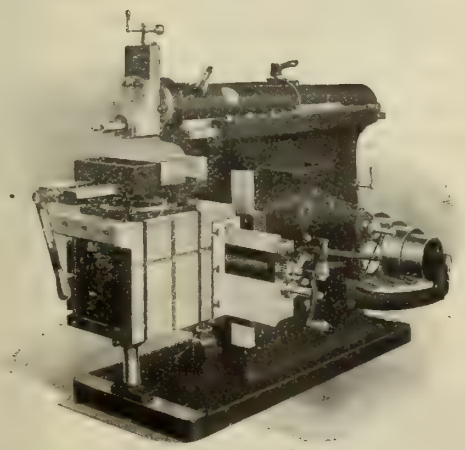
ROCKFORD
AUTOMATIC LATHE



No matter how efficient your plans there is a point beyond which out-of-date equipment cannot go. The only way to insure the highest production and the lowest cost is to pick machine tools which will give you the utmost return from your investment.

The ROCKFORD Automatic lathe has the weight massed in the important places thereby giving necessary rigidity that must back up multiple tools turning and facing steel forgings or iron castings. It provides an even steady drive to the front and rear tools, absorbing vibration under the heaviest cuts. An anchored support directly below rear cutting tools. The headstock is all helical gear drive, running in a bath of oil. Heat treated speed gears. Lathe accommodates work 18″ between centers, and has a swing of 14″ over carriage bar and 10½″ over cross carriage. Net weight 4,000 lbs. Conservative production estimates given upon request.

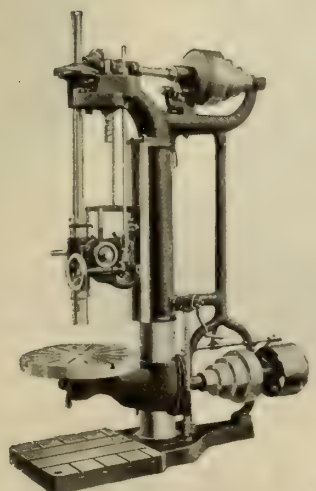


24″ Back Geared Shaper

OTHER ROCKFORD PRODUCTS

ROCKFORD PLANERS are heavy, powerful tools specially designed and constructed to meet the severe conditions which the extensive use of high speed steel has created. They are designed for rigidity, durability, convenience of operation and adaptability for all classes of work. It will pay you to investigate the many features of this planer.

ROCKFORD SHAPERS. If you are looking for a machine which is always on the job and equal to anything you wish to do, investigate the Rockford Shaper. It is powerful, rigid, accurate and convenient to handle and has a range of cutting speeds and feeds that adapt it to all classes of work.



32″ Sliding Head Drill

ROCKFORD "MECHANICS' " DRILLS. The efficiency of these drills is best appreciated by their many users. Sizes range from 14″ to 36″ and all sizes are provided with adjustment for taking up wear on spindle sleeve; have four step cone pulleys; improved enclosed back gears and a correctly cut crown gear and pinion. Positive geared feeds are instantly available and can be changed while machine is running.

Let us send you a catalogue

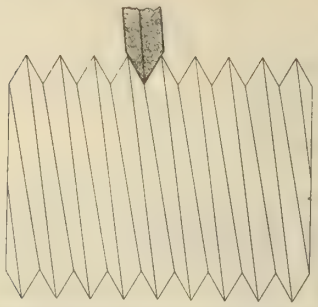
ROCKFORD MACHINE TOOL CO.

2500 Kishwaukee Street
ROCKFORD, ILL.

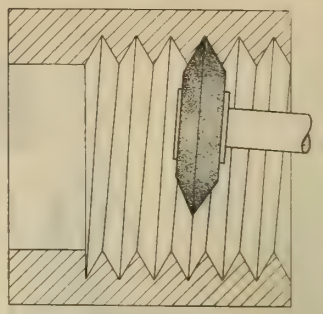
VERSATILITY

The Multi-graduated Precision Grinder Qualifies

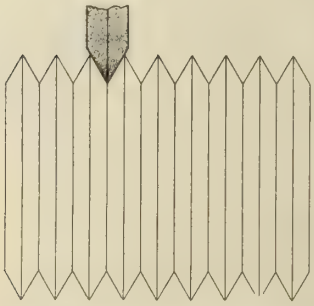
These four examples outline some of the possibilities for improving threading service by means of this unique mechanism.



Showing the external grinding of threads—whether on gages lathe spindles or in any other place where precision threads are required.

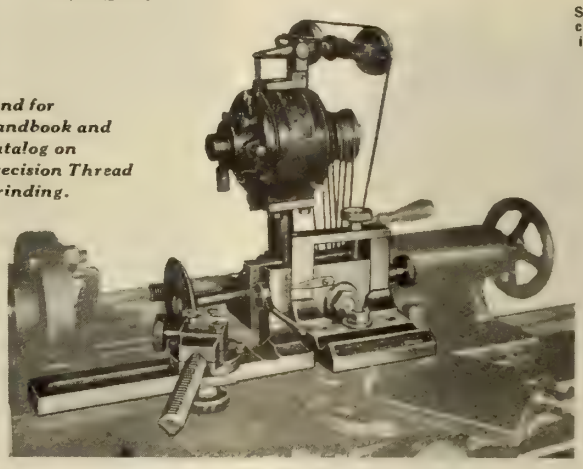


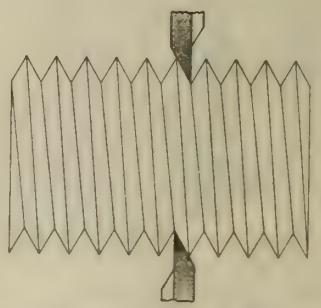
Showing the internal grinding of threads—a difficult operation without a Multi-Graduated Precision Grinder.



Showing the grinding of annular grooves such as are used on thread milling hobs.

Send for Handbook and Catalog on Precision Thread Grinding.





Showing the manner in which the Duplex Multi-Graduated Precision Grinder operates on production thread grinding—thread grinding reduced to a production basis.

Precision & Thread Grinder Manufacturing Company

MFG. PLANT AND OFFICES: 1 SOUTH 21st STREET PHILADELPHIA, PA.

Makers of the World's Most Complete Thread Grinding Apparatus—The Multi-graduated Thread Grinder—Thread Lead Variator and Permanent Alignment Wheel Trueing Heads.

CANADIAN AGENTS

The A. R. Williams Machinery Co., Ltd., Toronto, Vancouver, Winnipeg, Halifax, Nova Scotia, St. John, N.B.

BUCKTON TOOLS

PLANING MACHINES up to 16 ft. wide, any length.

PLANO-MILLING MACHINES.

VERTICAL and HORIZONTAL PLANERS up to 35 ft. long × 20 ft. high.

PLATE EDGE PLANERS up to 45 ft. long.

LATHES to swing from 30 in. to 16 ft. dia., any length.

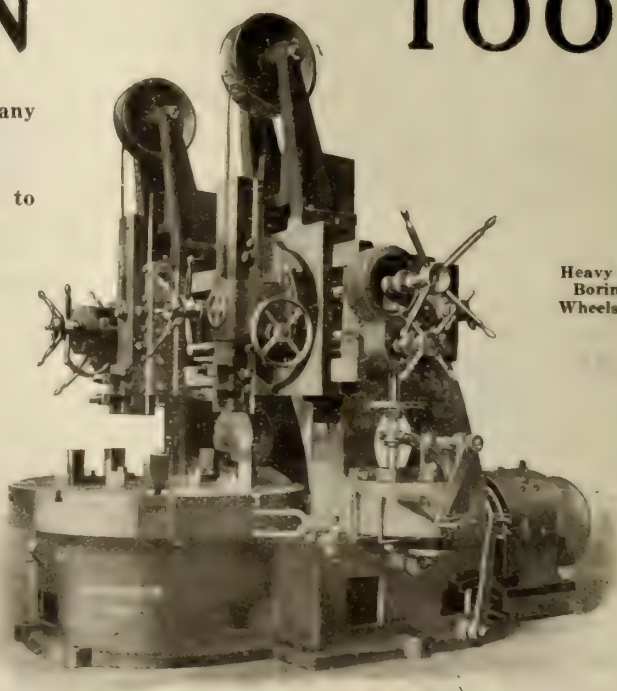
BORING and TURNING MILLS, 5 ft. to 30 ft. diameter.

SLOTTING MACHINES, 12 in. to 60 in. stroke.

SHEARING MACHINES up to the largest sizes of Plates, Blooms, or Bars.

BORING MACHINES, all sizes.

TESTING MACHINES, for Tension, Compression, Deflection, Torsion, and Shearing Tests.



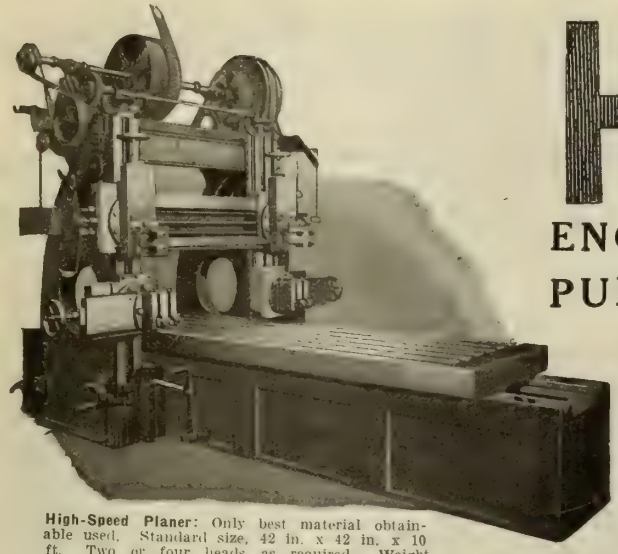
Heavy Turning and Boring Mill for Wheels and Tyres.

Special Machine Tools For Turbine Locomotive and Marine Engine Builders Steel Works and Forges

Joshua Buckton & Co., Ltd., Well House Foundry, Leeds, England

ESTABLISHED 1843. INCORPORATED 1886

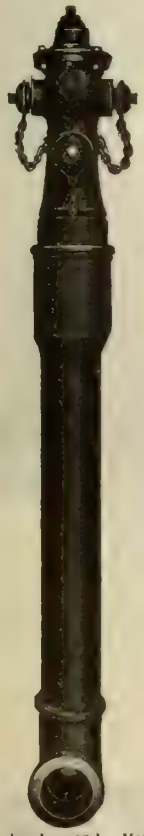
Cable Address—"BUCKTONS, LEEDS." Codes:—A.B.C., 4th & 5th Edition. A. 1, New Business, Bentley's Complete Phrase.



High-Speed Planer: Only best material obtainable used. Standard size, 42 in. x 42 in. x 10 ft. Two or four heads as required. Weight 22,000 lbs.

HEPBURN

ENGINES—PLANERS—PRESSES PUMPS—CRANES—DERRICKS WINCHES—CUT GEARS—SPINNING LATHES—GREY IRON CASTINGS—VALVES—HYDRANTS—Etc.



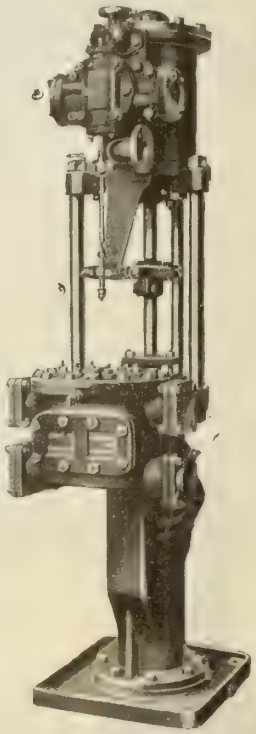
Hydrants and Valves: built to specification

These are but a few products of the HEPBURN shops.

A powerfully constructed POWER PRESS designed for long and hard service. Cranks are made from solid forgings. Long strokes. Exceptionally good finish.

Up-to-the-minute in design, made of carefully selected material and built by workmen who are experts in their line, Hepburn products are appreciated throughout Canada for their top-notch quality and reliability even under adverse circumstances. Tell us your requirements and we will send you some interesting particulars.

Hepburn Centrifugal Pumps for all services. They are of the most modern design and embody many excellent features.



Hepburn Special Vertical Ram Feed Pump: A high pressure type with only one gland to require packing. Operates with positive Lever Valve Motion. Minimum floor space required.

HEPBURN SCOTCH DERRICKS

For Hand and Power, from 1-2 Ton to 8 Ton capacity

JOHN T. HEPBURN, LTD.

Engineers and Iron Founders

18-60 Van Horne St., Toronto

Dickow's NEW IMPROVED Index Centres

The Highest Degree of Accuracy Guaranteed in Every Respect

In our many years of experience and specializing on Index Centres, we have developed many special machines, fixtures and testing tools for making Index Centres with the highest degree of accuracy obtainable.

The Index Centres are Dickow's original design, which were designed for heavy and very accurate milling, simple in construction, convenient and durable.

Some of our Accuracy Tests of this 10-Inch Universal

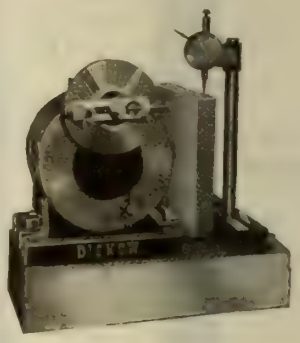


Fig. 4

Figure 4 shows the method used in testing the accuracy of the worm gear in every tooth, by which we are able to get a very accurate test of every tooth, and the accumulative error reading to .0001. The accumulative error allowed in spacing of the entire circumference of the worm gear is .0005; the average is .00025.

Fig. 5

Figure 5 shows the testing of tail stock center parallel alignment with sides of tail stock block; error allowed, .0002.

Figure 6 shows testing of spindle alignment with base, spindle alignment with T slot. Spindle alignment with base error allowed .00025, using 16 inch test bar. Spindle alignment with T slot error allowed .00075, using 16 inch test bar. Spindle test error allowed .0005 at the end of 16 inch test bar. The average ones are perfect.

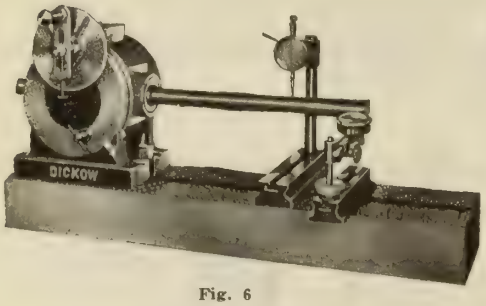


Fig. 6

Figure 7 shows testing of alignments of tail stock centre with head centre, using 12 inch test bar. Error allowed, .0005; most are perfect.

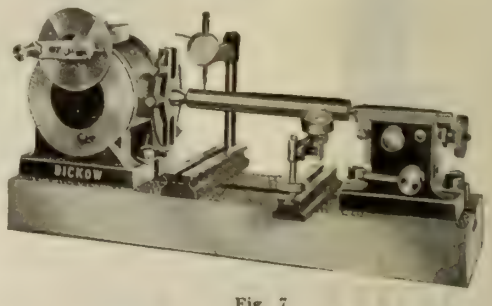


Fig. 7

DEALERS NOTE—Dickow's New Improved Ten Inch Universal Index Centres have been reduced to rock-bottom price. Dealers guaranteed against any further decline for a period of six months.

FRED. C. DICKOW MACHINERY CO.

2105 W. LAKE STREET **CHICAGO, U.S.A.**

If interested tear out this page and place with letters to be answered.

Types of "Illinois" Formed Cutters

MANUFACTURED IN CANADA

Illustrated above are some of the various types of formed cutters we manufacture. Materials and workmanship are of the very highest grade and every cutter is absolutely guaranteed to be accurate and thoroughly dependable in every respect. No matter what types of cutters you need, we have the facilities and the experience to produce just exactly what you require.

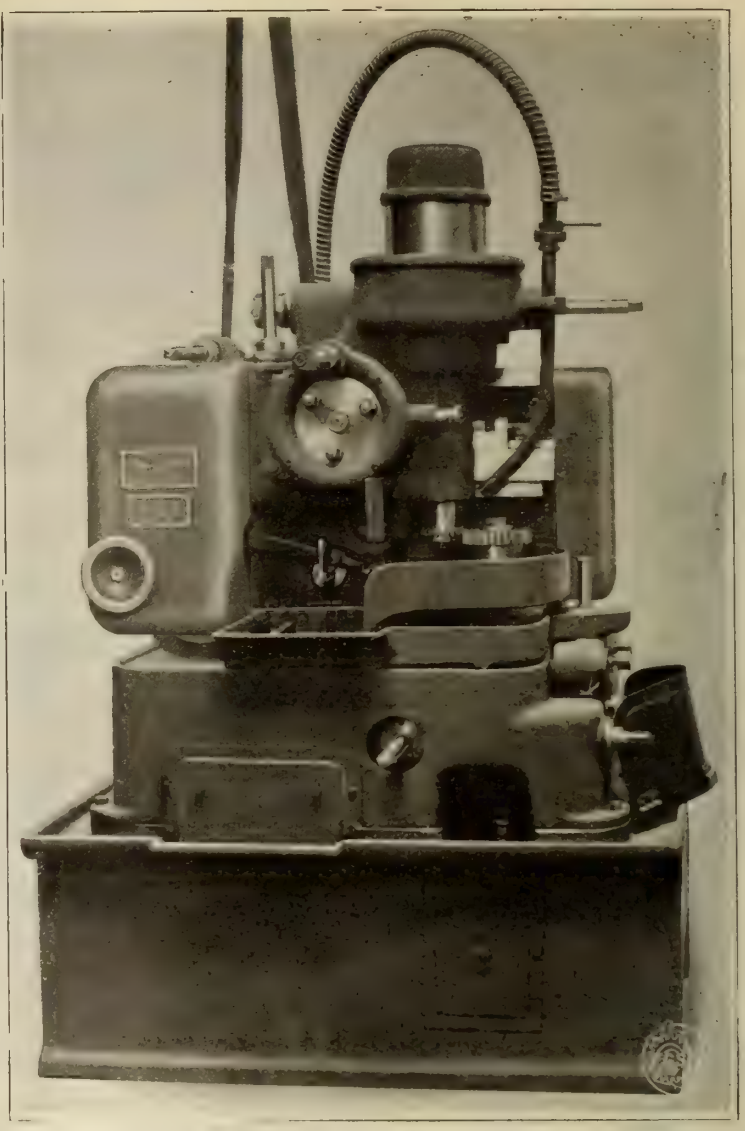
Canada Illinois Tools Limited

187 Dufferin Street - - Toronto, Canada

Designers and Manufacturers of HOBS—CUTTERS—REAMERS

What Users of The New High-Speed Gear Shaper are Saying—

"Just the Machine I have been Looking for."



The New High-Speed Gear Shaper—the Machine You Are Looking For

When this Works Manager was asked to express his opinion on the new High-Speed Gear Shaper, he used the words quoted.

He went on further to say that this machine had cut their costs on various parts, the savings resulting in some cases being beyond his wildest expectations.

The first machine has been followed by a battery of ten machines.

It is results that count.

Write for catalog describing this machine.

The Fellows Gear Shaper Company

Springfield, Vermont, U.S.A.

FOREIGN AGENTS: Alfred Herbert, Ltd., Coventry, England; Societe Anonyme Alfred Herbert, Paris, France; Societa Anonima Italiana Alfred Herbert, Milan, Italy; Alfred Herbert, Ltd., Yokohama, Japan; Societe Anonyme Belge Alfred Herbert, Brussels, Belgium; Alfred Herbert (India) Ltd., Head Office Calcutta, India; J. Kamenicek & Co. Prague, Czecho-Slovakia; Bohm & Bormann, Berlin, Germany; Werkzeug-Und Maschinenfabrik A. G. Wemag, Wien, Austria. **PACIFIC COAST REPRESENTATIVES:** Eccles & Smith Company, Portland Oregon Seattle, Washington, San Francisco and Los Angeles, California

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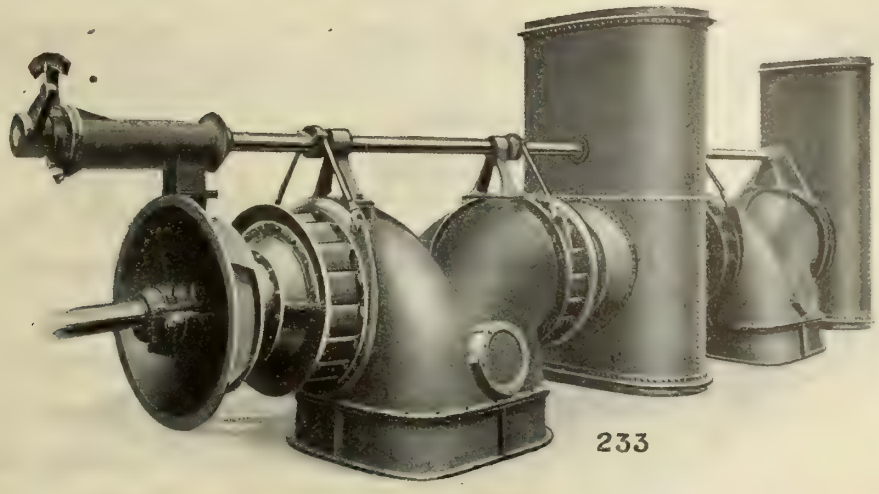
KENNEDY



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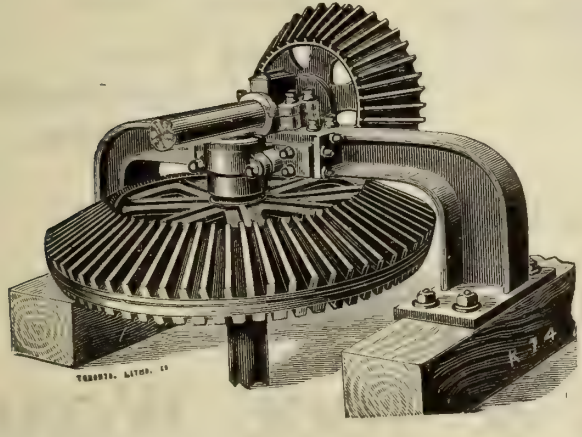
Equipment for all requirements—Hydraulic Turbines, Stoplog and Headgate Winches, Hoists, etc. Large supply of repair parts always in stock. Special machinery built to engineers' drawings and specifications.



TRANSMISSION MACHINERY

We have the largest stock of patterns in Canada for gears, pulleys, bearings and bridgetrees.

CASTINGS

Sound, clean castings in malleable iron, grey iron, steel, aluminum, brass and bronze. Fully equipped machine shops.

The Wm. Kennedy & Sons LIMITED

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SHEET METAL WORKING MACHINERY

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Inclinable
Horn
Side Seaming
Punching
Arch
Straight Sided
Double Crank
Trimming
Riveting
Reducing
Toggle
Double Action Cam
Straight Line Bending
Foot
Screw
Power Punches
Sprue Cutters
Gang Punches

SHEARS

Foot Squaring
Power Squaring
Circle
Ring and Circle
Slitting
Circle and Flanging
Curve

SPECIAL EQUIPMENTS

We make special Machines and arrangements of our regular and special machines for the manufacture of a large number of sheet metal products.

TINNERS' TOOLS

Folders
Brakes
Bench Machines
Crimpers
Beaders
Groovers
Seamers
Forming Rolls
Stakes
Snips
Bench Shears
Lever Punches
Lever Shears
Roofing Tools
Gutter Beaders
Slaters' Tools
Hand Tools
Stove Pipe Machines
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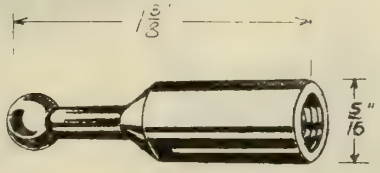

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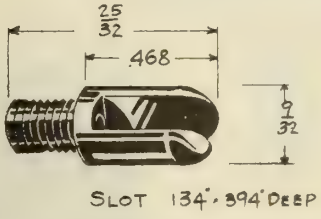

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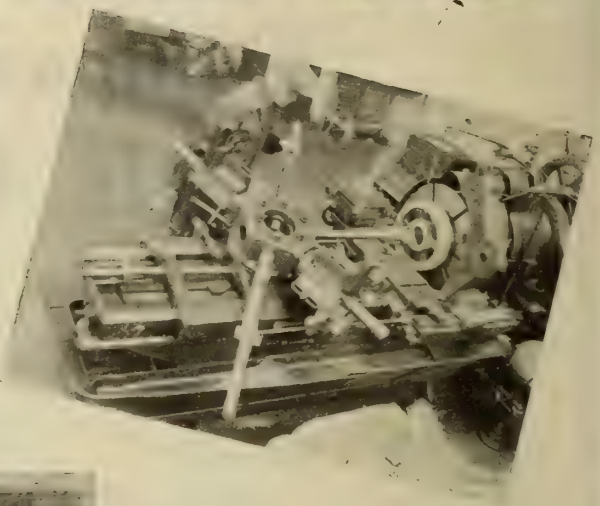

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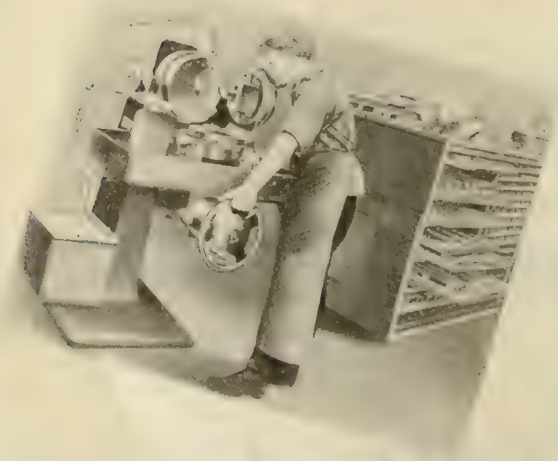

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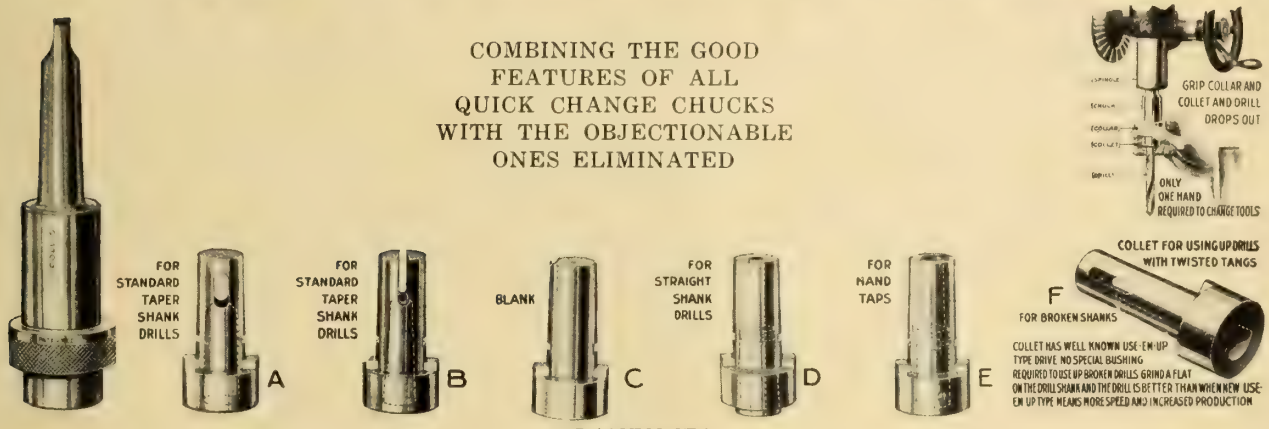

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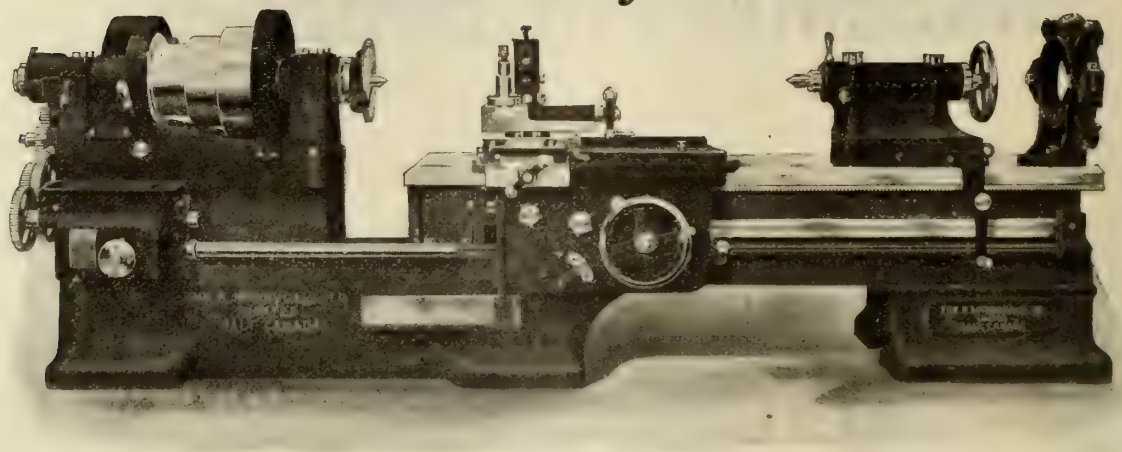

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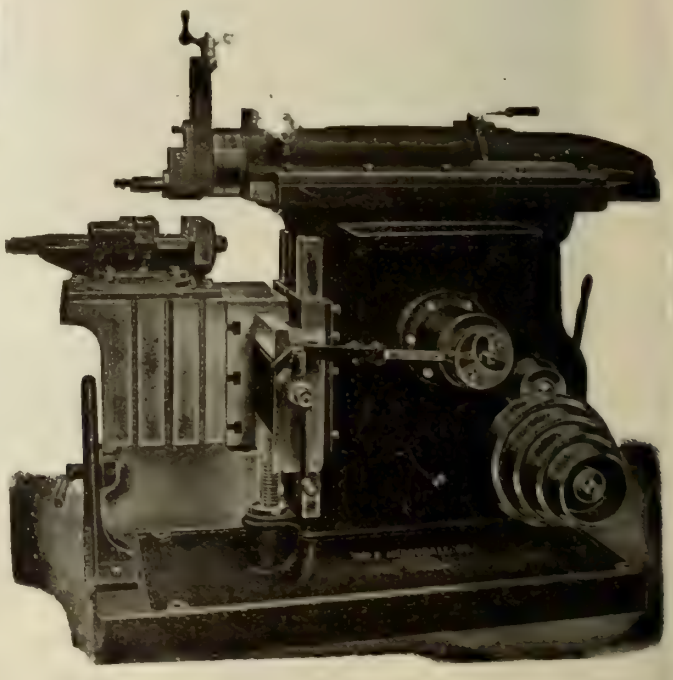

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CANADIAN MACHINERY
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MANUFACTURING NEWS

VOL. NO. XXVIII No. 26 DECEMBER 28, 1922

Opportunity — Responsibility

IT HAS been stated that the difference between opportunity and responsibility is that the latter is aggressive and always present, while the former is passive and on best terms with those who invite its acquaintance. Recognition of the one, however, leads with confidence and courage, to development of the other.

Canada, as a nation, is assuming increasingly important world position. Rich endowment in a nation, as in an individual, should be a relative condition, finding its best expression in breadth of contact. It entails an interpretive vision and its proper development requires untiring industry, and a poise that will correctly reflect national status and aspiration.

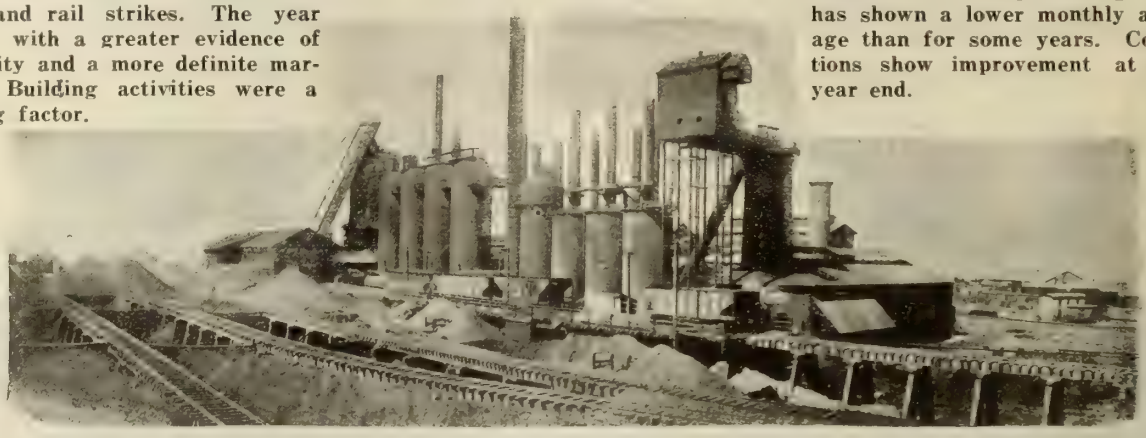
Canadian industry is on the threshold of another year. Looking backward, the fact that stands out is that the past twelve-month has demanded, in many instances, the most of courage and the best of every resource. In the iron and steel and machinery industries, results have not been lacking, although production and sales have not been altogether comparable with some records in recent years. These, for the most part, had behind them the impetus created by unusual circumstance. The task of the present has to do with normal growth. Much that has a relative bearing is a trifle out of tune, but there must be a response to well applied effort.

Though imbued with immense responsibility, the new year will be richly endowed with opportunity. An attitude that brings the two into proper alignment is necessary to an optimistic outlook. May the year warrant the fullest confidence, and brings a full measure of prosperity.

Progress in Steel Industry

Pig iron and steel prices during 1922 were influenced upward by coal and rail strikes. The year closes with a greater evidence of stability and a more definite market. Building activities were a strong factor.

Typical Blast Furnace



Total production of pig iron, steel ingots and castings during 1922 has shown a lower monthly average than for some years. Conditions show improvement at the year end.

Iron and Steel Strong Base for Industrial Growth

Year Closes With Reason for Optimism Because of Industry's Past Record—Inspiration From 1920—All Divisions Made Great Showing—Outlook Encouraging—Some Interesting Comparisons

HOW CLOSELY iron and steel are associated with the great industrial fabric of the country, and the extent to which they contribute to general prosperity, may best be ascertained by a review of their different divisions. When it is stated that the maximum year from the viewpoint of production was 1918, with a total value of $789,000,000, the significance of the fact is affected in that these figures represented abnormal war conditions. However, it did set a new record for the country's capacity production. Then came 1919, notable because it brought with it what was referred to as a "relaxation of the sinews of war," or a reduction in values of $300,000,000.

In 1920, regarded as the banner year — one worthy of the industrial aspirations of 1923 — the country devoted itself to rehabilitation, iron and steel production again reached a level of $640,000,000. It was in this year that work in car shops reached a value of $75,000,000, a figure which indicates what this field of activity must mean to business in general. Toward the end of 1920 a depression set in which continued during 1921 and well into 1922, for many of the divisions making up the whole. The three years referred to from what has been called the "return-to-normalcy cycle," made up of, first, a sharp break, then a strong recovery and finally a decline to very low levels in production with high cost averages. The end of 1922 brings every indication that the chart will reveal steadily climbing tendencies.

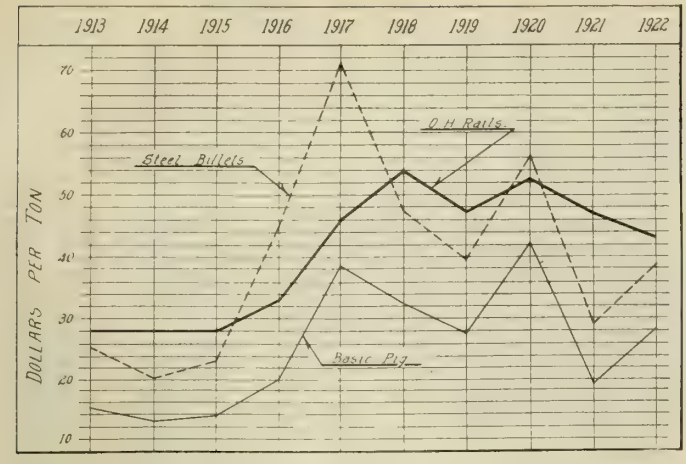
How have wage-earners been effected in the period under review? Employment statistics show the number engaged in iron and steel in 1918 to have averaged 128,125; in 1919, this declined to 88,300; 1920 saw an increase to 102,661. Taking 100 as a base, 1920 averaged 104 per cent.; 1921 declined to 76.6, while the first four months of 1922 saw an index of 68.1 with a minimum of 64.5 in January. There has been steady improvement in employment during the year. Of the amount paid in wages and salaries in 1920, a total of $158,504,947, the wage-earners received 83.8 per cent.

An interesting fact is revealed by official statistics in that the year 1870 is credited with 4,000 establishments in the iron and steel series. This, of course, included a large number of very small shops. The total number employed was 27,666; the wages amounted to $5,119,414, and the value of products, $28,158,189. Compare this with 1920, confining the compilation to 1,475 establishments, the average number of wage earners was 102,661; wages, $132,885,132, and products valued at $640,233,785, or practically thirty times greater than the record of fifty years ago, although the number of wage earners employed was hardly five times as great. Every period has its standards of industrial production, and there is here an interesting commentary upon the development that has taken place in machine tools and equipment for facilitating business.

Machinery Production Develops

Of the iron and steel commodities produced in Canada, the figures pertaining to 1920 are particularly interesting. This year, let it be understood, is regarded as a standard representing industry on the whole as functioning at its best. Production of machinery by, and to serve, important industries was valued as follows:

Autos, passenger No. 83,974	$80,558,204
Autos, freight, No. 10,174	8,153,517
Bicycles, No. 34,418	1,484,833
Railway cars, No. 5,174	21,947,175
Car and locomotive repairs performed by entire car and repair works	85,903,830
Pig iron production, net tons $1,000,396, value	27,912,147
Castings, net tons, $67,285, value	12,918,000
Blooms, billets, slabs, net tons 737,720, value	15,781,687
Pulp and paper	4,739,763
Mining and engineering	1,191,336
Saw and shingle mill	1,175,031
Special	1,948,258
Transmission	1,542,466
Woodworking	1,305,896
Sewing machines, No. 72,949	2,553,072
Scales, No. 22,489	1,739,468
Elevators, No. 542	1,101,979



Price trend on steel billets, open hearth rails and basic pig iron for period 1913—1922.

Price trend on galvanized sheets, tank plates, and steel bars during period 1913—1922.

Value of imports of iron and its products from 1917 to 1921 averaged $16,861,596, while the first six months of 1922 was 67.65 of the five-year average. The highest import value during the present year was in May when it reached $12,803,074.

According to compilations by the Employment Service of Canada, the average monthly employment in 1920 was indexed at 104 per cent. In 1920 this fell to 76.6, while the monthly average for the first six months of 1922 was 68.1 per cent. There was an increase in employees engaged in May over those of January, the former being 109,329, with 734 firms, and the latter 100,294, with 700 firms.

In the metal and engineering group the aggregate duration in man days of all strikes and lockouts averaged as follows: 1918, 10,571 days; 1919, 52,442 days; 1920, 29,108 days; 1921, 5,471 days; average four years, 24,398 days; Jan., 1922, 4,357 days.

Primary power employed by the iron and steel trade in 1920, according to Dominion Bureau of Statistics, was 266,454 horse power. Rented electric power was 55.4 per cent. of total elementary power. Capacity of operating plants was 28,864 units with a rating of 301,265 horse power. Boiler capacity of operating plants was 773 units, with a rating of 125,285 boiler horse power. Power actually used during the year was 98,615 horse power. Blast furnaces and steel mills, with an equipment of 249 boilers, rated at 60,036 horse power, led all other groups in this respect. The foundry and machine shop group came second with 126 boilers rated at 10,369 horse power. Fuel requirements of iron and steel trades amounted to 1,386,032 tons of bituminous, valued at $9,753,156. This was 53.2 per cent. of the total fuel cost. The chief remaining items listed in order of value were fuel oil, 20.2 per cent., coke, 12.5 per cent. and hard coal 6.1 per cent.

Total capital employed in foundries and machine shops amounted to $68,346,628 for 581 plants; boilers and engines, $32,662,552 for 55 plants; machinery, $52,066,936 for 156 plants; agricultural implements, $110,868,713 for 99 plants, and hardware and tools, $32,798,513 for 152 plants. The cost of materials entering into the operations of all plants engaged in iron and steel and products in 1920 was $321,298,396; value of products was $640,233,785.

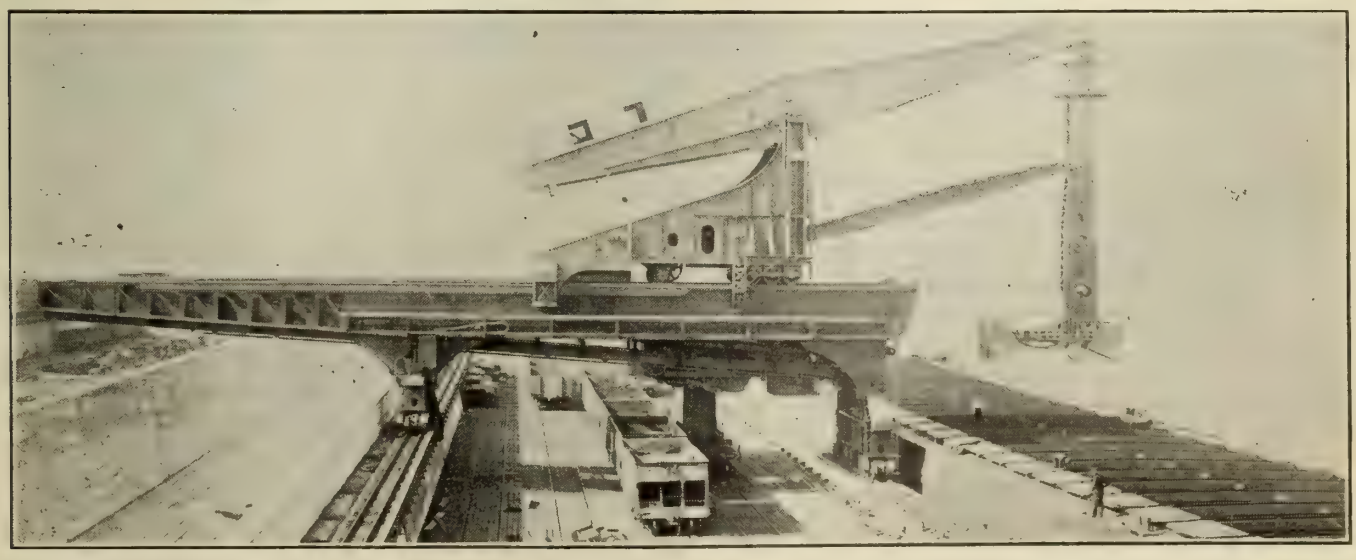
Leading Position of Ontario

Ontario leads other provinces in the manufacture of iron and its products. Of the total amount of $642,904,322, 65.9 per cent. was invested in Ontario, while 61.8 per cent. of unemployment and 66.3 per cent. of production is credited to the same source. Quebec, second, represented 20.5 per cent. of capital invested.

* * * *

BLAST FURNACES AND STEEL MILLS SHOW HIGH RECORD OF AVERAGE

PIG IRON and ferro-alloy plants in 1920 numbered 9; steel furnace plants, 17; rolling mills, 18; combined steel mills, 6. The average monthly output of pig iron and ferro-alloys in 1920, reported as 90,866 net tons, was 118.8 per cent. of monthly production of 1919; 163.8 per cent. of the record for 1921 and 25.3 per cent. of average monthly output of first four months of the present year. The monthly output of steel ingots and castings in 1920, given as 102,725 net tons, was 119.6 per cent. of the monthly production in 1919; 164.8 per



Conveyor bridge and unloader such as used in removing ore from the holds of lake freighters. Some such equipment as this is proposed for the Canadian Steel Corporation at Ojibway.

cent. of that for 1921 and 322.8 per cent. of average monthly output during the first four months of 1922. The average annual and monthly production of iron and steel in Canada from 1913 to 1922 is as follows:

	1913	1917	1918	1919	1920	1921	1922
Iron Products	1,128,967	1,170,480	1,195,551	917,781	1,091,396	665,676	
Monthly Average	94,081	97,540	99,629	76,482	90,865	55,473	35,914
Steel Products							
Monthly Average	97,416	145,178	156,142	85,862	102,725	62,296	31,810

Imports to Canada of iron ore from United States:

	1920	1921
Quantity	1,300,647 tons	514,651 tons
Value	$4,866,644	$1,885,494

From Newfoundland:

	1920	1921
Quantity	616,287 tons	139,394 tons
Value	$861,432	$184,851

Imports of various iron and steel products from United States into Canada, 1913-1921:

	Short tons	Value	Value per ton
Sheets and Plates			
1913	356,344	$12,364,721	$34.70
1921	180,428	11,950,255	66.28
Steel Rails for Railways			
1913	18,408	4,791,559	26.41
1921	25,796	1,057,752	41.00
Billets, Ingots and Blooms			
1913	45,568	964,373	21.16
1921	8,079	264,386	32.73

Interesting Comparison

The output of foundries and machine shops in 1920 was valued at $76,766,903, of which $23,972,550 or 31.2 per cent. was the production of combined machine shops and foundries, and $21,997,839 or 28.7 per cent. was the output of plants engaged in production of iron pipe and fittings. There were, on an average, 161,345 wage earners employed. The year opened with a payroll of 15,786, increased to 16,803 by April and in December this had decreased to 15,007.

An interesting comparison as between 1870 and 1919 in foundry development is shown in the fact that in 1870, the plants numbered 430, while by 1919 this had increased to 731; 7,653 wage earners in 1870 increased to 21,680 in 1919. Value of products in 1870 was $7,325,531, while in 1919 the amount was $81,710,215. Cost of materials in 1870 was $2,477,423; 1919 it amounted to $26,301,761.

Import and Export Items

Large import items of foundry and machine shop products in 1920 and 1921 were the following:

	1920	1921
Seamless steel or wrought iron boiler tubes, including flues and corrugated tubes for marine boilers	$2,591,452	$807,364
Seamless steel tubing, valued at not less than 3½ cents per lb.	480,517	100,424
Wrought or seamless tubing, 4 in. or less in diameter	460,903	344,698
Wrought or seamless tubing not over 10 in. in diameter	642,270	217,651
Screws, nuts, rivets and bolts	614,309	305,291
Axles and axle parts	3,190,403	1,474,450
Fittings of iron and steel	1,082,655	683,954
Chains	1,294,736	684,370
Fittings, iron or steel for iron or steel pipe of every description	1,082,655	683,954
Springs	622,305	263,668
Valves, iron and steel	868,109	609,210
Brass valves	562,153	186,036

Financial summary of the foundry and machine shop group, 1920.

Total capital employed	$68,346,128
Salaries and wages	24,941,887
Cost of fuel	2,967,121
Cost of Material	52,603,268
Miscellaneous expenses	8,310,814
Total expenditure	68,823,090
Value of products	76,766,903

Exports from Canada of the principal foundry and machine shop products, 1920-1921:

	Canadian Products		Foreign products re-exported	
	1920	1921	1920	1921
Castings	$ 895,650	$ 289,968	$ 32,070	$23,278
Forgings	1,108,980	43,061	207,427	1,721
Bolts and nuts	265,970	164,387	26,127	2,483
Brass valves	325,974	156,804	2,167	4,797
Tubing and pipe	2,614,154	2,019,860	53,609	22,331

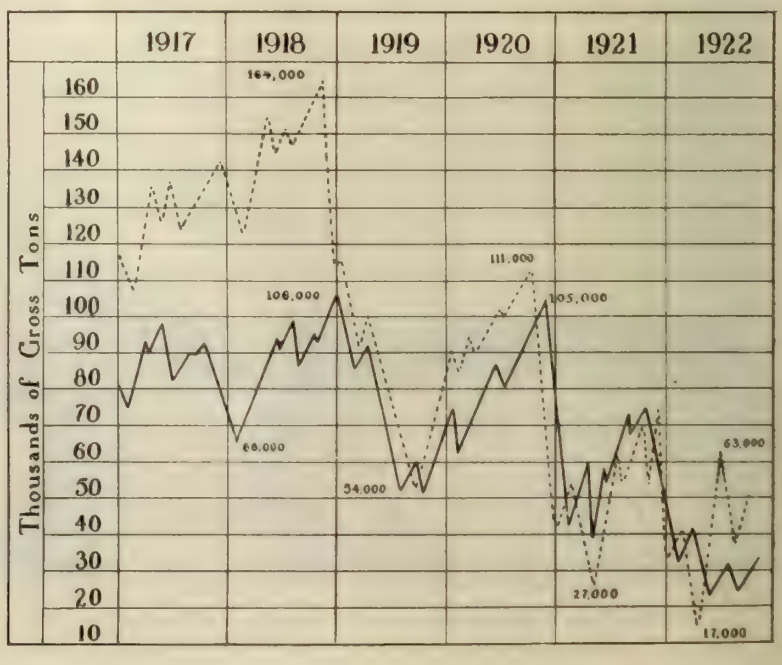
Fabrication of Iron and Steel

This group includes metal furniture, safes, railway track equipment, architectural and structural iron and steel.

Fifty plants in 1920 produced goods to the value of $14,318,685, of which $8,030,218 was the value added by the manufacturer. The 19 establishments fabricating structural iron and steel had a production of $5,897,467. The average monthly payroll carried 2,511 wage earners, as compared with a minimum employment of 2,341 in December and a maximum of 2,627 in August.

Financial summary of iron and steel fabrication group, 1920.

A study of pig iron and steel production in Canada during the past six years. The record for 1922 reached unusually low levels but an upturn is in evidence. Steel Company of Canada will start the year 1923 by blowing in their second furnace; Algoma Steel Corporation, it is reported, are preparing for greater activities, after running one furnace only for some months; and the British Empire Steel Corporation are also equipped for larger output. Foundries report that business is improving. Radiator plants have ordered large tonnages of pig iron recently, and it is evident that the building industry is to continue active the coming year. Pig iron markets are showing more strength than for some months.



Number of establishments	55
Capital	$12,355,869
Salaries and wages	4,101,094
Cost of fuel	116,562
Cost of materials	2,216,846
Miscellaneous expenses	2,216,846
Total expenditure	12,722,969
Value of products	14,318,685

* * * *

ENGINE SHOPS HAD HIGH AVERAGE

OF THE production in this group during 1920, valued at $22,614,951, the boiler and tank industry contributed $5,265,913, or 23.3 per cent. Products of the engine and locomotive industry were valued at $17,349,038 or 76.7 per cent. of the output of the group. Average employment was 4,660, and the amount paid in wages was $5,904,352.

Financial Summary of Boiler and Engine Group

Establishments	55
Capital	$32,662,552
Salaries and wages	7,113,052
Cost of fuel	668,560
Cost of material	9,891,832
Miscellaneous expenses	2,545,829
Total Expenditure	20,219,273

AUTO IMPORTS INCREASE—PRICES DOWN

For the twelve months ended September, 1922, Canada imported iron and its products to the value of $119,297,888, as against $165,439,295 in 1921 and $237,541,838 in 1920. The amount in pigs, ingots, blooms and billets was $1,381,860, as against $3,384,855 in 1920. Rolling mill products imported for the year ending September, 1922, were valued at $26,372,403, as against $56,644,372 in 1920. Passenger autos imported for the same period were valued at $11,015,689, for 10,088 cars, as against $11,728,008 in 1920 for 8,884 cars. These figures are significant of the drop in auto prices.

Imports Curtailed in 1922

That buying in certain lines was very much curtailed this year is shown in the fact that for the year ending September, 1922, the importation of tubes, pipes and fittings amounted to $2,281,978, against $5,565,188 in 1920. Machinery imported was valued at $22,498,264, against $44,558,184 in 1920; engines and boilers were imported to the value of $5,644,117, as against $13,471,818 in 1920; farm implements imported, $7,670,605, as against $22,613,938 in 1920.

Export Trade Declined

Canada exported, year ending September, 1922, iron and products valued at $35,647,293; against $82,742,384 in 1920. Notable items were: Farm implements, 1922, $4,590,332; 1920, $11,715,339. Hardware and cutlery, $1,240,730; 1920, $9,041,919. Passenger autos, 1922, $15,370,858 for 26,909 cars; 1920, $14,674,190 for 21,286 cars. Pigs, ingots, blooms and billets, 1922, $1,184,279; 1920, $8,994,613. Iron ore 1922, $1,013,283 for 105,643 tons; 1920, $5,723,828 for 435,540 tons. Gold ore exported year ending September, 1922, was $3,542,908, against $4,816,041 in 1920; scrap metal, 1922, $1,025,184 for 94,286 tons; 1920, $3,320,070 for 185,058 tons; rails, $511,395 for 17,093 tons in 1922, against $2,544,263 for 59,232 tons; machinery, $2,106,176, against $6,326,547 in 1920.

MANY PLANTS BUILDING MACHINES

THIS GROUP includes establishments engaged in manufacture of machinery. Thirteen plants were employed in the making of household machinery, including sewing machines, washing machines and wringers; 21 were employed in production of business machinery, including typewriters, computing machines and scales, and 122 firms were engaged in building industrial machinery and elevators.

Total production of $40,535,474 in 1920 was divided as follows: Sewing machines, 7.2 per cent.; washing machines and wringers, 5.2 per cent.; office machinery, 14.2 per cent.; scales, 3.8 per cent.; industrial machinery, 65.1 per cent., and elevators 4.5 per cent. The cost of materials was $13,605,268, leaving a value added by manufacturers of $26,930,206. The net output computed in a similar way for the industrial machinery industry was $17,741,194. The value of production for the industry was $26,380,284, while the cost of materials was $8,639,000.

The maximum employment for the year was in May, when 9,842 wage earners were engaged. The year opened with a payroll of 9,006 and noteworthy increases were recorded until May. A declining trend set in until the end of the year when 8,822 wage earners were reported. During 1921 the industry confronted a steady uphill climb. There was little improvement in the forepart of 1922, but the end of the year shows an improvement of from 40 to 50 per cent. over January of this year.

Notable among the imports for 1921 were the following:

Steam shovels and electric shovels	$ 332,697
Mining and metallurgical machinery	1,488,386
Typecasting and typesetting machines	975,255
Other printing and bookbinding machinery	1,566,773
Air compressing machines	220,772
Coal handling machines	182,428
Power lathes (1920—$848,800)	162,249
Machine drills (1920—$1,274,993)	324,897
Paper mill machines (1920—$1,550,476)	1,993,222
Rolling mill machinery (1920—$721,044)	260,802
Saw mill machinery (1920—$310,809)	148,049
Textile machinery (1920—$5,745,802)	3,366,850
All other machinery (1920—$2,315,210)	12,385,370

Total production of principal items, 1920, amounted to $26,387,804. The following are notable:

Hoisting equipment	$ 682,762
Boring and turning machinery	111,206
Grinding	114,714
Other	890,440
Lathes	479,496
Pulp and paper machinery	4,739,765
Mining and engineering	1,101,336
Saw and shingle mill	1,175,031
Transmission	1,948,258
Woodworking, N. E. S.	1,305,896
Scales	1,739,468
Sewing machines	2,253,072
Freight elevators	1,101,385

STRENGTH OF AGRICULTURAL IMPLEMENTS

Production in the agricultural implement group in 1920 was mainly divided as follows:

Horse and power implements	$28,783,424
Hand implements and tools	1,173,130
Dairy equipment	2,421,843
Power units and machinery	3,488,451
Miscellaneous products	14,434,434
Materials used amounted to	$22,588,390

The number of employees receiving salaries and wages in 1920 was 12,838; salaries and wages amounted to $16,941,987.

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ACTIVITIES IN RAILWAY SHOPS

THE CAR group, including railway cars and parts, as well as repair shops, made progress in 1920. The value in production and repair was in excess of $135,590,000, of which the steam railway car repair shops was credited with $70,568,913 or 52 per cent. The electric car repairs were valued at $4,661,706 or 3.4 per cent. The output of 11 car works was $53,313,260. The car wheel and parts industry, comprising seven plants, produced $6,535,000 and the three firms chiefly engaged in the manufacture of brakes and brakeshoes reported a production of $511,251.

The increase in the value of repair work on steam cars over the record of 1919 was 45.1 per cent. and the production of brakes and brakeshoes industry increased by 39 per cent. The output of the car works, on the other hand, decreased by $6,649,059, or 11.08 per cent. from 1919, reported as $59,962,319.

The employment indicated that payrolls in January carried 41,254 wage earners. An improving tendency was maintained in November when the peak was reached with 46,190 wage earners. The year closed with 43,870 under employment as composed with an average of 43,305.

An improvement in this branch of the industry is confidently expected in 1923. It is claimed that the railways can no longer ignore necessities in rolling stock repairs and replacements and important activities are looked for.

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STRENGTH IN SHEET METAL INDUSTRY

IN SHEET metal products there were 122 establishments; twenty were employed in enamel ware and tinware; seven in making metal dress fasteners; ten in metallic roofing, siding and flooring, and 85 plants in other sheet metal products. Value of production was $37,369,576, of which $19,823,986 or 53 per cent. was in sheet metal products not otherwise classified; and $16,360,723 or 43.8 per cent. was the output of the enamelware and tinware plants. The value added by manufacturers in all plants was $17,108,756, of which the net output in the enamelware and tinware industry was $7,647,946, or 44.7 per cent. The net output in the metal dress fasteners industry was $225,741, or 1.5 per cent. The net production of the metal roofing, siding and flooring industry was $251,617, or 1.5 per cent. and the net output of those engaged in other sheet metal products was $8,959,452 or 52.3 per cent.

Employment increased from 6,366 wage earners in January to 6,650 in April. The decreases after July, when 6,610 were employed, were steady, excepting October when the employment of 6,374 equalled that of September. The year ended with a payroll of 5,818 as compared with 6,366, the average for the year.

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HARDWARE IMPORTS DECLINED

OF THE value of output in the hardware and tool group of $22,556,316, 27.6 per cent. was the production of edge tools and cutlery. The value added by manufacturers, obtained by deducting cost of materials from volume of products, was $15,356,314 for the group, of which 30.1 per cent. was the net output of the edge tool and cutlery industry.

Among the imports the following items are notable:

	1920	1921
Hand tools	$2,005,126	$1,025,171
Knives and forks of steel	720,932	674,643
Files and rasps	226,769	132,060
Saws	201,172	78,857
Locks of all kinds	742,287	388,267
Builders' hardware, carriage hardware, saddlers', etc.	1,071,100	706,062
Edge tools and cutlery	$6,232,128	
Tools and implements	4,496,248	
Builders' hardware	4,100,000	
Screws	2,511,710	
Saws	2,183,240	
Dies and taps	1,417,564	
Needles and pins	728,337	
Hardware N. Q. S.	717,278	
Skates	79,040	

For year ending September, 1922, hardware and cutlery importations amounted to $3,299,684, as against $5,545,331 in 1920; tools, 1922, $1,258,858; 1920, $2,581,591; clocks and watches, 1922, $1,615,478; 1920, $3,803,912; pneumatic tires, 1922, $1,145,831; 1920, $2,034,087.

Canadian exports in hardware lines in 1922 included the following: Binder twine, $566,226; 1919, $1,660,387. Paints and varnish, $456,401; 1919, $852,773. Tubing and pipe, $1,173,515; 1919, $2,674,413. Hardware and cutlery, $1,240,730; 1919, $3,364,062. Tires, pneumatic, $3,664,604; 1919, $4,067,669. Activity in this industry at end of 1922 shows steady growth, with encouraging outlook.

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PRODUCTION OF WIRE PRODUCTS

The wire group comprises wire, wire rope and nails, wire fencing, etc. Following are statistics for 1920:

Capital	$18,339,020
Salaries and wages	4,731,717
Cost of fuel	490,387
Cost of materials	14,219,338
Miscellaneous expenses	2,215,359
Total expenditure	21,056,801
Value of products	30,251,349

Experts Investigating Ontario's Ore

By HON. E. C. DRURY,
Premier of Ontario.

THE position of Canada is fortunate in many respects at the present time. We have been blessed with a good harvest. Our financial situation as compared with that of other countries is excellent, although it presents serious problems. The industrial development of Ontario is intimately associated with our mineral production. In the matter of precious metals, we have gained an enviable position. Gold production has made great strides and new discoveries and new camps are being developed. The production of silver has been well maintained, and we are also making substantial advance. The nickel and copper industry is now being revived after a temporary depression, and the mines and smelters are again in operation, although on a reduced scale.

The iron and steel industry in Ontario has been hampered in the past by the fact that we are almost entirely dependent upon imported ore. We realize fully that if we were able to use ore from Ontario mines more extensively it would be of great advantage to this industry. There are extensive low-grade iron deposits in Ontario, and at the present time a committee of experts is investigating the problem of the utilization of these ores in the manufacture of pig iron and steel.

The extension of the Temiskaming and Northern Ontario Railway may have an important bearing on the iron industry. The Legislature has authorized the construction of the railway through to James Bay. Contracts have been entered into which will carry the road one-half the distance in the next two years, and when this has been done we will probably be in a position to complete the undertaking.

Eventually, we may look for the discovery and the development of important iron deposits in the North. I feel that in this and in other ways the Province is building well for the future.

"Besco" Operates Modern Wire Products Plant

Many Problems Confronted British Empire Steel Co. During Year —Miners Scarce and Coal Output Down—Production Costs Up— Union Opposition—Good Demand for Certain Steel Products— Market for Wabana Ore

By F. W. GRAY, M.E.
British Empire Steel, Nova Scotia.

COMMENCEMENT of iron and steel manufacture in Cape Breton Island, now not far from twenty-five years ago, gave to the coal mining industry the stimulus to which is traceable most of the remarkable expansion in coal outputs that culminated in 1913.

In Bulletin 14 of the Mines Branch at Ottawa, written in 1916, the writer showed that coal production in Nova Scotia had increased in the period between 1830 and 1910 in a geometrical progression of 78 per cent. per decade, and stated: "The war which commenced in 1914, and the resultant dis- "organization, first of trade conditions, and afterwards of the "labor supply by reason of the needs of the army, has caused a "lessened rate of production that will in all probability persist "over several years to come." ....."it seems probable, for "many reasons, that the large output of 1913 will not again "be materially exceeded within the current decade, and that "for several years to come at least, the coal production of "Nova Scotia will not be greater than seven million tons per "annum."

The following table of annual outputs in Nova Scotia will show serious recession in coal production since 1913:

	Gross Tons (Estimated)		Gross Tons (Estimated)
1913	7,263,485	1918	5,211,000
1914	6,650,031	1919	5,160,000
1915	6,709,951	1920	5,800,000
1916	6,171,434	1921	5,100,000
1917	5,665,477	1922	4,700,000

In the period 1914 to 1918 inclusive the decline in production was caused by army enlistments, and the outputs attained represented the maximum capacity of the workmen at the collieries. Since the conclusion of the war the decline in production is the combined result of shortage of skilled miners and the prostrated state of the steel industry.

Production Down

The production for the year 1922 promises to be the smallest since 1902, which last-named year was about the date when the consumption of coal in steel-making commenced to exert a decided effect on coal production in the province.

As compared with the year 1913 there exists at the present time a shortage of approximately 1,500 skilled faceworkers at the collieries, or, put in another way, the men who actually dig coal in the province have been reduced to two-thirds of their numbers in 1913, and it is of course inevitable that a reduction in output exactly proportionate to the reduction of coal diggers should occur.

With full-time production from the number of miners available in the province, an output of a little short of six million tons per year should come from the collieries of Nova Scotia, and the difference between this figure and the estimated quantity of 4,700,000 tons for 1922 represents the absence of any demand for coal for steel-making purposes in the first half of the year, coupled with a loss of from 250,000 to 300,000 tons consequent upon the two weeks strike of the United Mine Workers in August.

The public is generally unaware of the price paid by the coal industry of Nova Scotia for the assistance in men and ships that it gave to the prosecution of the war. The enlistments from among the coal-mining population were, to the extent of ninety per cent. of the total enlistment from the collieries, taken from the faceworkers. The number of men actually producing coal was thereby diminished, while the ranks of the non-producing laborers and auxiliary workmen remained but little lessened. Immigration since 1914 into Nova Scotia has been negligible. The existing population cannot provide the miners required to replace the deficiency caused by enlistments, and, unless miners are brought in from abroad, this deficiency must persist for a generation or so. Paradoxically maybe, but nevertheless quite logically, this shortage of coal diggers exists alongside a surplus of other classes of workmen, and has been accompanied by serious unemployment of coal diggers and auxiliary workmen alike.

Increased Production Costs

Combination of high wages (or a high rate of wages) with the unbalanced condition of mine organizations due to shortage of coal diggers, has raised the cost of producing coal to a point which has made it difficult for Nova Scotia coal operators to sell coal in competition with outside fields, and this has caused unemployment. The replenishing of the ranks of the coal diggers would cheapen the cost of coal and create greater opportunities for employment, but it is difficult to make unemployed men see any advantage in bringing new men in from the outside. The opposition of the unions to the employment of new men is probably not a smaller difficulty than the virtual impossibility of obtaining skilled miners, for precisely the same situation exists in Britain and those European coal-mining centres that were drained of men by the wastage of war.

Recovery From Depression

Following the customary lag in relation to the trade conditions of the United States, the steel industry in Nova Scotia did not feel the full effect of the depression in steel demand

General view of the Sydney Steel Mills in Nova Scotia.

until almost a year after steel plants in the United States had closed down on a wholesale scale, and, correspondingly, the recovery from this memorable depression is only just setting in in Nova Scotia, although in the United States steel plants have been operating at seventy per cent. of capacity, and more, since the spring of the year.

The Dominion Iron and Steel Company's plant at Sydney has two blast furnaces in operation, and is making all the products for which the plant is equipped except steel rails and plates. The demand for wire products is especially good, and the Steel Company is reaping benefit from its modern and well equipped nail and wire mills. There is a fair demand for billets, most of the shipments being sent to the Scotia plant at Trenton, where the mills are quite busily engaged in the manufacture of small plates, angles, rail fastenings, and the general line of small steel products for which the Trenton plant is so well equipped, and because of which this plant fits in well with the Sydney plant, generally designed for large tonnages of large-sized steel products.

Ready for Rail Demand

The Sydney Mines Plant of the Scotia Company has been idle since the autumn of 1920, and it is unlikely to be operated until such time as a demand arises for steel rails and plates, in which event the blast furnaces and open-hearth plant at Sydney Mines will function as a convenient supplement to the Sydney plant.

The Sydney Plant is now, with the exception of the open-hearths, a well-balanced and modern unit, having coke-oven capacity of the most modern kind for a sufficient blast-furnace output, combined with adequate and up-to-date power plants. The rail, billet, wire and rod, nail and plate-mills are in good shape, able to produce good tonnages at economical expenditures, but the open-hearths are capable of much improvement, although very satisfactory performances are being obtained from the existing furnaces, considering the age of the installation.

Wabana Ore Operations

The consolidation of the iron-ore properties at Wabana, Bell Island, has put under one management an ore property capable of producing ore to any desired annual quantity, and there are now no hindrances to selective mining of ore or technical operation of the mines, the property being entirely at the disposal of one management. In a property where the leases and holdings of two companies are so intimately connected as is the case at Wabana, the advantages and economies resulting from unity of management are very great. All questions of management and transportation have been simplified by consolidation, and matters of sale policy also. The export of iron ore to Europe, which before the war was largely carried on from Wabana, has been resumed on a large scale, and there is little doubt that in years to come the export trade in iron ore will exceed in extent the use of iron ore in the steel plants in Nova Scotia.

The iron ore reserve at Wabana constitutes the largest and most accessible body of ore, commercially available, in the North Temperate Zone, and owing to the steady depletion of the Lake Superior reserves and the never very great European reserves, Wabana will in years to come be looked to to provide iron ore for the needs of the steel industry on both sides of the Atlantic. The iron ore deposit off Bell Island is probably the outstanding asset of the British Empire Steel Corporation.

Busy on Car Repairs

The Eastern Car Co. at New Glasgow, which has for some time been without orders, is now busy on repairs to Grand Trunk Railway cars. This plant can produce cars at prices which give it a wide competitive range, and its ability to manufacture cars and allied products has been largely increased by the affiliation with the British Empire subsidiaries and the not inconsiderable amount of work that the Corporation itself needs to be carried out on railway and mine-car equipment.

The equipment needs of the Canadian railways, as is well known, have been delayed about as long as they can be, and activity at the Eastern Car Plant should be expected to continue.

While there is no reason to expect a demand for steel products such as was witnessed in the war years, it seems very probable that a real improvement in steel demand has set in and will continue for some years. Optimism for the near future is fully justified in regard to the steel industry in Nova Scotia.

HON. W. E. FOSTER.

New Brunswick on Forward March

By HON. W. E. FOSTER,
Premier of New Brunswick.

NEW BRUNSWICK, let me tell your readers and the rest of the world, is on the forward march. One of the most important basic industries of the Province, that of lumber, is again functioning with considerable activity. The pulp situation is likewise showing improvement. Advances are being made in coal mining, also in the production of lime and gypsum.

With the utilization of the hydro plant which has just been completed by the Provincial Power Commission at Musquash, industrial expansion along broad lines is expected. From an agricultural standpoint, as far as crop yields are concerned, the Province has made marked progress this year, but unfortunately market conditions at the present moment are not up to the anticipated standard. This situation, however, should show early improvement. New Brunswick, with its extensive coastal area, is the producer of great varieties of splendid fish, but in this line, too, there is not the activity that the quality of the product is deserving of.

The Province is the possessor of many natural resources outside of those above indicated which offer great possibilities. With its fertile farm lands, beautiful orchards, great sporting opportunities, wonderful scenic attractions, healthful climate, good roads, active open ocean ports and its many other advantages, New Brunswick undoubtedly offers one of the finest home-making and industrial opportunities that is to be found on the North American continent. It is also a Mecca for tourists from all points of Canada and from all States of the Union. The Provincial Government, co-operating with the governments of the other Maritime Provinces, is endeavoring to do its share toward building up this important area of the Dominion and is getting good results. Further objectives are now being planned.

Loading grain for the United Kingdom at the Government elevator, Vancouver.

Export Equipment Must Be Well Organized

Much Being Done to Co-operate With Manufacturers—How Intelligence Service is Being Used—Actual Cases in Which Buyers and Sellers Have Been Brought Together—Details of Export Market

IN ORDER to ascertain the extent to which the service of the Commercial Intelligence Service of the Department of Trade and Commerce is being employed by manufacturers, Canadian Machinery has been making enquiries. In reply, some very interesting material is made available by C. H. Payne, secretary of the Service.

Export business has had increasing attractions for Canadian producers. Empire trade has its advantages, and, realizing this, one thousand American plants, representing large investments, have located here. This number is increasing by 200 a year. The coming year will augment the number and it is becoming increasingly evident that manufacturers are interesting themselves in every essential entering into the growth of this business.

Canadian trade commissioners are showing keen appreciation of the fullest co-operation with manufacturers. Much is being done and much remains to be done in the broadcasting of information calculated to be of service to buyers and sellers, to the end that Canadian trade may be developed.

Following the series of questions and answers referred to, several enlightening instances are given in which manufacturers and prospects have been brought together and actual transactions closed.

Another feature of the article deals with the import requirements of the countries in which Canada is represented by a trade commissioner, the amounts purchased from Canada and exports to this country. Many of these items were subjects of enquiry during the past year.

Value of the Service

Question.—Do Canadian manufacturers, while abroad, make use of the offices of Canadian trade commissioners?

Answer.—The weekly diaries forwarded by trade commissioners to the department contain a record of all visitors to their offices, from which it would appear that representatives of Canadian firms travelling abroad do make considerable use of the service. Many firms, of course, have their own permanent offices in foreign countries and do not to the same extent use the trade commissioner's.

Q.—Do Canadian manufacturers, returning from abroad, make available to the department any useful information obtained by them?

A.—Generally speaking, exporters returning from abroad do not communicate to the department the results of their investigations. As a rule, business men prefer to keep private their own affairs. Occasionally, however, on their return to Canada we write to manufacturers, of whose visits we have been advised by own trade commissioners, and ask them for their impressions.

Q.—To what extent are Canadian manufacturers making use of the information available in the department?

A.—Interviews by trade commissioners during their visits to Canada, and by junior trade commissioners during the course of their tours for training indicate that the information furnished is very highly appreciated in a great many cases.

Q.—What kind of information seems to be most in demand?

A.—This is an extremely difficult question to answer, as the information in demand covers a very wide range, but generally speaking it can be stated that it relates to the products of this country for which there is a market in foreign countries. It might also be added that many specific inquiries are received in regard to the following: (a) Names of importers in foreign countries. (b) Appointment of suitable agents abroad. (c) Trade statistics for particular commodidies. (d) Customs duties in foreign countries and tariff rulings. (e) Proper forms of invoice, etc.

Q.—Do manufacturers extend co-operation of any kind to the department? Is it desirable?

A.—Manufacturers, who are familiar with the service co-operate to the fullest extent. They are always willing to give information, and are exceedingly glad to have visits from trade commissioners, junior trade commissioners and officers of the Department. In the majority of cases, where a Canadian exporter has received assistance from a Canadian trade commissioner, he voluntarily notifies the department of the facts, and expresses his appreciation of what has been accomplished.

Q.—Instances in which the services of the department have been of distinct benefit.

A.—Choosing certain instances which have been reported in the last few months, the following might be instanced:

(a) In September a vessel reached Buenos Aires and according to our information, 80 per cent. of the total values of the ship's manifest was due to the efforts of our trade commissioner directly or indirectly. There were 30 shipments listed from Canada including the following items: malt, cloth, paper, adding machines, tire chains, paint, steel wire, maple skewers, printing paper, nail wire.

(b) Within the past few months a Canadian firm has secured, through the efforts of our trade commissioner in Australia, orders for 8,000 telephones.

(c) A few years ago, a firm manufacturing carriage wheels, etc., entered the South African market, and our trade commissioner there recommended the appointment of a suitable agent. According to the testimony of the manager of this firm, last year, when the domestic market was dead, this factory was able to run for 48 hours per week on their export orders to South Africa alone.

(d) Another instance was that in which 90,000 tons of wire were diverted from an United States manufacturing plant to a Canadian branch, owing to the efforts of a trade commissioner.

(e) In a very small way, a man in Canada undertook to market a product which he had patented, and to-day, largely through the advice and assistance of Canadian trade commissioners, he is exporting to practically every country in the world, or at least to those countries in which the Commercial Intelligence Service is represented.

(f) A firm in Ontario was producing a certain type of table. When the demand in the domestic market appeared to be satisfied, he was advised by this department to undertake exportation. As a beginning, he enlisted the services of a trade commissioner in Great Britain and today his export trade is regarded by him as entirely satisfactory.

(g) The export manager of one of Toronto's large exporting houses stated in an interview recently, "I would feel just as confident in placing my business in the hauds of our trade commissioner ..... as I would if I were on the ground myself. He has the happy faculty of grasping just what is required and backs this up with a thorough knowledge of his territory, its requirements, and Canada's ability to supply them."

(h) A small manufacturing company in Toronto who desired to cultivate an export market, shipped samples to the trade commissioner abroad and reports, "As a direct result of his activities, I am doing a substantial business now, and hope to sell $25,000 annually there."

(i) A trade commissioner in South Africa represented to the municipal engineers of a South American city, the ability of a certain Canadian firm to supply material for a large civic contract. This Canadian firm, on the advice of the trade commissioner, appointed an agent and secured an initial order for $20,000 worth of material. Previous to this a Scotch company, known the world over, had practically a monopoly.

In addition to the above, according to our records, there are many instances in which manufacturers have voluntarily notified the department that they have been enabled to work up a profitable business owing to the direct assistance of our trade commissioners abroad.

WHERE CANADA BUYS AND SELLS

Australia, D. H. Ross, Melbourne.—Imports fiscal year ending June last—£101,063,661, decrease £62,267,479. Exports, £127,949,455 decrease £3,975,636. Stocks of merchandise have since become somewhat depleted, hence with the continuance of a prospective good season, and the present purchasing power of the Australian people, imports should soon indicate considerable expansion in value. Imports in metal and metal products included agricultural implements, electrical and gas appliances, hardware lines, electrical cable and wire, iron and steel bars, rods, pig, scrap, pipe fittings, rails, fishplates, etc., machinery, alloys, motor bodies, chassis and cycles, tinplates, vehicles and parts, motor cars, footwear. Direct imports from Canada in 1920-21 are given at £4,646,352. Imports of agricultural implements in that period amounted to £917,920 of which £425,435 represented Canadian products. Factories for agricultural implements, however, are in operation in all of the States, and some export business has developed. The shipbuilding industry at Sydney is important. The Commonwealth has greatly increased in wealth in the past two decades.

In 1901, production was valued at £114,585,000; of recent years this has increased to £350,000,000. A recent report states, "Importers selling certain classes of machinery on the usual time payment system, report that their collections this year have been above the average and that farmers and dairymen are enjoying a period of prosperity."

Imports from Canada, year ending September, 1922, £14,251,011. Exports to Canada, $1,377,922. Canadian sales included large items under the heading of wood products, including paper, and iron and products.

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Argentine Republic, B. S. Webb, Buenos Aires.—Requirements of seven million population in manufactured products are all filled from abroad. Canadian agricultural implements are sold in quantity, binder twine, newsprint, edge tools, autos, auto tires, wall paper and lumber of Canadian make find ready market. Some steel products are being sold at lower prices than those quoted by the United States and Europe. There is a growing market for electrical material, the imports in 1920 under that head being $4,700,000. It is estimated that 40 per cent. of fixtures and 70 per cent. of appliances used are of local manufacture. Much material such as wire, cable, motors, dynamos, conduits, lamp sockets, dry cells, etc., are imported from U. S., United Kingdom, Germany and Italy. Though highly competitive in this respect, the market is not without opportunity for Canadian manufacturers. The shoe industry has grown so that only the better classes of shoes are imported. Total trade amounted to $1,250,000,000 in 1921. Chief products are grain, wool, hides, sheepskins, frozen and chilled beef, and frozen mutton.

Canada exported, 12 months ending September 1922, products valued at $3,850,953, largest item being iron and its products, wood and wood products. Canada imported goods to value of $2,516,497 chiefly animal products.

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Belgium, A Stuart Bleakney, Brussels.—Exports for past year were 17,160,355 metric tons, valued at 17,160,355 thousand francs; imports, 175,110,863 metric tons valued at 10,054,583 thousand francs. Countries from which Belgium has purchased goods to greatest value are France, Great Britain, Germany, Holland, United States. For twelve months ending January, 1921, the total Canadian exports to Belgium were $12,642,495 as compared with $47,717,448 in 1920. Exchange rates and high prices in general are given as a reason for the slump. There has never been a decided improvement in the outlook for Belgian business, however. There is a market for Canadian hardware, hand tools such as forks, rakes, hoes, shears, lawn mowers, sprayers and agricultural goods, which have to be stocked in Belgium during January or February and offers should be made well in advance of this period. Canadian firms can either make direct offers to firms or send samples and full data to Trade Commissioner's office whence effort will be made to interest suitable firms and exporters should specify conditions of sale.

Canada exported to Belgium year ending September 1922, products to value of $12,041,221; imported from Belgium, $3,817,931. The largest export from Canada was in vegetable products.

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Brazil, Major E. L. McColl, Rio de Janeiro.—Market featured by highly developed sales organizations. Firms represented can quote on goods delivered at buyers' warehouse. The edge tool trade is keenly contested. Carpenters', cabinet mak-

In the accompanying article instances are given where Canadian manufacturers and prospective buyers abroad were brought much closer together, and business actually closed, through the agency of the trade commissioners.

ers' and bench tools are required for the building trade. The exchange situation has caused weakening in Brazilian trade and importers have been cutting down stocks in many commodities. There is, however, a slight improvement. Much electrical equipment had been imported by Brazil in connection with hydro-power development.

Canada exported, year ending September, 1922, $1,306,825, chiefly animal products, and iron products. Canada imported $1,657,147, chiefly vegetable products.

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British West Indies, E. H. S. Flood, Bridgetown, Barbados, also for British Guiana.—Canadian imports by Trinidad include flour, cornmeal, oatmeal, cheese, pickled fish, undressed and dressed white pine lumber, box shooks. These lines are also imported by Barbados together with birch staves for molasses puncheons. Canada, in 1920, exported £14,705 in shoes to the West Indies out of a total of £287,617. The use of motor buses for transport has been developed recently in Bermuda. There is a demand for edge tools, agricultural implements and tools, machinists', coopers', farmer's, blacksmith's, shipwrights' tools and other hardware lines. Canadian trunks and valises, brooms and brushes, chemical manures, iron and steel manufacturers, paper, wood and timber, paints and colors, have been increasing in demand in British Guiana. While the demand for motor vehicles is dependent upon the prosperity of these colonies, there is steady growth although the possible market is comparatively small. For the first six months of 1921, Jamaica imported tires and tubes to the value of £32,000 of which four fifths were from United States. British Honduras also imports food products, condensed and evaporated milk, confectionery, wearing apparel, grocery specialties, beverages, textiles and bicycles. Canadian goods, exported, for year ending September, 1922, $9,514,785; large items of vegetable and animal products, iron and wood products. Canada imported $12,360,627, mostly vegetable products.

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China, J. W. Ross, Shanghai.—Canadian goods which can be sold in China include soft wood timber, railway sleepers, paper, fish, fruits, flour, bacon and dairy products, rubber goods, woollen textiles, boots and shoes, typewriters, electric lighting and heating fixtures, enameled and aluminum ware, small hardware, finest drills and files, iron beds, lawn mowers, felt hats, machinery and engineering materials. During 1921, 41,000,000 square feet of Douglas fir were exported from Canada to China.

Canada exported, year ending September, 1922, $2,266,747, chiefly wood, wood products and paper and iron and non-ferrous metals and products. Canada imported $1,516,946, chiefly vegetable and animal products, fibres and textiles.

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Cuba, J. L. Gonzales, Hoyela, Havana.—Canadian goods marketable here are wheat flour, potatoes, codfish. Yellow pine, white pine and spruce are used here, much of the pine and spruce coming from Canada. Canada exported, year ending September, 1922, $4,337,497, chiefly vegetable products. Canada imported $9,346,437, chiefly vegetable products.

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Norway and Sweden, C. E. Sontum, Christiania, Norway.—Hides, skins, leather and leather goods, coal, fertilizers, tanning exports, Douglas fir, whitewood, deck planks, mining machinery, asbestos fibre and asbestos products, chemicals, asphalt, paints, colors, varnishes.

Canada exported year ending September, 1922, $3,150,972, chiefly vegetable products, Canada imported $745,956, large items being animal products and iron and its products.

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Straits Settlements, P. W. Ward, Singapore.—Newsprint, canned fruit, chemicals, foodstuffs, electrical goods, machinery, building materials, dredging equipment.

Canada exported, year ending March, 1922, $608,294, chiefly wood, wood products and paper. Canada imported $1,445,774, largely in vegetable products.

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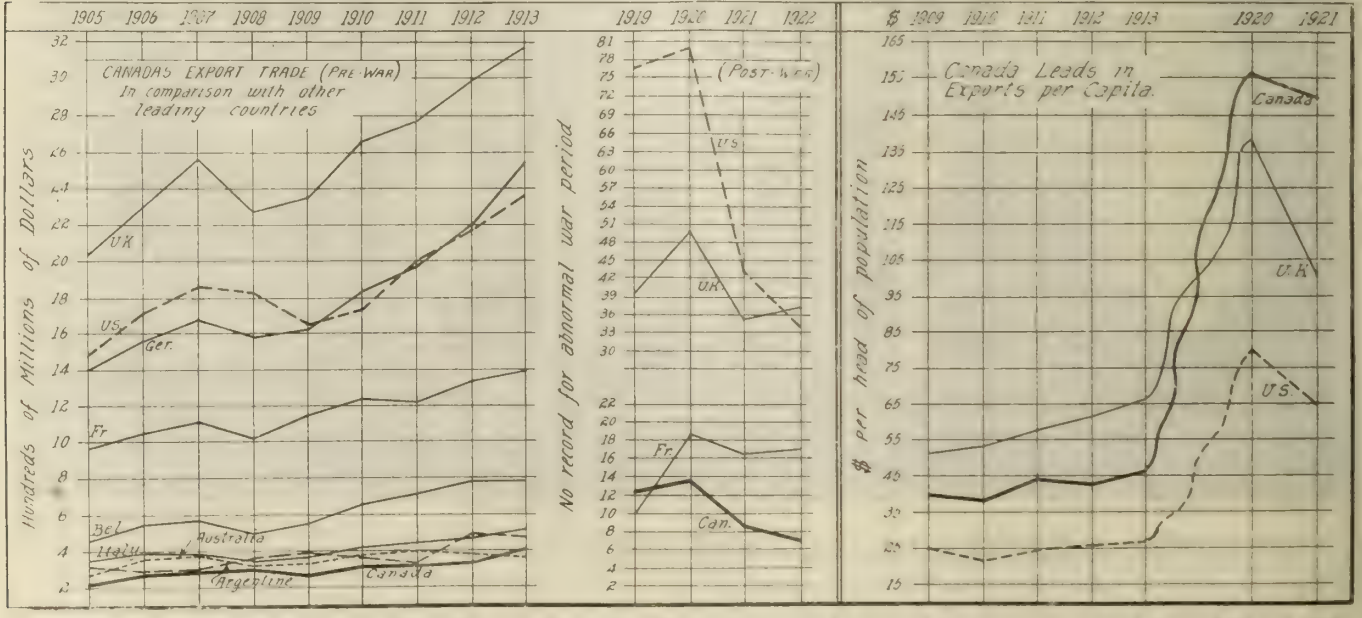
South Africa, W. J. Egan, Cape Town.—Metal products, barbed wire, cement, cabinet makers' metal fixtures, cements, doors, mouldings, furniture, carpets, linoleums, stoves, plumbing materials, engineering equipment, sporting goods, printing machinery, motor cars and accessories, agricultural implements, are required here.

Canada exported, year ending September, 1922, $4,612,015, largely in vegetable products, wood, wood products and paper, iron and products. Canada imported $228,512, largely in vegetable products, fibres, textile and textile products.

* * *

New Zealand, W. A. Beddor, Auckland.—Parchment papers, hardware, hollow ware and ironmongery, wrought iron, wire and wire fencing, bare copper, agricultural implements, cement, paper hangings, newsprint, wrapping paper, calcium carbide, stationery, foodstuffs, wearing apparel, motor cars and accessories, fruit, grass and clover seed, insulated cable and wire, japanned and enameled leather, lorries, trucks, vans and buses, fur and fur trimmings are imported. The total value of imports into New Zealand from Canada for



Charts showing the comparative extent of Canada's export trade since 1905. No record is made of the abnormal period between 1914 and 1918. The centre chart shows that Canada now has fourth place in the volume of export business.

the year ending December 31, 1921, was $7,911,290, a decrease from the previous year of $4,023,285.

Canada exported, year ending September, 1922, $5,226,932, large items being wood and iron products. Canada imported $1,790,856, largely vegetable products.

* * * *

United Kingdom: Harrison Watson, London; J. E. Ray, Manchester; J. Forsyth Smith, Liverpool; A. B. Muddiman, Bristol; Major Gordon B. Johnson, (Scotland and Ireland), Glasgow, Scotland.—Dairy and agricultural products, grains, cereals, flour, hams and bacon, household goods, brushes and toilet materials, calcium carbide, mouldings, condensed milk, canned salmon, textile, machines, rivets, nuts, bolts, galvanized link wire, tinned mattress wire, rivet and screw wire, hollow ware, baby carriage fittings of aluminum, pneumatic drills, artesian well pumps, ecclesiastical woodenware, cement, hay mixtures, galvanized products, steel bars and sections, kraft and wrapping papers, proprietary articles, sugar, grocery lines are imported.

Canada exported, year ending September, 1922, $311,294,751, large items being vegetable, animal, wood and iron products. Canada imported, $127,437,704, large items being in vegetable, animal and metal products, fibres and textiles.

* * * *

Holland, Norman D. Johnston, Rotterdam.—Canned goods, dried apples, chemicals, surgical and rubber goods, wallpaper, linseed oil cakes, asbestos, mica, beeswax, agricultural implements, are imported.

Canada imported from Netherlands, year ending September, 1922, $4,599,284, large items being vegetable products and non-metallic minerals and chemicals. Canada exported, $9,547,512.

* * * *

United States, Frederick Hudd, New York City.—Enamelware, glassware, rye, corn, glucose, durum, wheat, poultry, cattle, fish, food products; raw materials such as metals, chemicals, etc.; manufactures for further use in manufacturing, wallpaper, newsprint, pulp and pulpwood, furs, fertilizers, are imported.

For the twelvemonths ending September, 1922, the imports into United States from Canada amounted to $322,624,068; outstanding items being wood products and paper, non-ferrous metals and products, animal and vegetable products, non-metallic minerals and chemicals. Canada imported $492,965,967, large items being iron and iron products, vegetable and animal products, fibres and textiles, non-metallic minerals and products and chemicals.

* * * *

France, Lieut.-Col. Hercule Barre, Paris.—Canadian goods in demand include boots and canoes for recreation purposes, agricultural implements, grains, flour, tractors, tinned fruits, jams, lumber, wood pulp, sulphite, acetone, cobalt salts, fish glue, salmon, lobster, lumber and wood products.

Canadian products imported for twelve months ending September, 1922, were $11,307,042, largely consisting of vegetable and animal products, wood and iron products. Canada imported $12,342,753, in which large items were fibres and textiles, chemicals, vegetable and animal products.

CANADIAN EXPORTS

1922 Year Ending October	$815,530,510
1921	926,654,122
To United Kingdom	193,755,967
1921	166,746,900
To United States	200,812,638
1921	166,654,122

In total exports, October showed an increase of $22,733,665 over the same month of 1921.

CANADIAN IMPORTS

1922, Year Ending October	$740,261,771
1921	859,710,152
From United Kingdom	77,914,841
1921	63,349,105
From United States	282,534,114
1921	304,882,272

In total imports, October showed an increase of $7,356,953 over the same month of 1921.

Jamaica, G. R. Stevens, Kingston.—Flour and feed, vegetable and animal products, refrigerators, stationery, carriages, canned goods, beverages, metal products, are imported. Imports of Canadian goods for twelve months ending March, 1922, were $2,215,164, a large item being animal products. Canada imported goods to value of $2,213,873, chiefly vegetable products.

* * * *

Italy, W. McL. Clarke, Milan.—Footwear, cordage, vegetable products, grain, hides, skins, wheat, agricultural implements, metal products, are imported. Purchases from Canada, year ending September, 1922, were $12,097,798, largely in vegetable products. Canada bought from Italy produce valued at $1,674,353. Large items were vegetable fibre and textile products.

* * * *

Japan, A. E. Bryan, Yokohama.—Rubber footwear, cullulose acetate, dairy cattle, leather, Douglas fir, newsprint, flaxseed, steel strips for bicycle tubing, textiles, umbrellas, agricultural machinery, motor trailers, glasine paper, canned fruits and jams, dairy products, are imported.

Canada exported, year ending September, 1922, $16,599,444. Canada imported $7,449,636. Large export items were non-ferrous metals and products, wood, wood products and paper, vegetable products. Canadian imports were largely made up of fibre, textile and textile products, vegetable products and non-metallic minerals.

* * * *

India and Ceylon, Major H. A. Chisholm, Calcutta. Agricultural implements, tractors, sugar, wheat, motor cars and carriages, are imported. During the fiscal year 1920-21, 1938 motor cars, out of 15,432 imported, were from Canada. Machinery importations have been large. Other import lines are iron and steel goods, paper, pasteboard and stationery, pressed steel wheels, railway plant and rolling stock, yarns and textile fabrics, wire fencing, rivets, bolts, nuts, packing house products and galvanized goods.

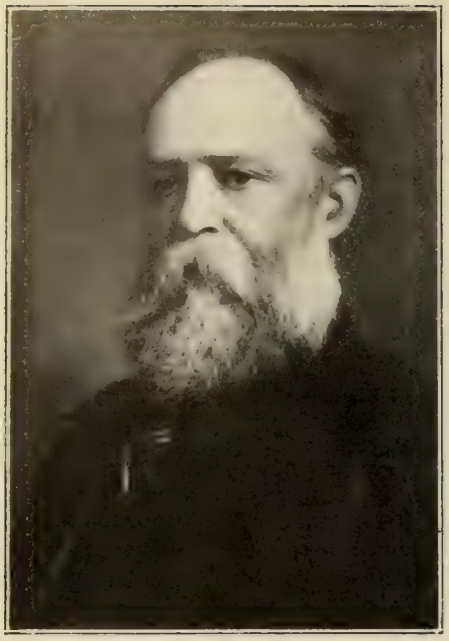
Canada exported in twelve months ending September, 1922, $2,430,253, chiefly in iron and products. Canada imported, $10,307,427, largely in vegetable, fibre and textile products.

* * * *

Germany.—Canada exported to this market goods valued at $5,729,213, in year ending September, 1922, large items being vegetable and animal products, non-ferrous metals and products, and non-metallic minerals. Canada imported $1,304,827, a large item being chemicals.

* * * *

Greece.—Canada sold to this market products valued at $6,003,424, chiefly in vegetable products. Under the same heading Greece sold to Canada, products worth $921,191.



The Future of Canada

"Optimism must be ballasted with common sense. Without optimism we can ruin Canada or any other country."

By Sir EDMUND WALKER.
President of The Canadian Bank of Commerce.

IN EUROPE they are holding one conference after another in order to wrestle with the most difficult problems the world has ever faced. They seem not to accomplish anything except endless talk, but they are really passing through processes of education, and at least it may be said that each conference kills some new scheme by proving it to be impracticable and to this extent the air is clearer.

In Canada we have our own very serious problems to face but, because there are so many brights spots in our future as compared with Europe, we are in danger of some day finding ourselves in that paradise of fools in which national destruction finds its root.

Trustees of Largest Country

By confederation we became the trustees of the third largest country in the world. We had no conception of its fertility, nor have we yet for that matter. We know that its winters bred strong men and that its summers were beautiful beyond praise, but we feared the north all the same, and only experience has taught us how good for man and beast our north country is.

We know that our people were British and French, the latter already tried out for over two hundred years, and we faced a future of great uncertainty with the spirit of Samuel Chapdelaine and of the prairie schooner.

As a country we are not isolated like Australia and New Zealand, but we have to make our experience alongside the great and prosperous people to the South. This propinquity should never be forgotten when we consider our relation to the Empire. We cannot escape the powers of attraction of 110 millions speaking the same tongue, nearer the warm latitudes, with great cities, further advanced powers of production, and possessing the clearing-house of North America in all financial transactions with the outside world, New York. Because of this we grow in population slowly and retain our sons and those who come to us from abroad, with difficulty in the East, while in the West, the land-seekers leave the United States and come to us.

Transportation Great Problem

When we faced the difficulties of confederation we realized that the greatest problem was transportation and although we have overbuilt for the moment in railroads, it is still our greatest problem. Let us see how we managed this problem so far as railways are concerned. We first accomplished as part of the understanding in confederation, the Canadian Pacific and the Intercolonial railways. I need not recall the moments of doubt and despair over these ventures. The one, the Canadian Pacific Railway was eventually a surprising success, the other remains a railroad built for political reasons and although under the recent improved encouragement, it is doing much better, it should not be considered from a purely business point of view.

After years of struggle the time came when the power and prosperity of the Canadian Pacific Railway seemed to demand that a second transcontinental railway should be built and the Canadian Northern Railway system was the result. *Had no other transcontinental system been built we should today be in a condition nearly perfect for our time in Canada's history.* The second transcontinental system was the result in the selection of routes, in material, engineering and cost the result of what we had learned in the construction of the Canadian Pacific Railway, and of itself it would have afforded that competition with the Canadian Pacific which the country demanded. In grades and cost it was an accomplishment so great that some day the Canadian people will praise instead of criticise the two men who built it.

But for some reason, not I am sure understood by any Canadian who has not been admitted to the secrecies of politics, a third transcontinental system was planned. Some of us thought that the government of the day was stark mad and today we know that this was true, but perhaps it was thought that the men who were building the Canadian Northern Railway would stop half way in their undertaking and capitulate. Whatever should have been the outcome, the fact is that we have three complete transcontinental systems instead of two. And while no private company would have built the Intercolonial or that vast sinkhole of money, the Transcontinental, and the government has therefore always been the owners, the state has also been obliged, mainly because of the overbuilding, to take over both the Canadian Northern Railway and the Grand Trunk Pacific, and because it was completely involved in the fortunes of the Grand Trunk Pacific, the old system in the East of the Grand Trunk Railway has also fallen into the hands of the state.

My purpose in recalling what must be well known to all of you is to cause you to bear in mind as you watch the fortunes of the government railways and compare the whole results with the Canadian Pacific Railway that a vast mileage of the government system should never have been built and much more of it, say the Grand Trunk Pacific has been built a generation or more before it could be expected to pay. Long after portions of the government system have justified their existence by handsome profits, other portions will be showing large losses, only in many districts to be avoided by scrapping the road.

Settlement and Production

Whether any government can give the system its only chance of success: administration by officers selected purely for their ability as railroad managers, and freedom from political interference, or not, the duty of the country as a

MUST HAVE FREE HAND

"Given a strong, fearless and efficient organization, and with the free hand which all officers of successful enterprises enjoy, there is no reason why the transportation problems of the two systems should not be handled as effectively and as fairly as if they were privately owned and operated."—E. W. Beatty, president, C. P. R., at banquet to Sir Henry Thornton.

whole is clear. *We must so manage as to build our country up to the railroad mileage where that is possible. This means land settlement and industrial production generally.* We have obtained immigrants heretofore largely by the North American plan; an invitation to all so-called white people to come and share our fortunes, and as the land-worker is always hard to get, we have given away 160 acres to any settler and have so allowed him to select it as to be the cause in part of our present railway overbuilding.

We need a new immigration policy very badly indeed. We want land settlement almost alone at the moment and Europe has no land-workers to spare, but she has millions of the kind we do not want. We can no longer afford to give 160 acres away for nothing, even if the policy was ever a good one, and we must force Western settlement on the unworked lands, largely privately owned, within the areas provided with railroad facilities. What is needed in land settlement in the prairie provinces is needed also in every other province.

I am not able to suggest how this is to be accomplished. The work of our Soldiers' Settlement Commission shows that it can be accomplished if both the Dominion and the Provincial Governments will bend to the task. Great Britain is probably willing to join in the financing of some types of settlers. Mr. Noxon, our own agent-general has just made most interesting and practical suggestions. Quebec is exploiting its plan and there are many other suggestions.

Call of Dominions

When in London a few months ago one could not pass the day without evidence on every hand of Australia's needs and New Zealand and South Africa were not far behind in their alluring statements and offers to those who desired to leave Great Britain and venture in the outlying parts of the Empire. Offices in splendid buildings, exploitation on a large scale of products, cinemas every day, advertising of a lavish character, the names of these Dominions in every mouth, made one feel that Canada had allowed herself to be forgotten and that in any event she seemed to be clearly intimating that she did not want what the others so fiercely demanded. It is true that in this depressing time certain of our agents-general are fighting most vigorously against such odds for their provinces but they are having a hard time.

It is not numbers that we need but land-settlers. We can afford to spend more money and more effort on one real settler than on a score or more of mere immigrants. The one we should search for in the agricultural districts of Great Britain and of Europe and elsewhere if he is a good type and is willing to be taught farming. The other will be at our gates trying by every device to get in. We have filled our cities and our factories with the other and have nearly lost the social conditions which once made us sure that we could build up a law-abiding and even a high minded democracy. The problem of placing men without capital but with agricultural experience, or even willing to be taught first, on land with necessary improvements to be paid for by annual amortizations over twenty or thirty years is not new, and our Dominion and Provincial legislature must develop schemes to this, or some such, and immediately if we are to avoid large annual increases to our national debt caused by deficits in working our national railroads.

Problem of Taxation

Apart from these deficits we can balance our national budget and perhaps in a time not far off our new requirements for provincial, municipal and industrial growth, but it is certainly only by continually increased production that we can possibly prosper as a nation. And as only half of our people are devoted to agriculture we must increase our manufactures in at least a like proportion. This brings me to the point of next importance to land settlement in our future, that is, the incidence of taxation. We do not need to be told

A SOLVENT ENTERPRISE

"It will be necessary for Parliament to provide further sums needed for capital expenditures whereby the National System of Railways will be established as a solvent enterprise. Happily we seem to have passed the first milestone. There will be no operating loss during the current year. The combined revenues of the National and Grand Trunk Systems will meet the combined operating charges, and will leave a substantial surplus to be applied toward the fixed charges."—Sir Joseph Flavelle, retiring chairman of the board of the Grand Trunk Railway System.

TO STOP DRAIN ON TAXPAYERS

"Let it be emphatically understood, now—once and for all—that there is to be no political interference, direct or indirect, in the administration and working of the Canadian National Railways. There are four factors which constitute the sum of successful railway administration: First—Adequate net receipts. Second—The development of the property to meet the requirements of future traffic. Third—The relations between the railways and its men. Fourth—The relations between the railway and its clientele. Our national railways must earn, roughly, $40,000,000 net annually, to stop any further advances from the government; that is to say, to stop the drain on the taxpayer. How soon this can be brought about, I hesitate to say: but I will go so far as to indicate that it may not be so far distant as most people might imagine." — Sir Henry Thornton, newly-appointed president of Canadian National Railways.

MUST BE LAND SETTLEMENT

"Administered by officers selected purely for their ability as railroad managers, and freedom from political interference, or not, the duty of the country as a whole is clear. We must so manage as to build our country up to our railroad mileage where it is possible. This means landed settlement and industrial production generally. We need a new immigration policy very badly indeed. We can no longer afford to give 160 acres away for nothing, even if the policy was ever a good one, and we must force Western settlement on the unworked lands, largely privately owned, within the areas provided with railroad facilities. It is not numbers we need, but land-settlers. We can afford to spend more money and more effort on one real settler than on a score or more of mere immigrants."—Sir Edmund Walker, president, Canadian Bank of Commerce.

that if we borrow for private or public needs in another country we can only pay interest or principal by creating and shipping more goods to a relative value. We know how anxiously we watched to see how far we could absorb our own war bonds knowing what it would mean to owe that much more to the United States. Why is our dollar at par and why are we in so different a position from the allied nations of Europe and our enemies? It is because we found the cost of the war mainly at home.

It used to be an accepted view that a nation could not be ruined by a debt due to its own people, but super-taxes and other expedients for relieving the bulk of the people, and levying taxation as far as possible upon a few citizens or a few business ventures had not then been carried to such extremes.

We are often told that the business of the modern politician is to bribe the poor with the money of the rich and Robin Hood has always been so popular that if the injustice went no further than it sounds we might not hope to avert it. *But what we cannot afford to do is to cripple industry by the absence of fresh capital, and what is worse, to kill the desire for enterprise.* As we have not arrived at socialism and the state does not support all of our hospitals, asylums, churches, universities, art galleries, museums or other institutions for the good of the people, what do we think will become of these institutions for social well-being when we have completed the ruin of those who possessed a surplus out of which to give?

Result of Super Taxes

Doubtless many will think I am exaggerating the result of super-taxes but I am sure, at least, that I am not exaggerating the result of such extreme taxes as are now being levied in Great Britain, the United States and Canada. The empty consulting room in Harley Street may not stir you nor the empty seats in the theatres in London. The bitter exclamation of the British taxpayer that the tax collector "seems determined to leave us nothing but our brains" touches us nearer, but I heard nothing more conclusive than the quiet but emphatic statement of one large landowner that with the present income and death taxes the families in Great Britain who have no income from trade or outside sources, would not last longer than three generations. It there are any here who think that it matters little if such people are forced to what is termed work, I have no time to deal in full with them, but I will give you one example of what is already happening.

In mid-summer in London every newspaper, every hoarding, every mail disclosed the appeal "Save our hospitals" and with the King's personal letter urging everybody to help in one of the direst emergencies London had ever faced, a great campaign was being carried on. When I left England the subscriptions were pathetically inadequate and many hospitals had closed. That sign on countless London buildings, "Supported by Voluntary Subscriptions," the splendid evidence that people in Great Britain with a margin in income remember their social duties, may as well be obliterated. The people cannot have it both ways. The super-tax has absorbed the surplus out of which the "voluntary subscriptions" for the public good were made.

Debts Will be Paid

Our war debts must, of course, be paid. *Great Britain will pay the United States if it breaks her back and we too are debt-payers and don't understand anything else.* Even if we could prevent the terrible waste of money by governments we must levy taxes that hurt if we are to pay our debts. We are proud of our share in the war. We are now a nation and a member of the League of Nations and our voice in its councils is listened to with respect.

Do any of us really wish to escape whatever may be our fair share of the cost of the war? I refuse to believe that there are such Canadians. We can levy certain taxes which will not hurt production, will not hurt any individual materially and will raise what is needed for the war debt. Even with such taxes we should still have graded income taxes that will hurt, but would not positively crush, and men with a surplus would not as many do now, refuse to invest in industrial stocks in which the government proposes to share the profits and leave the investor to bear the losses. If you doubt this consider the dealings in tax-free bonds in the United States. I leave this subject with the warning that our system of taxation will set Canada back for years, while a reasonable system would demonstrate that no nation need be ruined by a debt to its own people.

Canada's Great Opportunity

I think it very hard to speak in what may seem a doubtful vein about Canada. I am by nature an optimist and when I survey the future of other nations my heart leaps at the possibilities of Canada. We have the greatest opportunity of any country in the world. But optimism must be ballasted with common sense and without common sense we can ruin Canada or any other country.

The conditions of life in Canada have in the last quarter of a century improved beyond our highest hopes. Our farms, despite some lean years, are better cultivated, better stocked with animals as to number and far better as to quality, less in debt down to two years or so ago, than any prophecy we had made. Our cities are a surprise to all visitors. In our universities, colleges, schools, conservatories of music, art galleries, museums and in most of the things which make life worth while, and which give us a place among world's leaders of opinion, we have arrested the attention of outsiders who come in numbers to be convinced that such a growth has really taken place.

Pulling Together

We have done this by pulling together. The so-called rich have given millions beyond estimate to bring this about and down to three years ago it was comparatively easy to get money for any cause which would better life in Canada. Just now the fountains are drying up rapidly. It will be better for all of us if we conclude to be fair to each other and pull together again in our vast task of the future of Canada.

SHERBROOKE PLANTS ACTIVE; METAL TRADES DOING WELL

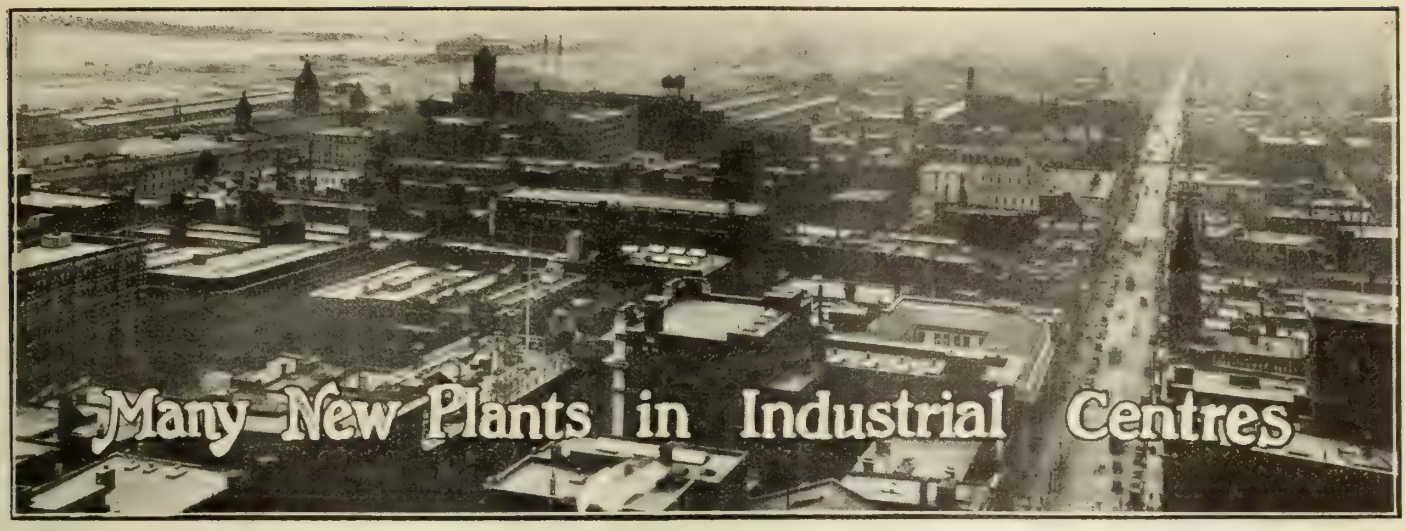
By J. H. BROSSEAU,
Secretary-Treasurer Board of Trade.

ONE OF THE most important industrial developments of the year is the decision made by the Johns-Manvile Co., Ltd. to erect a large factory at Asbestos, Que., for the manufacturing of finished asbestos products. Work on the new plant is expected to start early in the coming spring. The cost of erecting this plant, together with its equipment, will be in the neighborhood of $1,500,000. This big concern has been doing extensive underground development this last year, so that a sufficient quantity of raw material can be assured in order to supply the new plant. It is claimed that this will be the first manufacturing concern in Canada which will turn out a complete line of finished products such as roofing, insulations, packings, etc., and the elimination of duties and freight rates should have a decided effect in reducing the cost of many of the products now being secured through the United States.

Here in the Eastern Townships conditions are generally good and the mills have been operating at a high degree of capacity except for a few exceptions. Conditions in the paper industry are relatively good, prices were firm during the past month. Paper productions during September were 27 per cent. larger than in the same month last year. Manufacturers' stocks are lower than last year, while shipments are larger.

There was little change in the activity of the metal trades between September and October and, in fact, dealers reported during November that their sales had fallen off. The metal trade, however, are nevertheless operating at a higher rate than they did in the fall of 1921, or, in fact, at any time since the business depression started.

As to labor conditions, unemployment has practically ceased in this section of the country.



View of downtown Toronto looking west from Board of Trade Building. To the left is Toronto Bay, on which extensive reclamation work is being carried out in connection with an elaborate waterfront scheme.

Sturdy Growth Rather Than Speculative Prospect

Increases in Industrial Activities Throughout Canada—American Branch Factories to Make Most of Opportunities—Western Cities Also Make Gains—Cheap Power Strong Factor

Information given below epitomizes, to a large extent, the annual reports of Industrial Commissioners, Secretaries of Boards of Trade, or other officials in close contact with equipment employed in the expansion of their respective towns and cities.

INDUSTRIAL centres report, on the whole, a very encouraging year with reference to new plant location. Some have made more pronounced gains than others, reflecting recognition of some particular advantage in available facilities. There is apparent a reasonably conservative attitude on the part of municipalities toward new propositions. The tendency is to eliminate bonuses or any inducement that seems to encourage purely speculative propositions. It is generally felt that thorough investigation and sound business-like conditions will be sufficiently attractive to any concern that is serious in its intentions.

Those municipalities that are best organized to draw prospective manufacturers make gratifying reports as to the past year, and all view the coming year with optimism. American branch factories have been well represented. Expansion of export trade with the British Empire has been a strong inducement to these concerns, and there is a growing feeling that the future will show very material development in this respect. Discussing reasons why American enterprises are turning their eyes toward Canada as a base for branch operations, a publication circulating largely among United States manufacturers recently pointed out:

"The most marked development of the trade of Canada in 1921 was the decline in the value of operations with the United States. In 1920 the total value of this trade was $1,512,000,000; in 1921 was a drop to approximately $930,000,000. Imports from the United States suffered most; in 1920 they were $921,625,000, whereas in 1921 they were approximately $574,000,000. At the end of the year trade with the United States was found to be in a much sounder and better balanced condition than it was at the end of 1920. At that time the balance of trade against Canada in favor of the United States was $347,000,000; on the operations of 1921 it was only about $230,000,000. All of which emphasizes the need of a branch factory in Canada to supply that country and the other units of the British Empire.

"In the task of making herself self-sustaining, Canada is being helped by the course of events. Canada is an exporting nation of importance and this development is making it increasingly possible for Canadian manufacturers to produce commodities in quantity and bring down initial costs. The development of Canada's export trade has stimulated the imagination of the Canadian manufacturer; he sees more clearly his opportunities in the world's markets and he is filled with an ambition to make the most of these opportunities. The inevitable outcome will of course be greater ability on the part of the Canadian manufacturer to hold his own domestic markets against outside competition; even the competition which he has most to fear—American competition. This will mean less buying in the United States as time goes on, and increase to a still greater degree the urgent need of the American manufacturer going to Canada; and through the instrumentality of a branch factory, answering the demand for domestic-made wares."

One of the most important features of the year, as regards industrial relations between Canada and the United States, was the return of the Canadian dollar to par, and the approach of the pound sterling to within close range of a like position. Thus, it may be said, an important factor in the alignment of English-speaking countries for commercial intercourse has been re-established, and the coming year should see a great improvement.

Following are statements from industrial centres, describing the past year's record:

BRANTFORD HAS RECORD YEAR DECIDEDLY HOPEFUL FUTURE

By W. H. WOOD, Manager Chamber of Commerce

BRANTFORD.—Competition between the hundreds of Canadian communities for the few industries of merit seeking a desirable location is very keen. Inspired by Brantford's success, sister cities have been stimulated to action. Canada will reap the benefit.

No city of Brantford's size in Canada has over the past four years had as many industries established within its borders. Included in this statement are those factories whose managements established them without the aid of any community organization. The city is the greater benefited thereby:

From the United States: J. & J. Cash Inc.; Robbins & Myers; S. C. Johnson & Son, Ltd.

Other gains: Brantford Brass Foundry Ltd.; Brant Foun-

dries Ltd.; Thermo Electric Co. Ltd.; Happy Thought Co. Ltd; Schuler Button Co. Ltd.; Lockwood Mfg. Co. Ltd.; D. J. Hanna Co.; Parisian Knitting Mills Ltd.; Bradley's Machine Shop; Ruddy Mfg. Co. Ltd.; Crown Electrical Mfg. Co. Ltd.; Dominion Dress Co.; Ontario Gypsum Co.; Brantford Computing Scales Ltd.; Bluebird Corporation, Ltd.; Kanadda Biscuit Co.

Extended their plants: In addition to this, long-established firms have built additions to their plants. Included in this number are: Slingsby Mfg. Co. Ltd; Massey-Harris Co. Ltd.; Sterne & Sons, Ltd.; Cockshutt Plow Co.; Dominion Flour Mills, Ltd.; S. C. Johnson & Son, Ltd.

The splendid efforts of men responsible for the development and increasing of Brantford's industries bear striking testimony to the principles of the modern chamber of commerce that service to establish industries is not the least important part of a community program of industrial development. Thus the Brantford Chamber of Commerce, while putting forth persistent efforts through the Industrial Commission to interest basic and diversified industries to locate in Brantford, has endeavored to render every possible service to encourage and expand home industries.

It is realized that every factory is a great potential source of wealth to our community and to Canada, and that they are of greatest actual value only as they are running to fullest capacity. A recent survey of 216 cities in connection with industrial development shows their citizens consider the greatest industrial expansion to have been due to the enlargement and growth of existing plants.

To assist local manufacturing plants is, therefore, sound economics. Included in chamber of commerce activities for established industries are much appreciated features including: Domestic and foreign trade promotion; employment bureau; trade commissioner services; trade enquiries; home products exposition; trade information and data; aid in insuring adequate service to industries by public utilities; transportation problems; directories, codes, etc., and community advertising so that the city's products may find a ready market.

Protecting the Public

Many propositions have been investigated with the result that Brantford has been protected against questionable stock selling campaigns. This phase of the program of industrial development is universally recognized by chambers of commerce and industrial commissions as being proper and scientific. This policy safeguards the interests of the whole community and has already saved Brantfordites at least one hundred thousand dollars in three instances where promoters "turned down" here went to other cities and defrauded citizens of those cities out of this amount. The general policy, considered wise and safe, of the Brantford Chamber of Commerce in connection with stock selling propositions is that of not assisting in the promotion or financing of such.

Propositions of this type may be all their promoters claim them to be, or they may not. The Brantford Chamber of Commerce never endorses any. But with the municipal council, the Brantford Chamber of Commerce has the "best" city in Canada in which legitimate industries are encouraged to locate. A city that has all the facilities that make a city a good city in which to locate, work and live. These facilities include a good class of workmen, central location, excellent lines of transportation—steam, electric, highways—homes, schools, churches, parks, playgrounds, etc.

Retail Trade

With the lessening of unemployment through the upward trend of trade and the migration of men to centres where work is assured, a much better condition exists in wholesale and retail trade circles. Purchasers are better able to pay for commodities ordered; there is not the same call for credit; lines of credit having been carried over a number of months are being reduced, with the result that merchants are moving goods and replenishing depleted stocks from the wholesale houses. This movement in the right direction is having a strengthening effect on the mercantile community in particular and all in general.

The outlook for the coming year is decidedly hopeful. Every person desiring work may find employment. Factories are becoming busier and are employing men at standard wages.

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STEADY INDUSTRIAL GROWTH AT POINT OF POWER PRODUCTION

NIAGARA FALLS.—It is evident that the day has gone by when this city is satisfied with the oft-applied designation, "the city beautiful." It has long ago recovered from that complacency naturally arising from its possession of one of the wonders of the world, and is now emphasizing the fact that, as here is the hub of hydro-electric power production, here should be the scene of greater industrial activity.

Although the American city opposite has preserved its beauty spots, it has not neglected the fact that, grand as nature may be, it is industrial development that contributes immeasurably to the upbuilding of a prosperous community. Many important plants line the river on the American side. It is true that there are stacks and factory buildings in sight on the Canadian side, and there is, in fact, a good showing of industries, but some impetus is working into the movement to make the record one that is more compatible with its location at this strategic point, with its potential electric development of 840,000 horsepower, whence many other thriving towns and cities in Ontario have been receiving their supplies of electric energy.

Already headway has been made. Several new industries have been placed, others are in prospect. Like other border cities, Niagara Falls has the advantage of being within comparatively easy distance of American concerns desirous of locating branch factories in Canada, it is within an hour of Buffalo, and its rail facilities comprise all important Canadian lines with international switching and transferring service. From shipping and marketing viewpoints it is, in general, a gateway to Canada, but a threshold to busy Ontario in particular.

Naturally the city is assured a supply of electric power adequate for all requirements. The present price is about $17.50 per horsepower per annum. It is this abundance of power that practically explains the presence in the Falls' zone of such large concerns as the American Cyanamid Co., the Carborundum Co., the Union Carbide Co., Acheson Graphite Co., the Herbert Morris Crane & Hoist Co., Dominion Chain, Canadian Shredded Wheat, American Can, Ramapo Iron Works, Spirella Corsets, and three silver works—Oneida, William Rogers and McGlashan Clarke, depending to a large extent upon electricity and electrical processes. Among recent additions to the industries of Niagara Falls is Dominion Insulators, Ltd., the Canadian branch of the Ohio Brass Co., making high tension insulators and insulating materials and electrical brass goods.

The Robert Mfg. Co., of Lockport, N. Y., manufacturing knives for paper mills, is an infant industry which has outgrown its first factory and is now building a more substantial one of cement and steel.

Adjacent to the city is the industrial area reserved for factories by the Hydro-Electric Power Commission. This is near the Chippawa-Queenston power canal, and here it is proposed to allocate sites to prospective factories. The layout of the entire district, however, lends itself to good industrial location.

It is not so long ago that the prediction was made that the time would come when this entire peninsular zone from Niagara Falls westward to Hamilton would be practically an unbroken row of industrial plants. Niagara Falls, when that time comes, according to F. C. Clarke, industrial commissioner, will be found to have held up her end.

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HAMILTON IMPROVES POSITION EIGHTEEN NEW INDUSTRIES

By C. W. KIRKPATRICK, Commissioner of Industries.

HAMILTON.—Taking into account the fact that practically the whole world has been, and still is, passing through a period of reconstruction, Hamilton has no reason to complain of the industrial progress made during the year 1922.

True it has not been a year of unsurpassed activity or prosperity but it has been a year of substantial growth and development and the closing months find conditions greatly improved over the opening months of the year, while the improvement over the corresponding months of the preceding year is even more marked.

To be more explicit, Hamilton has not experienced any boom during the year 1922, but there has been a slow but steady and permanent recovery of industrial and general trade conditions, which gives every promise of being maintained until a condition of normalcy is reached, possibly in the spring of 1923. Confidence—not only on the part of the purchasing public but also on the part of the retailer, wholesaler and manufacturer—which was so badly shaken by the slump of two years ago, is being restored and all classes are beginning to take a more optimistic view of the future than they have been able to take for some considerable time. And, best of all, Hamilton is emerging from the period of business uncertainty and depression without having sustained any very serious scars or wounds. Reverses, some of them quite serious in their nature and extent, have been met and overcome, but there have not been any serious failures and there are many indications that business in general is coming out of the fire of trial in a much more healthy condition and on a much more substantial basis than it went in.

Industries Reduced Forces

During the winter of 1921-22 the unemployment situation was very acute. While few industries were forced to close down entirely, nearly all were forced to greatly reduce their working forces or their hours of operation owing to scarcity of orders and general business stagnation, with the result that many heads of families and others were either thrown out of employment altogether or placed on such short time that they found it impossible to make ends meet, and the city spent a very considerable amount on unemployment relief. But with the approach of spring conditions began to gradually improve.

Slowly but steadily the industries began to absorb the surplus of labor and with the opening of outdoor work the need for unemployment relief disappeared and it was discontinued. Throughout the summer months conditions continued to improve, with some fluctuations. The textile industries in particular continued unusually busy and the steel and iron industries began to pick up. There was little industrial or commercial building, but house building became more active than at any previous time in the city's history, the building permits as a whole exceeding those of the preceding year and almost equaling those of the record-breaking years of 1912 and 1913.

It was feared by some that the improvement might not be permanent and that the fall would again see a return of unemployment conditions as they were a year ago, but such has not been the case. On the contrary, the factories, as a whole, have continued to increase their working forces each month and though many of them are not yet back to normal, indications are that the year will close with but little unemployment and bright prospects ahead for the year 1923. The recovery of the steel industry was somewhat hampered by the long-drawn-out coal strike and even yet some of the larger industries are feeling the effects of the coal shortage, but it is anticipated that this will shortly be overcome.

Conditions Satisfactory

General business conditions continue very satisfactory considering what has gone before. Manufacturers, wholesalers and retailers all report that the confidence of the purchasing public is gradually being restored and that orders are being received in greater volume than for many months past. At the same time it cannot be denied that all classes are purchasing more conservatively than was their wont during the prosperous years immediately following the close of the war. They are buying only for their immediate needs. This is taken as a healthy sign, anticipating, as it does, that the days of skyrocketing and speculation are over and that all classes of business men have settled down to their pre-war policy of doing business strictly on a business basis.

The unusual volume of house building during the first ten months of the year is in itself an indication of a renewed confidence in the continued growth and prosperity of the city. Despite the fact that there has been practically no industrial building this year, the value of the building permits for the first ten months reached a total of $4,421,890 compared with $4,639,450 for the whole of the preceding year. The population, according to a census taken by the assessment department in the early fall, also showed an increase of 1,992 and now numbers 120,235, while the city's assessment is now $140,-854,340, an increase of $4,939,400 over that of 1921. The majority of the homes for which permits were issued were of moderate size and value, such as might be required by the working and middle classes.

Eighteen New Industries

The fact that there was practically no industrial building during the year does not mean that there was not any industrial growth or development. On the contrary, Hamilton improved its industrial position by adding eighteen new industries up till the end of October, while negotiations are pending that should result in several others being secured before the close of the present or early in the new year. Eight of these new industries were of either United States origin or parentage, the most important being the Canadian branch of the Beech-Nut Packing Company, of Canajoharie, N. Y., one of the best-known food products industries in the United States. All of the new industries commenced operations on a modest scale and were able to secure temporary accommodation in existing manufacturing buildings, but many of them give promise of developing in both size and importance just as rapidly as normal conditions are restored throughout Canada. The new industries and their respective lines of manufacture are:

Beech-Nut Packing Co., (Canajoharie, N. Y.), chewing gum, confections and food products; Beacon Electric Co., electric lamps; Beacon Soap Co., castile soap; Canadian By-Products Co., (Scranton), fire brick; Canadian Shell Oil Co., oils; Climax Cleaner Mfg. Co., (Cleveland), wall paper cleaners; Diamond Devices, Ltd., automobile accessories; Devine, J. S., woodenware products; Dexter Lock Co., (Grand Rapids), locks; Gerrard Wire Tying Machine Co., (Chicago), wire ties; Jones, A. C., & Co., hardware; Kismet Co., silk and mull underwear; McColl Bros. Ltd., oils; Pilgrim Product Co., soft drinks; Security Fountain Pen Co., (Chicago), fountain pens; Townsend, Krug & Greaves, (Perry, N. Y.), cutlery; Whistle Bottling Co., (New York), soft drinks; Woods, W. A., & H. S. Johns, crushed colored stone.

Another important industrial development was the commencement of manufacturing operations by the Firestone Tire & Rubber Company, which located in Hamilton about two years ago but whose plans were considerably interfered with by the period of depression. This year the company completed its first manufacturing unit and during the month of September started manufacturing tires. By the end of October it was manufacturing practically all classes and sizes of tires and it is expected that by the end of the year it will be operating to the capacity of the first unit with a working force of not less than 500 and that next year considerable extensions will have to be made.

Outlook Promising

The outlook for the future industrial development of the city was never brighter. During the year the city's department of industries and publicity had correspondence or other negotiations with upward of 500 American and British industries that contemplate establishing Canadian branches as soon as conditions warrant. It was noticeable that early in the year the interest of the outside manufacturer was rather passive—he was interested and glad to receive all the information he could get, but there was little to indicate that he contemplated making a move at an early date. During the fall months, however, a considerable number of those who had carried on negotiations by correspondence earlier in the year sent representatives to personally investigate local and Canadian markets and manufacturing conditions, indicating a more active interest and leading to the belief that in the not distant future they will be ready to act on the information they have been getting during the quiet times. Hamilton, therefore,

looks back on the year 1922 with no small measure of pride and satisfaction and looks forward to the future with every confidence.

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SARNIA INDUSTRIES EXTEND; FUTURE VIEWED WITH OPTIMISM

By GEORGE P. TRANCE, Manager Chamber of Commerce.

SARNIA:—There have been no new firms commence operations in Sarnia during the past year, and no marked changes in the industrial development of this district during the year. Some of the industries have experienced considerable difficulty in getting in their raw material, which has caused them to abandon plans for increases in output. On the whole, however, practically all the plants have enjoyed a good year.

The John Goodison Thresher Co. are building an addition to their plant, which will enable them to increase their production considerably; the Holmes Foundry Co. increased production this year; the Peninsular Sugar Co. are building a new plant at Petrolia and should be ready for operation next season; the Dominion Alloy Steel Corporation has completed the purchase of plant site adjoining the city limits and the purchase money has been paid; erection of plant has not yet been started.

In summing up the industrial situation, this district has enjoyed a very good year and is very optimistic for the immediate future. Building to date has been very brisk, the number of permits issued for the year to October 31st is 621, with a total value of $752,190. The value of permanent improvements, such as sewers, sidewalks, curbs and water mains, in the city of Sarnia for the past year amounts to $43,300.

Conditions in the building trades are good and no skilled men are out of work here. There will be considerable building carried on here during the winter months. There is very little unemployment and the outlook is good for the coming winter. With reference to encouraging prospective industries, depending upon the industry, its size, and its relationship to other industries, various concessions can be arranged through the city council and the taxpayers.

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WINNIPEG INDUSTRIAL GROWTH ASSISTED BY CHEAP POWER

By J. M. DAVIDSON.

WINNIPEG, MAN.—Most of Winnipeg's industrial development during the year has been confined to smaller industries, of which no less than 148 have been established. Included in the list are printers and bookbinders, candy manufacturers, sheet metal works, food products, restaurants, brushes, paper boxes, laundries, music publishers, bedding manufacturers, gloves, soft drinks, dyers and cleaners, bakeries, loose-leaf books, washing machines. Both the Coca-Cola and Orange Crush Bottling Company, have enlarged their plants during the year and the following soft drink manufacturers have established factories: Lucerno Co.; Green River, Ltd., and B. B. Bottling Co. A branch of Child's restaurant was established early in the year and is said to be one of the most outstanding successes in their chain of restaurants.

Outlook for the coming year seems to be very favorable. There is no doubt that the immigration plans which are now being formulated will result in benefit to the city of Winnipeg. The $10,000,000 hydro-electric power plant which is rapidly nearing completion will vastly increase the supply of hydro-electric power for manufacturing purposes. The prospects are that an aggressive campaign for industries will be conducted. Indications are that 1923 will be a good building year. Several large undertakings are in prospect and we look for a record year in home building.

The chief encouragement for industries in Winnipeg is the cheap hydro-electric power and unexcelled transportation facilities. No free sites or bonuses of any kind are offered to prospective industries.

Early summer there was very little demand for laborers other than for farm work. During the next three or four months conditions improved very materially. The demand has been decreasing during the past ten days and unemployment has commenced to manifest itself. This is due largely, of course, to the influx of men to the city from the country. Congestion in the city is not nearly as great as during the past two years. Heavier demand for bushmen than corresponding period in 1920 and 1921.

Men engaged in building trades are finding steady employment and will continue to do so as long as fine weather lasts.

Wages for mechanics average fifty cents per hour; unskilled help forty-two and a half cents per hour. Bush workers $35 per month, including board and room. Pulp-wood cutters $4 per double cord. Tiemakers from twelve and a half cents to fifteen cents per tie.

Men going to farms for winter, work for average wage of $15 to $20, a number receiving as high as $25 per month, but others getting only $10 per month.

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FORT WILLIAM ADDS NEW INDUSTRIES

By W. WEBSTER, Secretary Board of Trade.

FORT WILLIAM.—The several industries that were initiated this year include a tannery for which a site has been acquired and machinery is being selected; expected to be in operation in the spring of 1923; a small factory now in operation, making any kind of string instrument; a plant manufacturing small ornamental statuary from composition resembling marble. Another small industry in the embryo stage is the Swanson Ornamental and Structural Iron Works, which has a commodious site at the west end of the city and is away to a good start. Additional equipment is being installed as required.

A good deal of grain elevator construction has been done, notably the additions to the Northwestern and Paterson elevators.

The Canadian National Railways are at present constructing a large railway terminal to be known as the Mount Terminal; this is situated close to the western boundary of the city, and entails the construction of two and one-half miles of main track and about ninety miles of terminal track.

Present plans call for a twenty-four stall roundhouse, provision is made for an additional twenty-four stalls which shall be added as required. Industries generally have enjoyed a good year; there have been no industrial disputes.

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BROOM FACTORY FOR OWEN SOUND

By R. D. LITTLE, Secretary-Treasurer, Board of Trade

OWEN SOUND.—One industry commenced operation here during the past year, namely, J. F. Jeffcott, broom maker.

We give tax exemption for a period of ten years if approved by the ratepayers, by way of assistance to prospective industries.

There is not much unemployment here, though some industries were running only four days per week. Laborers are receiving from 30c to 39c per hour.

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GUELPH'S INDUSTRIES IMPROVE; GOOD PROSPECTS FOR NEW YEAR

By H. WESTOBY, Guelph Chamber of Commerce.

GUELPH:—The industrial situation in this city is very much better today than it showed prospects of doing at the beginning of the current year. The basic industries of Guelph are the iron and steel, rubber, woodworking and textiles. The iron and steel trade, which began the year at very low ebb, has gradually improved throughout the year, and practically all of the Guelph iron industries are now on full time, with prospects of continuing so throughout the winter. The woodworking, rubber and textiles industries, are all running overtime, and report very large orders on their books.

The outlook for the coming year is therefore viewed with complacency by practically all of the Guelph manufacturers.

Three new firms have located in Guelph during the current year: Lander Bros., Ltd., from Buffalo, N.Y. They established a silk hosiery industry in this city. J. T. Arnold & Sons have erected a new factory in which they will manufacture excelsior. The McArthur Construction and Engineering Co. have acquired property and have now a large equipment incidental to such a business.

Guelph has been in times past willing to grant fixed assessments to new industries of merit, and I think it is very likely that such a policy will be continued. Through the kindness of a local resident there is a large acreage of manufacturing ground available, which will be given free of charge under certain obligations.

The building trade for Guelph reports $900,000 worth of new buildings under construction for the current year, and in addition to this, several very large new buildings are just being completed for the Ontario Agricultural College, which is outside of the city limits.

The civic officials have carried out a very extensive paving program, and have laid nearly 7 miles of new concrete highway this year, whilst the Suburban Road Commissioners are just completing the eighth mile of new concrete paving from the city limits. The radial railway has been completely overhauled, and new rails and track laid, involving an expenditure of very close to $300,000. The result of all this work has been that we have had a dearth of unemployment, and on the contrary laborers have been difficult to secure in many instances.

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CALGARY'S NEW OIL REFINERY WILL BRING OTHER INDUSTRIES

By J. H. HANNA, Secretary Board of Trade.

CALGARY, ALTA.—In connection with Calgary's industrial development the principal feature of the year was the location of the new refinery of the Imperial Oil Company in this city. After a thorough investigation Calgary was selected as the most suitable site in this Province for the plant in question. The present plans provide for a plant to cost at least $2,500,000 and will have a capacity of 3,500 barrels per day. This will provide steady employment for at least 250 men, but there is no doubt a much larger number will be required, as in addition to the manufacture, the distribution of the Imperial Oil Co., will be centered in this city. Other contingent industries will follow.

Another new industry is the Rocky Mountain Paint Co., which has been started this year, and which is developing our natural resources, as most of the raw material in connection with this industry is found within a short distance of Calgary.

In connection with industries already established here, the Ford Company are putting up, at a cost of $150,000, a new building to take care of their increased business. The plans make provision for further extensions as required.

Another Telephone Exchange, to take care of the rapidly expanding telephone business, was built in the north-west part of the city at a cost of $115,000, including equipment. Calgary has now five telephone exchange buildings located in different parts of the city. These take care of 16,000 subscribers.

The Riverside Iron Works have improved and enlarged their plant at a cost of $25,000 in order to take care of their increasing business. The D. V. Cope Co., wholesale furniture dealers, have extended their business and are now manufacturing a number of lines of furniture here. There has also been an extension to the Totem Manufacturing Co., who handle gum vending machines and store fixtures.

Other industries in Calgary, including the C. P. R. car shops which employ on an average of 1,125 men; the P. Burns Packing Plant with 400 men and women employed; the soap works, flour mills and sash and door factory, etc., have all been pretty fully employed throughout the year.

In connection with the retail trade, the new Arcade Building just opened, formerly the Pantages Theatre Block, leading from 8th Ave. through to 7th Ave., is attracting considerable attention. In this building are housed fifteen different lines of trade.

Under the laws of Alberta municipalities are not permitted to give bonuses or financial assistance to prospective industries. The city, however, agreed to make a fixed assessment on the new plant of the Imperial Oil Co., and assurance was given by the Provincial Government, that if a plebiscite on the question was submitted to the people and carried by a large majority, the necessary legislation would be passed confirming this agreement. The matter was submitted to the electors and carried by a large majority, in fact there was scarcely any opposition whatever.

The crops have not turned out as well as was anticipated some months ago, and this, of course, has some effect on business. There is not much change in the unemployment situation, and it is anticipated that the city will have to take care of quite a number during the winter months.

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RECORD BUILDING IN STRATFORD

By A. W. DEACON, Secretary-Manager Chamber of Commerce.

STRATFORD:—There has been a strong, steady, general improvement in industrial conditions in this city during the past year. Our furniture factories are working well up to strength and full hours, and in some cases overtime. The Stratford Frames & Novelties, Ltd., purpose establishing a plant in this city, commencing building operations as early in the new year as possible. Plans and specifications are now out, and work will be rushed along. During the past summer building operations have by far exceeded that of any other year in the city's history. This, together with a great deal of permanent road work done by the city, has amply taken care of any unemployment, and, at the present time, unemployment is at a minimum.

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VICTORIA HAS LARGE ADDITIONS

By GEO. I. WARREN, Industrial Commissioner.

VICTORIA, B. C.—There have been approximately one hundred and sixty new businesses established in Victoria during the past year. The business prospects for the coming year are exceedingly bright. Not since the years of 1910 and 1911 have the indications been as favorable as now.

The city assists prospective industries in the matter of leasing city lands, and granting certain concessions in regard to water rates, etc. Laborers' wages are governed here by union laws, and are the same as elsewhere in Canada. The employment conditions are rather better than during the previous winter.

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WOODSTOCK MAKES PROGRESS; INDUSTRIES APPROACH NORMAL

By H. SYKES, Secretary Board of Trade.

WOODSTOCK, ONT.—At the close of 1922, the industrial activity of Woodstock has seen a decided improvement over the early part of the year. At the present there is a spirit of optimism throughout Woodstock and district, generated by the increased business which has come to our industries. The furniture industry is well pleased with present business coming in and prospects for the future. There has been a marked increase during the past three months. The textile industries are very busy in some departments and steady business is certain until spring. The stove industry and foundries are all very busy and report that they have sufficient business in process to keep them going for several months. The music industries report that at present there is a marked improvement over the same period last year. These industries would be very busy if they had even a reasonable amount of the foreign trade they had previous to the war, but they report it is impossible to secure this owing to the high cost of delivery charges and the tariff against Canadian instruments in Great Britain and the colonies. This splendid foreign business is being diverted to Germany owing to these obstacles. Wood-working industries, including the wagon factories, report business about the same, with prospects of a slight increase. There is very little business com-

ing from the West to these industries and they report collections much behind.

A high record has been made in our local customs. The returns for October are the highest in the history of the Woodstock office. The figures show that local trade has grown tremendously. For the month of October the total collections amounted to $38,174, which were the highest ever registered in one month since records were kept in Woodstock. Compared with last year, the collections for October were almost double. The sales tax amounted to $26,000. In 1921 these were only $7,931. This shows the extent to which business has grown in the city and district since a year ago.

Building activities are well maintained. Permits for this year continue to show a satisfactory increase over last year's figures. The total for the ten months of this year is more than double the amount for the corresponding period in 1921.

Two very important industries have been established in Woodstock during this year. The Woodstock Pipe Organ Builders, Ltd., report business excellent. This new industry has recently made shipment of four large pipe organs and have many prospects for early business.

The Oxford Milk Products Company is now operating. The capital of this company is placed at $150,000. The plant which was recently installed cost $80,000. The plant is now receiving five thousand pounds of milk a day and expects in a short while, to be using double this quantity. Should this plant operate to capacity, it is capable of using thirty thousand pounds of milk per day. Shipments were recently made abroad, to different parts of the British Empire.

The Bell Telephone Company has erected a new building on Graham street. It is a three story building of red tapestry brick, with white stone trimmings; of fire proof construction and will be equipped with the latest switch boards of the common battery type. The cost is estimated at $130,000. As an evidence of how the Bell Telephone service is appreciated in Woodstock, it is interesting to note that under the able management of Mr. Davidson, the number of telephones has increased from five hundred and three in 1910 to fourteen hundred and ninety-eight at the present time. This is considered a wonderful increase, especially when considering that the population of Woodstock has not greatly increased during this period.

At present, several of our industries are advertising for skilled mechanics. The general consensus of opinion among our business men is that as prospects now seem, our industries should be running almost to normal during 1923.

STRONG RECOVERY OF ST. JOHN FROM AFTER-WAR PARALYSIS

R. E. ARMSTRONG, Secretary Board of Trade.

ST. JOHN, N. B.—New Brunswick, whose open ocean ports and varied natural resources in agriculture, fish, timber, lime, gypsum, coal, oil shales, hydro power, and minerals offer such splendid opportunities for the development and expansion of Canada's world trade, has begun this year to show marked symptoms of recovery from the after-war business paralysis which has affected so many countries.

St. John is sharing in the progress of other sections of the province. The lumber industry is improving and several mills are operating actively here. One of these mills, belonging to Stetson, Cutler & Company, known as the Jordan mill, was suddenly wiped out of existence by fire, as well as a large quantity of lumber.

The Stephens Brick Company's plant (formerly the Lee Bros.' plant) which was only established a few months ago, was also burned recently. While all the wood-work in the buildings was reduced to ashes, the machinery was only slightly injured, and the plant, it is expected, will soon be re-established again.

The Nashwaak Pulp Company's pulp mill is in active operation, and throughout the province there is a general improvement in pulp conditions. At Bathurst, the pulp mill there proposed carrying on the manufacture of news-print paper. No other mill in the province is engaged in paper-making.

The Simms Brush Factory, the Cornwall and York Cotton Mills, and the several nail factories of the city are quite busy at present; so also is the Atlantic Sugar Refinery, which has been doing a large export trade this year.

There have been few new industrial enterprises started in recent times, although several are being considered, among them a marine railway dock plant, and a cooperage factory. With the effective functioning of the new hydro-power system, which has just been installed at Musquash, the outlook for the new year is very favorable. The assistance that is usually extended by the city to new industries consists in a reduced valuation for assessment purposes, or in the lowering of water rates or other charges.

The port outlook for the coming winter is very bright. The grain elevators are being filled up and a large increase in grain shipments is anticipated.

With the lumber mills operating, a large winter cut of timber is looked for, building conditions improving and a busy harbor season expected, there should be very little unemployment at St. John this season.

CHATHAM REPORTS FAIR OUTLOOK

By W. R. LANDON, Manager Chatham Chamber of Commerce.

CHATHAM.—There have been no new manufacturing firms located in Chatham this year. The prospects for next year are fair.

We do not assist by bonus, loan or guarantee. Other concessions of importance, however, are given to thoroughly reliable concerns.

There is no unemployment just now. The weather has been mild and consequently labor has been very well employed. Ordinary labor runs from 30c to 40c per hour.

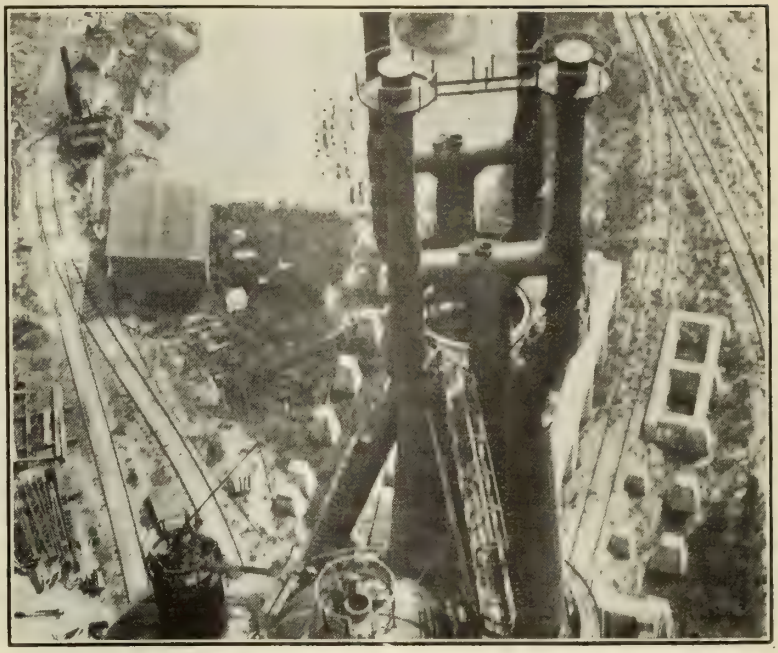
HISTORICAL SUMMARY OF THE AUTOMOBILE INDUSTRY IN CANADA
1910-1921

	Year	Establishments No.	Capital $	No. of Employees	Wages Paid $	Cost of Materials $	Value of Products $
Automobile Manufacturing	1910	8	4,699,256	2,204	733,558	3,808,139	6,251,885
	1915	8	14,019,455	3,619	2,669,333	16,739,643	24,357,627
	1917	11	28,192,858	5,015	4,862,779	35,585,820	54,466,273
	1918	10	31,550,353	4,668	5,558,042	37,058,645	66,814,266
	1919	11	34,949,739	5,839	8,152,155	51,690,715	80,619,846
	1920	17	53,906,506	7,192	10,688,657	77,157,045	101,465,846
	1921	14	40,080,269	4,449	6,484,637	45,119,345	67,050,209
Automobile Supplies and Accessories	1917	24	3,155,893	1,527	1,198,596	3,795,308	6,519,868
	1918	25	3,386,271	1,147	961,958	3,636,453	6,278,431
	1919	42	8,364,991	1,378	1,462,144	5,221,439	8,571,890
	1920	62	15,332,887	2,764	3,747,149	10,603,632	19,361,882
	1921	64	15,700,288	1,824	2,254,636	8,229,855	14,783,017
Automobile Repairs	1910	11	361,272	109	55,332	40,893	170,930
	1915	120	3,540,441	1,233	944,561	2,434,197	4,329,938
	1917	497	4,431,926	1,542	1,200,958	1,961,773	5,091,066
	1918	675	5,832,710	2,022	1,853,450	1,835,989	6,461,262
	1919	1,236	13,628,288	3,375	3,389,794	4,368,810	12,004,970
	1920	2,503	19,943,913	4,688	4,932,203	6,671,767	16,592,623

In the year 1915 the returns for Automobile Accessories and Repairs were not separately reported.

Visioning Canada's Future Steel Market

Canada Steel Corporation Has Expended, to Date, Seven Millions at Ojibway, Ont., in Preparation for the Country's Development—Location Favorable to Larger Export Trade.



View from top of 250 ft. stack, looking down on No. 2 blast furnace. To left are seen group of piles for additional furnace foundations. Plans call for 14 furnaces in all.

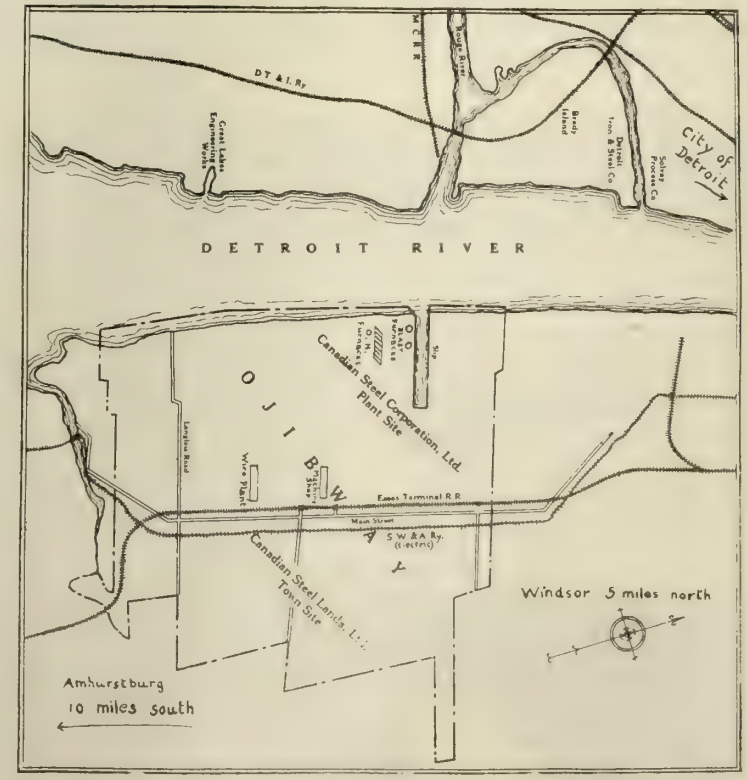
IN the work that is being done by Canadian Steel Corporation, Limited, (subsidiary of the United States Steel Corporation) at Ojibway, five miles south of Windsor, Ont., one must appreciate the vision represented in the scope of the proposed undertaking. It involves ultimately, the expenditure of millions, but it appraises the industrial future of Canada. It glimpses in the perspective a potential market for iron and steel. The proposition seems to develop the fact that, as a first prospect, Canada encourages confidence and presents advantages. Certain facts afford explanation. In the year 1920, for example, Canada displayed unpredecented industrial vigor. Steel production values amounted to $640,233,785; steel imports, $245,625,703 of which $178,661 606 were from the United States. Now, give proper bearing to the country's ownership of great national resources, not the least of which is evident in electrical power, and all of the elements upon which industrial expansion thrives and develops world-wide importance, and the background of the picture is complete. It is the purpose of the Corporation to parallel the future, to make their growth coincident rather than a matter of sudden entry after the forward movement has developed headway.

Property Two Miles Square

Comprising two thousand acres, the property extends two miles along the Detroit river, and practically two miles back. The highway between Amherstburg and Windsor forms a dividing line. To the east is the Ojibway townsite, to the west the site of the proposed steel plant. When the Corporation took over the area some years ago, the post office of Ojibway was included.

Thus, to-day, for all practical purposes, geological or otherwise, the Corporation is Ojibway and Ojibway is the Corporation. The town has a government charter, and is, in every respect, conducted as a municipality with a mayor, and board of commissioners These are appointed by the crown and will so act until an electorate is established. Their duties at present have to do with those matters that relate it to other municipalities. A uniformed police force is maintained on the property.

As planned, the townsite has capacity for a population of 22,000. It should be explained that this property is under the control of a subsidiary corporation—Canadian Steel Lands Limited—that none of it has ever been sold, and that there is none for sale. Operation of the proposed plant will call for homes for employees. It is for this object that



Plan of the Canadian Steel Corporation, property at Ojibway, showing relation of townsite, with capacity for 20,000 people, to that of the steel plant. The property is five miles below Windsor on Detroit River, and is served by electric and steam railways.

this section is being reserved. A plan they have in view is an attractive town layout with a large square, 750 feet long, for municipal or other notable buildings. For some distance surrounding the Corporation property, lots have been laid out by real estate agencies who have done a veritable "land office" business. In these operations, however, the Corporation has had absolutely no part. Dwellings now on the property were there when it was taken over; no new ones have been erected.

When the area was acquired it became advisable, in working out plans, to divert the Windsor-Amherst road, practically one-half mile to the east. Here the Corporation gave new for old. A concrete highway was built, with roads north and south and with the tracks of the Sandwich, Windsor and Amherstburg electric line between, forming a modern boulevard. This work, with all necessary changes in services, was carried out by the Corporation and handed over to the municipalities interested. The road, so diverted, passes through the centre of the property and adds an important link to a thirteen-mile stretch of concrete extending north beyond Ford, Ont. It is now proposed to carry it still further to the south and eventually to Amherstburg on Lake Erie.

Important Work Carried On

Although none of the units as constructed on the steel site immediately west of the town, are equipped or ready for operation, a large amount of work has been done. Most important is the unloading slip, 200 feet wide, 23 feet deep and extending 2,400 feet from the Detroit river; the two blast furnaces, each having daily capacity of 600 tons, the first of fourteen (possible;) the wire plant 162 x 364 and the machine shop, 142 x 340, built to handle repairs in connection with the works. Both buildings are of steel and concrete. In normal season, there are, on an average, about 300 men regularly employed. Large tonnages of steel, water and drainage pipe are stacked on the townsite for proposed services, and large concrete trunk sewer sections have been built on the property. Canadian workmen, industrial institutions and business generally have benefited from the expenditure, to date, of about seven million dollars.

It is an interesting fact that the unloading slip is the first of its kind on the Canadian side north of Lake Erie. As at present constructed it will accommodate six of the largest type of lake freighters—three on each side with sufficient room for a ship to pass between. As the operations of the corporation extend, it will be possible to double the length of this slip. The entrance expands to a width of 400 feet. Massive concrete side portals or lips, on piles of Douglas fir, 75 or 80 feet to the rock, have been built and these have rear ties or braces of concrete on piling. This will be filled in with slag from the furnaces, and other materials. A detail that indicates the corporation's belief in safety first, is the setting of steel ladders in the concrete work at intervals of 120 feet at the entrance and for the entire length of the slip connected by festoons of chain hung at the water's edge in the intersections.

Reaching in from the Detroit River the slip makes it possible for navigators to use the current of the river to advantage in arriving or departing. Coming down, a boat may make the turn and enter the slip head on with plenty of steerage way and without tug assistance. Departing if upward bound the current may be used to swing the stern downstream thus giving clearance with minimum effort.

Modern Automatic Equipment

How important this slip and water carrying service is in relation to the operation of the steel plant is strikingly evident. On the north side will be

WORLD'S BUSIEST WATERWAY

Volume of water-borne freight traffic passing through Detroit River—the "Straits"—affords interesting comparison with that of other famous waterways, and also indicates the extent to which lake and river routes are serving the behest of business. The net registered tonnage passing through in 1919 was 53,664,745 or 10,000,000 tons less than in 1918. The estimated value of this tonnage was $979,423,795. Of the 928 vessels, 113 were Canadian. This does not take into account the passenger boats, tugs or sand scows. One vessel passed every 13.2 minutes. The tonnage through Panama Canal in 1918, a notable year, was 6,131,675, and through the Suez, 9,251,601. One of the earliest and most notable flotillas that entered "The Straits," was that of de la Mothe Cadillac, founder of Detroit, who, in 1701, made the perilous detour by way of Ottawa River, Georgian Bay and Lake Huron, arriving in small boats before the site of the future Auto City, 49 days after leaving Montreal. Danger from the Iroquois made the longer trip advisable.

Bird's-eye view of slip entrance on Canadian Steel Corporation's property at Ojibway. The slip will accommodate six of the largest lake carriers. It is 202 feet wide and 23 feet deep. This view was taken from the top of a 250 foot chimney and shows location of important industries on the American side of the Detroit River.

the coke oven location and here the coal will be unloaded. On the south, provision has been made for the installation of ore unloading equipment. The concrete sub-struction for the massive ore unloaders has its base on the rock and extends the full length of the slip. With a span of 658 feet, the ore bridges serving the ore storage yard will probably be the longest of their kind in the world.

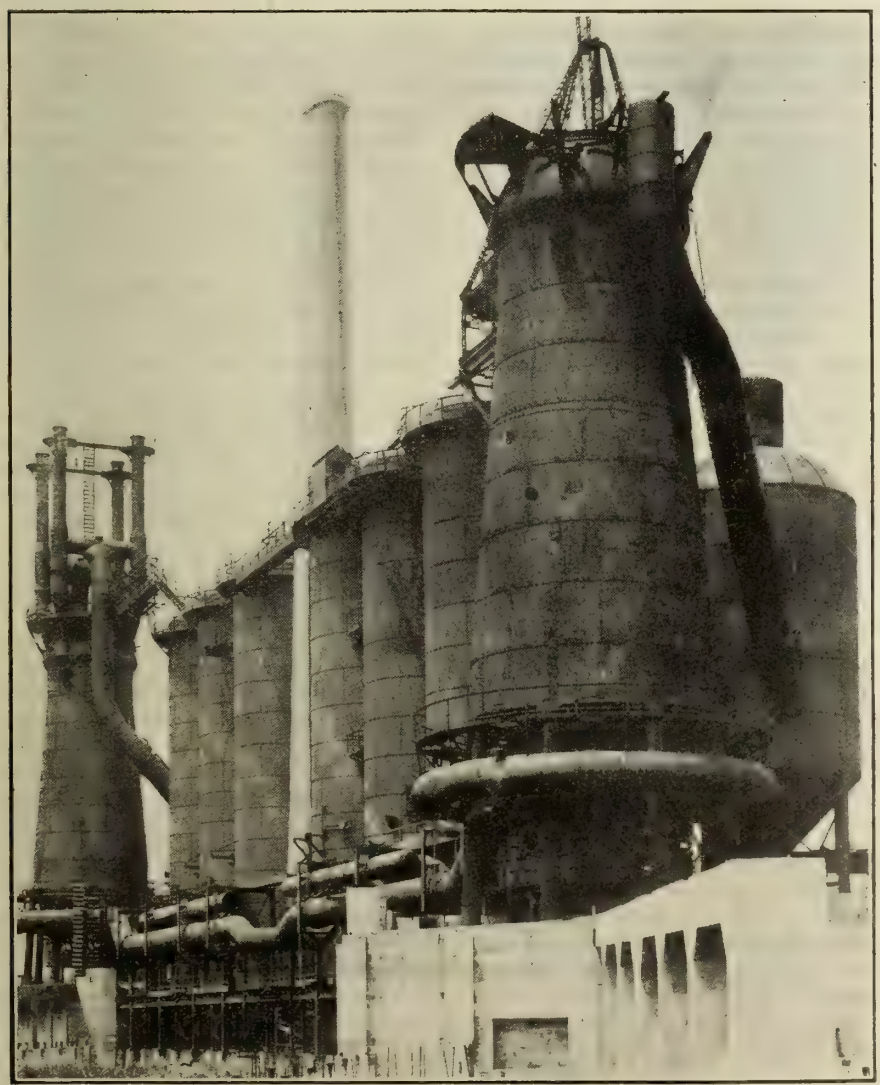
By-product coke ovens, on the north side of the slip, will be served by the Essex terminal railroad, owned and operated by the corporation, and the product thus carried to the furnaces. The entire equipment in connection with the plant is as fully automatic as it is possible to secure, representing the last word in modern practice. The two blast furnaces and seven stoves were fabricated and built by the Canadian Bridge Co., Ltd., Walkerville, a subsidiary of the corporation. They also had charge of the steel construction on the two buildings.

Plans, therefore, show that materials, unloaded on the north, pass southward to the furnaces. Beyond this again, it is proposed to locate the open hearth furnaces and their varied activities. Toward the river there is an area of low-lying land which may be reclaimed and made valuable when built up by the slag and refuse emerging from the plant.

Building of steel and concrete to be occupied by Canadian Steel & Wire Co., Limited, Hamilton, for manufacture of field fence wire. This building will equip this industry to double its capacity.

Accessory Plants

Located toward the eastern side of the steel property, the machine shop, wire plant and so-called accessory buildings appear somewhat apart from the central zone at present. There was good purpose in this, however, the desire being to make these units easily accessible to workmen from the town and to avoid over-proximity to base operations. At present, the layout seems somewhat disconnected but the very extensive plans as proposed will bring all units into proper relationship with the idea of most economic operation. The accompanyng plan reveals this idea. There are also comprehended in the accessory grouping a forge plant, a foundry equipped with electric furnace, pattern shop and storage brick sheds, oil houses, boiler plate shop, electric repair depot, car repair shop and locomotive sheds. Again there is a safety provision in a subway under the highway from the town to the plant grounds.



Two blast furnaces and seven stoves have already been built. The first of fourteen possible. The chimney in the centre is of reinforced concrete 250 feet high. The furnaces have a capacity of 600 tons of pig iron each per day.

An Aerial View

Recently a concrete chimney 250 feet high was built to carry off the combustion products from the furnace plant. Two of the illustrations in this article are from the top of this chimney. One gives a view of the mouth of the slip, the concrete walls bounding the ore storage area on the north, while to the west is the American shore. Here is shown the mouth of the River Rouge, converted into a slip or channel to the Ford blast furnaces and tractor plant. It was here, during the war, that the building of the eagle boats for the United States navy was carried on. Other plants on the American side, directly opposite, are those of the Solway Process Co., Detroit Iron and Steel Co. and the Great Lakes Engineering Co. To the north of the corporation plant on the Canadian side is the plant of the Canadian Salt Co. The underlying rock formation of this section is limestone, and underneath this are extensive salt beds.

Another view, taken from the top of stack eastward, looks down on No. 2 blast furnace, shows also the tops of one of the stoves and of the dust accumulator. Slightly to the right may be noticed a cluster of piles preparatory to the erection of furnace foundations and bases for other structures are nearby.

Built of reinforced concrete, by the Rust Engineering Works of Pittsburg, Pa., the chimney has a diameter of 11 ft. 0 in. inside of lining. The shell will be 15 ft. 6 in. inside diameter at the bottom and of 11 ft. 6 in. at the top. At the base, the thickness is 24 in. and at the top 5 in. It is built upon the same foundation as the stoves and furnaces which consists of concrete on piles driven to rock.

Served by Railway

Railway tracks noticed in these views, are spur lines from the Essex Terminal Railway. This road now runs from

General view of machine shop, which will be equipped to take care of repairs in connection with steel plant.

Ford City to Amherstburg, the corporation having extended it 12 miles from Sandwich to Amherstburg. The road crosses and has connections with the five trunk railway lines serving this busy industrial section. These are the C. P. R., Canadian National, M. C. R., Wabash and Pere Marquette. The E. T. R. is in contact with 120 industrial plants and is self supporting. As the district develops, this line will become a still more important shipping artery.

Frequently questions are arising as to the why and when of the Canadian Steel Corporation's activities. The answer may be said to represent 50 per cent. interpretative vision and 50 per cent. recognition of practical industrial economics. On the one hand is confidence in the future of the Canadian market; on the other there is conviction that such confidence must carry with it preparedness. The growth and development of the country means the increasing importance of the steel industry.

It is felt that the day will come when it may prove to be unsound, economically, to import huge tonnages of finished steel product. The output of the plant as proposed will consist of rails, plates, structural steel, bars, sheet steel, tin plate and tubes. The wire plant will eventually house a subsidiary, the Canadian Steel & Wire Co. of Hamilton, manufacturers of fence wire, and here they will be enabled to double their capacity. Other units and finishing plants will be added as the market requires. There is at present an import duty on such products as the corporation would manufacture, ranging all the way from 15 to 35 per cent. Location in Canada with an assured market has "ground floor" advantages, and then there is the matter of preferential tariffs, with British Colonies as a factor in development of export trade. The corporation is served by its own line of lake steamers under the name of the Pittsburgh Steamship Company, and by an ocean fleet, the Isthmian Steamship Company. It is equipped, therefore, to improve its position relative to the Canadian market and, through the same productive activities, to extend its contact with world markets.

Location of the plant has exceptional advantages as regards supplies of raw materials such as American hematite ores and of metallurgical limestone. The former enter duty free but there is still a duty of 17½ per cent. on limestone due evidently to some misunderstanding of industrial requirements on the part of those who framed the tariff. Importation of coking coal does not constitute a problem because of 99 per cent. refund when used for purposes of Canadian production.

To adjust itself to the future Canadian market is, then, the object behind the proposals of the corporation. When those plans may become directly operative, depends upon pressure of demand and upon attendant circumstances.

Judge Elbert H. Gary, chairman of the United States Steel Corporation, is president of the Canadian Steel Corporation, Limited. Ward B. Perley, vice-president, is in charge of operations on the property. W. H. Baltzell, formerly with the engineering department of American Steel & Wire Co., is chief engineer. E. J. McIntyre is construction engineer. He was formerly with the Republic Iron & Steel Co., Youngstown, Ohio, in similar capacity. W. J. Filbert is secretary and auditor and F. Parrish, purchasing agent. The executive offices occupy one of the large homestead dwellings on the property and this has been remodeled to suit requirements. The location chosen as a site for this great industrial development is, in some sections, one of the most charming along the Canadian shore of the Detroit.

A HISTORIC COUNTRY

Property occupied by the Canadian Steel Corporation at Ojibway, Ont., is located in historic territory. Through it runs the old road between Amherstburg and Windsor. Memories of Brock, Hull, Pontiac and Tecumseh and many others who played prominent parts in pioneer days and passed on, everywhere suggest themselves. The property occupies what was known as Shore Acres, whereon was, at one time, a famous roadhouse. The old building shows the stress of years in spite of its brave showing of massive grey limestone construction. It was evidently built in 1812, as attested by a corner stone bearing a Masonic sign and the legend, "1812, B. C." What the "B. C." means, even the oldest inhabitant refuses to guess, unless it is that the times were so troublous as to suggest that the advent of the second Christian era had been, even then, long overdue. What transformation is the locality to undergo in the next hundred years? The appearance of the American side, with its flourishing mills and factories, might afford a modest idea.

LARGE STEEL PLANT PLANNED FOR WELLAND

WELLAND.—The Electric Steel and Metal plant at Welland, idle these past two years, will be in operation in February, having been purchased by Welland Alloy Steel Company, Limited.

The above announcement which is one of the most important pieces of industrial news of the year, was made by J. Ferguson Black, who has had negotiations for the company in hand for many months. In an interview Mr. Black gave a comprehensive outline of the company, its property, its purposes and its personnel. It is proposed to have rolling mills in operation before the close of 1923, and to employ 2,000 men. It is the intention to increase electric furnace capacity to daily output of 300 tons.

The officers of the company include men who are noted in the steel industry:

G. F. Alderdice, first vice-president of the Brier Hill Steel Company, Youngstown, Ohio. This company operates blast furnaces and open hearths, coke plant, blooming mill, merchant mills and sheet mills. It owns its own coal mines and has a fleet of lake carriers for carrying ores. It employs between five and six thousand men.

W. H. Devlin, for twenty years general superintendent Carnegie Mills, Sharon, Pa. This plant is owned by the United States Steel Corporation and employs upwards of 2,000 men.

H. William Sharpe, first vice-president of the Joliet Forge & Steel Company, of Joliet, Ill. The rolling mills and forge shops are owned by the Sharpe family. The company has reserves in excess of a million dollars.

G. B. Nisbet, M.E.L.C.G., formerly metallurgical engineer for the Brier Hill Steel Co.

H. E. Timmerman, Welland, formerly engineer Hydro Electric Commission.

J. Ferguson Black, mining engineer.

Active management of the industry will be in the hands of Messrs. Devlin, Sharpe, Nisbet and Black.

The company owns 700 acres of nickel lands in Northern Ontario.

The business will consist principally of the manufacture and sale of alloyed and straight carbon steel ingots, billets, rounds, squares, bars and shapes, also high grade electric steel castings. The company owns a patented process for the manufacture of nickel steel. This process has been tested out in commercial production. The reports of the company's engineers have been verified by engineers appointed by interested steel men, and again by engineers appointed by the underwriters.

Solving Problems in Selling Machine Tools

Peculiarities of Demand Must be Studied—Business Cycle in Relation to the Market—Pure Logic to Buy in Times of Depression—Conservatism a State of Mind—Sales Engineers

By ERNEST F. DUBRUL,
General Manager National Machine Tool Builders' Association.

BOTH BUYER and seller of machine tools would profit if they thoroughly realized some peculiarities of the demand for machine tools. The machine tool is an instrument of production whose sole utility lies in saving of time of high priced labor used in producing other goods, or in its making a product of greater accuracy than could be made without it. There is, therefore, no market, no demand for a machine tool at any time or in any place that is not producing or expecting to produce other goods from which the user of the machine tool derives his own income.

Machine tool demand comes from three sources; first, there is wear-out demand, which is quite small because well-made machine tools in actual practice last a long time. The second is expansion demand arising where a new shop is to be started or an old one is to be expanded. Expansion of industry is irregular in extent and in time. The experience of the world shows that while expansion, in the long run, takes place at an increasing rate, this rate is far from regular and goes forward by rapid general movements succeeded by general slow-downs. This condition we have come to call the "business cycle." These movements create much more complicated conditions than if the movement of business were steady. Both buyers and sellers should recognize their existence and the effects they have on the machine tool industry in the various periods of activity and depression.

A third class of demand partakes very largely of the nature of expansion demand. It is obsolescence demand. The machine tool industry is a progressive one, staffed with a corps of inventors who are continually seeking to build machines that will turn out either more work or better work than could be done with an older type of machine. It is a cold fact that the sale of machine tools, whether due to expansion, wear-out, or obsolescence demand, is very largely influenced by the conditions in the purchaser's own establishment at different stages of the business cycle.

PERIODS *of depression in the machine tool business, compared to other businesses are relatively long. Consequently there is a stand-by expense to which the machine tool builder is subject by the nature of his industry. Unless this expense were paid in the long run by its customers, the industry could not exist. He must carry a force of experimenters, designers, inventors, pattern-makers and other similar auxiliaries whose salaries and costs must go to the expense sheet. It is to the interest of both builder and user to minimize as much as may be the costly effects of the marked fluctuation in machine tool demand.*

Effect of the Cycle

In a period of depression, men who have shops full of idle machinery are not very susceptible prospects for a machine tool salesman who attempts to sell them additional machinery. As a matter of pure logic that is precisely the time when the user should buy his machine tools, but as a matter of fact, that is precisely the time when he does not buy them. In times of depression, he has time to plan changes in his methods of production, to look ahead, to revise his costs and get them as low as possible. In such times he could get plenty of labor, working at greater efficiency to do all this sort of preliminary work. The direct costs of labor and material being lower in a time of depression, the machine tool can be and is produced and sold for a lower price. All these would seem to be good and sufficient reasons for the machine tool user to buy his machinery when his own business is depressed.

Since he does not in the mass, make his purchases at such time it is evident that there are some stronger reasons to the contrary. These lie in the financial and mental condition of the buyer himself. His business is depressed and so is his mind. He is filled with a spirit of caution, as well as fear for the future. He does not know how long the depression is going to last and as his financial condition is not the strongest at such times, he holds on to all the cash he can get hold of. Very few business men can so well calculate the future as to be very sure of where they are going to come out.

THE COMPETENT *salesman can be of great value to the sympathetic buyer. Many a time suggestions occur to such a man as he goes through a shop, resulting in cost reduction without additional investment, that has been well worth the time and trouble taken in talking to the salesman. At this particular time, this policy ought to be pursued. "There are many machine tools at work in various shops in Canada and the United States that ought to be sent to the cupola. The buyer pays more by using them than he would pay for new machines."*

Human to Defer

So it is the most human thing in the world to defer purchases of equipment until the prosperity is evident, and one is sure to need the machines, even though he knows he must pay more later on. In every depression it becomes very evident that a low price is not a stimulant to the wide purchase of machine tools. Naturally, the provident, well-informed user, who has both the cash and the courage to make purchases at that time, is able to pick up some very good bargains. If more buyers realized that fact they would benefit themselves by making their purchases in the very depth of depression.

With general improvement in business the machine tool user gains financial strength and gains courage, but it is a human fact that most business men wait to place orders for machinery quite a bit longer than they should. They seem to think that because they could have gotten immediate delivery six months before, they can always get machines just about the next day after placing orders. They wait until their own shops are full of work and even a blind man could see that they need more machinery.

Unfortunately, however, so many do the same that there is a heavy rush of orders into the market just when all the metal working industries are busy. They have about cleaned up the labor market, are probably raising wages; so just when the machine tool orders come in strong, that industry faces the same scarcity of labor to make those machines. The machine tool shop is not a mass production shop; it can make only relatively small quantities of any one thing. Its product requires a high-grade of mechanical skill for proper fabrication. This labor is already at work in the shops of the ma-

chine tool industry's customers. So, the machine tool builder must induce these men to come into his shop at a wage considerably higher than they are getting where they are.

Reason for Higher Costs

The machine tool builder has little alternative but to get his men from the shops of his own customers to make the tools that they require. Only to a small extent can he use unskilled or semi-skilled labor in fabricating machinery of high precision. Even to rebuild the force costs money. A well-knit, well organized force will always produce a given quantity of work in shorter time than a new force. So just when his customers clamor for deliveries the machine tool builder has to rebuild and weld together his labor force with attendant high cost.

The man producing an article in large quantity does not make proper allowance for the higher cost necessarily involved by making similar articles in a small quantity. He compares the price of a machine tool with his own product, and weighs what he thinks were the costs to the machine tool builder compared to the actual cost of his own product. Although he can well afford to pay the price in view of the productivity of the machine, he lets his mind stray away from the earning of his own capital invested in the machine, and worries about the machine tool builder's apparent profit. This attitude is entirely unfair to the machine tool builder. If the user had the contrary idea that the machine tool could not possibly be produced at a profit for the price asked, he would promptly forget the machine's apparent cost and stick to figuring the utility of the machine to himself regardless of its cost. If he could not figure a profit to himself in the purchase of the machine he certainly would not buy it no matter how much it had cost the builder.

Responsibility of Buyers

These are all some human reactions of the buyer that increase the cost to him. If each buyer would act differently machine tools would be cheaper. But few buyers stand off and look to see what they are doing to themselves in the way of increasing the cost of selling and of manufacturing. The operation of machine tool demand with relation to the business cycle involves maintaining a plant large enough to take care of a heavy peak load, and even when the peak of demand is on, the plant may not be large enough to supply immediate wants, and deliveries become more and more deferred. The user himself loses money by being unable to turn out his product, for whose production he has placed his orders for machines. There is a hectic rush all around for a while.

Periods of high activity are relatively short in the machine tool business and periods of depression, compared to other businesses, are relatively long. Consequently, there is a stand-by expense to which the machine tool builder is subject by the nature of his industry. Unless this expense were paid in the long run by its customers the industry could not exist. Because his recurrent demand through wear-out depreciation is so very small the machine tool builder is largely dependent on the expansion and obsolescence demand. He must necessarily carry a force of experimenters, designers, inventors, pattern makers, and other similar auxiliaries whose salaries and costs must go on his expense sheet. All this requires a large capital. Small establishments have not been able to survive as a rule.

It is to the interest of both machine tool builder and machine tool user to minimize as much as may be the costly effects of the marked fluctuations in machine tool demand. The buyer can help himself materially by studying his own conditions, taking advantage of the time when prices are the lowest to place his orders. To do this he will have to anticipate his own requirements as far as he safely can. Certainly the cheaper his machinery the better earnings that machinery will make for him when it gets to work. Buyers have not given as much consideration to this as they fairly could. Long before their own activity develops, buyers should give a sympathetic hearing to the machine tool salesman, provided of course he has something to say.

Salesmen Should Study Conditions

The real machine tool salesman is not a man with a superficial knowledge, but is in the best sense of the term a sales engineer. He should be given the run of the shop especially when times are dull. He should be allowed to study conditions to intelligently recommend new equipment for cost saving production. Of course if the selling agency, whether manufacturer or dealer, puts out salesmen who are not able to offer valuable suggestions along those lines the user will not be bothered with them. The competent salesman can be of great value to the sympathetic buyer. Many a time suggestions occur to such a man as he goes through a shop resulting in cost reduction without additional investment, that has been well worth the time and trouble taken in talking to the salesman. At this particular time this policy ought to be pursued. General business has now reached a stage of improvement that makes it safe to predict continuance for some time to come. Financial conditions are good. While agricultural prices are still somewhat low, continued improvement in European conditions will show improvement in the farmers' purchasing power. Competition is of course keen in every line and the wise manufacturer will use every means to reduce his costs of production. There are many machine tools at work in various shops in the United States and Canada that ought to be sent to the cupola. The buyer pays more by using them than he would pay for new machines. Just because they are still running, however, many machines are kept at work without regard to economy of operation.

The machine tool user should carefully scrutinize his own equipment and at the same time scrutinize the advertising columns of the technical press and pick out what seem to be better machines than what he has. Then he should call in the manufacturer's representative to go over the situation with him. The machine tool industry has always provided machines that made a very good return on the investment, and the present time is no exception.

IN A PERIOD of depression, men who have shops full of idle machinery are not very susceptible prospects for a machine tool salesman who attempts to sell them additional machinery. As a matter of pure logic, that is precisely the time when the user should buy his machine tools, but as a matter of fact, that is precisely the time when he does not buy them.

MOST BUSINESS men want to place orders for machinery quite a bit longer than they should. They seem to think that because they could have gotten immediate delivery six months before, they can always get machines just about the next day after placing orders.

The general increase in building created a much better demand for goods, reports the Port Hope Sanitary. The tendency of prices was lower but then the increased volume more than compensated in the cut in costs. The company had a good year last year and a better one this, while it is generally predicted that the coming year should show another increase.

Manufacture of radio equipment by the Canadian General Electric Company is a new venture which is said to be turning out profitably. While the company, in line with others, had felt the trade depression, prospects were that commercial and municipal construction, continuing to grow, would improve the operations of this concern.

General aeroplane view of Niagara Falls, Canadian side, where large power plants are situated. A—Toronto Niagara Power Co. B—Canadian Niagara Power Co. C—Hydro Electric Power Co. D—Hydro Power Intake, Chippawa Canal.

Manufacturers Express Confidence in Future

Individual Reports Are Encouraging—Evidence That Country Has Made Steady Recovery From Adverse Conditions—Lumbering Industry Active—Western Crops Help Create Confidence

REPORTS from Canadian industries as to the past year's operations contain much that is encouraging. There is a pronounced feeling of optimism. In not a single instance is there an evidence of doubt with regard to 1923. Those basic industries that have not been as well employed as they would like, reflect improvement. The iron and steel industry has been one of these. Production during the year reached very low levels, but the year closes with more active markets, and with buyers recognizing that the country's growth cannot be denied.

* * * *

In Quebec, manufacturers report that conditions improve steadily. Here, too, lumbering operations have been extended by reason of liquidation of stocks. Paper production has increased and the market somewhat brighter. Asbestos mines have resumed under more favorable conditions. Furs, hides and leather have had a better year. Firms engaged in iron and steel report a more encouraging prospect. The same may be said of the sugar industry. In textiles the demand has been active, and while the clothing industry has not realized expectations, footwear factories have been well employed.

Industry generally is working courageously out of a period of depression and the prospect is much brighter. There have been bountiful crops and these will prove an important factor in the recovery.

* * * *

Ontario industries, generally, are closing the year in better condition than last year. Lumbering operations are being conducted on a much larger scale. Export and domestic trade will require increased quantities, while the pulp and paper industry will have to meet a strong demand in similar markets.

Development of electric power had an important extension by the completion of the Chippawa enterprise and the installation of three units aggregating 165,000 horsepower. Not only this undertaking, but the equipment of several other important power plants throughout the country indicates an appreciation of industrial requirements. The mining industry has had a record year, and activites have been such as to encourage associated activities, such as the erection of special machinery. The textile industry is also in good position.

Probably the building industry has shown a more remarkable growth than any, and its activities have absorbed not only large amounts of material, but have reduced unemployment to low levels.

Public works by municipalities and provincial government have been carried on extensively. Much highway improvement has marked the year. The Welland ship canal has been proceeded with and large sums have been expended on new schools and other public buildings.

Although farmers have had good crops, prices have been discouraging. It may be said however, that although the year has had its handicaps, industry in Ontario, on the whole, has found reason for viewing the future with sound optimism.

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Industry in the Maritime Provinces shows tendencies similar to those in other provinces—a steady recovery from adverse conditions which hampered production, impaired markets and made for unemployment. Crops have been good, fisheries had large catches and fairly good market conditions. Old stocks of lumber have been moved and operations assume a more normal aspect, though on a conservative scale. Owing to labor troubles coal output was curtailed but in some departments steel mills are making a better showing. Considerable expenditure has been made on good roads and electric power development.

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Quantity and quality of crops in the prairie provinces represented a record. The season, with few exceptions, was free from setbacks, and the crop started on its way to market with exceptional speed. Low prices were to a certain extent offset by decreased operating costs and reduced freight rates. The year has demonstrated the importance of high production and of the adoption of means whereby costs may be reduced to a minimum. For the whole of Canada the yield of wheat was not far from 380,000,000 bushels or some 100,000,000 better than last year. Other grains show proportionately greater

gains. Stockmen in the West are encouraged with the prospect of the removal of British cattle embargo.

Mining in Alberta has had some development during the year. Shortage of anthracite has improved the demand for coal, and it is estimated that 75% of the requirements of the prairie provinces will be taken care of from Alberta mines. Six million tons were mined in 1921.

Manitoba is proceeding with important power development. At Great Falls a plant of 168,000 h.p. capacity is being completed.

Western provinces are badly in need of high standard immigration. There are large acreages of untilled land still available.

The good crops came at a time when the money thus placed in circulation will assist in debt liquidation, in the reduction of liabilities and creating more encouraging prospects. Confidence in the recuperative power of the West has been re-established.

British Columbia reports increased lumbering activities, more normal conditions in mining, an exceptional salmon catch, important government works, especially by way of harbor improvements and increasing export trade.

Following are reports from a number of individual industries, nearly all of whom report improvement during 1922 and express confidence in the future:

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UNDOUBTED QUICKENING IN BUSINESS

By P. FORD-SMITH, President and Manager The Ford-Smith Machine Co.

HAMILTON.—Our total volume of business up to this point of the year is a little larger than last year. The volume of work coming in, however, right now is very much in excess of what was coming in this time last year; the gross volume being about the same because in 1921 we had a fair amount of work not completed at the end of 1920. The machinery business is not good, but there is no comparison between the very dull period at this time last year and the undoubted quickening this Fall.

There have been no extensions to the plant, but we have bought some equipment to cut down the labor cost on our work, particularly on machines for cutting the cost on our large die work. Our only new lines are the extending of our operations on large sheet metal dies and the designing and building of several standard machines which are used in the underwear and hosiery business. We do not pay any bonus plan here, but we gave our employees group life insurance two years ago, on which the company pays the policy entirely.

It is the writer's opinion that business will gradually improve, though it may be two or three years before we are getting all the business we would like. Most of us forget that we enlarged our activities considerably between 1914 and 1920, probably more than the growth of the country in population called for. We have no worries about the future in regard to the machine tool and general machinery business, as long as we can keep ahead in our endeavors to serve our customers and give them satisfaction.

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DEMAND FOR BALL-BEARING MACHINES

By W. J. MURRAY,
Secretary-Treasurer Preston Woodworking Machinery Company

PRESTON.—This year has been considerably better for us than last year in the matter of volume of business. We have been exceptionally busy in the last three or four months, and have hopes that it will continue. Last year the size of our staff was reduced to about 35 or 40 hands, but we are glad to say now that we are nearing the 60 mark, and propose taking on more if business keeps up. We have made no extensions to our plant, although we hope next year to finish an addition of 100 feet square for which we laid the foundation a few years ago.

We have been concentrating in the last year very considerably on ball bearing machines, with such effect, that in the last few months fully 80 per cent. of our business has been for ball bearing machines. We embody them in all our lines and have hopes that in a few years ball bearings will be standard equipment in woodworking machinery. A couple of years ago we took out group insurance on all our employees, and have continued it. We also have a bonus system in connection with our work, which allows any employee by extra effort to materially add to his wages. Ours is a small shop, and such things as this can't be as well developed as we would like, but the plan we have we find to be of considerable assistance in increasing production.

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CUSTOMERS SHOULD ANTICIPATE THEIR WANTS

By H.F.E. KENT, President Kinleith Paper Mills.

TORONTO.—The book and writing section of the Canadian Pulp and Paper Association experienced rather quiet business for the early part of the year. It improved gradually up till about midsummer when there was a decided change for the better, and this improvement has held up to the present time. We believe the prospects for the coming year are bright, and while we do not anticipate that it will even come back to what might be called a normal condition after the first of the year, we believe the improvement will be quite noticeable over what we have experienced during the early part of this year.

All mills at the present time are facing the increased cost of production, in view of the fact that the runs are small. Orders are not placed as far ahead as they would be under normal conditions, with the result that the mills cannot lay out the work to advantage. Naturally the frequent changes increase the cost of producing per ton, which, on account of the close competition, means in many cases a loss to the manufacturer. If it were possible for our customers to anticipate their wants well in advance it would enable the mills to not only cut the cost but give a better article.

* * * *

COUNTRY PROSPEROUS —MUCH BETTER OUTLOOK

By E. M. THURBER, Manager Nicholson File Company.

PORT HOPE.—Our business has steadily increased since the low point, reached in the summer of 1921, and we do not see any reason why it should not continue to increase. The country is prosperous and increasing in population, and trade should increase accordingly.

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EQUIPPED FOR BETTER BUSINESS

By A. T. ENLOW, President Dominion Sheet Metal Corporation

HAMILTON.—In our business the production of Galvanized sheets will run about 2,000 tons excess over 1921 to date and the volume of sales about a quarter of a million dollars beyond the same period last year. We are employing about 100 men this year as compared with sixty-five to seventy last year, the increase beginning in early part of September.

Wages are based on similar rates paid in Pittsburgh-Ohio district and run from about $100 a month for labor to double that amount for an expert workman.

We have added one galvanizing unit to our equipment which will give us when operating steadily a fifty per cent. increase in tonnage, making possible 25,000 ton output per annum.

For three years we have adopted the group system of insurance covering all employees who had been with us six months, beginning with a thousand dollars and going to fifteen hundred as a maximum. One of our staff only has died, being a returned man who had just completed the final payment on his small home and the $1000 was turned over to his widow on Armistice Day, 1921, and came as a total surprise to her.

Fifteen employees hold stock which is fully paid up in every case and cost them about sixty-three dollars per share for $100 par value preferred stock paying 8 per cent dividend.

We have always given a bonus at the end of a year to employees, based upon the value of the individual, in preference to a general or blanket bonus and in addition have assisted about twenty employees to buy or build homes by mak-

ing loans to them which are repaid at stated intervals. We have no securities for these loans and in only one instance has an employee failed to make good in the matter of repayment.

We are all set for a big year 1923 and have every confidence that with our new capacity it will prove the best and biggest year we have ever had and it is our earnest hope that there will be no inflation in either prices or wages.

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PLANS ADDITION TO FOUNDRY

By H. C. NORRY, Vice-President, The Eureka Planter Company.

WOODSTOCK, ONT.—Our foundry department, during 1921 and 1922 has been kept running to full capacity. We have made an extension during the last few months to our foundry and have plans made for an additional extension as soon as spring opens up in 1923. We have made no reduction in wages in this department since 1920.

Our foundry is run on an open shop basis. We have an up-to-date equipment in every respect which we believe is very essential to obtain the co-operation of our employees; our idea and our aims have been to keep the men satisfied in every way, and as soon as we find an employee otherwise we immediately replace him. At the present time we are running thirty men in this department. A number of these men have been with us since we opened our foundry a number of years ago and as far as we can ascertain every man is well satisfied with his position. We are looking forward to the largest year in our history during 1923.

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LOOKS FOR GOOD SPRING BUSINESS

By F. H. CROSS, Assistant Manager Hull Iron & Steel Foundries.

HULL, QUE.—The volume of business for the past year shows a decided improvement over the previous year. There has been a considerable advance in the cost of raw materials and in the last few months wages have also risen slightly. We have made no extensions to our plant as our present plant and equipment is large enough to take care of a considerably increased tonnage.

The demand for special heat resisting grate bars, which we originated about three years ago, is increasing rapidly and we look forward to handling a large volume of this special business during the next year. We do not anticipate much improvement in our line of business for some months, but we certainly think that conditions will improve in the early spring.

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MORE BUSINESS THAN YEAR AGO

By C. H. WATEROUS, Manager The Waterous Engine Works Co.

BRANTFORD.—We have had somewhat more business than a year ago; in that respect there has been an improvement. There has not been any change in the average wage, and there has been no extension to plant or equipment worthy of notice. Neither have we added any new lines, still manufacturing wood pulp machinery and sawmill machinery. With reference to bonus, we only have this in a very moderate degree, and have never had any outside group insurance.

As to the future, it seems to the writer that there will be some improvement unless we have unnecessary government interference, or there is a continuance and extension of the strikes that have taken place, particularly among railway and coal, which would disastrously affect the whole community. The expense of doing business now is so great that a very little addition is liable to throw the whole machinery out of gear.

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CONFIDENCE IN COUNTRY'S FUTURE

By H. V. HAMILTON, Managing Director Burlington Steel Co.

HAMILTON.—Our business this year has shown a very great improvement over 1921, some of our months being equal to our best in 1920. Recently, however, we have found the demand for steel in general falling off considerably, but we have every confidence that on account of practically no stocks being held by consumers that next year will show a very large improvement over this year. We have all confidence in the future of Canada and look for a gradual increase in business during the next few years. With this in mind we have commenced construction of a number of additions to our mill which will enlarge our output.

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NEW DESIGNS HELP BUSINESS

"THIS YEAR has been a little improvement over last," states the manager of a large woodworking machinery plant. "The number of hands employed this year is slightly over that of last year. Particularly this last four months. No extensions have been made to plant or equipment. Considerable of the stock that we had manufactured ahead has been disposed of and our stock of finished machines is considerably lower now than it has been for some years and we believe that conditions will gradually improve and we will from now on be gradually increasing the number of employees. We have taken on no new lines, but we have got out a few designs for similar work to those formerly made. These have assisted somewhat in increasing business. We do not adopt any plan of bonus — tried group insurance, but this was not appreciated and was discontinued. We think that conditions generally throughout the country are improving and the future is getting a little brighter."

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CARBORUNDUM GOOD BAROMETER

By FRANCIS D. BOWMAN,
Advertising Manager Carborundum Company.

NIAGARA FALLS.—We are running 80 per cent. of our normal capacity. Carborundum products are used in practically every known industry. When there is a general depression of business we feel it to a marked degree. In other words, we are pretty good barometers of business conditions. We are now employing 1,800 hands, our normal is 2,000. Wage scale is about 20 per cent. lower than formerly. We predict that business for the first few months of 1923 will be very good indeed. The question of labor shortage should be seriously considered.

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WILL WANT EQUIPMENT YESTERDAY?

GALT.—Col. A. J. Oliver, secretary manager of R. McDougall Co., discussing conditions during the past year, stated that considerable activity had developed in their pump department. However staff and wages had remained about the same and careful curtailment of overhead expense carried out. No new extensions had been made. It was his opinion that about one year hence, business should make a good showing. As to problems of manufacturing he observed, "You might suggest that in a very short time comparatively many machine operators will be wanting equipment yesterday instead of to-morrow."

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YEAR'S RECORD INFINITELY BETTER

By CHESTER B. HAMILTON,
President The Hamilton Gear & Machine Co.

TORONTO.—The past twelve months have been just a steady upward grind, infinitely better than the previous twelve because we could see where we were going, which was hardly true before for many firms. Our principal complaint of the previous period was against people afflicted with unreasoning optimism in a slack period. Now we think the reverse is rather true. The volume of business has increased, but what is just as important, it is of a substantial and healthy nature.

The number of men employed has been steadily increased, with wages unchanged. The turnover of employees is very small—practically negligible. We do not have any bonuses or special employees' co-operation systems. Our idea of a factory organization is a hand-picked crew who have been long in the same shop, a fairly high wage rate, and strict standards of quality, production and safety. In the past year we have

had practically no accidents except among new employees, and practically every new man has had to be checked for some kind of recklessness, whether serious accident resulted or not. It seems certain to us that industrial accidents and labor turnover are very closely connected.

You ask for views of the future. The future looks hard, but safe for those who will be careful and work hard enough. It will be a time for nice discrimination both in buying and selling to get service and safety of credit respectively. We do not think it will be a good time for the easy-going, daily-golf-playing executive of "reconstruction" days, who will probably be labeled a bad risk.

We have increased our mechanical equipment substantially, by picking up here and there nearly new machines from firms in financial difficulties. We have not made nor do we contemplate any serious capital investments. A new line which we have taken up is the manufacture of heavy duty motor truck rear axles, of the double reduction type, in sizes from 1½ ton up to 5 ton capacity. Present indications in this line are very favorable. With the prospect of very severe American competition in the cheaper grades, we feel that only in the higher quality lines is the motor truck industry a safe venture.

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SALES DOUBLED THIRD QUARTER

By H. J. WADDIE, President and Manager Canadian Drawn Steel Co.

HAMILTON.—We found business slow for the first quarter, but it has steadily improved, and in the third quarter, our sales were just double the sales of the third quarter, 1921. As our material goes into a large variety of machines, automobiles, railroad work, etc., we feel confident that trade conditions are much better and will continue to be much better for some time. No one buys our material on speculation as it is all bought for actual consumption.

The price question has been serious and the steady increase in the cost of our raw material has made outside competition heavier; this applies particularly to export orders, but we look for an improvement in this line also and we think that all manufacturers should feel confidence in 1923.

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BUSY, WITH IMPROVED PROSPECTS

By A. RENDALL, The William Kennedy & Sons.

OWEN SOUND.—We are busier now than we were at this time last year. We have approximately the same number of men employed now as we had a year ago, that is 120. We have not had any noticeable difference in our pay roll, the same averaging about $4,500 for two weeks. We are running nine hours per day six days a week. We have not made any extensions to our plant or equipment nor undertaken the manufacture of any new lines. We have not adopted any plan of bonus or group insurance. The majority of our employees have been with us for years. With reference to our views as to the future, from inquiries received we would expect that business would be better, possibly, than last year.

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TENDENCY TO LABOR TROUBLES LESS

By W G. SMART, The Smart-Turner Machine Co.

HAMILTON.—The number of men employed has been pretty much the same this year as last but we have not always been able to run full time. There has not been much change in the wage rate.

We have recently absorbed the Hamilton Motor Works and are now manufacturing air compressors, semi-rotary pumps, hand oil pumps and foot valves which were formerly their product. We believe 1923 will show a marked improvement over this year, and we are inclined to think that the tendency towards strikes and labor troubles is less now than it has been for some time. We believe that by an early date the shortage of coal will be remedied and that by spring the shortage of cars will have been overcome. We hope for a great improvement next year.

DOUBLED BUSINESS IN NOVEMBER

By H. POCOCK, President London Concrete & Machinery Co.

LONDON.—Our business during the year 1922 has been about the same as 1921, each of those years being about 20% less in dollars and cents than our business of 1920, which would represent about the same volume. However, we might state that our fiscal year ends on October 31st. To date in the month of November we have done double the business of that of any previous November. We believe that, inasmuch as stocks throughout the country are about all sold out, and building operations are becoming quite active, there will be a revival in our business. We are looking ahead for a big business next year.

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FIGURES SHOW STEADY ADVANCE

By Malcolm R. Meldrem, President Herbert Morris Crane & Hoist Co.

NIAGARA FALLS.—Our business is showing steady and healthy improvement. Beginning a year ago and taking successive periods of three months, the figures show a steady and gratifying advance. I attribute this satisfactory position to a gradual improvement in general business conditions, coupled with the fact that we have regularly and promptly adjusted ourselves to changing conditions, regulating our prices in accordance with the possible reduction in the cost of our standard manufactures, and aiming always at giving our customer the fullest possible value for money. We are hoping and preparing for a continuance of the improved sales turnover I have already referred to, and I have no reason to doubt that it will be forthcoming. Canada is obviously in the position of the most favored nation today, and the Canadian people should take their courage in both hands and step right forward into normal business.

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BUILDING LARGE PAPER MACHINES

By G. E. BELL,

Assistant to Vice-President Dominion Engineering Works.

MONTREAL.—Owing to the increased activity in the paper industry, we have been fairly busy during the past year and have under construction several large paper machines for Canadian mills. The outlook in this line of business is good and it is expected that several other machines will be ordered within the next few months, of which we hope to obtain some.

In our hydraulic machinery department, we have also been busy, having obtained the contract for several turbines of varying sizes. The two 28,000 H.P. units for the Manitoba Power Company are now nearly completed, but we have recently obtained the contract for four large units and two exciter units for the Cedars Plant of the Montreal Light, Heat & Power Consolidated, together with several smaller turbines for other customers.

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NORTON PRODUCTS IMPROVE POSITION

By R. C. DOUGLAS, Manager Norton Company of Canada.

HAMILTON.—Our business this year has shown a great improvement over what we have had for last year, due to the general improvement in the manufacturing conditions, more especially to the automobile trade and in the manufacture of tools for the lumber trade.

We would consider that we are employing slightly under a normal force and that the wages are lower than they have been, but likely to go up rather than down.

The outlook for the coming year is uncertain. We anticipate that the agricultural machinery and allied lines will become quite busy, and if so we look for a very good year.

The principal problem as it appears to us is the question of immigration, which should be actively encouraged if the general conditions are to improve in Canada.

EFFICIENT LABOR REDUCED COSTS

By F. J. CAMPBELL, General Manager Canada Paper Co.

WINDSOR Mills, Que.—Replying to yours of Nov. 24, business has been reasonably active in paper throughout the year, though somewhat erratic at present. Owing to increased efficiency of labor and reduced costs most of the mills have made fair profits. The recent increased cost of raw material necessitating higher prices has reduced the demand and rendered the market very spotty. The market for next year can hardly be considered hopeful until the present state of Europe improves.

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REPAIRED U.S. FREIGHT EQUIPMENT

HAMILTON.—Referring to activities of the National Steel Car Corporation, an official states:—As no new equipment orders were placed by Canadian Railways during the past two years our ordinary productive volume of business decreased, but this situation was relieved to some extent by our taking on export orders from the United States for repairing United States freight equipment.

No special extensions were made to the plant or equipment as its activities have been practically confined to its general lines, that is, the manufacture of all kinds of freight and passenger railway equipment, motor trucks, drop forgings, etc., for which the plant is equipped in a modern manner.

* * * *

HAVE INTRODUCED ADDITIONAL LINES

By RICHARD CORBETT, Manager Corbett Foundry & Machine Co.

OWEN SOUND.—Regarding our business in general, there is nothing of special mention as business in marine machinery has been exceptionally quiet and we do not expect it to revive along this line for two or three years owing to the market being flooded with ships and owing to strikes, wars, etc., which have a very bad effect on business. However, we are not pessimistic and it is our intention to go into other lines of manufacture. We have just completed a new glue spreader and mixer for veneer work in furniture factories. This is the first machine of its kind manufactured in Canada and is giving satisfaction. We have also installed a new Fox Grinder for re-grinding motor car cylinders and furnishing new pistons and rings. This helps to keep some of the men employed and is developing into quite a business.

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DEMAND INCREASING SINCE SPRING

By JAS. ARNOLD, General-Manager Canada Foundries & Forgings.

BROCKVILLE.—We have found business very much better during first nine months of 1922 than during the similar period of 1921. Early this spring a change for the better was noticed and this has gone on increasing and we think will be fairly well maintained over the winter months, and we cannot see why business should not be really good by next spring.

At Brockville and at our two Welland plants shipments have materially increased this year and we feel that the country is gradually settling down and developments long held in check are beginning to come to life again. Competition in all lines continues very keen and owing to advancing prices of raw material, revisions of prices are becoming frequently necessary.

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CONTRACTS RUNNING INTO NEXT YEAR

By C. H. TALLMAN, Manager Tallman Brass & Metal, Limited.

HAMILTON.—Business during 1922 has been gradually improving and the prospects for the balance of the year are much better than former months. 1923 will be decidedly better. We have contracts running well into the year and from reports general trade is much brighter. Our die casting department is very busy and other departments are feeling the effects of the fall improvement. Labor is plentiful.

McCLARY'S APPROACH NORMAL; PROBLEMS DEMAND SOLUTION

By J. M. GUNN,
Assistant General Manager The McClary Mfg. Co.

LONDON, Ont.—The basic raw materials of our industry consist of sheet iron, both black and galvanized; pig iron; copper; spelter; tin and tin plates. It was expected that there would be a general decline in values during 1922, towards pre-war prices, but, on the other hand, there has been a general advance, though not a large one; and we have not advanced our manufactured goods to correspond with these increased values. It is quite possible that this will have to be done in the near future. The reason for this secondary inflation is the increased cost, occasioned by the scarcity of coal, and railway troubles, owing to refusal of the miners and operators to take their share of the liquidation which is going on.

During the year our trade was increased in volume considerably, but the value was not very much greater than the year before, owing to lower prices, and it was done at a narrowing margin of profit. It is hard to say how long the present conditions will prevail but there is not likely to be much change during the first quarter of the year. An advance is predicted in some lines of raw materials which will certainly affect our costs, but if an amicable settlement is made with the labor elements above referred to, this anticipated advance may be avoided.

The conditions of employment were considerably improved during this year, as the first part of the year we were running about 65%; whereas now conditions are more nearly approaching normal.

The elimination of the Marking Act has been detrimental, as imports are coming from European countries and when placed on the market the public are unable to determine the source of manufacture.

We look for good trade in 1923, but before a normal condition is reached the farmer must be able to obtain better prices for his product, and the labor situation must be cleared up; it must take its share of the general liquidation. This refers particularly to the miners and railway operatives.

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LARGE EXPORT BUSINESS PLANNED

By F. E. MUTTON,
General Manager International Business Machines Limited.

TORONTO.—Our Hollerith tabulating and sorting machine division has had the biggest year in its history, showing an increase of some 20 per cent. against any year and some 30 per cent. increase against 1921, and we have a very large volume of business already in sight for this division for 1923, indicating the large corporations who lease these machines from us have developed the necessity of a greatly increased number of records, which these machines mechanical classify.

The time recorder division has shown quite an increase in school equipments and while the year will show a decrease against 1921, yet the last four or five months of 1922 show a gradual increase against the same month last year and we know of a great many firms that are contemplating installing our equipments.

The Dayton scale division is holding its own against last year and notwithstanding the economic conditions in the retail trade are not as good as they were in 1921. The retail merchants have apparently suffered severely, particularly in the last four or five months, owing to business conditions but notwithstanding that, we have been able to keep our factory running almost normal.

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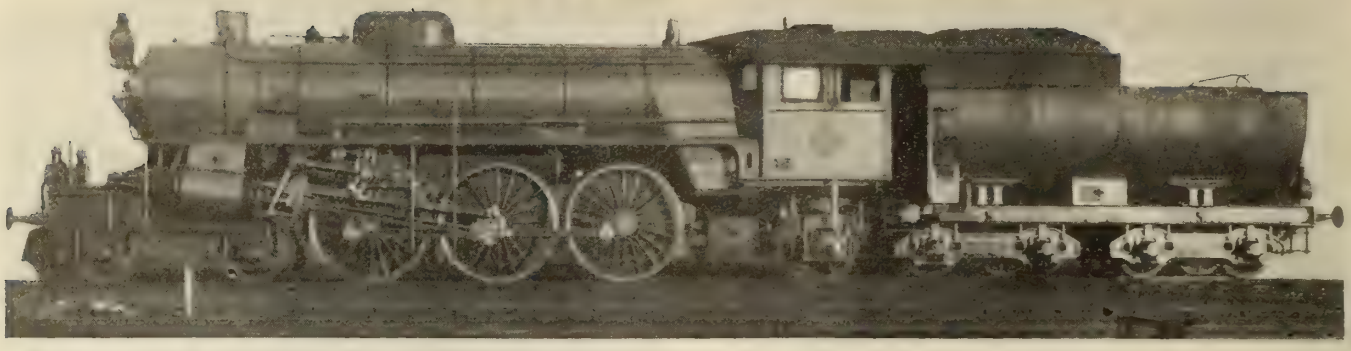
Extensive plans are being made in the West against strike trouble anticipated for next spring. Agreement with the United Mine Workers expires March 31, and owners are declaring that they will not enter into another agreement on the same basis. It is claimed that production costs are so high that the price to the consumer is stilting the mining industry.



Strenuous Railroad Year With Prospects Brighter

Economies Observed in Those Departments Which Affect Outside Industries—Revenues Declined Owing to Lower Freight Rates—Cuts Applied to Maintenance Charge—Heavy Grain Traffic—Revenue Ton Miles Increase

RECENT railway statistics throw an interesting light upon a question that is uppermost in the iron and steel industry—that of expenditure in maintenance of way and structures and also of equipment. Now that Sir Henry Thornton, the new head of the Canadian National Railways, has assumed charge, an early announcement with reference to long-deferred activities may be expected. It will likely follow upon his completion of an inspection of terminals and a consideration of available equipment in relation to the requirements of the country. One of the most interesting statements that he has made since his arrival is with reference to electrification of those sections for which electricity may be easily secured. Some comparison with the coal, in these remote parts of the system, will undoubtedly be carried out. It is known that the new head is determined to introduce economies where such are feasible in order to convert the people's lines into a paying proposition—or as close to it as it is possible under present conditions.

It may be taken for granted that the C. P. R. will be one of the interested parties, and that factors of efficiency will be quite as keenly developed in that quarter. The element of competition has been known, before now, to develop phases from which business generally has derived some benefit. Both systems in view of inactivities during the past two years are likely to apply considerable sums in track improvement, and in betterment of rolling stock.

Marked Decline from Peak Year

In the matter of revenue as in that of operating expenses 1920 was the peak year. There was considerable shading off in 1921, while during the present year slightly lower levels have obtained, with a decided improvement during the heavy grain-carrying months from mid-August until November. September is probably the most interesting month in the year so far as railway operations are concerned, as it is then that the results of the country's agricultural effort become evident. Total operating revenues for this month, 1922, amounted to $41,817,612 as against $43,258,401 in the same month last year. Of this amount freight amounted to $29,632,335 which was $713,909 less than the year preceding. Passenger traffic also declined in that month from $8,060,005.29 to $7,746,-015.76. As a whole, the railways showed an increase of $374,-427,779 in revenue ton miles or in the number of tons carried one mile, or 14.2 percent. The decrease in receipts noted above, however, was almost entirely due to lower rates. The average receipt per ton mile in September was .932 cent as against 1.148 cents in September, 1921. This average is greatly affected by the relative amount of grain, coal and other low rate commodities carried. The October record is lower with a heavier movement of grain and coal. Passenger traffic and revenues showed declines and total was $1,-440,789 below those for last year.

Maintenance Expense Cut

It will be interesting to the steel trade to learn that operating expenses showed a reduction of $2,426,888, the cuts being practically all in maintenance expenses. Transportation expenses increased $668,663 or 4 per cent. with the increased traffic and freight train mileage, the latter increasing 9.7 per cent. The average net tons per freight train mile increased from 551.4 tons to 569.9 tons, but the average

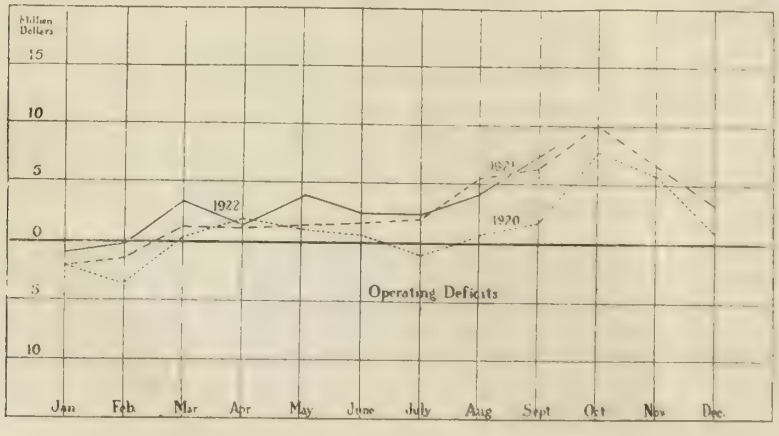
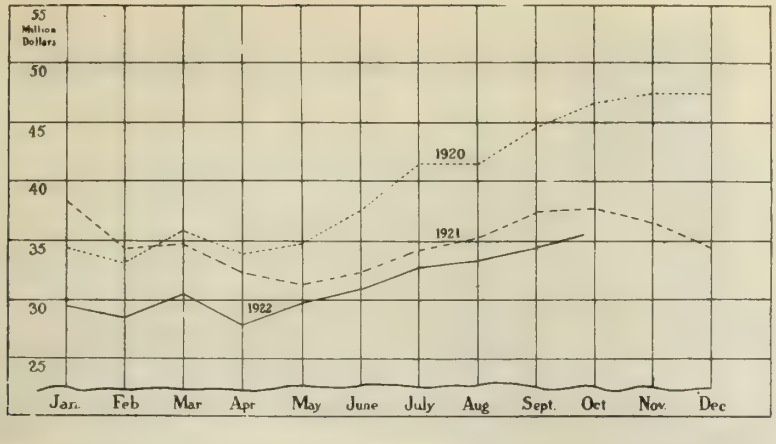


Chart shows where Canadian railroads have stood in the past three years with regards to deficits. It will be noticed that, on the whole, 1922 has made a stronger showing and finishes the year trending toward a higher peak.



Operating expenses of the railways during the past year have followed lower levels than during the past two years, the cuts being chiefly in maintenance expenses. It is evident that 1923 will see much more activity in rolling stock construction, repairs and general efficiency work than has been evident for the past two years. It is stated that the year's supplies already proposed for the National lines will run over the fifty million mark.

load per car was .9 below last year's average. Increases in coal movement will raise these figures.

Explains Buying Inactivity

Several items may be cited as reflecting the general inactivity in railway work from which considerable benefit accrues to industry. In maintenance of way and structures, during the busy month of September for example, the expenditure was less than that of last year by $1,401,117. In maintenance of equipment there was a falling off in that month of $1,097,676. The Canadian National Railways expended a trifle less than last year, or $101,462 in maintenance of way and structures, while in maintenance of equipment the amount was less than September of last year by $788,730. The Canadian Pacific expenditure on maintenance of way and structures in September was less than last year by $456,339, while on maintenance of equipment they were less by $1,008,102. The reduction in operating expenses on the Grand Trunk Railway also was strongest in those items which bear a relation to outside industry. On maintenance of way and structures the reduction amounted to $712,918, while on equipment maintenance the reduction was not pronounced, only amounting to $16,995.

On the Canadian National, as distinct from the Grand Trunk, expenses increased $221,485, or 2 per cent., over September, 1921, but the freight traffic increased from 863 million revenue ton miles to 1,161 millions, or 34.6 per cent., increasing the revenue $570,278, or 6.8 per cent. This more than offset decline in passenger, express and other revenues, giving an increase of $356,509, or 3.1 per cent. in total revenues.

Freight traffic loading increased from 521 net tons to 604.7 net tons, while the average load per freight car increased 1.1 tons. The average receipts per ton mile were .769 cent, as against .969 cent in September, 1921, and 1.140 cents in August, 1922.

The effect of recent reductions in rates was not so marked on the Grand Trunk as on the transcontinental lines; the average receipts per ton per mile were 1.328 cents, compared with 1.338 in September, 1921. Total revenues decreased $209,838, but expenses were reduced $937,328, giving an increase in net operating revenues of $727,489 and an operating ratio of 87.86 per cent., compared with 98.23 per cent. in September, 1921.

C. P. R. Reduced Expenses

The C. P. R. also benefited from the increased traffic. Revenue freight ton miles on the C.P.R. increased from 763 millions in August to 1,277 millions, or over 67 per cent., and also increased 9 per cent. over September, 1921.

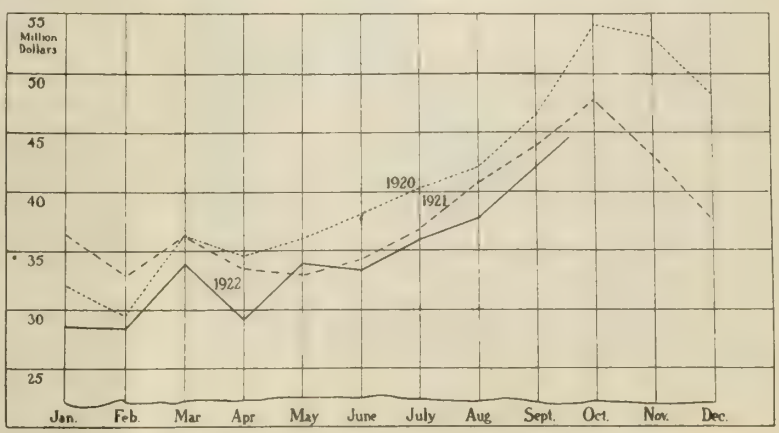
Although revenues decreased with the lower rates, the full effect of the reductions in rates on grain and coal being felt, the operating ratio was reduced from 81.96 per cent. in August ratio of 87.86 per cent., compared with 98.23 per cent. in September, 1922.

Revenues on the C.P. R. declined $1,549,159, or 7.8 per cent., and expenses were reduced $1,591,388, or 10.4 per cent., increasing the net revenue $42,229. The average receipts per ton mile declined from 1.157 cents in September, 1921, to .989 cent. Passenger traffic showed a sharp seasonal decline from August and was 1.3 per cent. lighter than last year, with the revenues showing a decrease of $431,824, or 11.3 per cent.

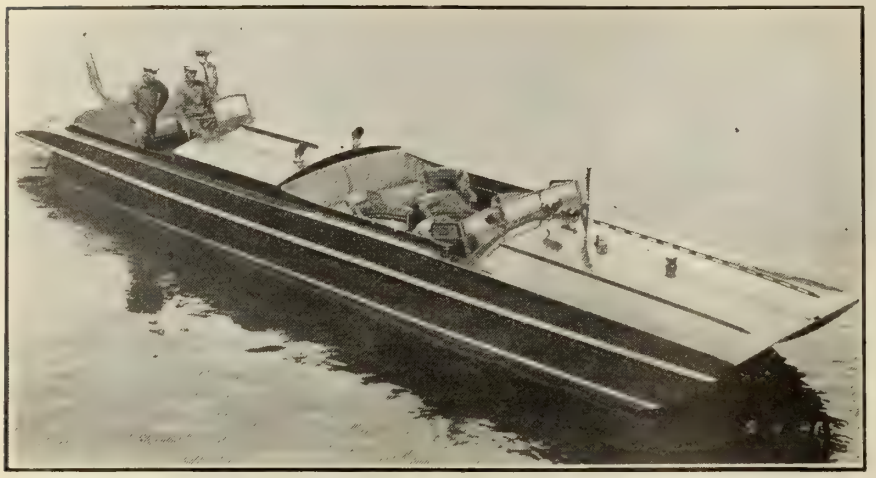
It is reported that the November output of the International Nickel Co. passed the 2,000,000-pound mark and that there is an increasing demand from the steel industry for the products of the company. The output of monel metal from the new mills at Huntington, W. Va., is around 500,000 pounds monthly.

The distribution of something like $50,000,000 throughout Canadian industry for material, equipment and supplies for the Canadian National Railways will go a long way toward developing a prosperity that has been somewhat lacking in many plants especially equipped for railroad work. Tenders for large amounts have recently been called and, while many of these may not lead to actual orders immediately, it is stated sufficient will be released to give the year a propitious send-off.

Total railway revenues for 1922 are shown to be below those of last year. The average receipt per ton mile in September, when grain and general fall traffic gave added impetus, was .932, against 1.146 cents in Sept. 1921. A more intensive policy is likely to follow the re-organization of the National lines, in connection with which the electrification is proposed for sections that are in contact with the more thickly populated portions of the country. C.P.R. policies also point to similar development.



Few Ships Built But Prospects are Promising



Sea-sled built by Canadian Vickers, Limited. This is a new type of inverted V-bottom hull, driven by surface propellers. Photo shows 36 ft. 6 in. sled, with speed of 40 miles an hour.

Activities in Canadian Shipyards Not Extensive — Outlook Is Encouraging—Some Distinct Types Turned Out—Canal Statistics Show Increase

COMPARISON of the past year's operations in the shipbuilding industry with those, say, of 1920, does not make the most gratifying kind of reading. Outside of reports, very little was done in Canadian yards. While in 1920 there were 81 shipbuilding plants reported as active, the present year has seen a large proportion of these non-existent. Such are the fortunes of war. As early as 1920, in fact, the shipbuilding industry decreased by something like $31,675,073, and since then there has been a process of elimination which finds whatever business there may be, largely in the hands of plants which were well established before the war. As to the future, the recent remark of a prominent shipbuilder would seem applicable: "To predict anything in connection with the shipbuilding industry in Canada, would require a far better prophet than I am. There will be an occasional ship for Great Lakes traffic. There will be special boats for special purposes as in the case of the 'Charles Dick,' built by the Collingwood Company during the year. The government will require a boat occasionally, and as the industry of the country develops, boats will be called for. The country's future must take waterways into consideration, and export must increase. Completion of the Welland Ship Canal will help to emphasize the importance of large ship passage to the sea. This may cause a quickening of the ship-building industry. Competition with the Old Country yards is a serious factor, but with an equalization of all conditions, colonial ship builders may have a better chance. It was undoubtedly because of lower production costs that a number of boats for Great Lakes traffic were placed recently with British yards. On the other hand, it is stated that German yards are becoming serious competitors of Old Country builders, and have already picked off a number of important contracts."

Some Comparative Figures

Referring to the world's shipbuilding, and affording a comparative slant as regards England and her Dominions and other countries, including United States, Lloyd's Register recently issued the following facts:

1. Counting only ships on which work actually is in progress, the United States is led by England, France and Holland, with Japan and the British Dominions right on the heels of the United States.

2. The United States is now building only 6 per cent. of the world's tonnage; England is building 60 per cent. and the other maritime nations 3 per cent. combined.

3. This country now has only 150,000 tons of ships in the yards; has not contracted for any new ones since last July 1, and has largely suspended work on those already on the ways.

4. America's decline since the post-armistice peak of vessel construction has been 4,036,000 tons—a goodly percentage of the decline for all the world, which aggregates only 5,346,000 tons.

5. Her shipyards are building only one-third as much tonnage as they were a year ago. Great Britain's are building one-half.

6. America is building today only 2,000 tons more of freight bottoms than she was at the outbreak of the World War in July, 1914; all other nations taking into account the wholesale suspension of building, during the last three months, aggregate 919,000 tons above the pre-war construction totals; Great Britain is building 1,200,000 tons compared with 1,750,000 she had under way in July, 1914.

Vessels Registered in Canada

Statement showing the number of vessels and tonnage on the registry books of the Dominion on December 31, 1921:

	Sailing Vessels			Steam		
	No.	Gr. Tns.	N. Tns.	No.	Gr. Tns.	N. Tns.
N. Brunswick ..	607	29,117	28,126	252	18,405	12,330
Nova Scotia	944	111,957	99,565	606	87,325	53,896
Ontario	450	125,937	133,394	624	64,467	160,614
Prince Ed. Is. ..	106	6,745	6,309	31	7,036	3,257
Saskatchewan ..	1	145	145	4	534	302
Manitoba	14	3,877	3,877	72	8,503	5,722
Yukon				4	1,204	813

During 1921, there were built in Canada 51 wooden sailing vessels with gross tonnage of 11,128; 32 wooden steam vessels, tonnage, 4,629; 74 gas vessels, tonnage, 1,509. There were 24 metal steam vessels with a gross tonnage of 92,722 and net tonnage of 55,917.

* * * *

INCREASING TRADE WILL BRING IMPROVEMENT IN SHIP-REPAIRING

By P. L. MILLER, Canadian Vickers, Limited.

MONTREAL.—Our activities during the past year may be summarized as follows:

Shipbuilding.—Completed hopper bucket dredge No. 16, 284 feet long by 48 feet beam by 20½ feet draft; fitted with twin screw triple expansion engines of 2,000 I.H.P.; speed, 9 knots; gross tonnage, 1,964 tons; for Department of Marine and Fisheries, Canada.

Constructed steel pontoon lock gate lifter for service in Sault Ste. Marie canal, for Department of Railways and Canals, Canada.

Commenced construction of hopper barge No. 3, 210 feet long by 35 feet beam by 19 feet draft, with triple expansion engines 1,250 I.H.P.; hopper capacity, 1,250 tons; for Department of Marine and Fisheries, Canada.

Str. "Charles Dick" built by Collingwood Shipbuilding Co., for a firm of sand and gravel contractors. See description in this department.

Also a number of sea sleds—a new type of inverted V-bottom hull driven by surface propellers—which possess many advantages over any other type of motor-boat. Photograph is of 38′ 6″ sea sled, speed 40 miles per hour, which aroused interest during demonstration trips at Montreal, Toronto and Quebec in the fall months.

Ship-repairing.—During the navigation season, 56 ships were docked and repaired. Repairs afloat were also executed on 150 other ships.

Industrial engineering.—The work in this department includes the following contracts: 36 mine cars for Teck-Hughes Gold Mines, Ltd.; one Hardinge ball mill for McIntyre Porcupine Mines, Ltd.; 8 pressure still drums of steel plate 2″ thick, for working pressure of 350 lbs. per square inch, for Imperial Oil, Ltd.

The average number of men employed during the past year is 450.

With the exception of the above small vessel for the Government, no new ship construction work has been booked by this company, and practically the same condition applies throughout Canada.

Improvement is looked for in the ship-repairing business during 1923, due to the increasing international trade passing through the port of Montreal.

* * * *

THINKS OUTLOOK BRIGHTER FOR CANADIAN SHIPBUILDING

By JOHN S. LEITCH,
Vice-President Collingwood Shipbuilding Co.,

COLLINGWOOD.—The steamer "Charles Dick" is the only steamer which we completed this year. At both our Collingwood and Kingston plants we have had a large volume of repair work and have now a number of vessels in for this winter's repairs. Business therefore will be good as far as repair work is concerned. We are about to start work on a canal-size steamer, which will be ready for spring delivery.

The outlook generally for shipbuilding, we believe, is brighter. The probability is that a number of 10,000-ton type upper lake freighters will be built in the near future, the movement of this year's record grain crop showing that there is room for more tonnage. Following are particulars of the "Charles Dick."

Particulars of Steamer "Charles Dick"

Built for National Sand & Material Company, Ltd., Welland, Ontario, this steamer is the only one of her class ever built in Canada and is the last word in ships of this type. She is equipped with special pumps for loading sand and gravel and with special equipment for unloading in the shortest possible time. The ship is quite an acquisition to Canadian tonnage.

Following are the vessel's dimensions: Length over all 258 ft.; length between perpendiculars 250 ft.; breadth moulded 43 ft.; depth moulded 20 ft.; gross tonnage 2,015; deadweight 2,650; capacity of cargo department 2,000 cu. yds.

The vessel was built of steel to the requirements of the British Corporation for the Survey and Registry of Shipping. The machinery, consisting of one triple-expansion engine having cylinders 19 in., 32 in. x 36 in. stroke, and 2 boilers 14 ft. 7 in. dia. x 10 ft. 8 in. long, is placed aft. Cargo is carried in two compartments amidships and is fed into these by means of a trough with discharge openings at intervals. At each side of the cargo compartments are buoyancy spaces, closely sub-divided by watertight bulkheads. Water ballast is carried in double-bottom tanks under the machinery in peaks and in peak tank forward.

Gravel is loaded by means of two 18-in. pumps located forward. The suction pipes are connected to shell plates about 4 ft. 6in. above keel. The shell is recessed in way of suction inlets so that vertical slides for flanges of pipe elbows will not project beyond moulded line of ship.

Unloading is carried out by means of a grab bucket carried on "A" frames. This bucket discharges into hopper amidships which in turn feeds an elevator. The cargo falls from the elevator to a conveyor which lands it on dock.

The Captain and crew are accommodated forward and the officers' dining room, galley, etc., are housed aft.

Although production in agricultural implements during the past year has been considerably below normal, with comparatively limited export, the next year has its possibilities. The Massey-Harris Co., Toronto, have been increasing their force, particularly in the foundry, and it is anticipated that the plant will be running full by February.

Gull's eye view of a sea-going freight carrier. Canadian Government Merchant Marine type.
(From Industrial Digest.)

Welland Ship Canal Great Lakes-to-Ocean Link

Work on Stupendous Engineering Project Carried on Vigorously During Year—About 2,000 Men Engaged—Will Be 25 Miles Long With Seven Liftlocks—Over Thirty Millions Expended

By ALEX. J. GRANT,
Engineer in Charge.

DURING the year construction work on the Welland Ship Canal has been carried on vigorously on Sections 1 to 5 inclusive, which are now under unit price contracts. J. P. Porter has the contract for completing Sections 1 and 2; Peter Lyall & Sons Construction Co. for Sections 3 and 4, and the Canadian Dredging Company for Section 5. These Sections extend from Lake Ontario entrance to Port Robinson, about 14½ miles in length, and include all the lift locks and most of the other important structures. No construction work has yet been done on the remaining portion of the canal extending from Port Robinson to Lake Erie.

During the current year, on Sections 1 and 2, nine of the large concrete cribs required for the docking at Port Weller harbour, Lake Ontario, were constructed and placed in position. The harbour is being dredged and the embankments on each side are being built with excavated material. Concrete is being placed at Locks 1 and 2 and their weirs, and these structures are nearing completion. Excavation work is being carried on in the canal prism south of the Queenston Road and to some extent elsewhere on the sections. About 820 men were employed during the year, but the force is now somewhat reduced owing to curtailment of concrete work with the approach of winter.

On Sections 3 and 4, excavation of the canal prism north of Lock 4 and throughout the greater part of Section 4 is being done. Concrete work is well advanced on Twin Locks 6 and a small amount has been done on Lock 7. The re-location of the Welland Division of the Grand Trunk Railway on Section 4 has been graded, ballasted and track laid and operation over the diverted line will probably begin in April, when it is expected a couple of necessary structures will be completed. About 840 men have been employed on these sections during the year.

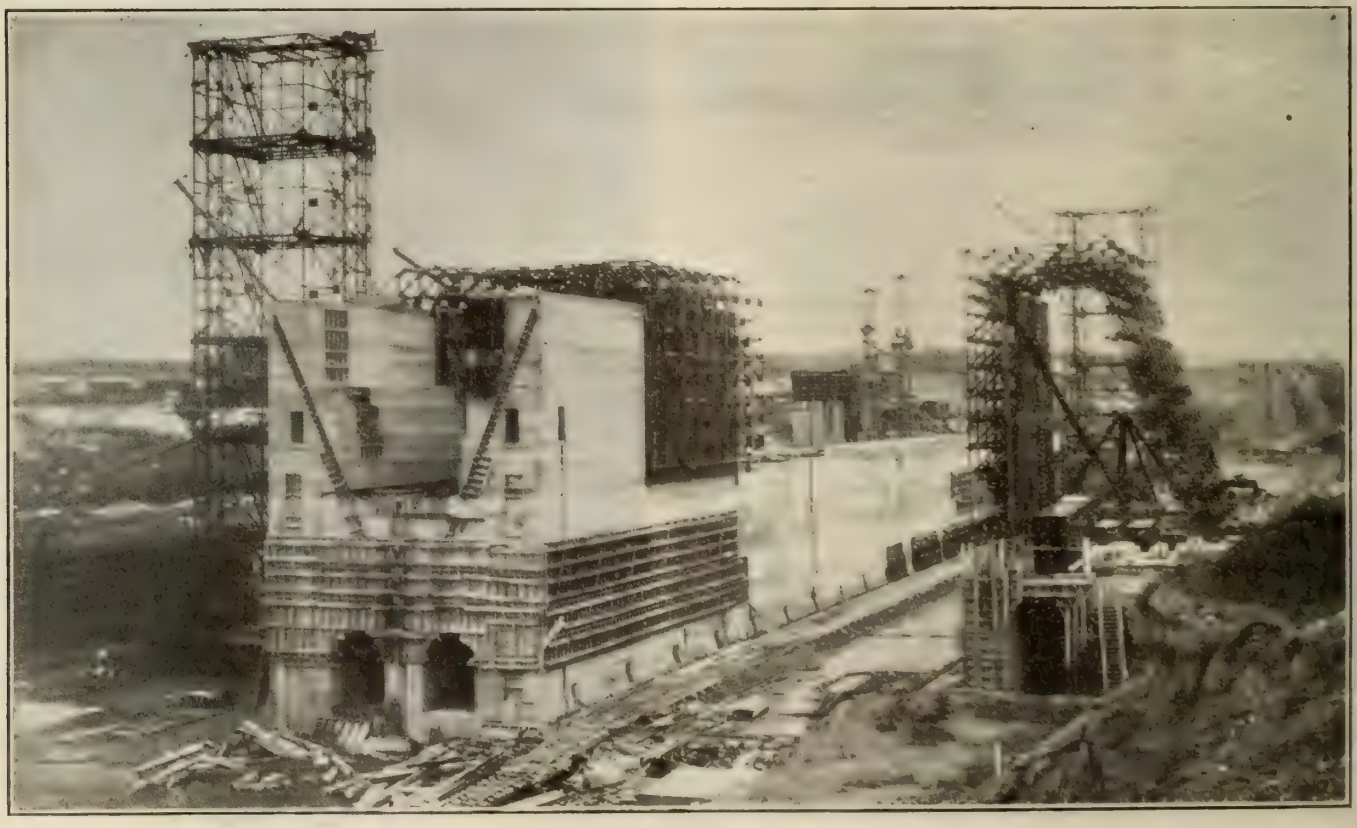
On Section 5, dredging operations are being carried on and the substructure of Bridge No. 12 is nearing completion. This section is nearing completion. About 170 men represent the average number employed during the current year.

The Parliamentary Appropriation for the fiscal year ending 31st March, 1923, amounted to $8,000,000 and about $5,000,000 of this has been spent to the end of November.

Details of Ship Canal

The Ship Canal as finally located, follows the valley of the Ten Mile Creek between its mouth (Port Weller) about three miles east of Port Dalhousie, and Thorold, crossing the present canal below Lock No. 11 where the level of both canals will be at an elevation of 328.0. Between Thorold and Allanburg a new cut will be made for the purpose of straightening the alignment of the canal between these points.

The Ship Canal will cross the present canal below Lock No. 25, where the water levels of both canals are at elevation of 568.0, the extreme low water level of Lake Erie. From Allanburg to Port Colborne, it will follow closely the course of the present canal. The total length of the canal will be 25 miles, and for all practical purposes of navigation, it is a straight line throughout. The difference in level between the lakes will be overcome by seven locks of 46½ feet lift each. The direct line of the canal down the face of the escarpment, and the topography of the lower pla-



Welland Ship Canal—Lock No. 6, showing completed section of centre wall.

teau permitted the adoption of these high lifts which constitute a peculiar feature of the design of the canal and has no precedent in actual construction for locks of their size.

The canal will be made 200 feet wide on the bottom, with two to one slopes and, for the present, will be excavated to a depth of 25 feet only. All structures, however, will be built for 30 feet depth, so that the canal, at some future date, can be enlarged by simply dredging out the canal prism and harbour entrances.

Some of the dimensions and notable features of the canal are as follows:

Number of lift locks (Three of which are twin locks in flight similar to the Gatun Locks of the Panama Canal).	7
Useable length of locks	820 ft.
Useable width of locks	80 ft.
Depth of water on mitre sills	30 ft.
Lift of locks	46½ ft.
Height of lower mitre gates	82 ft.
Width of bottom	200 ft.
Width at water line	310 ft.
Navigable depth of canal (all structures built for 30 ft. depth)	25 ft.
Weight of each leaf of lower gates	425 tons
Total estimated weight of metal in lock gates and their machinery	12,300 tons
Total estimated weight of metal in valves of locks and weirs and their machinery	3,200 tons
Estimated connected motor load for operating and lighting canal and Port Colborne elevator	11,200 h.p.
Time required to fill a lock	8 minutes
Estimated time for vessel to pass through canal	8 hours
Total rise	326½ feet
Length	25 miles
Number of railway and highway bridges across canal	22

Quantities

Earth excavation	Cu. yds.	40,200,000
Rock excavation	Cu. yds.	6,740,000
Watertight embankments	Cu. yds.	2,700,000
Concrete (all kinds)	Cu. yds.	2,850,000
Steel reinforcing	Lbs.	18,500,000

The estimated cost of the canal at 1912 prices was $50,000,000. For the purpose of construction the work was divided into nine sections and contracts were awarded for the construction of Sections 1, 2, 3 and 5 in 1913. The first three sections include the Lake Ontario entrance (Port Weller Harbour), the seven lift locks, eight bridges and the canal prism between the lake and Thorold.

Owing to the European war, the work on the canal practically ceased in 1916. In March, 1917, it was entirely closed down and the contracts cancelled in 1918. After the armistice of November, 1918, the Government decided to resume work on a small scale on Sections 1, 2, 3 and 5. During 1919 and 1920 it was continued in a more or less intermittent manner due to want of materials, labour troubles and other causes.

During 1921 the work of completing Sections 1 and 2 combined and Section No. 5, with a small portion of Section 4 added, were re-let on a unit price basis. The contract for the former was awarded to J. P. Porter and for the latter to the Canadian Dredging Company and in June, 1922, Section No. 3 and No. 4 were re-let on the same basis to P. Lyall Construction Company.

The expenditure on the Ship Canal to the 31st March, 1922, including surveys, engineering expenses and right-of-way, amounted to $30,588,026.07, less value of plant sold and to be sold $4,254,300.24 leaving a net expenditure of $26,333,725.83 which includes some other redeemable assets.

FAIR VOLUME OF BUSINESS

HALIFAX, N. S.—We completed and delivered the last ship we have built, the "Canadian Constructor" to the Department of Marine, on January 7th last, and this year we have built no new tonnage of any description, our work being confined solely to dry docking and hull and machinery repairs, of which we have had a fair volume, considering the depressed condition of shipping the world over.

During this year, our dry dock at Halifax and marine slips at Dartmouth, have been continuously engaged, but the volume of repair work has been much below that of former years, consequently we have been working with a very much reduced staff. Last year we were employing 1,400 to 1,500 men at Halifax, while this year our force has been running from 150 to 250 men

CANAL TRAFFIC INCREASES

LARGE increases in canal traffic over last year are shown in the record for September, 1922, an important month, due to the marketing of Western products. The following canal statistics are illuminating:

Sault Ste. Marie Canal.—Total traffic through the Canadian and American locks at Sault Ste. Marie showed an increase of 4,503,984 tons, or 70 per cent. over September, 1921. The big increases were in iron ore and bituminous coal which increased 3,047,694 tons and 1,360,892 tons respectively. A total of 2,354,743 tons of bituminous coal passed up the canal during the month. Wheat increased 9,376,874 bushels and other grains increased 1,472,527 bushels.

Welland Canal.—Total traffic increased 84,167 tons, or 19 per cent., grain, steel and general merchandise accounting for the greater portion of the increase. Corn showed a falling off, but increases in oats, rye and wheat more than offset it. Pulpwood and soft coal showed decreases of 7,964 tons and 53,822 tons respectively. Soft coal upbound totalled 3,729 tons as against 9,703 tons during August, but downbound shipments increased to 39,549 tons from 7,100 tons the previous month.

St. Lawrence Canals.—Total freight traffic increased 125,587 tons or 24 per cent., but the passenger traffic showed a slight decline, being 8,412 against 8,571 for September, 1921. Corn shipments declined 51,317 tons but rye increased 43,141 tons and wheat increased 116,053 tons or 3,868,400 bushels. The total shipments of wheat since the opening of navigation were 39,463,800 bushels, an increase of 17,029,200 bushels over the same period last year. Iron and steel showed an increase of 7,652 tons over September, 1921, and for the season showed an increase of 47,986 tons over last year. Pulpwood also showed an increase of 53,294 tons for the season, although September shipments showed a slight decline. Coal shipments had not reached last year's record although they showed considerable increase over August 1922.

MAURETANIA'S RECORD

NO STEAMSHIP ever launched can claim so magnificent a record of service as the British liner "Mauretania." As a passenger ship she has steamed 850,000 miles and carried nearly 400,000 passengers. Including her voyages during the war, she has travelled over one million miles. Moreover, she holds all the speed records and has further achieved the remarkable feat of maintaining an average of 25½ knots on twenty-seven consecutive runs across the Atlantic. Even more striking is the fact that on three recent successive voyages the times taken for the Atlantic crossing differed by less than five minutes.

In stressing the need for immigration Lord Shaughnessy in a recent speech, stated: "We have been hiding our light under a bushel, with the result that we have lost to other countries thousands of excellent settlers, who should have come to us. Indeed, it is worse than that, because the census returns show that in 1922 Canada has a population of 7,200,000, and the census returns for 1921 show a total population of 8,700,000. But in that period the vital statistics show that there was a natural increase of 1,836,000, and immigration into Canada from other countries of 1,975,000. Had we received no immigrants at all, the natural increase should have given a population of 9,000,000."

Some Factors in Power Transmission

Care Required When Installing Shafting—Figuring the Size of Shaft—Joints Should be Properly Made to Ensure Efficiency—Reducing Friction by Means of Ball Bearings

OPINIONS of engineers differ as to the best method of power transmission when a number of machines are to be operated in the one plant or department. Some advocate the individual, while others stick to the older method of grouping the machines and operating from one main shaft. Experience has shown that no fixed rule could be made as to the best method to adopt, and each individual case must be solved on its own merits, the solution being based on existing conditions.

Installing Line Shaft Supports

The fundamental consideration in the problem of power transmission is the erection of the line shafting that is to carry the numerous pulleys for driving the various machines. Where individual drives are used long lengths of overhead shafting are seldom necessary, but it is only in comparatively few plants that one will not see a line shaft of some description. It must be obvious that in order to obtain an installation of high efficiency great care must be given to the erection of the various brackets or hangers used for supporting the shaft. The practice followed when erecting a line shaft cannot be clearly defined, as the methods adopted by individual millwrights and mechanics will vary according to their own personal ideas and experience, as well as the local conditions governing each specific case. However, a brief outline may assist those who may have such a duty to perform. Each individual instance must be solved on its own merits, but the summary here given will be the practice recommended when erecting a line carried on ball bearings.

Placing the Hangers in Position

When the approximate location of the shaft has been determined, the hangers or brackets are arranged and secured in their respective positions and aligned by means of a spirit level and a taut string. During the process of securing the bracket or hanger to the wall or ceiling supports, a steel square is used to assure proper alignment of the machined surfaces that carry the boxes or ball bearing housings. It is advisable also to check the erection both horizontally and vertically by means of plumb lines. In the case of S.K.F. bearings the housings are thoroughly cleaned, the felt washers saturated with grease, and placed in the grooves in the housing. The lower sections of the housings are placed in their respective positions and the bearing seatings painted with cylinder oil to prevent the outer ring of the bearing from becoming firmly attached to the housing through the action of rust. Before placing the ball bearing on the shaft the latter should be wiped thoroughly to remove all grit and dirt.

Placing and Aligning the Shaft

The shaft is then raised and placed in the lower sections of the plummer blocks, after which a spirit level is used to make final horizontal alignment of the shaft. The bearings are then fixed in their respective positions in the housings, by means of the locking nut. In the case of free bearings, care should be taken to make sure that the ball bearing fits into its seating in such a manner that the bearing as well as the shaft can move sideways with perfect freedom. When fixed in the desired position the sleeve nuts are firmly locked by the safety grub-screws. Before fitting on the upper sections of the plummer blocks the bearings are well lubricated. When bearings are supported in hangers, care should be taken to avoid excessive tightening of the top locking screw. Final alignment in a vertical plane is then made by means of a plumb line. Examination should not show the shaft rubbing at any point on the bearing housing.

Figuring the Size of the Shaft

When making calculations for size of shafting, it is well to use shafts of ample dimensions to take care of unexpected overloads and subsequent additions to plant equipment to be driven by that particular shaft. For the usual run of line shaft service, where supports are provided every eight feet or less, and where average loads and speeds are used, the shaft rating as given below may be considered good practice:

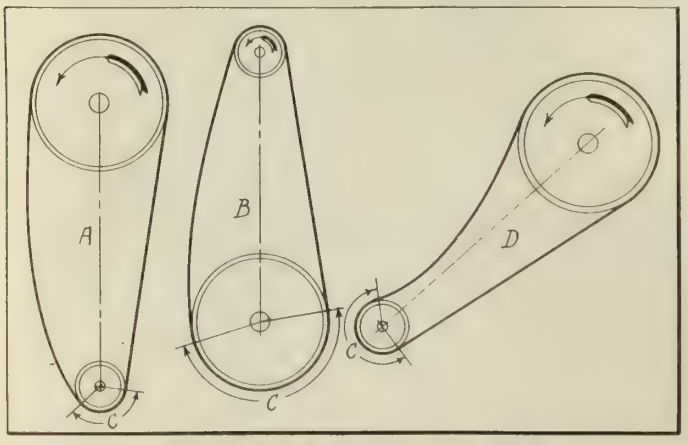


Fig. 1—Points to watch in vertical drives.

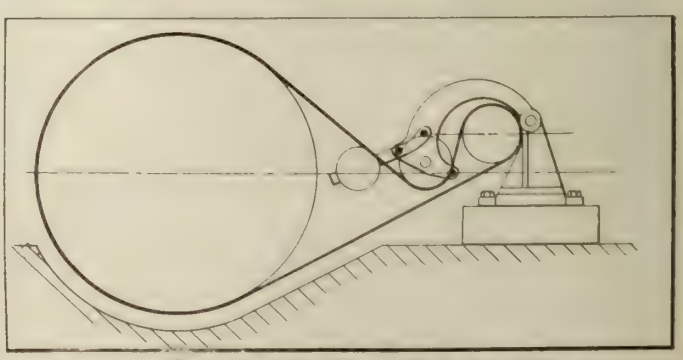


Fig. 2—General outline of Tenix short drive.

H. P. Transmitted by Steel Line Shafting

Dia. of Shaft	Number of Revolutions per Minute					
	100	150	200	250	300	350
1 1-16	6	8.9	11.9	14.9	17.9	20.9
1 15-16	8.9	13.3	17.7	22.2	26.6	31
2 3-16	12.6	19	25	31	38	44
2 7-16	17	26	34	43	52	60
2 11-16	23	34	46	58	69	81
2 15-16	30	45	60	75	90	105
3 3-16	38	57	76	95	114	133
3 7-16	47	71	95	119	143	167
3 11-16	58	88	117	146	176	205
3 15-16	71	107	142	178	213	249

A formula for above table would be:

$$H.P. = \frac{D^3 \times R}{83.7}$$

Shafts Subjected to Heavy Loads

When severe service is required, such as shafts carrying gear drives, large pulleys with wide belts, and where heavy loads and shocks are delivered at intervals or suddenly, a greater factor of safety should be taken. This is necessary to take care of the variations in the stresses on the shaft. A reasonably safe formula in such cases would be the following:

$$H.P. = \frac{D^3 \times R}{125}$$

where D = dia. of shaft in inches.
R = rev. per min.
H.P. = horsepower.

It will be understood that the table and formula given are only approximations. More accurate results may be obtained from the charts shown in Figs. 5 and 6. To use the chart it is necessary to calculate the twisting and bending moments of the shaft, based on the load, distance between supports and other factors. The figures between the heavy black lines indicate the h. p. at the point of intersection of the bending and torsional moments. The charts are based on the formula:

$$D = \frac{\sqrt[3]{5.1 \times (M + \sqrt{M^2 + T^2})}}{S}$$

when:
d = Shaft diameter in inches.
M = Bending moment in inch-pounds.
T = Twisting moment in inch-pounds.
S = Fibre stress in pounds per sq. in.

Stress and Tension in Belts

When a belt is stretched over a pair of pulleys, is cut to the proper length and laced together to form an endless band, it is obvious that uniform tension will exist throughout all portions of the belt, as long as the same is at rest, due to the tightening exerted by the lacing. If the distance between the respective shafts is considerable, the weight of the belt itself will increase the tension in that section of the belt near the pulleys. This increase of tension due to the weight of the belt would make but little difference in the unit-stress of the material, so it is safe to assume that the tension is equal at all points when not exerting a pull.

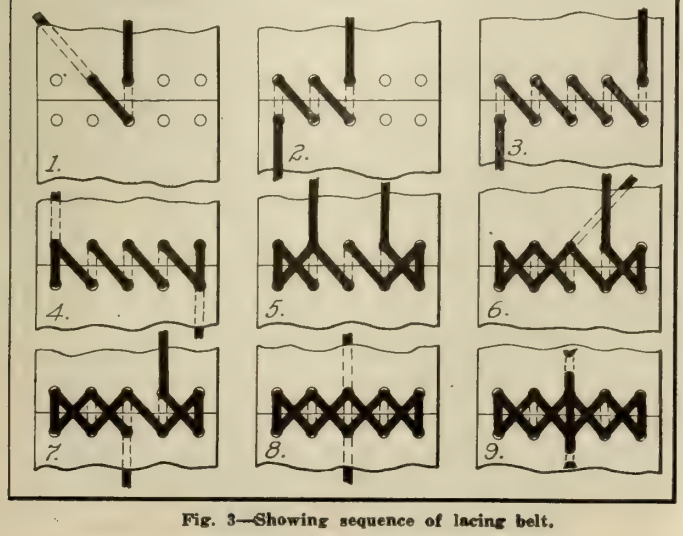


Fig. 3—Showing sequence of lacing belt.

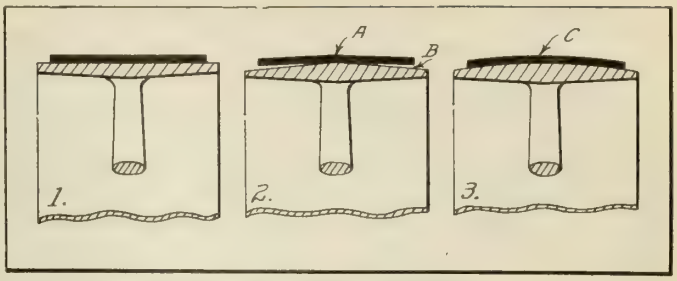


Fig. 4—Flat and crowned pulleys.

In the process of transmitting power, however, the condition of stress in the belt is materially changed. Owing to the flexibility of the belt it is only by pulling that power can be transmitted to the other shaft, so that increased tension is evident in the power side of the belt, the opposite side developing a sag or slackness caused by the stretch due to load resistance. The sum total of the tight and slack side tensions is approximately the same as the uniform stress when belt is at rest. The amount of pull that can be applied to a belt is limited by the tension at which the belt slips around the pulley. Since the force of friction between belt and pulley is dependent upon the normal force with which the belt is pressed against the pulley, and the coefficient of friction between the two, it is obvious that the tighter the belt is laced, and the rougher the contact surfaces, the greater is the power that can be delivered by the belt. From this it would appear that it is possible to transmit any amount of power through any size belt, if such belt were only laced tight enough.

While theory might lead us to this conclusion, the same would be impossible in practice, as no belt would stand the strain. Other practical conditions are likewise involved which fix the limit of power transmitted at a point far below the breaking strength of the material.

Effect of Centrifugal Action

When the belt, as it passes around the pulley, changes its straight-line direction to circular motion, each particle of the belt — like a body whirling at the end of a cord about a centre of rotation — tends by centrifugal force to fly away from the surface of the pulley, thereby decreasing the normal pressure, and hence the friction. This centrifugal action also changes the tension in the belt between the pulleys. As the centrifugal force increases in proportion to the square of the linear velocity, it is evident that the effect is greater at high speeds than at moderate or low speeds.

A further circumstance that affects the driving power of a belt is the stiffness of the leather or other material of which the belt is made. When passing around a pulley, the belt is bent to conform to the circumference, and is again straightened out as it leaves the pulley. It is evident then that the theoretically perfect action is modified somewhat according to the nature of the bending and the thickness or flexibility of the belt, so that a small pulley carrying a thick belt would be the worst case for successful theoretical calculations.

Joints Should be Properly Made

A very important factor in power transmission by belt is that of the laced joints. This, naturally, is the weakest portion of a belt and therefore special care should be exercised in seeing that the connection is properly made. The first thing to consider is the cutting of the belt ends. This must be carefully done. The ends should be cut perfectly square with the run of the belt and the holes in each end properly aligned with each other. An effective method of lacing is shown in Fig. 3. In all cases it is advisable to have the laces on the pulley side of belt running parallel, the crossing being made on the back. Knots should not be used. The best practice is to lock the lace by passing it through an extra hole and pulling it tight. A cut is then made in the lace just

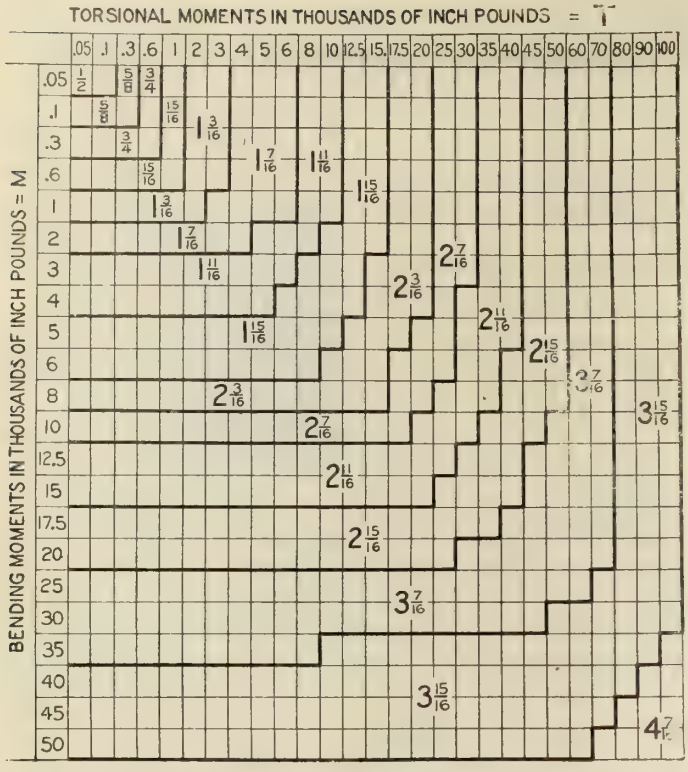


Fig. 5—Chart for finding the h. p. of shafts of small diameter.

clear of the hole, and about half way through, at an angle to prevent lacing pulling back. The lace is then cut off about ¼ in. back of lock.

Crowning the Pulley Face

The crowning of pulleys is a very important feature. A flat faced pulley would give the highest frictional value, but unless conditions are ideal, it is difficult to keep the belt on the pulley. It is general practice to crown pulleys on which the belts are permanently running. There are two methods in use, the flat conical crown and the spherical crown. In the former the apex of the crown is a pronounced point as shown in Fig. 4, and the tendency is to make a poor contact with face of pulley. The method shown at Fig. 3, where the face is rounding, is the better way as it permits a more uniform bending of belt fibres.

Different Systems of Rope Drive

Properly designed rope drives are highly economical and efficient in many situations, for transmitting power between long centres, at angles, around obstructions and particularly where larger units of power are to be carried. The flexibility of manila rope, its positive operation, relatively low cost and long life give it many advantages.

There are two systems of rope transmission. What is known as the English system is made up of individual ropes, separately spliced and running constantly in the same groove of the driving sheave and of the driven sheave. Due to more or less unequal stretch, it is almost impossible even to approximate uniform tension on all the ropes. Consequently it is usual to employ ropes of larger diameter and load them heavily. English system drives are practicable only when the ropes run horizontally or nearly so and in some such situations they are very satisfactory.

The fundamental principle of the so called American system of manila rope transmission is that one continuous rope is used (with only one splice), which travels consecutively through all the grooves of the sheaves and which runs continuously around a winder and tension carriage arrangement, that keeps the rope adjusted at a uniform tension throughout its entire length at all times, for ordinary variations in load. The American system is far better adapted and more efficient for most service.

Efficiency of Rope Drive

The successful operation of any rope drive is dependent primarily upon the design and the proper adaption of those principles which have been demonstrated by experience to govern efficient rope drive practice. The diameters of the sheaves in relation to the diameter of the rope and the speed are important. The location of the tension outfit and how the rope leads to and from it also are vital factors.

The diameter of rope to select, the number of wraps, the form of the sheave grooves, the general arrangement and location of the sheaves, the "wind" of the rope and other questions are individual problems with each drive. They can be answered only from an extensive experience with rope drives for all kinds of service.

To plan a rope drive, complete and definite information is required about the conditions of service. This data should be accompanied by a rough sketch showing the layout of buildings and equipment. The information required to enable engineers to prepare plans and estimates for rope drives is specified below:

The approximate amount of horsepower to be transmitted.

The type of unit that supplies power to the driving shaft and the class of equipment that power is to be delivered to.

Direction of rotation and speed of the driving shaft; also that of the driven shaft.

The diameters of both shafts.

The location of both shafts and their position in relation to adjacent floors, ceilings, walls, posts and other obstructions. This is necessary to properly determine the sizes of sheaves and the location of tension equipment.

How close bearings can be placed on each side of both driving and driven sheaves.

The centre distance of the shafts and whether they are parallel and on what level.

It should also be stated whether the ropes have to clear any obstruction.

Considering the Friction Loss

Present-day factory operation demands that every possible source of leakage be eliminated, or at least minimized. A frequent, and very often inestimable, cause of leakage is the power loss caused by inefficient or faulty transmission installations. Owing to the variable stresses that hangers, shafting and bearings are constantly subjected to, it is imperative that great care be exercised when erecting all classes of shafting that is to transmit power. Friction in bearings is one of the chief sources of lost power. With modern ring-oiled bearings the frictional loss may be reduced considerably, but even with this type of bearing the best results are only obtained after the bearing has been well "worn in," and in attaining this objective, constant care and attention is requir-

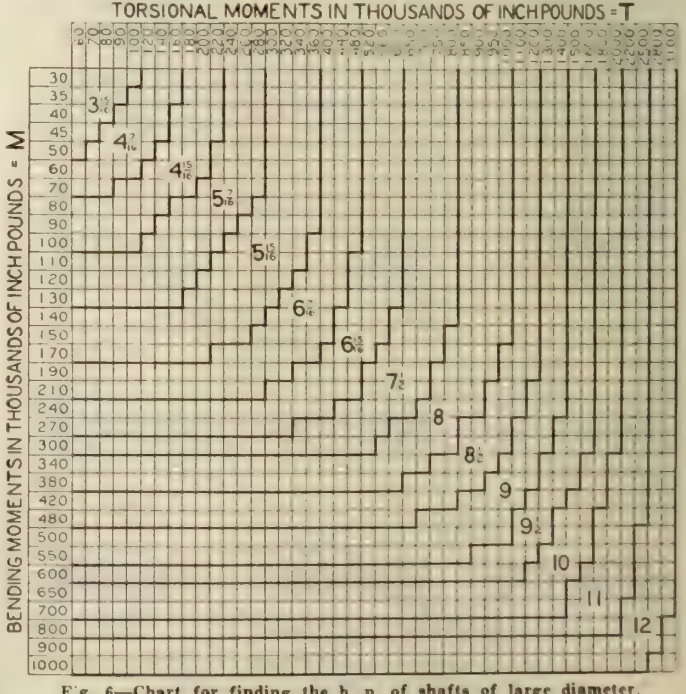


Fig. 6—Chart for finding the h. p. of shafts of large diameter.

ed to see that the oil supply is adequate and shafting kept in perfect alignment.

Allowance for Shaft Deflection

By equipping line and counter-shafts with ball bearings, the cost of lubrication and attention is reduced to a minimum; there is no necessity for "wearing in," and the starting effort is almost negligible. It is essential, however, to avoid bearings of a rigid construction, and provision should be made to counteract shaft deflection, a condition that is invariably present in some form or other when long lengths of shafting are subjected to a number of varying and opposing stresses. Some bearings are designed with swivel housings, but considerable unnecessary strain is often placed on the balls when the bearing is under heavy load. In self-aligning bearings any deflection of the shaft is taken care of by the special arrangement of the housing that permits the balls to roll sideways in the spherical ball race. This instantaneous response to shaft deflection minimizes loss through friction.

The problem of friction loss in transmission equipment must be faced by the engineer sooner or later. It is generally conceded that well designed ball bearings have a lower co-efficient of friction than the plain bronze or babbitted bearing. Few of the plain bearings will register an efficiency greater than 80 per cent. and when poorly installed may show a loss through friction of 30 per cent. or even greater. By the installation of ball bearings this loss has been reduced by upwards of 70 per cent.

Typical Example of Power Saved

As a typical example of the saving possible through the use of ball bearings we will assume that 40 ft. of 3 in. shafting is carried on five plain bearings, the power delivered being 60 h.p. at 250 r.p.m., the total load on the five bearings, including pulleys, belt pull, etc., being about 18,000 lbs. Placing the co-efficient of friction for a plain journal bearing at 0.04, the friction load will be:

$$18{,}000 \times .04 = 720 \text{ lbs.}$$

This gives the ft. lbs. per minute, as:

$$\frac{720 \times 3.1416 \times 3 \times 250}{12}$$

and the h. p. absorbed by friction in the plain bearing of:

$$\frac{720 \times 3.1416 \times 3 \times 250}{12 \times 33{,}000} = 4.28 \text{ h. p.}$$

For well designed ball bearings the co-efficient of friction will seldom exceed .002, so that the loss in such cases would figure out at:

$$\frac{36 \times 3.1416 \times 3 \times 250}{12 \times 33{,}000} = .214 \text{ h. p.}$$

This indicates an approximate saving in power of:

$$4.28 - .214 = 4.06 \text{ h. p.}$$

Aside from the actual power saved, a feature of economic advantage is the low starting effort required for shafts equipped with ball bearings, as the initial pull is relatively the same as when running.

In making calculations for and the selection of suitable bearings, it should be borne in mind that tables generally give the sizes for steady loads and speeds, so that where bearings are subjected to shocks, ample margin should be allowed in excess of the load stated. For this reason it is recommended that a reasonable factor of safety be used when figuring.

Rules to Follow When Installing

When fitting a line shaft with ball bearings it is advisable to adhere to certain conditions. These might be stated briefly as follows: One bearing only should be fixed axially on each independent line of shafting; it is advisable to locate this fixed bearing as near the centre of shaft length as possible; bearings on either side of fixed unit must be located centrally in the housing and be free to move laterally in either direction; where sleeve nuts are used for tightening or adjusting, they should be screwed on in the direction opposite to shaft rotation; be sure and tighten grub screw that locks the sleeve nut; see that ball race is well lubricated with the necessary grease.

The Lenix Short Drive

Lack of sufficient space frequently restricts the length of drive that can be used. In such instances it is generally the practice to fit up an idler to make up for the loss of centre distance. This is especially true when there is a great difference between the diameter of driver and driven pulleys. Fig. 2 illustrates the application of the Lenix flexible idler as used on equipment such as ice machines, air compressors, etc., where the shaft centres are necessarily close together. It is important, however, in obtaining effective service from a drive of this character that a belt be selected with a high degree of pliability and one that will not break down readily under the constant changing positions of belt fibre.

Tension and Power Transmitted

When a belt is working at its full efficiency the pull on the tight side will range from 60 lbs. to 120 lbs. per inch of

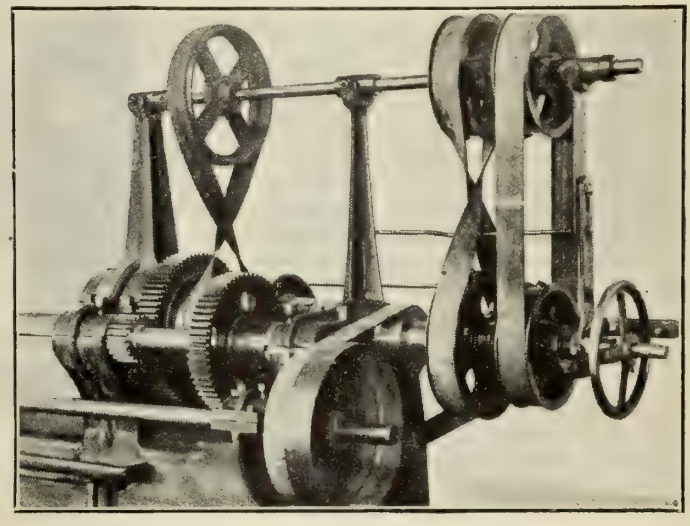


Fig. 7—Interesting arrangement of belt drive.

width for single belts, this stress varying according to the thickness of the leather from which the belt is made. A fair working average is about 90 lbs. per inch of width. For double belts this is increased to approximately 150 lbs., the average between the range of 135 lbs. for light and 160 lbs. for heavy leather. In order that the belt shall do its maximum work the strain in lbs. on the slack side of the belt must bear a certain ratio to the pull tension that slippage does not take place. In practice this ratio will be about 1 to 3, dependent on the condition of the belt and pulley surfaces, and on the percentage of belt contact. Safe practice places the ratio at 1 to 2, so that a fair average for stress would be 45 lbs. for single and 75 lbs. for double belts.

The following rule will be suitable for determining the power capacity of any given belt: multiply the belt width in inches by 45 for single and 75 by double belts, and by the speed in feet per minute, dividing the product by 33,000. The result will give the h. p. delivered by the belt. Suppose a 4 in. single belt is running at 1,200 ft. per min., the result will be found by the rule given, using it in the form of a formula:

$$H = \frac{w \times t \times v}{33{,}000} \text{ where}$$

H=horsepower; w=belt width; t=tension; v=velocity.

$$H = \frac{4 \times 45 \times 1{,}200}{33{,}000} = 6\tfrac{1}{2} \text{ h.p.}$$

For a 10 in. double belt running at 1,500 ft. uer min., the h. p. transmitted would be:

$$\frac{10 \times 75 \times 1{,}500}{33{,}000} = 34 \text{ h.p.}$$

(Continued on page 132)

Greater Production the Aim of Tool Builders

Pleasing Appearance Second Only to Productive Quality—Special Attachments Facilitate Continuous Operation—Ever Widening Field of Grinding Machine — Use of Ball Bearings

By F. F. BARBER,
President of the F. F. Barber Machinery Co.

TRACING the trend of machine tool design and development is both interesting and instructive. From rough, semi-finished, and in some cases uncouth designs, we have come to the stage where general appearance is considered almost as much as the design of the parts themselves. It is quite common nowadays to hear someone remark: "Isn't that machine tool a beauty—look at its lines, and splendid finish."

Thus we have reached the point where machine tool builders appeal to the eye as well as keeping in mind the actual productive value of the tool. This is as it should be, for while the productive capability of a machine is of first importance, still there is no reason why the design outwardly should not be as pleasing as possible.

Take Fig. 1, for example, and compare this miller with the up-to-date style in use today. So far as productive capacity is concerned, there is no comparison, because the latest developments in milling practice have placed the earlier types of milling machines upon the scrap heap. Rather than dwell on what used to be, let us consider a few examples of modern milling practice, which will be more to the point, and of more value to the reader.

Fig. 2 shows a very interesting example of good milling practice. The work being machined is connecting rods, and, as readers know, this is one of the big problems in any motor shop. The milling of the sides of both crank and wrist pin ends usually causes considerable trouble because not only must the sides be parallel and in line with each other, but care must be taken that the rod is not sprung while being held and machined. The set up shown in the photograph gives splendid results.

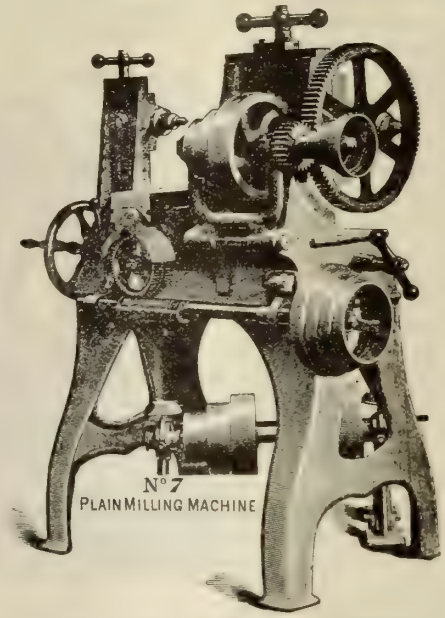


Fig. 1—One of the first types of milling machines.

Two holding fixtures are used, one on each end of the table. Each fixture holds two rods, with alternate ends toward the cutters. As the rod shown is made with both heads of different thickness, the cutters are arranged so that one side straddles the small end, while the large end is milled between the larger cutters nearest the face of the milling machine column.

When two heads on one fixture have been milled, the table traverse is reversed and the two heads held in the other fixture brought into cut. The holding fixture is then swiveled 180 degrees, bringing the other two heads toward the cutters.

To show the remarkable difference in production time over the former method employed, here is the comparison. Instead of twelve per hour, the firm using the method shown now get sixty per hour, and a higher quality of workmanship. Previously the rods were held in an indexing fixture and milled one end at a time. Another point in favor of the modern type of miller is its adaptability. When necessary, special attachments can be quickly placed on the standard machine and with very little

Figs. 2, 3 and 4 illustrate Milwaukee Milling Machines; Fig. 5, Warner & Swasey turret lathe; Figs. 6, 7, 8 & 9, Gould and Eberhardt equipment; Fig. 10 is a Lucas boring machine; Fig. 11, a Landis grinder; Fig. 12, a Bullard vertical boring lathe.

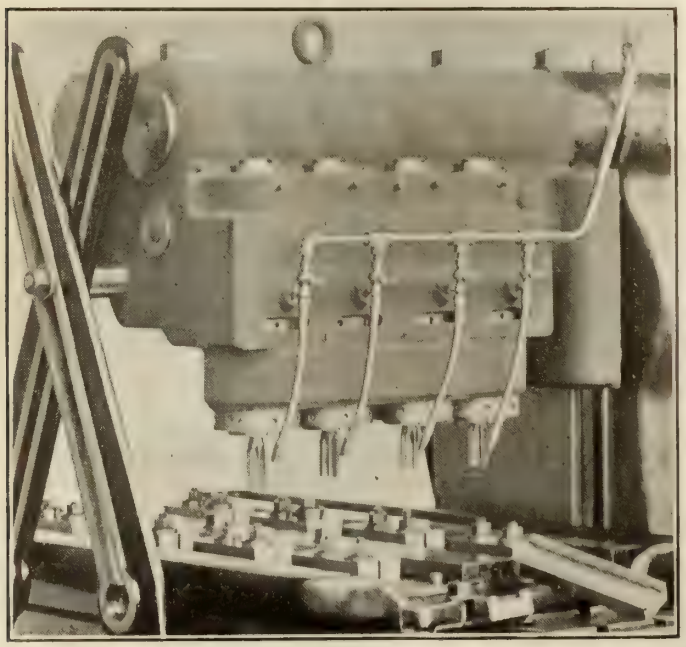


Fig. 3—Special 4-spindle vertical attachment milling channels in patented tool holder.

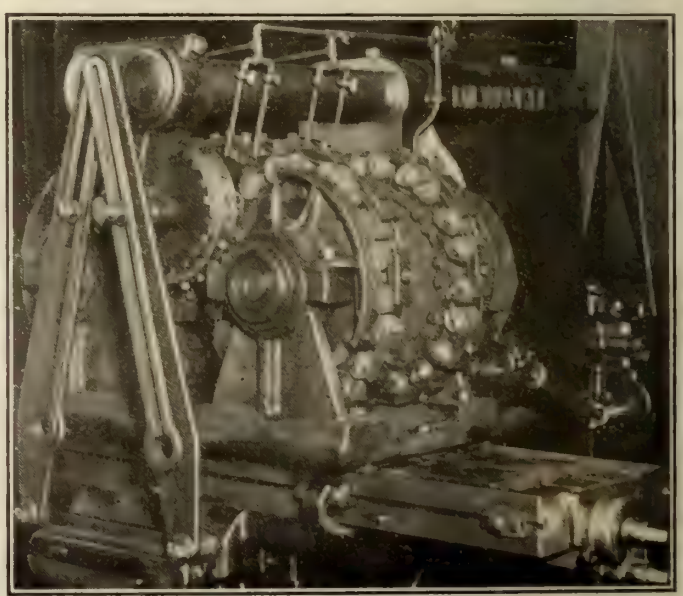


Fig. 4—Plain milling machine milling both ends of rifle grenades.

trouble. Fig. 3 is a good example of this.

Here we see a special four-spindle vertical attachment together with work holding fixture, placed on a standard horizontal milling machine. This device was used to mill channels in patented tool holders, and while special in character, proved a decided success. The head containing the four vertical spindles is carried on the overarms, and is clamped to the face of the column, thus forming a rigid attachment. Each spindle can be adjusted for height separately, so that no confusion can arise from this point. A sample of the work is shown in foreground of photograph.

Other Production Stories

As this article will try to cover in a brief manner other classes of machine tools, we will only give a few production stories on each type of machine, trying to tell these in words instead of pictures wherever possible. This will conserve both time and space.

The milling of a worm on a milling machine a decade ago would have been considered a ticklish proposition. Today it is a commonplace occurrence, and with the help of a worm-cutting attachment splendid production times can be obtained. For example: Recently a worm 5¾ in. in dia. with a cut of 2½ in. wide and ¾ in. deep was completed in 25 minutes, which is mighty good time, even on a modern miller. This was done for a large oil refinery company in the Phillipine Islands, and proved very satisfactory.

Railroad shops here found great use for milling machines. In machining locomotive connecting rod brasses on a rotary table, on a standard horizontal miller, it was found that with one set up the part could be finished complete in one hour and five minutes, against four hours, the former time. Originally the job was finished on a shaper, proving the selection of the machine used is very important. It is often good practice to switch from one type of machine to another, even if you have followed some certain routine for years.

There is also the question of studying the proper type of cutter to use. Here is a case in point. In milling gear shifter fingers for a firm in the United States, steep spiral, coarse tooth cutters were used to remove machine steel ¼ in. deep, 2 in. across and 8 in. long. By using this style of cutter, the work was completed in one minute, floor to floor time. Where a heavy reduction of metal is required it is good practice to use cutters of the type mentioned. Examples of work performed could be quoted almost indefinitely, but we pass on to another machine after two further examples.

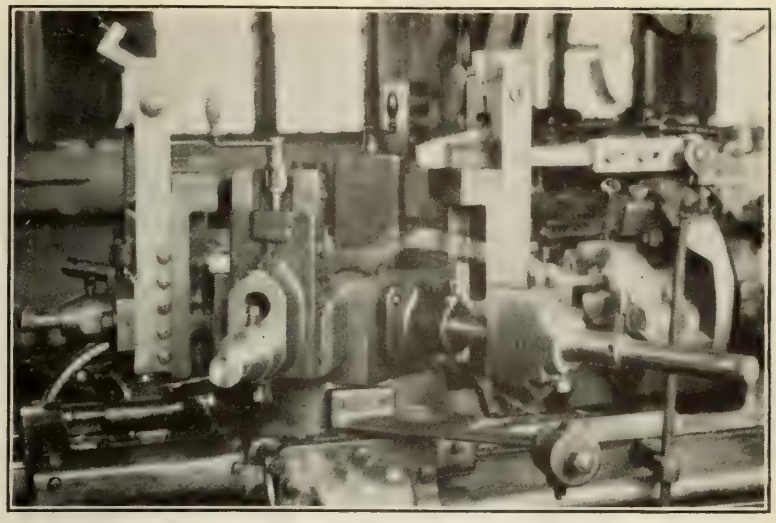


Fig. 5—Finishing bore of glass insulator mould on hollow hexagon turret lathe.

Fig. 4 shows an extremely interesting operation. This was the milling of both ends of rifle grenades. It will be noted that two special rotating drum fixtures are mounted on the table, each holding two rows of parts, so arranged that four grenades are in the cutters at all times. The drums are rotated by means of a universal shaft from the feed box to a worm shaft which drives one drum, the other being geared up with the first, so that both drums revolve toward each other.

Four inserted high-speed cutters are used, and two operators, one at each drum, load and unload. A production average of 800 per hour was obtained over a three-months' period, and to show the comparison over the former method, here is what the fixture saved the firm who adopted it. Thirty-four lathe operators, for previously these parts were competed in the lathe, and the one machine shown took the place of the thirty-four operators spoken of above.

The next example of milling practice will be told in words only. To mill the slots in open wrenches, a vertical milling machine was used. A circular fixture was mounted on the table, holding 28 wrenches. The wrenches were made of drop forgings, extremely tough, yet by linking the machine up in this way a production of two thousand per ten-hour day was obtained.

Lathe Development

The development in lathe design has also been very rapid. This is particularly true in that style of machine known as a turret lathe. Designers have studied the problem from every angle, keeping upmost in their mind the question of production and accuracy. They felt production was absolutely essential, but that accuracy was equally important, especially in the present stage of interchangeability.

Thanks to careful design, plus intelligent tool layout, wonderful production figures have been made possible, and in order to save space, we will only touch upon a few, giving the story in words wherever possible. For brevity's sake we will simply name the piece, the material, dimensions, and time. Following are some interesting figures worthy of study. A two-step gear blank of cast iron, 12 in. outside diam., finished in five minutes.

A cast iron power pulley for tractor, 14 in. diam., 10½ in. face, with limit of accuracy of bore, plus or minus .001 in., was finished in a production time of twenty-five minutes.

A cast iron flywheel 15¼ in. diam., finished in fifteen minutes, the limit of accuracy, plus or minus .010 in. In this case the part was rough turned, faced, bored, finish bored, and reamed, then finish turned and faced.

Another case—A bevel gear of chrome nickel steel, finished size 11.632 in. dia., 2.0448 in. bore. Accuracy of bore, plus or minus .001 in., accuracy elsewhere .010

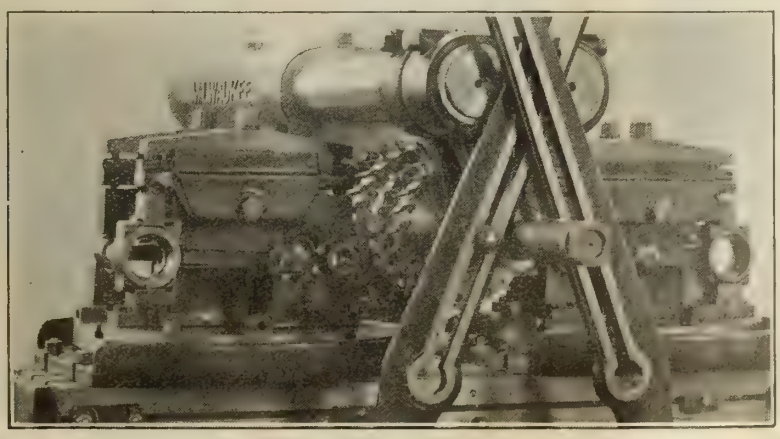


Fig. 2—Machining connecting rods for motors.

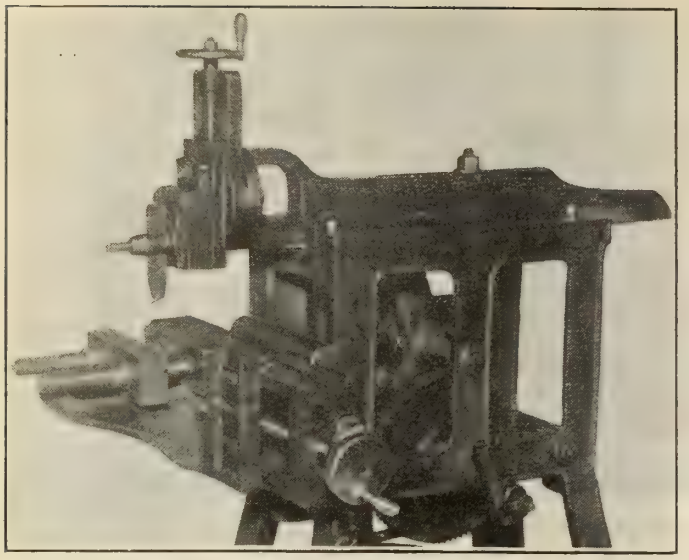


Fig. 6—G. & E. shaper of 1875 period.

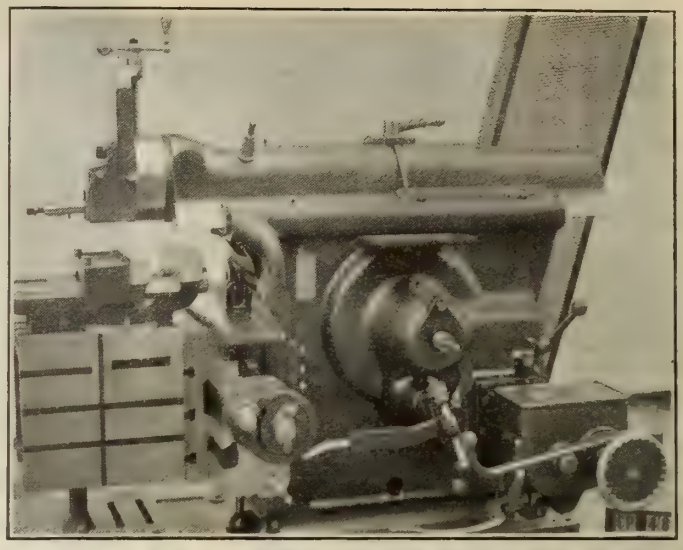


Fig. 7—28 in. invincible type shaper with single pulley drive and gear box.

in., yet the total time was only 1¼ hours.

The next example is better illustrated. Fig. 5 shows a universal hollow hexagon turret lathe equipped with tools for finishing the bore of a glass insulator mold. The time to complete this work, including the two large faces, is only thirty minutes, against a previous time of eight to ten hours. These figures are almost unbelievable, but have been proved by actual test. This shows conclusively how important it is to select the proper machine for the work. It will be noted that special tools were fitted to the turret, to form the bore of the mold. This also proves the value of careful tool layout study.

Before leaving the subject, attention is called to the fact that several factors have been helpful in the development of turret lathe work. First the design, then the following aids:—Careful tool layout, quick action chucks, better steel for the cutting tools, and more intelligent treatment of the tools after their being in use. These, coupled with a better understanding of manufacturing conditions by makers of such machines, and careful and painstaking experimenting on their part, has all helped to make the turret lathe a favorite production tool. In many cases, the adoption of the factors already expressed have resulted in boosting production as high as four times the figure of a few years ago.

Shaper Development

The best way perhaps to show the development in shaper design is to reproduce an old model and a new. Figs. 6 and 7, tell a story in themselves. The machine shown at Fig. 6 was designed in 1875, while the one shown at Fig. 7 is a modern tool, although even further development has taken place since the latter photograph was made. This is one feature of machine tool development that keeps up the interest. There is always something new coming up, and generally it is a still further improvement on a well-known grade of tool. Designers are continually striving for something just a little better than their former efforts

No attempt will be made to show actual shaper operations. Enough to say that to-day we have work completed on shapers that would have been impossible a few years ago. As the design improved, the versatility increased, until at the present time, batteries of these tools are installed in manufacturing plants, all working on a production basis. Rigidity, quick feed changing, rapid and easy moving of the ram for stroke, etc.; these features and many others have helped to make the shaper a productive and accurate tool.

Gear Generators

Then we come to gear generating machines. There has been a wonderful development in this field, and as an example of modern practice, look at Fig. 8, which shows an automatic gear generating machine cutting steel forging herringbone gears used for steam turbine

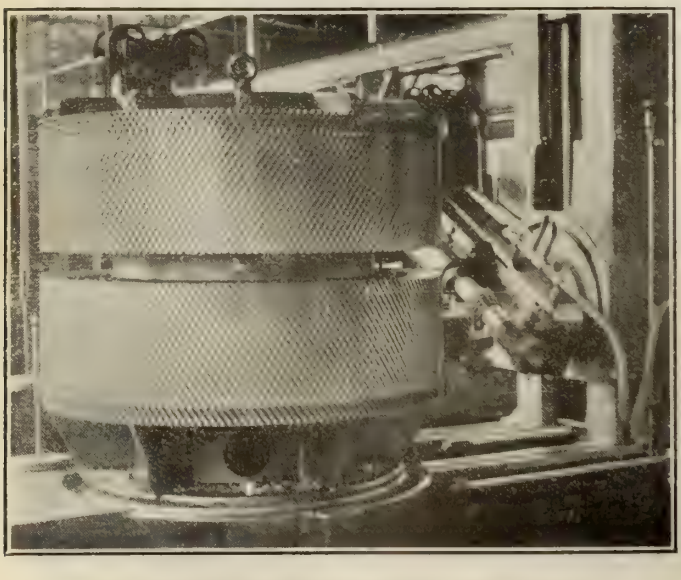


Fig. 8—Cutting herringbone gears for steam turbines.

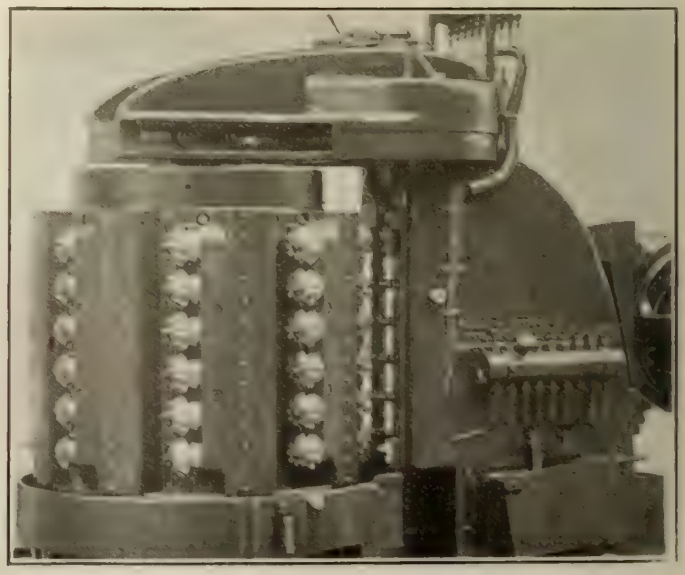


Fig. 9—Continuous milling machine arranged to cut 9T., 3/4 pitch steel pinions.

propulsion units. A decade ago this work would have taken about five times as long to complete, and even then special arrangements would have been necessary before such a job could have been completed. Twenty or thirty years ago it would have been considered impracticable, now it is a matter of course.

To go into gear generators would take an article in itself, so we will pass on to other developments which have occurred. We now have rack cutting machines, vertical automatic gear cutters, cam milling machines, continuous milling machines, both vertical and horizontal, worm wheel generating machines, and many other tools of kindred nature.

Take briefly one production time on a continuous bevel gear milling machine shown at Fig. 9. The pinions being cut are tooth, ¾ pitch, and are made from steel. Six are being cut at one time, forty-eight being held on the turret. The cutters used are 5½ in. diam., running at 90 r. p. m., 130 ft. per minute. The production is sixty-four per hour complete.

Boring Mills

Horizontal and vertical boring mills have also received the close attention of designers. The horizontal mill of today is a highly perfected machine, capable of performing work not even thought of a few years ago. This includes milling of dies, gas engine frames, crank cases, large and small castings of all kinds, frames of pumps, etc., and all classes of general manufacture. Fig. 10 is a good illustration—this being the boring of 8 in. holes in a tractor crankcase. The center distance had to be correct, and the surface milled at the same setting. It will be noted that no jig is used, also that the facing cutter does not need to be removed for the boring operation. What holds true of this particular job is likewise true of other classes of work.

Grinding Machinery

Grinding machinery has also shown great improvement during recent years

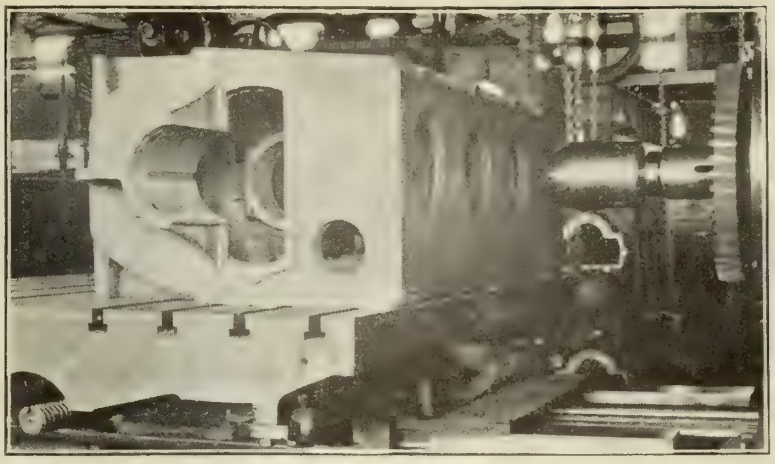


Fig. 10—Boring 8 in. dia. holes in tractor crankcase with boring head.

This applies to all classes of grinding machines, but to save time and space, we will confine ourselves in this case to one type, viz., cylindrical grinding machines.

To show how production conditions have improved, here is an actual comparison. Several years ago, it was considered good business when seven four-throw crankshafts could be ground per day. Now, a "Ford" four throw crankshaft can be ground at the rate of one every four minutes, one minute to each pin. This means easily one hundred finished crankshafts per day.

The same improvement holds true on other classes of cylindrical work. It may not be so pronounced in all cases, but the percentage is very large. This is due to the careful thought of the designers, plus the intelligent selection of the wheel used. The study of grinding wheels is now a well known one, not as well known as it should be, but much improved over a few years ago. This fact, coupled with easily controlled machines makes for added production.

For special purposes, the regular style machine is often modified to meet in with certain conditions. For example, Fig. 11 shows the front view of a self-contained piston grinding machine which not only grinds the piston concentric, but relieves it around the pin hole when it reaches that stage. This is done by means of a cam in the headstock, operated by a convenient lever on top.

Surface Grinding

Surface grinders have also developed rapidly within the past few years. So much so, that many operations previously machined on other tools are completed on the vertical surface grinder. The production time is usually very large, and briefly, here are a few figures of actual experience:

A gear box surface 18¼ in. x 14 in., approximately ⅝ in. wall, material cast iron, ⅛ in. stock removed, ground at the rate of 6 per hour.

Cylinder castings, material cast iron, weight 90 lbs., stock removed from .015 in. to .020 in., with limits of plus or minus .003 in. Two sides ground. The production time 16 parts per hour, or a total of 32 surfaces ground. The cylinders spoken of were rough milled before grinding, this being the usual practice.

Ball races, hardened steel, size 21/32 in. Amount of stock removed, .007

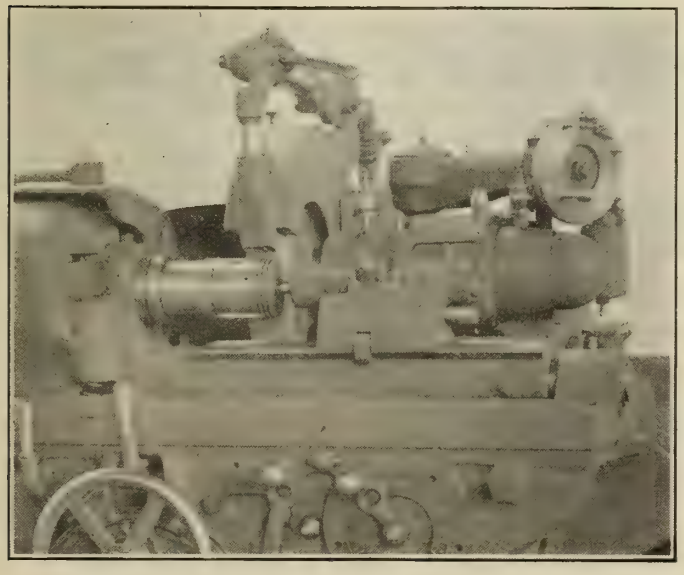


Fig. 11—Front view of grinding and reliving machine.

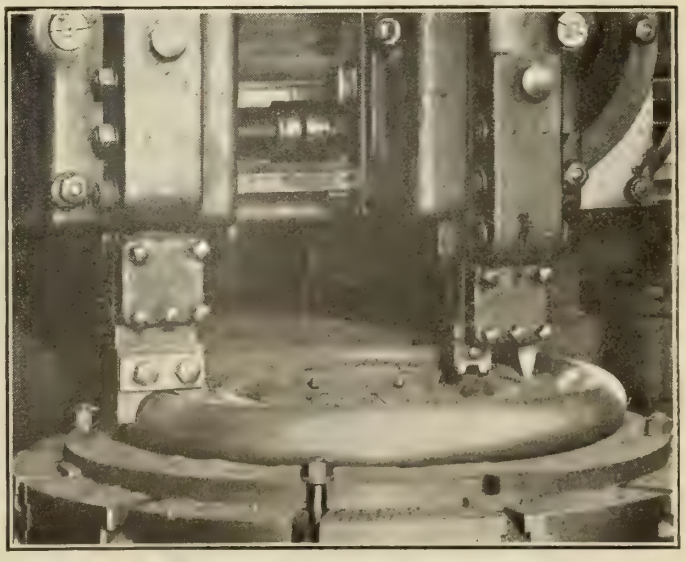


Fig. 12—Machining a mold core for rubber tires.

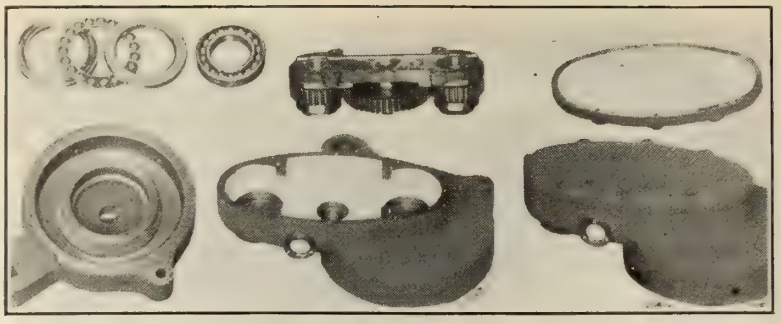


Fig. 13—Showing some applications of ball bearings to machine tool mechanism.

in. per side, two sides being ground. Limits, plus or minus .0005 in. Production 700 pieces per hour, or a total of 1,400 surfaces.

Bevel pinions, stock removed .010 in., ground on one side, material, hardened steel, production rate 400 per hour.

There is no need to quote further. Sufficient has been shown to prove that the surface grinder has reached the point where it is a production tool, not merely a finishing-off machine. The use of magnetic chucks in connection with this tool has helped considerably. No fixtures or set-up is necessary. Simply place the pieces on the chuck, switch on the current, and the parts are securely held. On thin parts, this method is especially valuable, because warping, etc., is avoided. Of course, where the part is heavy, and it is deemed advisable, fixtures can be used to good advantage.

Vertical Boring Mills

The vertical boring mill must not be forgotten. From a crudely constructed tool, it has reached the point where it is one of the important members of the production family. For brevity's sake we will show only one application of vertical boring mill work.

This shows the machining of a mold core, and three operations are performed on this piece. First, rough bore and recess, rough face for setting. Second operation, roughing, rough around the core to center line outside. Second setting, turn core over, rough around core outside to meet previous operation.

Third operation—finish, set in ring fixture shown in photograph, finish form to one side, reverse and finish form to the other. The total time under ideal conditions was one hour, seventeen minutes, but a general production time has been obtained of two hours, forty-seven minutes.

As stated previously, this is only one isolated example, but if this were not merely a sketchy outline of machine tool development, we could fill a volume on work produced sucessfully on this type of tool.

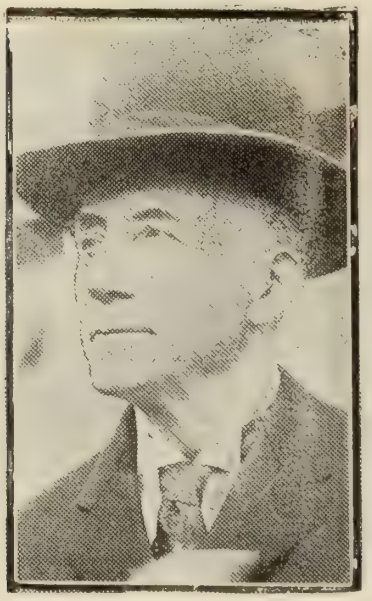
Ball bearings have played a large part in the development of machine tools, and practically every class of tool has found its own particular application. It is impossible in an article of this nature to touch upon the subject in detail so we will simply show how they have been applied to one make of radial drill.

Fig. 13 shows one cap unit at (A) assembled complete. The center view (B) shows the cap dissembled, while (C) shows the cap used on machines with motor on arm drive. Above the cap will be noticed the ball bearings, which fit into the cap and take the weight and radial load of the outer column on the inner column. This machine has several features, but one point is worthy of special attention. It is claimed by the makers that all parts are interchangeable. In other words, the entire machine is built up of separate units, and are interchangeable should the occasion arise when a new unit is required. The tool is also equipped with ball bearings throughout, and has all steel gears running in oil.

These features are mentioned in a brief way, because in concluding this article, it is desired to call attention in a general way to several improvements which have made the development of machine tools as rapid as it has been. Following are a few:

Improvement in general design, steel gears in place of other metals, more efficient lubrication, improved feed changing mechanism, a greater range of feeds and speeds, study of the operator with the resulting placing of operating levers in convenient location, better driving methods, all gear headstocks in some cases, use of ball and roller bearings, friction clutches, collapsible taps and dies, quick action chucks, special fixtures, and other production aids. Last but not least, the designing of the tool to stand overload if placed upon it.

These improvements, and thousands of others, have taken time, but not so much as might be imagined. Our machine tool designers have showed wonderful ingenuity, even to the developing of special machinery for special purposes. A trip through the "Ford" plant, or any other large automobile factory, will convince the most skeptical that machine tool designers deserve a high niche in the hall of fame. As stated at the beginning, this is merely a sketchy outline of a few of the developments which have taken place in the machine tool industry during the past few years.



Prince Edward Island to Pay Its Way

By HON. JOHN H. BELL,
Premier of Prince Edward Island.

DURING the years of depression we are endeavoring to move along quickly. The main distinguishing characteristics of our regime are:—

First.—To improve and place on a satisfactory basis the school system of the Province.

Second.—To build improved roads. Of these some 300 miles have already been constructed.

Third.—To establish and operate an agricultural technical school with a view to make farming more productive and to induce the young men to stay by the farm.

Fourth.—To administer the public affairs on the principle "pay as you go." At the end of each financial year to exhibit a small surplus and make a payment towards the redemption of the public debt.

Notwithstanding the general depression, the industrial conditions are highly satisfactory.

Money Available to Finance Industrial Growth

Current Loans Smaller Than at First of Year—Deposits and Loans Ahead of 1914—Confidence Indicated by Investment in Industrial Securities—Danger of Labor Shortage

By J. W. TYSON,
Editor, The Financial Post.

ALTHOUGH the year has been marked by a gradual but substantial expansion of industrial activity, particularly in the pulp and paper, textile and lumbering trades, the fact that current loans by the Canadian banks, as shown in the latest bank statement, were smaller than at the beginning of the year may be taken as an indication that as yet capital has not been heavily called upon in this direction and that, as consumption warrants, there will be money available to finance that further development in manufacturing and in general business which is looked for in 1923. This may also be judged from the fact that although there has been a decline in savings deposits during the year these are still substantially more than the current loans; while to go back to pre-war conditions we find that it was not by any means an unhealthy situation when current loans were greater than savings. In the following summary will be found comparative figures of savings and current loans for various months during the year together with yearly figures back to 1914.

August	Savings Deposits	Current Loans
1914	$ 659,399,151	$ 836,574,099
1915	692,580,626	758,342,735
1916	806,774,687	739,938,513
1917	952,591,821	836,429,670
1918	1,014,411,865	920,775,269
1919	1,196,632,931	1,011,785,424
1920	1,261,647,732	1,385,470,153
1921	1,279,830,731	1,226,467,704
1922—		
January	1,233,208,401	1,138,151,455
February	1,231,349,001	1,143,538,489
March	1,230,628,840	1,149,187,869
April	1,218,195,262	1,162,975,332
May	1,197,789,747	1,140,425,500
June	1,181,404,188	1,117,844,707
July	1,175,781,711	1,104,122,176
August	1,164,069,400	1,102,466,692
September	1,158,462,380	1,114,678,735
October	1,156,442,453	1,122,840,459

One impressive feature of these figures is that although we have seen considerable deflation both deposits and loans are far ahead of what they were in August 1914. This particularly refers to savings and this despite the fact that there has been a considerable decline during the period of depression as an increasing number of people have found themselves in a position where they have had to draw on their reserves.

Evidences of deflation are to be found in the latest bank statement which shows that the gross bank assets of $2,680,000,000 are $126,000,000 less than a year before. In addition to the reduction of $120,000,000 in current loans, there was a reduction of $16,000,000 in gold reserve, $8,000,000 in municipal loans and $43,000,000 in loans of public securities, while call loans abroad, loans on government securities, and holdings of specie were considerably increased. In addition to a reduction of about $95,000,000 in savings deposits there was a cut of $34,000,000 in demand deposits during the year and of $15,000,000 in circulation, the latter being an indication of the smaller requirements as regards cash for business purposes.

Capital for Development

In addition to funds for current business as provided by the banks, the investment of capital in securities—bonds and stocks—is an important factor in the development of industry. Here again there is not only confidence in the future of the country from the manufacturing standpoint on the part of Canadian investors but also on the part of investors in the United States who have been putting large sums into Canadian enterprises and Canadian branches of American concerns. Canadian capital dominates in industrial investments and particularly in the steel and iron industries but American holdings are much larger than those of British investors who evidently prefer to put their money into government or municipal bonds and utilities and into land or mortgages rather than venture in the industrial field where management and direction is so important and where the Americans, with their knowledge of Canadian conditions, have shown marked superiority. Following is a summary of Canadian industrial securities showing where they are held. The figures are prepared by the Department of Statistics at Ottawa and while they may not cover all forms and classes of industry, they are indicative of the large total of money invested in Canada's manufacturing concerns and also of the sources from which this money has been secured:

ALL CANADIAN INDUSTRIES

	Owned in Canada	Owned in United States	Owned in United Kingdom	Owned in Other Countries	Total
	$	$	$	$	$
Stocks.	1,416,653,060	801,657,448	245,812,994	14,250,878	2,478,374,380
Bonds..	164,835,207	33,006,441	34,821,543	4,179,585	236,842,776
Oth. sec.	9,558,329	13,791,700	4,818,638	105,000	28,303,667
Totals.	1,591,076,596	848,455,589	285,453,175	18,535,463	2,743,520,823
Approx. p.c.	58%	31%	10.3%	.7%	100%

STEEL FURNACES AND ROLLING MILLS

Stocks..	$37,379,288	$47,625,500	$1,076,000	$672,500	$86,753,288
Bonds..	30,220,981	150,000	....	....	30,370,981
Oth. sec.	....	....	....	....	....
Totals .	67,600,269	47,775,500	1,076,000	672,500	117,124,269

FOUNDRY AND MACHINE SHOP PRODUCTS

Stocks..	25,077,052	20,847,905	5,378,129	117,400	51,420,486
Bonds..	1,057,100	500,000	609,298	....	2,166,398
Oth. sec.	24,000	....	....	....	24,000
Totals .	26,158,152	21,347,905	5,987,427	117,400	53,610,884

The faith in Canada's future of investors and financial and industrial interests in the United States is also indicated in the fact that, according to reliable estimates, Canada borrowed in New York $240,000,000 during the first nine months of the year. These borrowings were chiefly new money and of the total $100,000,000 was raised by the Dominion on particularly favorable terms. This flow of new capital into Canada has been the dominating factor in the restoration of the Canadian dollar to par in terms of New York funds. As compared with these borrowings the favorable trade balance was only about $6,000,000 a month during the period referred to, while other factors which helped to strengthen the Canadian dollar were the congestion on Eastern American railroads, which aided the export of Canadian grain and comparatively small imports of coal because of the strike. Such authorities as Sir Frederick Williams-Taylor and Sir John Aird express the opinion that the dollar will return to a discount in the future but this has a favorable rather than unfavorable effect in creating opportunities for the investment influence in regard to the investment of American capital in Canada.

Wages and Prices

Definite indication of the expansion of industry during the year is is to be found in the upswing of industrial employment from 77.9 per cent. in January to 95.8 per cent. in November. Reports from 6,600 firms show 785,451 persons employed, an increase of 6,180 above the last report, thus increasing the index number from 94.6 to 95.8 for October and November and 90.2 for Nov., 1921.

In this situation there is a danger that a labor shortage

(Continued on page 138)

General view on the Canadian prairies during the harvesting season.

Proposals Looking to Improved Immigration

Returns Since 1921 Show Arrivals Falling Off Since Pre-War Days—Twenty-Five Million Acres Suitable for Cultivation Along Railway Lines—Opportunities—Government Plans

THAT ALL interests from whom co-operation would seem desirable are anxious to promote policies looking to immigration and colonization along high standard lines is evident at the present time. The population of Canada, in relation to the resources and opportunities of the country, has not grown as it should. There is enormous railway mileage along which settlement is practically negligible. All plans or suggestions looking to a more progressive policy are entitled to careful consideration. Well directed action is desirable.

Probably the situation cannot be better described than it was in a recent memorandum addressed recently to the Hon. Charles Stewart, acting minister of Immigration and Colonization, by transportation interests. While it may be contended that these interests have selfish reasons, it is undeniable that, to a very large extent, the fundamental object is the upbuilding of the country, and that they are in very close contact with problems confronting the government, and with information calculated to be of immeasurable value in formulating a course of action.

"Aside altogether from the question of transportation of immigrants," states the memorandum, "we have a special interest in the adoption of a broad immigration and colonization policy for Canada which justifies them in directing your attention to certain basic facts as bearing upon this important subject, and in asking that prompt consideration be given to the recommendations which they make hereunder:

General Conditions

"We direct your attention to the very unsatisfactory showing with regard to the population of Canada as indicated by the census of last year.

The census of 1911 showed that Canada then had a population of	7,206,643
The immigration returns of your department from 1911-1921 showed an immigration into Canada of	1,975,393
The vital statistic return (births only) for the same period shows a natural increase of	1,836,407
Net	900,000
The census returns for 1921 show a total population of only	8,769,494

"Our national debt has now reached the enormous sum of $2,387,676,000 as compared with a total national debt in 1914 of $335,996,850. The present national debt, on the basis of the census of last year, indicates a capital charge of $272.27 per head, or an annual charge per capita of $16 to pay the interest thereon.

"The mileage of railways in operation in Canada at the present time is 37,080 miles, which shows that we have one mile of railway in operation in Canada for every 236.5 of our population, and in the four Western provinces one mile of railway for every 110 of our population.

Lands Unoccupied

"Careful investigation has indicated that in the three prairie provinces of Western Canada we have, adjacent to railway lines in operation, at least 25,000,000 acres of land within 15 miles on each side of these railway lines suitable for immediate cultivation, but, at the present time unoccupied, and that in the older and Eastern provinces, many thousands of improved farms are unoccupied and unproductive.

"The immigration returns for the first eight months of the current year ending August 31, show a total immigration into Canada of 45,162 as compared with a total immigration for the same period of 1921 of 70,034. It is further pointed out that the returns for 1921 showed a serious falling off in immigration as compared with pre-war days, and these facts, when taken in conjunction with that mentioned above, relative to the unsatisfactory returns of the 1921 census, indicate that we are losing in emigration from Canada as many people as we are bringing in.

"The transportation interests have made every provision through the medium of additional fast ships and additional railway rolling stock, to handle a large influx of immigrants, much of which additional equipment, both of ships and rolling stock, is lying idle owing to the cessation of any marked movement of immigrants into Canada.

"We would further direct your attention to the fact that new trade routes to and from Canada cannot be established, or ships maintained on some of the existing routes, on the basis of freight traffic only, and we urge that consideration be given to these facts as bearing upon the necessity for stimulation, in every way, of the movement of desirable colonists.

"The facts above stated, and the additional fact that the necessity for a comprehensive and progressive immigration

policy is now being urged through the medium of the newspapers of Canada, resolutions from boards of trade, clubs and other public institutions, including the Trades and Labor Council of Canada, justifies our laying before you, somewhat in detail, our views relative to the general policy which should be promptly adopted to meet this important and pressing situation.

"We are of opinion that a general policy for immediate adoption by the government to meet this serious situation should include the following:

"(a) That a return to the method formerly in effect by which the affairs of the Department of Immigration and Colonization were administered by a separate minister, together with a full and complete staff of qualified officials for his department, would facilitate an active immigration policy.

"(b) The immediate issue by the Department of Immigration and Colonization of a general invitation through the medium of advertising, publicity, lectures and exhibitions, to all desirable immigrants to consider the opportunities offered by Canada for home-making, and that this invitation should be addressed to Great Britain, United States and all European Continental countries from which desirable immigrants can be obtained, it being held that the responsibility for this general invitation to immigrants is the duty and function of the Dominion Government.

"(c) The immediate consideration and acceptance of the offer outlined in the Empire Settlement Act, 1922, for joint action with the British Government for obtaining from Great Britain and Ireland the greatest possible number of desirable colonists on the basis of joint financial expenditure.

"(d) The most careful consideration of the policies now being considered by certain Continental countries for financial aid towards the emigration of their nationals due to congested conditions of population resulting from the war and present industrial and financial conditions.

"(e) The immediate amendment of the present regulation relative to the continuous passage clause, so as to permit the entry into Canada of desirable colonists from selected countries irrespective of the fact that they may not start their journey to Canada from the country of their origin.

"(f) The adoption of more liberal regulations for the admission of colonists coming to Canada upon prepaid tickets supplied by their relatives or friends in Canada.

"We most respectfully urge that the fullest and most prompt consideration be given to the recommendations herein contained, and, in this connection, desire to direct your attention to the fact that unless a full and comprehensive policy is now adopted, the necessary staff provided and the required advertising and publicity undertaken during the coming Fall and Winter, it is safe to assume that the immigration during 1923 will be more disappointing than that of the present year."

* * * *

MAKE IT KNOWN TO WORLD CANADA WANTS SETTLERS

AS OUTLINING government policy in the matters of immigration, an important announcement was recently made by Hon. Chas. Stewart, Acting Minister of the Department of Immigration and Colonization. He states in part:

"One of our chief problems incident to getting new settlers in the rural parts of Canada is the fact that our farmers are passing through one of the most trying periods in the history of agriculture in Canada. Inflation of prices, due to war conditions and a tendency to indulge in speculative investments, had, to some extent, created a spirit of over-optimism and the pendulum has now swung the other way. After the war the prices of farm products were the first to drop, with the result that the farmer finds himself forced to pay high prices for labor, clothing, boots, shoes and other necessities while the prices of his produce have fallen, in some cases, to lower than pre-war levels. I think I am justified, however, in believing that the whole agricultural outlook justifies a more optimistic note than has for some time prevailed. Slowly but surely costs of production are going down, and there is every prospect that in the almost immediate future agriculture in Canada will be restored to its former healthy condition.

Settle Near Railways

"From the immigration point of view it must be recognized that one of the magnets which was most potent in attracting settlement to Canada in the early years of the century—the granting of public lands as free homesteads—is no longer a factor to the extent it previously was. There are still large areas of Crown lands in the hands of the government, but they are for the most part too remote from railways to be an important factor in our immediate colonization undertakings. The government is more disposed, for the present, to concern itself with the settlement of the available lands convenient to existing lines of railway which have not as yet been brought under production. Even with the lure of the free homestead largely removed, Canada is in a pre-eminent position in its ability to offer fertile and productive lands at a lower price than any other country in the world. With cheap and fertile lands convenient to railways, and with an era of agricultural prosperity reasonably within view, Canada can confidently invite settlers from other lands to take advantage of the opportunities which she offers.

Transportation Costs Heavy

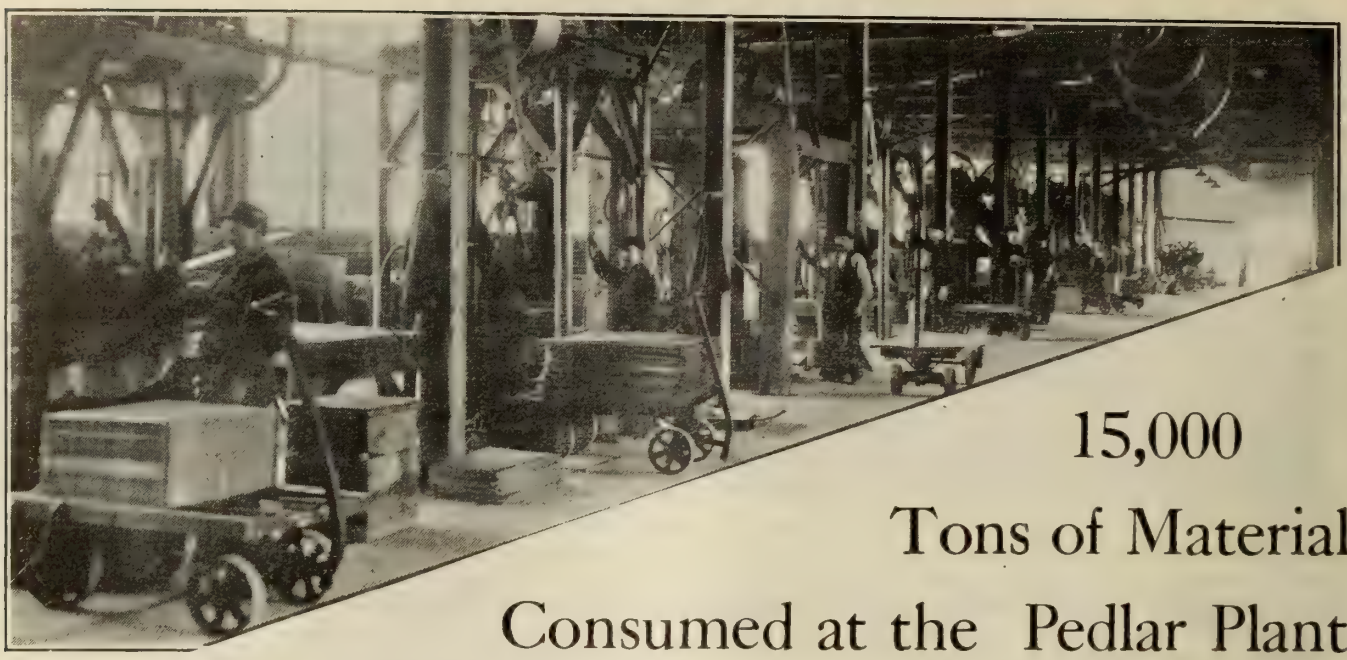
"Our agents have made reports on the possibilities in the various countries from which we hope to draw suitable settlers. The principal obstacle mentioned in these reports is the increased cost of transportation, which is at least fifty per cent. higher than before the war. This is a serious difficulty, particularly to those who contemplate moving large families—and large families are popular with us—long distances. The department has approached the transportation companies with a view to bringing about an amelioration of these conditions, and hopes that materially lower rates of transportation will result.

"Another difficulty, with respect to the settler from Great Britain, has been the discount on sterling exchange, which bears heavily upon the settler proposing to transfer capital to Canada. This condition is steadily righting itself and will probably not continue to be a barrier to British settlers with capital.

"This is a very brief outline of conditions as they exist today. In spite of the difficulties which I have mentioned I feel that there are grounds for a sane and reasonable optimism, and it is in that spirit that we propose to go forward.

Initiate Active Campaign

"These are our proposals. We propose to initiate at once an active advertising and publicity campaign in Great Britain and the United States, and to extend it into the favored countries of Northern Europe as circumstances permit. We propose to make it known to the world that Canada wants settlers, but at the same time to select only such settlers as are worthy to share in our Canadian heritage. We shall particularly seek settlers with some capital in a position to buy and cultivate the vacant lands now adjacent to our railways, but we shall also provide departmental machinery to bring the tenant farmer into touch with rental opportunities which will give him a chance to make a start in Canada. We hope, through the co-operation of the transportation companies, to see an era of lower transportation rates. We hope for the co-operation of public bodies who have the interest of Canada at heart. We realize that the development of Canada's resources by means of immigration is a big problem, and we are prepared to face it in a big way, but we feel that success can only be assured if the fullest degree of co-operation is forthcoming from the Canadian people. That the hands of the department and government will be strengthened by such co-operation from the people of Canada I have the fullest confidence."



15,000 Tons of Material Consumed at the Pedlar Plant

Showing line of drop presses for stamping steel ceilings, sidings, trimmings, etc.

Processes Arranged Along Economic Lines—Contact With Diversified Market—Export in Building Material—Complete Equipment for Auto Stamping—Description of Dies

HOW the million-dollar plant of The Pedlar People, Limited, Oshawa, converts 150,000 tons of sheet metal into products for a variety of industrial purposes, forms an interesting study in diversified routing. Established in a very small way in 1861, by the late George H. Pedlar, this concern may be said to represent a very striking example of development in manufacturing that is confined practically to one class of material. So far as market is concerned, the industry has wide contact, comprising agriculture, building, highway and railroad construction, motor car production, and special lines of activity calling for operations on machinery peculiar to sheet metal working. Metal used ranges from 30 to 6 gauge.

Main distribution considered, the output may be classified as follows:

1. For the building industry:—Expanded metal lath, steel studding, ornamental iron, copper and zinc, such as used in cornices for office and public buildings; ceilings and sidewalls for homes, semi-public buildings, stores, etc., skylights, ventilators, firedoors.

2. Farming industry:—Metal shingle and siding, eavestroughs and metal coverings of all kinds.

3. Highways and railroad construction:—Culverts of galvanized sheet metal, flumes, tanks, etc.

4. Motor car industry:—Metal stampings of all kinds for bodies, fenders, radiators. This has necessitated the construction of a large number of expensive dies, some of which are made in the Pedlar machine shop and some in outside plants.

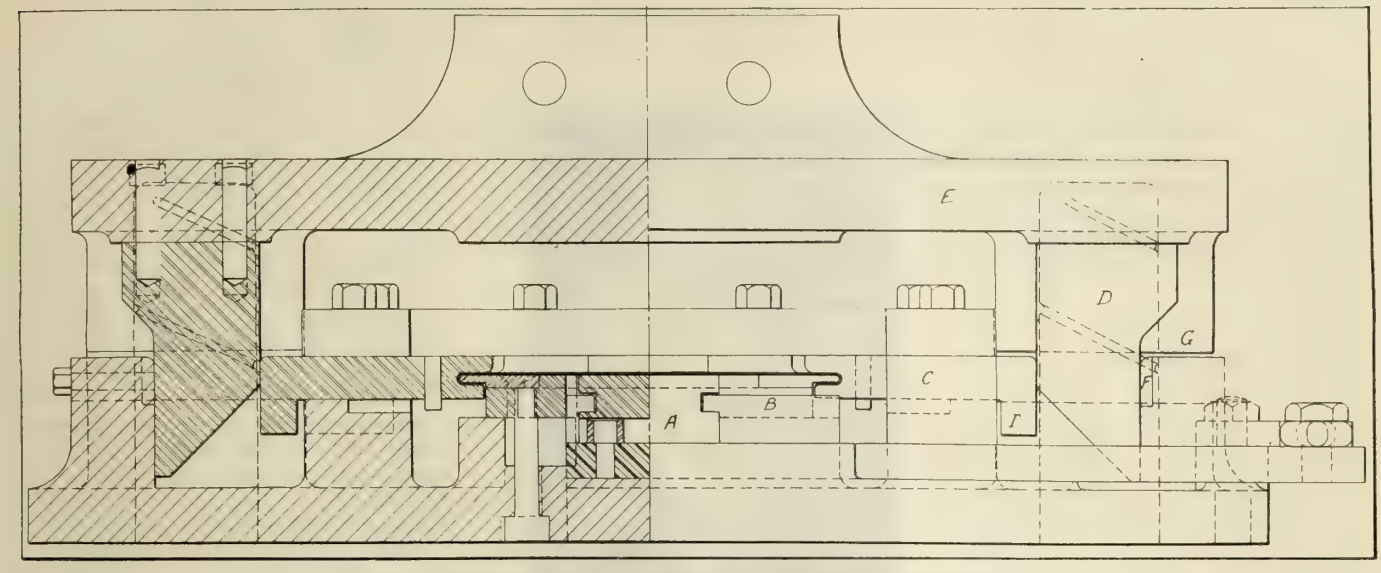
The equipment is such as to attract considerable special work, much of it calling for quantity production. As an example, a large number of specially-designed expansion plates were recently turned out for use in concrete work on the Welland ship canal.

New Plant Carefully Laid Out

In 1921 the Pedlar People moved into their new plant. This occupies an area 440 ft. by 360 ft., and is laid out with the object of departmentizing the different products having most economic operation in view. Processes move from south to north. Two railroad spurs enter from the main line and serve stock storage warehouses, one for the metal culvert, shingle and siding and metal culvert departments, and the other for the auto-stampng section.

The culvert department, occupying the extreme eastern section of the building, is served by a ten-ton Northern crane

General view of auto stamping department, 360 ft. x 83 ft. On the left i s a combination punch and rivetting machine. On the right a line of die presses. Note the hot-air distributing system on the left. This department has a mezzanine floor for light manufacturing.



Die for closing the nose of the front and rear fenders on Chevrolet car.

with 40 ft. span. Here are located the large brake or forming presses used in corrugating galvanized sheets for culverts, siding, roofing for barns, garages, etc. Here, also, are two Craig and Donald machines for the production of expanded metal such as used in concrete flooring for bridges and pavements. The metal, on being fed into one side of the machine, receives a diamond-shaped cut, after which a blade of sawtooth design descends in such a way as to expand or stretch the metal to one-half the extent of the diamond. A second strike, and the metal is expanded to full diamond mesh as seen in the accompanying illustration. Adjoining this department, is that in which expanded metal lath is produced. Here a machine of special type and design is employed. Metal of the desired width is fed in at one end, is cut, expanded in process and emerges, practically ready for the market at the other end. The superintending engineer of the Pedlar plant, F. Reesor, is now designing a machine that will produce a section of lath with a rib or stay, in the middle. This gives the lath more rigidity where there is wider spacing in the studding of a wall or ceiling.

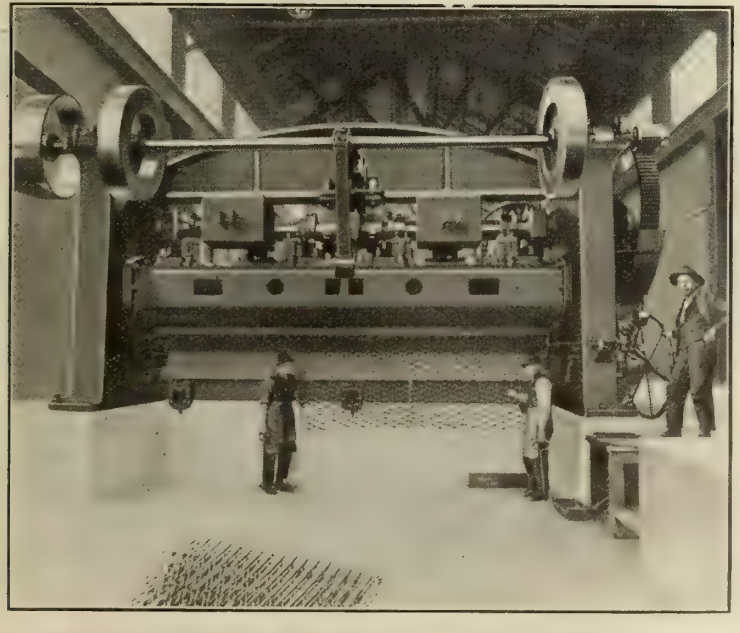
Electro-galvanizing and paint rooms are also in this section of the building, both located so as to receive work from the departments just described. The equipment of the paint room includes a machine having a trough containing the paint into which a blanket-covered roller revolves. Above this is a second roller, also blanket-sheathed, and between these rollers the sheet metal is fed. A necessary priming coat is thus applied to products requiring such treatment. The material is air dried.

Between each section of the building is a court, giving the general layout the appearance of an enclosed H. The east court contains a 50,000 gallon tank, 30 feet in diameter, for the water sprinkler system with which the entire building is equipped.

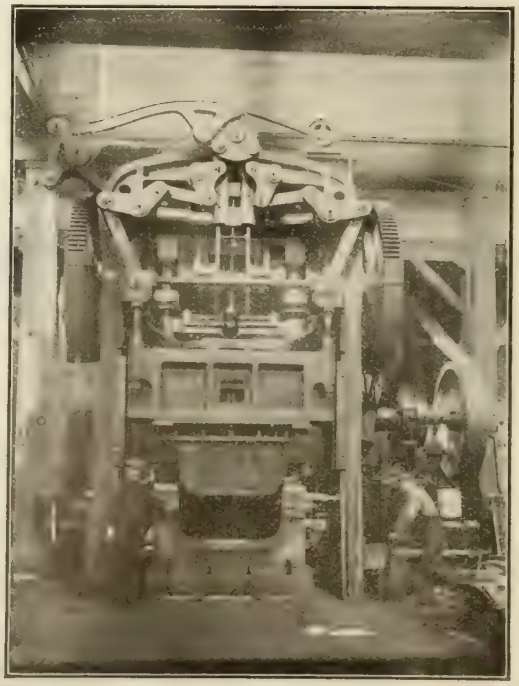
Battery of Drop Presses

The central manufacturing section is that devoted to press and stamping work. It has a floor space of 285 ft. by 70 ft., with a mezzanine floor, occupied by the cornice section, carpenter shop and knock-down garage frame department. The main floor is occupied by a battery of drop presses. Here is produced material for ceilings, sidings, etc. Some of the machines here employed were developed in the Pedlar machine shop. This occupies a space 80 ft. by 72 ft. between the central and western section of the building. Much die work is done here.

A space 360 ft. by 83 ft. is occupied



Machine for making Steelcrete Reinforcing. Width of sheets, 16 feet.



Large Toledo toggle press with die space 9 ft. wide, 5 ft. deep and 6 ft. high. Machine weighs 120 tons and is 25 ft. high.

SYNCHRONIZES WITH WORK

AS engineering head of The Pedlar People, Limited, Oshawa, whose annual output is valued at two and one-half millions, F. Reesor is a notable example of that combination of work and genius which almost inevitably locates itself in responsible positions. He admits that it was hard work that placed him where he is to-day, and they who know him intimately, declare that Mr. Reesor and industry synchronize.

Born forty-three years ago in Altona, Pickering Township, he learned the trade of machinist in the shops of the locality and was three years with Barkney Phonex and Ellis, general repair and brass works, Stouffville. Later he joined the toolroom staff of the Russell Motor Company, Toronto, and fifteen years ago, after a short interval with the McLaughlin Motor Car Co., in Oshawa, entered the employ of The Pedlar People, first as toolmaker and later in charge of the toolroom and drafting department. Opportunities were developing and by studious nights, Mr. Reesor equipped himself to select those that appealed to him. His after-hour application was such as to make him familiar with engineering problems and their solution and, in 1915-16, when the Pedlar People expanded their operations so as to take on a contract for the production of auto body stampings for General Motors, he was ready.

F. REESOR,
Superintending Engineer, Pedlar People, Ltd., Oshawa.

It was an important undertaking and while the work, in a sense, was along lines similar to those in which the plant was regularly engaged, it was new, more intricate, and called for much new equipment. Expensive dies were essential. There were those who went so far as to intimate that it couldn't be done—in a Canadian plant. However, time, a quarter million dollars' worth of equipment and the engineering of Mr. Reesor, demonstrated to the contrary notwithstanding, and successful operation of the stamping department is the result.

It required hard work, much of it running well over the time when clock-regulated operatives are wont to call it a day, but it won through, and Mr. Reesor gives full credit therefor to the co-operation of his staff.

As to the extent to which the motor car business has grown, Mr. Reesor states that stamping statistics show that while die runs were about 2,000, indicating an output of that number of a particular type of car, recent runs have ranged from 20,000 to 25,000. Recently Mr. Reesor has been concentrating on the construction of a machine for the production of expanded metal lath with ribbed centre. It is an intricate looking piece of mechanism, and of course means work—but that is Reesor's hobby.

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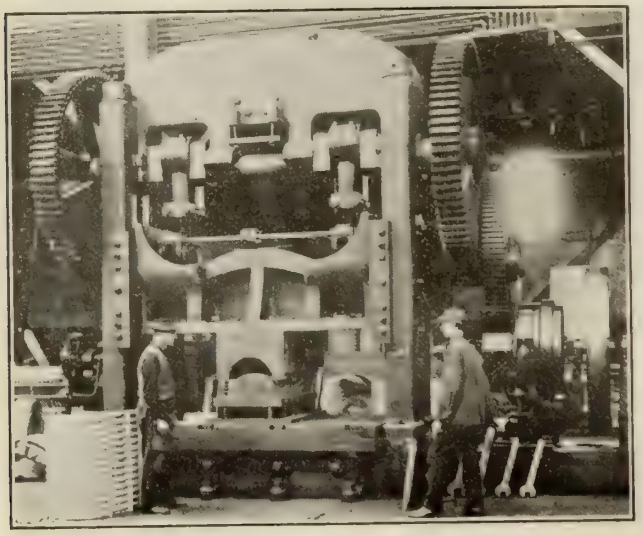
by the auto-stamping department. This is probably the most recent large development of the business, and was introduced in 1916 when it became evident that the plant could not be enlisted to any considerable extent in the production of war material. In connection with the shipbuilding industry, however, at a time when an impetus was developed by the urgent call for ships, part of the plant was assigned to the production of metal lifeboats, rafts, ventilators, cowls and other marine accessories.

Contracted to Produce Bodies

It was about this time the General Motors decided upon the production of the Chevrolet motor car in Canada, and the contract for making the body was given to the Pedlar People. Thus, the first industry of its kind in Canada, had its start by turning out the complete body for the Chevrolet 490. The future of the field was recognized immediately and to-day that part of the Pedlar plant has equipment to the value of a quarter million dollars. This includes a formidable array of die presses and hammers. Of the former there are four Niagaras, fifteen Toledos, three Ohls, and there is a battery of six Pettingil hammers used for forming, finishing and completing operations in stampings after leaving the larger presses. Several Quick-Work rotary cutters are also employed. There is a mezzanine floor in this department, devoted to light man-



Heavy corrugating machine.

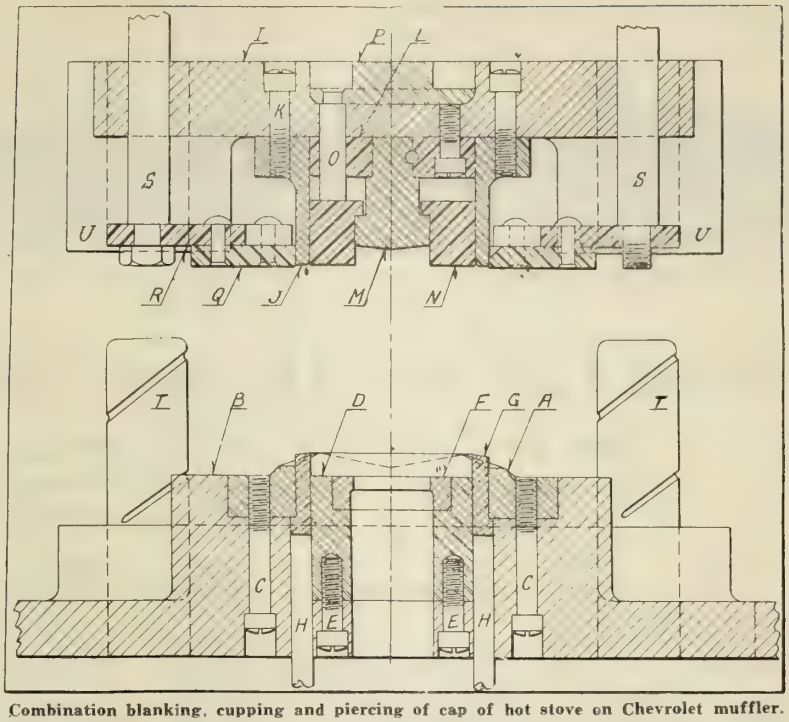
Plant of the Pedlar People, Ltd., Oshawa. Building is of brick and steel. Plan layout of the building is shown elsewhere.

ufacturing, such as the production of gasoline tanks, fender and engine-hood assembling and electric welding. Some idea of the development that has taken place in stamping production is obtained from the fact that, while original runs formerly ran from 4,000 to 5,000, at the present time motor car demand is such as to call for runs of from 20,000 to 25,000.

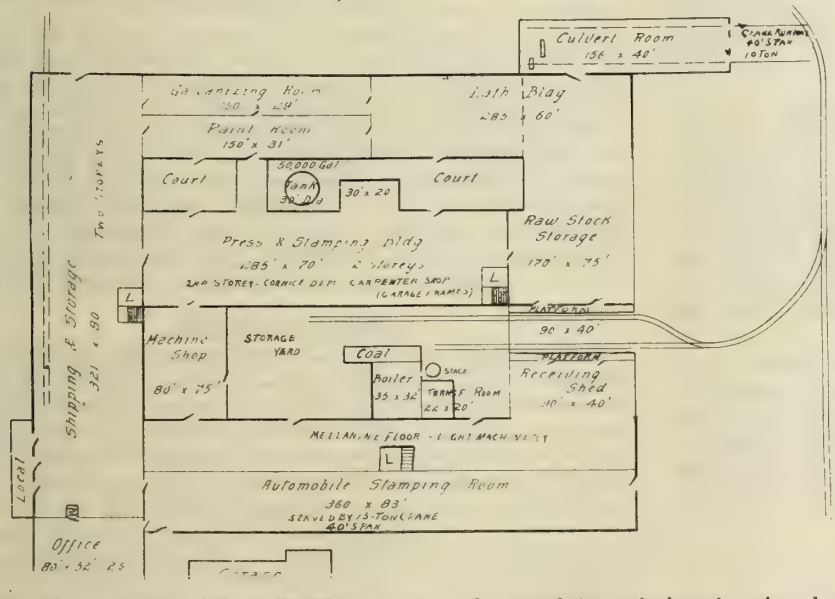
Group motor drive system is employed throughout the plant. The transformer station is located in the west court shown on the accompanying plan. The motor capacity is 700 horsepower, the average use is 350 horsepower, on a ten-minute peak basis.

One of the machine in the stamping building is a huge Toledo, double-action toggle press on which the rear, door-to-door, seat section of the Chevrolet is made. This machine weighs 120 tons, has a die space nine feet wide, five feet through and six feet high. Its height, over all, is 25 feet, and it is the largest and heaviest machine of its kind in Canada. This machine and a complete battery of presses is served by a 15-ton Northern crane, with 40-ft. span.

In the court containing the transformer station, there are located, also



Combination blanking, cupping and piercing of cap of hot stove on Chevrolet muffler.



Plan showing layout of the Pedlar plant. Process is from south to north through various departments to shipping room.

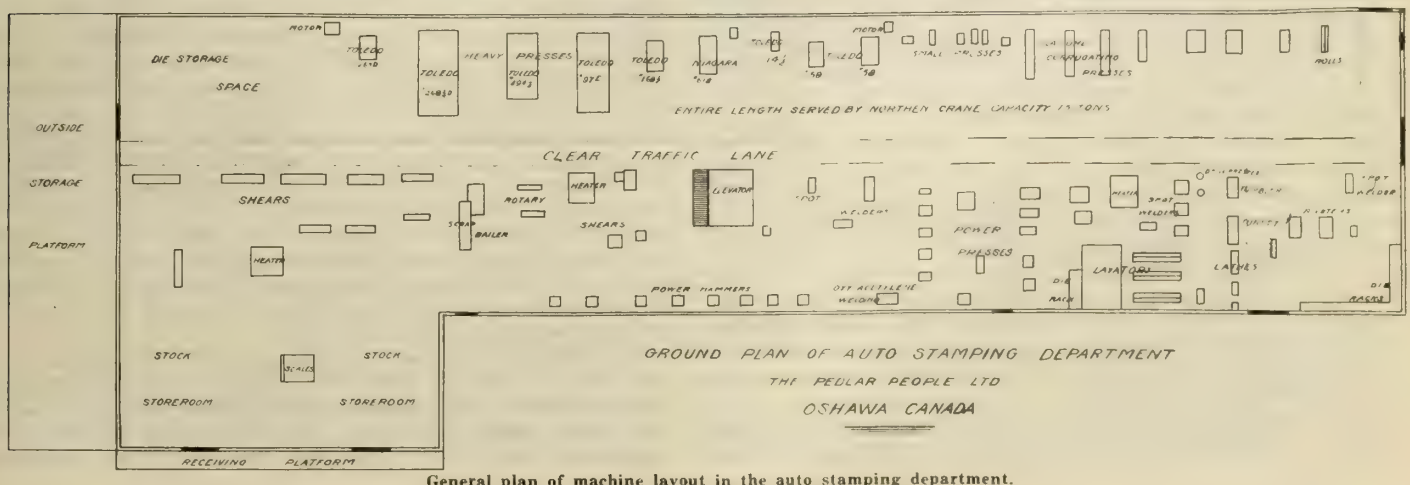
the boiler room and coal storage. In heating the auto-stamping section, three Skinner (Baetz) heaters are employed. These consist of a mass construction of enclosed coils with fan underneath. In this way the heat is discharged through large pipes or cowls. The system develops an even temperature in winter and may be employed in summer to develop air circulation.

Shipping Facilities Well Arranged

Work put into operation on the south end of the plant moves from process to process toward the shipping and storage room, 321 ft. by 80 ft. on the north. This department has two stories. It is equipped with railroad spur, under cover, and platform. There is also at this end of the building, a covered platform for use in connection with local delivery.

General offices, 80 ft. by 52 ft., two stories, are located on the northwest corner of the main building. The drafting room occupies a space along the

(Continued on page 142)



General plan of machine layout in the auto stamping department.

Plant of the Canadian Motor Products (General Motors). Typical example of the 206 operating industries of the Border Cities, most of which are American.

Motor Cars Pass Hundred Million Dollar Mark

Past Two Years Below 1920—Interesting Statistics as to Growth —Comparison in Production of Different Types—Parts and Accessories Important Adjunct—What Makers Say of 1923

By S. J. COOK,
Chief of Mining, Metallurgical and Chemical Branch, Dominion Bureau of Statistics.

PRODUCTION of motor cars in Canada at a price within reach of a very great number of people has so popularized this mode of rapid transportation that in spite of prevalent depression in many other industries and in business conditions in general, the production of motor cars has been maintained at a high level and the industry has forged its way to the forefront of national commercial progress till the annual value of its production has reached and passed the hundred million dollar mark.

The latest official statistics presently available indicate that 1920 was the banner year of the motor industry and that in the past two years the records have been considerably lower. During the last few months, however, indications have not been wanting that the coming year will be one of the busiest and most prosperous in the history of Canadian motor car manufacture. The depression of the past two years was temporary in character and natural in occurrence, the normal way of adjustment when a crisis has been met and passed.

In the review which follows, effort has been made to present to the reader in sequence the facts of the automobile industry in Canada to-day as brought out by a study of official statistics compiled by the Dominion Government. Little attempt has been made to interpret the data, it being assumed that the figures given and comparisons drawn are sufficiently comprehensive to prevent any misunderstanding of their purport.

In 1921, the automobile industry in Canada included 14 establishments manufacturing automobiles and 64 plants producing bodies and parts as compared with 17 manufacturing cars in 1920 and 62 making accessories. The total number of automobiles manufactured in Canada in 1921 was 66,246 or approximately 30 per cent. fewer than in 1920 when 94,144 were made. The passenger cars numbered 61,098, or 22,872 below the 1920 record. The decrease in the output of motor trucks was even more pronounced, the total for 1921 being 5,148 as compared with an output of 10,174 in the preceding year.

The fourteen establishments manufacturing motor cars in Canada were owned by 13 incorporated companies and one partnership. The par value of the securities issued by the 13 companies was $21,148,441 of which 77 per cent. was owned in the United States and nearly 23 per cent. in Canada. For the 35 incorporated companies manufacturing parts and accessories in Canada, the par value of the issued securities was $11,056,695 of which 80 per cent. was owned by residents of the United States and the greater portion of the remainder by residents of Canada.

In the four-year period 1918 to 1921, motor cars to the number of 325,915 were manufactured in Canada. Of this quantity, 66,246 or 20 per cent. were produced in 1921. Adopting the output of 87,835 cars in 1919 as a base equalling 100, the production of 1920 would be represented by 107 and of 1921 by 75. The output of 1921 was 23 per cent. less than the average production of the three previous years, and 30 per cent. less than the production in 1920.

The imports into Canada of all classes of motor vehicles in 1921 numbered 7,270 cars valued at $10,504,699 and the exports of Canadian manufacture were 10,726 cars valued at $5,305,444. While the exports exceeded the imports by 3,456 in number, the value of the imports was greater by $5,199,255. The re-exports of foreign cars were 254 valued at $457,657. Making the necessary computation, the number of new cars rendered available for sale during 1921 was 62,536. The value of these cars was approximately $62,100,000.

The number of cars withdrawn from use during 1921 was 11,811 as compared with 15,675 in 1920 a decrease of 25 per cent.

Passenger Automobiles

The output of passenger cars was 57,401 during 1921 or 27 per cent. less than in the preceding year and 16 per cent. below the output in 1919. With the exception of closed cars, decreases were recorded in 1920 for all classes. The production of open 4 to 7 passenger cars declined 33 per cent. in number 42 per cent. in total value and the average selling price declined from $967 each to $844 or 13 per cent. The output of runabouts was 3 per cent. lower in number and 16 per cent. less in total value; the average factory price decreased from $870 each to $751 or 14 per cent. The production of closed cars on the other hand, increased by 12 per cent. in number and 17 per cent. in total value and the average price increased by 4 per cent. from $1,222 in 1920 to $1,276 in 1921.

The increase in production was in the more expensive types of closed cars. The number of coupes made declined from 3,276 in 1920 to 3,229 in the following year and the assigned value decreased from $3,762,151 to $3,466,744. On the other hand, the output of 4 and 5 passenger cars increased by 974 in number from 4,589 to 5,563, and $1,816,528 in value, or from $5,644,403 to $7,460,931. The 7-passenger car production increased from 92 worth $314,693 to 137 valued at $460,077. The considerable increase in the output of closed cars in a period in which adverse records predominated may be taken as an indication of the growing popularity of this type in Canada, in spite of the fact that the average price was 52 per cent. over that of the open type.

The production of pleasure automobiles in Canada in 1921 was 57,401 valued at $40,607,389. Imported cars of the same class numbered 6,319 valued at $8,540,359 and the exports were 9,305 worth $4,586,664. The re-exports of passenger automobiles were 230 valued at $457,657. The resulting

number rendered available for sale in Canada was about 54,185 cars valued at $44,103,427.

Motor Truck Output

The decline in the output of motor trucks in 1922 was even more noticeable than the lessened production of passenger cars, the decrease being 49 per cent. in 1921 from the output of 1920 and 33 per cent. from that of 1919. The production in 1918 however was at a low ebb as only 2,618 trucks were placed on the market. The 467 trucks under one ton capacity produced in 1921 represented a decline of 15 per cent. from the record of the previous year, and the output of 4,681 trucks over one ton capacity was 52 per cent. below the 1920 record. The average price of the lighter trucks increased by 2 per cent. to $1,002 and that of the remaining class declined by 9 per cent. The number of freight automobiles imported into Canada was 951 valued at $1,815,723 and the exported cars of the same class numbered 1,421 worth $718,780. As the output in Canada was 5,148 trucks valued at $843,288, the number rendered available for sale in Canada was 4,657 with an approximate value of $4,940,231.

HOW CANADA ABSORBS CARS

Number of Motor Vehicles Registered in Canada by Provinces, 1915-1921

	1915	1918	1921
Alberta	5,832	29,300	40,235
British Columbia	8,360	15,370	42,900
Manitoba	9,225	24,012	40,215
New Brunswick	1,900	6,434	13,615
Nova Scotia	1,841	8,100	14,205
Ontario	42,346	114,376	206,521
Prince Edward Island	34	639	1,751
Quebec	10,112	26,897	54,670
Saskatchewan	10,225	50,531	61,184
Yukon Territory	69	87	82

Automobile Engines

As compared with the production of the previous year, the output of automobile engines in 1921 by the firms engaged chiefly in the manufacture of complete automobiles decreased 24 per cent. in number and 32 per cent. in horse power rating. The production in 1921 was 44,621 engines, of which 44,614 were of the 4-cylinder type. Of the engines made 44,591 had a rating of less than 25 horse power, and ten only were rated at 40 horse power and over.

The aggregate purchases in 1921 by the automobile manufacturing firms were 22,004 engines with a total rating of 512,311 horse power. The purchases of 4-cylinder engines were 15,270 in number, while 6,544 engines were of the 6-cylinder type. About 73.6 per cent. of the engines had a rating of less than 25 horse power while the rating of 26.3 per cent. of the engines purchased was in the range between 25 horse power and 39 horse power both inclusive. Of the 22,004 engines purchased in 1921 it was reported that 21,074 complete units with an assigned cost of $5,201,070 were assembled into cars during the year. In addition to the 44,261 automobile engines products.

Although the number of completed motor cars manufactured in Canada in 1921 was one-third less than in the preceding year, the production of engines in plants making accessories more than doubled, and in the same time the number of engines imported declined to less than one-third the number brought in during 1920. The production of motor engines in Canada in 1921, including some 44,621 made in plants when the completed car was the final product, numbered 57,349 and the number of cars made in the same time was 66,246. In 1920, the corresponding data showed that 64,526 motor engines were made in Canada, while in the same year the number of completed cars was 94,144.

Summing the output of engines in the automobile and accessory plants with the imports, in 1921 the number of engines rendered available was 67,288 as compared with a comparative figure of 95,051 in the previous year.

Parts and Accessories

An important adjunct of the automobile industry is the manufacture of parts and accessories for replacement and additional equipment required by the owners of cars. A large portion of the equipment of this nature is retailed through distribution establishments, while specialization in the manufacture of particular parts for sale under contract to the concerns manufacturing or assembling complete cars is a growing feature in the industry. The parts manufactured in 1921 by the 14 firms engaged in the production of complete cars as their chief product of value, were worth $5,149,503. The production of parts in 1921 by the 64 firms engaged principally in their manufacture was valued at $14,783,017. The total value of parts produced in both classes of industry was $19,932,520. The imports of automobile parts during the year in question were worth $11,071,420 and the exports were valued at $1,128,181. Deducting the exports and also the re-exports valued at $556,554 from the imports and production the resulting value of $29,319,205 was obtained for automobile parts and accessories made available from the above named sources for all in Canada during 1921. An examination of the list of materials used in the automobile manufacturing industry disclosed the fact that, aside from tires worth $4,616,482, the parts and accessories used were valued at $34,639,454 indicating that additional parts worth about $5,320,000 needed for use as materials in the industry were drawn from stocks or produced as subsidiary products in other industries.

The seasonal character of the industry is shown by the employment reaching a maximum in April in both 1920 and 1921. The expansion in the industry during 1919 resulted in steady expansion in the number of employees, the year opening with 3,450 on pay-rolls and closing with 9,146. The height of employment occurred in the following year, when in April, 12,090 men were employed. In 1921 the average was much lower, and the decrease from the maximum in April to the minimum in December was 47 per cent.

The salaries and wages constituted 15 per cent. of the gross value of production in 1920 while in the year under review the proportion was 14 per cent. The cost of materials comprised 64 per cent. in 1920 and 65 per cent. in the following year. The net output per employee in 1920 was $1,590 and $1,443 in the next year. The operating ratio in 1921 or the proportion of the value of production to the total expenditure was 87 per cent. The turnover, computed by taking the ratio of the current assets to the gross production was 277 per cent. The 14 plants manufacturing completed cars had an output of $67,050,209 while the 64 supply manufacturing plants has an output of $14,783,017.

Employment

The average number of employees engaged in the two classes of manufacturing plants in the automobile industry in Canada decreased 32 per cent. in the year under review as compared with 1920, the actual figures being 11,384 employees in 1920 and 7,707 in 1921. The 1,434 salaried employees were classified into four ranks as follows: salaried officers of corporations 5 per cent.; general superintendents and managers, 9 per cent.; technical experts, engineers and chemists, 5 per cent.; and clerks, stenographers and salesmen, 81 per cent.

* * * *

STUDEBAKER CORPORATION INCREASED OUTPUT

By W. G. PALMER, Sales Manager.

DURING THE past few years, over a period of extremely unsettled conditions in the automobile field, the position and progress of the Studebaker Corporation has been rather unique in so much as we have shown satisfactory and continued progress and increase in our volume, while, almost without exception, the reverse has been true.

The past few months have been extremely unsatisfactory to the industry as a whole, due to many contributing factors, but this does not in the least affect our plans and optimism for very considerably increased progress for the coming year. This year, we increased our production and sales tremendously over any previous year in our history, and are at the present time adding to our facilities, which will increase our production for the coming year by approximately 35 per cent. While we recognize the fact that this will necessitate the continued efforts of a first-class merchandising organization, we have the utmost confidence that the public will continue to recognize the sterling qualities and values of our product.

We have the utmost confidence in the immediate future of the general business situation in Canada, and believe that the coming year will show a very marked improvement in all lines of business, and particularly in the automobile business, which is one of the first to respond to improved general conditions. The progress of the automobile industry in the United States this year, is without precedent in the history of the industry, and the relations of the two countries are so close that we feel it is reasonable to expect that this same prosperity will be reflected in Canada for the coming year.

* * * *

FORD COMPANY EXTENDS PLANT

FORD, ONT.—Total output of the Ford Motor Co., of Canada, for the year, was 45,000 cars and 1,192 tractors, as compared with 46,832 cars and 3,063 tractors for the previous year. The total sales and other income amounted to $29,273,254.09. This is a reduction of $8,563,219.31 from last year and is almost entirely due to reductions in the selling prices of the product. The amount transferred to surplus, after deductions for all expenses, reserves and dividends, is $3,019,038.08, compared with $1,302,629.07 for the previous year.

Plant accounts are shown at book value and as compared with last year represent a net increase of $1,123,185.03 made up as follows: Land—$1,001,655.66 covering acquisition of 137.12 acres of land adjoining present home office plant, purchased in order to provide for additional manufacturing facilities and to take care of future expansion; buildings — $66,727.57 comprising purchase of building in which the Regina branch is located, which was formerly leased, and addition to the building in St. John, and the balance of $54,801.80 being miscellaneous additions to machinery and equipment.

Workmen are employed on a straight hourly wage, minimum 62½ cents, with increase to 75 cents after a probationary period of 60 days.

* * * *

HIGH RECORD PRODUCTION AT GENERAL MOTORS PLANT

OSHAWA.—General Motors Company of Canada set a new high record for November when they turned out 3,900 cars from their plant here. This is at the rate of 150 cars per working day, but this record will be broken in December when the sails are all set to turn out over 4,500, or nearly 200 per day. This production runs to over 45,000 machines per annum. The Company's production included McLaughlins, McLaughlin-Buicks, Chevrolets, Oaklands and Oldsmobiles. There are at present about 3,000 hands employed, and the annual payroll around $2,500,000.

On returning recently from England, where he had inspected the Company's new receiving station at Hendon, R. S. McLaughlin, president of General Motors of Canada, expressed the belief that export trade next year would exceed that of other years. At the Olympia Motor Show there were exhibited different models of Canadian production. It was evident that the smaller type of car was enjoying increasing popularity in England, one reason being the tax per horse power. As to bodies, European makers are inclined to adopt the stream line type of Canadian and American design.

Regarding certain re-arrangements of departments in the plant here, Mr. McLaughlin said that Buick closed bodies will be painted and upholstered here. This was formerly done elsewhere. Referring to local conditions he said that 3,000 names are on the payroll of the General Motors plant in Oshawa. Another 1,000 are employed at the Walkerville works; while 500 additional employees are scattered throughout the country. The local importance of this industry is seen in the fact that in all there are but 4,500 workers in Oshawa plants.

* * * *

NEW BUILDINGS FOR DURANT MOTORS

By GEO. E. PEACOCK.

DURANT MOTORS have enjoyed a very nice business and the reports we are receiving regarding the performance of these cars are most satisfactory and encouraging, and we are looking forward to the year 1923 with great optimism and enthusiasm. Right at the moment we have three new buildings nearing completion, one three storys, 400 ft. long by 100 ft. wide, another three storys, 400 ft. long by 80 ft. wide and a large train shed one story, 500 ft. long by 150 ft. wide

Our output of Durant four cars for 1923, will be approximately 10,000 jobs, and on the Star, approximately 33,000 jobs, aside altogether from export trade, the bulk of which will be handled from the Leaside plant, but in connection with which our manufacturing schedule has not yet been prepared.

We have at the present time 270 men on our staff, but as soon as our new buildings are ready and we get swinging on the new schedules (which will be somewhere along the first of the new year), we will be employing between 1,000 and 1,500 men.

* * * *

GRAY-DORT EXPECTS GOOD YEAR

By JAMES FAIRBROTHER.

GENERALLY speaking the season's operations for the Gray-Dort Company have been very successful, inasmuch as it has been entirely satisfactory in the volume of output. This is attributable, we think, especially to the creation of the new 19B special touring car and the phaeton which met with good response on the part of the automobile buying public in Canada. Shipments as anticipated at the beginning of the year, were heaviest in the provinces of Ontario and Quebec. In the spring and summer a large volume of business was done in the provinces of New Brunswick and Nova Scotia, and even in the west with its last year's handicap of a light crop and light prices, a good many more cars were taken than we anticipated.

With reference to the supposed output for 1923, we anticipate a much heavier volume of production owing to the following reasons: The stabilization of business in all lines; a good crop all over Canada, and proposed six cylinder car; new touring sedan, and the new Gray-Dort delivery truck.

* * * *

FOUR WHEEL DRIVE ORGANIZES

By A. M. KERR, Manager.

OPERATIONS of the Four Wheel Drive Auto Co., Kitchener, Ont., were confined principally to establishing dealers in various points in Canada and in selling trucks locally. We were very successful in both these cases and disposed of a number of heavy duty trucks, which have given excellent service. Operations extend from Vancouver on the west through to Nova Scotia on the east. Our plans for the future are well defined. We intend to make every point at which we are represented profit by the increasing confidence in business conditions in Canada, and we expect to sell through these channels a greater quantity of trucks.

The force we employ varies according to season. We have several service men whose duty it is to look after service both locally and at any point where our truck is being operated. Some of these men are almost constantly on the road, giving advice and keeping the trucks in operation.

Our men are paid good wages, the lowest rate of pay in our organization being 40 cents per hour. Some of our better class of men are on a steady monthly salary, so that their whole time is devoted to the interests of users. The tendency on the part of most buyers is to look more for quality than they have ever done.

Canadian Pulp & Paper Industry Optimistic

Now Well on Way to Normal—Almost Double Quantity Exported —Newsprint Mills Operating Nearly to Capacity—Increase in Values—Additions to Plants Will Increase Capacity

By GEORGE M. McKEE,
President Canadian Pulp and Paper Association.

AT THE opening of the year 1922 the situation in the pulp and paper industry was not very cheerful although there were several factors of promise and encouragement for the coming year. The industry, like most other industries, had been passing through the reaction from the industrial boom of 1919-1920. The bottom of the depression had been reached and the reconstruction period was under way. In the twelve months that have passed since that time, considerable progress has been made and much lost ground recovered. There have been readjustments and economies in operation; high priced materials have been worked off and inventories written down. There have been the desire and the necessity to get down to a solid basis which should serve as a foundation for the gradual return to prosperity which is so freely predicted by careful observers and the pulp and paper industry to-day is in good shape to take full advantage of the return to better conditions. The year 1922 closes with the pulp and paper industry well on the way to normal and 1923 can be faced with a well-founded optimism.

Prosperity Depends on Export

Canada produces a great deal more pulp and paper than her population can use, hence the prosperity of this industry depends greatly upon conditions in other countries, particularly in the United States which is our best customer for these products. In that country, conditions are similar to those in Canada and the return to normalcy there has had a good influence upon the situation in that country. Our exports to the United States have been considerably increased over the exports for the previous year, although the big reductions in prices have scaled down values. As far as quantities are concerned, our exports of pulp were almost double those of the previous year and our newsprint exports were greater by almost 40 per cent.

Financial and general conditions in the Scandinavian countries have also had their effect upon the pulp and paper industry in Canada, as these countries are our competitors in the United States markets chiefly for chemical pulp. The Canadian mills have had to face severe competition from the mills of Scandinavia and Finland. These countries, like ourselves, were badly hit by the slump of 1921 and had large stocks of pulp which they were forced to liquidate with consequent forcing down of prices. We find that for the first nine months of 1922 the imports of sulphite pulp into the United States from Europe amounted to 237,000 tons compared with 71,000 tons in the corresponding nine months of 1921. However, the stocks in these countries are now reduced and as political and economic conditions in Europe tend towards improvement these imports will decline to some extent, which will be to the benefit of the Canadian mills.

Year of Record Production

Improvement has been shown in all lines of the pulp and paper industry in Canada during 1922. Production has been greater than in the previous year by from 10 to 30 per cent. Our output of wrapping paper was more than double the output last year and our production of newsprint increased by nearly 40 per cent.; our exports of book and writing paper gradually increased during the year and while not equal to last year figures, showed steady progress. The newsprint industry has done best from a production point of view. For various reasons there was in the past year a tremendous increase in the consumption of newsprint paper in the United States and the quantity used broke all records. As Canada supplies about one third of this newsprint our mills have been operating nearly to capacity during the greater part of the year. Taking the Canadian and United States market as a whole the production of newsprint has kept ahead of con-

AIR PICTURE OF A TYPICAL PLANT SHOWING RELATION OF FORESTS, RIVERS, POWER AND TOWN SITE

No. 1 The St. Maurice River stretching 170 miles to the North; 2. Pulpwood floating down; 3. Dam and falls providing power with 82-foot head; 4. Power house (162,000 h.p.); 5. Pulp mill adjoining; 6. Paper mill; 7. Townsite, built in the wilds; 8. Golf course, one of many means of entertainment provided. This is what is termed an "oblique" photograph of the Laurentide Company's plant at Grand 'Mere, taken by the Fairchild Aerial Surveys Co. (of Canada), Limited.

sumption by only about one per cent. Present indications are that this state of affairs will continue for some time and that Canadian mills will be kept busy during 1923.

The steady decline of prices for pulp and paper which began in 1921 and continued into 1922 showed signs of coming to an end in the fall of 1922 and prices tended to stiffen slightly at that time. Pulp prices increased $5 to $10 per ton and newsprint prices were raised $5 a ton for the first quarter of 1923. This, together with the increasing demand for all grades of paper and improved outlook for business generally, gives an optimistic outlook for 1923 and shows justification for the faith that the Canadian manufacturers had in the fundamental soundness of their industry.

The following details of our export of pulp and paper will serve to show what progress has been made in that direction during the year, and to compare with the year 1921. Quantities are given where possible, as the fluctuations in prices rather nullify the inference to be drawn from values:

First Ten Months of 1922

	Mechanical Tons	Sulphite Bleached (Tons)	Sulphite Unbleached (Tons)	Sulphate Tons
January ..	28,608	12,470	11,120	9,807
February .	13,222	8,715	10,145	11,437
March	19,525	9,842	14,988	14,415
April	6,448	8,149	8,317	8,162
May	11,912	16,835	11,277	12,575
June	37,556	11,919	21,500	13,109
July	26,873	13,312	24,679	12,887
August ...	39,758	15,033	17,355	12,658
September	36,968	11,419	28,154	13,503
October ...	26,435	18,075	18,411	14,088
Total 10 months 1922	247,305	125,760	165,946	122,641
Do., 1921	150,344	53,380	88,014	73,016

The figures show the big increases in exports of pulp that took place in 1922 compared with 1921. Mechanical pulp exports increased 64 per cent., bleached sulphite 116 per cent., unbleached sulphite 88 per cent. and sulphate 68 per cent.

United States Big Buyer

Of our exports of mechanical pulp, the United States took 141,000 tons, Great Britain 79,600 tons and France 24,500 tons. Our best customer for sulphate pulp was the United States with 224,000 tons out of a total of 292,000 tons, followed by Great Britain, Japan and France in that order. Our exports of sulphate pulp all went to the United States. The table below gives the exports of various grades of paper for the first ten months of the year.

	Newsprint Tons	Kraft Wrapping Tons	Book Paper Cwt.	Bond & Writing Cwt.
January ..	67,701	1,358	118	250
February ..	70,729	1,633	1,112	227
March	95,196	1,467	86	202
April	61,452	638	35	563
May	75,783	651	562	1,355
June	86,479	2,185	1,214	839
July	77,004	1,826	6,177	1,574
August	84,023	1,922	6,684	1,301
September .	79,557	1,675	4,675	1,840
October ...	81,552	2,183	6,983	2,298
10 Mos. 1922	779,476	15,508	27,646	10,449
10 Mos. 1921	569,431	5,052	32,134	22,022

It will be seen that our exports of newsprint and wrapping paper are very much ahead of last year's figures for the corresponding period, newsprint being 37 per cent. greater and wrapping paper 207 per cent. greater. Book paper and bond and writings are behind last year's figures due to competition and decline in demand for these classes of paper, but the figures show great improvement during the year and demand is picking up in these lines. For newsprint our best customer was the United States, which took 720,000 tons, followed by Australia with 29,000 tons and New Zealand with 11,000 tons. Book paper went principally to Australia and New Zealand with Great Britain a poor third. Bond and writing paper also went chiefly to Australia and New Zealand with Great Britain not far behind. For Kraft wrapping paper Great Britain took the larger share, followed by Japan and Australia.

Canadian pulpwood exports are naturally a factor in the situation and of this raw material we exported in the first ten months of 1922, 860,936 cords valued at $8,872,392 compared with 997,698 cords valued at $13,522,576 in the corresponding period of 1921. These figures also show the decline in the prices of pulpwood that took place during the year. All the pulpwood was exported to the United States, which relies on Canada for a large amount of pulpwood annually in order to help out its depleted forest areas.

Increases in Value

It has been said previously that quantities give a better idea of the size of the industry than values, owing to the fluctuations which the latter have undergone in the past twelve months. As a big factor in our export trade, however, we might here mention that the total exports of Canadian pulp and paper for the first ten months of 1922 amounted to $94,198,335 compared with $88,877,237 in the corresponding months of 1921. These amounts were distributed between finished paper and pulp as follows:

	Paper	Pulp	Total
10 Months 1922 ..	$60,972,720	$33,225,615	$94,198,335
10 Months 1921 ..	63,660,837	25,216,400	88,877,237

Thus, in spite of the decline in prices, there was an increase in 1922 of $5,000,000 in value, the value of pulp exports having increased by $8,000,000 and that of paper having declined $3,000,000.

Additions to Plants

During the year there have been various additions to existing plants and new plants put into operation. The early part of 1923 will see at least four new newsprint machines in operation with others to follow during the year which will increase the capacity of Canadian newsprint mills to over 4,000 tons per day or about one and a quarter million tons per year, a big stride forward from 1913 when our total production for the year was 350,000 tons.

There are also various additions to our producing capacity in pulp and fine papers under construction or planned, which should make the year 1923 one of record production for Canada and show that this industry has established a firm hold in the country and a high place among the factors tending to its prosperity.

More new stations had been added to the system of the Bell Telephone Company up to the end of September than during the whole of last year. The development of the company shows rapid progress, from 40,000 subscribers in 1900 to 425,000 in 1922.

Interior view of newsprint warehouse.

Lumbering Industry Viewed With Confidence

Building Industry Active—Mill Yard Stocks Moving Out—Extensive Operations in the West—Production as Well as Demand is Increasing—Extensions to Plants Proposed

By G. B. VAN BLANCOM, Editor Canada Lumberman.

IT IS MUCH easier to review than to forecast. What has taken place in the lumber trade during the past twelve months is an open book. The developments of 1923 are yet to arrive, and while not making predictions with respect to prices, production or distribution, it is safe to say that all members of the lumber industry are looking forward to the coming year with greater confidence and more steadfast hope than they did in the one from which they are now emerging.

Representative men in the manufacturing, wholesaling and retail branches of forest products activities agree that 1922 showed a decided improvement over 1921 in turnover, demand and value. The past year has been one of liquidation, recovery and readjustment, after the slump which followed the boom period of 1920 when runaway quotations prevailed and all transactions in the timber trade resembled an auction market, so clamorous was everyone for stock and so insistent on getting it.

In 1921 conditions were almost diametrically opposite. Everyone was seeking to unload; no one wanted to purchase beyond actual requirements, and values shrank until they were below the cost of production. Toward the end of 1921 some confidence began to express itself but logging operators, although wages were low and men plentiful, did not believe in plunging too heavily and undertook cutting on a very moderate scale. The future was unknown and as lumbering is a long-range game, highly speculative and dependent upon more accessories in the way of climate, finance, labor, traffic, commercial and other conditions than any other national undertaking, its exponents restrained their activities.

Benefit from Building Boom

Early last spring a building boom set in in the larger cities. Houses went up in all directions and the aggregate of permits issued in the bigger centres of population topped all previous showings. This naturally created an unprecedented demand for hemlock, white pine, B. C. fir, jack pine and spruce. There were ample stocks left over from the year before to meet the requisitions for the first few months but as structural undertakings multiplied, a shortage developed in certain widths and lengths and it was necessary to substitute other woods if progress was to be made. Owing to the mild weather in the early part of December, building continued to be brisk right up to the end of the year and the prospects are that as the housing situation has by no means been met as yet, 1923 should be another period of activity and expansion. While a large trade has been done in softwoods, it is doubtful if many dealers have made much money owing to the fact that they had high-priced stocks on their hands which they had to get rid of before their business was on a firm footing. Operators of planing mills were kept on the move and toward the end of the year mill culls, which had been very low in price, began to be called for, showing that stocks of the better grades were getting lower.

Corner Turned in Hardwood

In hardwoods, which depend mostly upon industrial expansion for their demand, business was quiet for the first eight months and there was a wide spread in prices with few sizeable sales transactions except those made to automobile manufacturers. Furniture plants, agricultural implement works, piano and gramophone concerns were pretty well stocked up and were only running at part capacity. During the last few weeks, however, conditions have materially changed and representatives of these industries have entered the market to replenish their supplies. The lower ends, which at the beginning of 1922 were ridiculously low in price and accumulating in quantity, began to move, which is an indication that the corner has been turned in the hardwood arena and things are now headed in the right direction. Industrial activity is increasing and with its revival, the call for birch, maple, elm, oak, ash, etc., has grown appreciably. While a fair trade was done in hardwoods during the latter part of the year, the major portion of the demand came from the large consuming centres across the border. If wholesalers and producers had had to depend upon local consumption, they would have been sadly disappointed.

In New Brunswick and Nova Scotia the English stock of spruce deals—an aftermath of the war purchasing period—has at last been cleared out and Canadian cuts are now beginning to move. The demand for spruce from the United States has recently been pronounced and the English market is prepared to take a considerable quantity of deals and scantling. Prices on all lines of lumber show a tendency to stiffen owing to the improved market conditions, the brighter outlook, inquiries both from across the border and overseas and the ever-increasing use of wood products. The cut this year will be heavier in every province than it was last season and the increase is variously estimated from 10 to 40 per cent. over what it was last winter.

Stocks in mill yardu are also moving out freely and inventories will show that producers have many million feet less on hand than they had at this period last year. By some it is thought there may be a shortage of dry stock early next spring as lumber to-day either in hardwoods or softwoods, is in fewer hands than it was several months ago. This is evidenced by the number of stocks that have been sold to wholesalers and the way that manufacturers have been shipping out carloads since their mills closed for the season.

Demand for Bushmen

The number of men available for the bush, while none too plentiful in the early fall months, is now thought to be ample in most sections and wages have been pretty well established at $35 a month, with board. A few operators are said to be paying $40. Last year the figure was from $26 to $30, so that on the whole the wage advance is about 25 per cent. more than in 1921-22. This augmented outlay, however, has been offset to some extent by the reduced rates for camp supplies, but the consensus of opinion is that logging costs will be higher than they were last season. The estimates vary from 5 all the way up to 25 per cent., according to authentic advices.

With respect to prices, no one in the lumber industry desires to see a runaway market and ardently hopes for an equalization of production and demand.

Looking over the whole situation, it is believed that 1923 will be one of normal activity in the trade, a steady call for all good grades of lumber and a tightening up in prices that will enable producers to make a fair profit on the money they have invested in the enterprise and the arduous work they undertake in converting the raw material of the forest into the finished product, for the welfare and happiness of mankind.

Of late weeks the shortage in cars, embargoes, congestion at terminal points and other obstacles have interfered somewhat with distribution and deliveries, but the difficulties are gradually being surmounted and it is believed that the worst has been experienced. Traffic managers now report that transportation is gradually getting down to a normal basis.

1923 Should Be Good Year

In view of past upheavals, it is not safe to prognosticate but, in the opinion of nearly all representative lumbermen, 1923 should be a pretty fair year for the business. All speculative and fictitious elements have long since spent themselves and both consumer and producer have had sufficient experi-

ence to desire no repetition of the abnormal values which held sway a little over two years ago. The reaction has been long and somewhat painful and now that things are down to a stable basis, there will be a greater degree of satisfaction all around. The one fear is that prices may ascend too rapidly, with the result that there may be a relapse, and against this the conservative solid element has set its face.

The situation may be comprehensively summed up in the words of a Northern operator who in conversation the other day with the writer said: "Stocks are low, production will increase, but so will demand. The lumber trade to-day is brisk and we see no immediate sign of its changing. With the bountiful harvest of the past season, the fine weather for building which has been prevailing, coupled with a determination of the Canadian public to face all difficulties and make the wheels of commerce revolve smoothly, we see no reason to be other than optimistic for the coming season. We do not look for a record-breaking year but for one of normal activity and a gradual strengthening of prices, particularly on the upper grades."

It has been asked if the present revival of prosperity is not merely a spurt of "secondary inflation," soon to be followed by another long period of business lethargy and unemployment. The answer of those who have given close study to the situation, is that there will be continued activity for the construction and lumber industry. The housing demand has not yet been met, the railways are contracting for many new freight cars and industrial consumption is likely to increase. The prospective augmented demand, together with the changing conditions in the lumber arena, are such that it will likely be taxed to the utmost to meet the calls that are placed upon it. Each year the source of supplies becomes more remote, the drives or hauls grow longer, the character of the timber smaller and overhead expenses heavier.

There will never be a return to the low level of prices on lumber that prevailed before the war any more than there will be in any other national commodity of daily consumption. The era of pre-war quotations is a memory of the past, but, on the other hand, proportionate to the risk assumed, financing required, cost of production, etc., lumber is selling to-day cheaper than many allied lines.

Plants Being Extended

The best indication that 1923 will be a better year in the lumber line than 1922 is that manufacturers of equipment all report an ever-increasing number of inquiries. Several operators are extending their plants, and those mills which have been wiped out by fire are being rebuilt on a larger scale. Concerns which have done little or no logging for several years are once more entering the bush, all of which portends that greater confidence has been established and business is now on a much more settled basis. This improvement is noted all along the line and with "a strong pull, a long pull and a pull all together," the lumber industry for 1923 should bring with it a larger measure of satisfaction and monetary returns than has been experienced since the collapse of high prices in September, 1920, when the word went forth to unload and cancel contracts and values dropped almost as suddenly as a mist clears before the rising sun.

Fundamentally and economically, the outlook for 1923 is reassuring, and as one eastern operator says, "Most of the wise men down here are preparing to supply a normal quantity. They believe there will be a lively demand, firmer prices and a larger volume cut to meet the ever-increasing call for wood products."

SOME FACTORS IN POWER TRANSMISSION

(Continued from Page 113)

It is always advisable to use pulleys as large as possible, as the action of the belt in passing over small pulleys creates stresses in the belt that add greatly in shortening its life. The percentage of the pulley circumference in contact with the belt has a vital effect on the friction between the two elements. It is obvious if the belt contact exceeds 180 deg. the friction will be greater than when less than half the circumference is covered. At the same time it will be understood that what is gained on one pulley of a connected pair is lost on the other. However, when the slack side is on top any sag in the belt when operating under load will add to the power factor. If an idler is used it is best located near the smaller pulley and on the sagging side of belt. A glance at Fig. 1 will show the advantages of proper installation of vertical or oblique drives. The ideal belt drive is the horizontal, but this condition is not always possible so that some alternative must be resorted to. In Fig. 1 the drive shown at A would be very inefficient as the contact on the small pulley is reduced as the speed increases. That shown at B is better as the effect is not so pronounced when the large pulley is the driven and at the bottom. Vertical drives should not be encouraged and some modification between it and the horizontal will give better satisfaction. A serviceable drive is shown at D, where the sag of the belt due to load causes the belt to increase its wrap around the small pulley and thus add to power transmitted. The efficiency of a belt when running horizontally will be reduced about 30 per cent. when operated at an angle of 70 degrees.

CANADIAN MINING INDUSTRY HAS PROMISING OUTLOOK

By WYATT MALCOLM, Geological Survey.

WHAT BENEFIT does Canadian industry as a whole obtain by reason of the mining industry? Some interesting statistics were recently submitted to the Ontario Mining Association by the secretary, H. B. Neilly. In arriving at the percentage distribution of funds spent for mining supplies, the disbursements of a north country gold producing mine were taken as the basis. It is, of course, apparent that the conditions at no one mine can properly be taken to represent all the mines. Had a Sudbury nickel mine been taken as a basis, the freight and fuel expenditure would have been proportionately much higher. Had it been a mine increasing its capacity and equipment during the period, equipment cost and customs duties would have increased. This then is an estimate, based upon the data available and sufficiently correct to indicate the market possibilities arising out of the development of the mining industry. The year 1920 is taken as a basis, but since that time there has been marked development, especially in the gold mines of Northern Ontario. It must be borne in mind that, apart from mines altogether, millions of dollars are being spent in hydro electric power development, road building, etc., in order to more adequately serve this thriving industry. Supplies, etc., purchased in 1920, amounted to $30,492,249, distributed approximately as follows:

Ball mill liners, castings and machine shop work	13.00%	equals	3,963,993
Customs duties	1.00%	"	304,923
Chemicals and apparatus	9.36%	"	2,854,074
Coal	4.34%	"	1,323,363
Drill steel	1.65%	"	503,122
Express	.95%	"	289,676
Equipment	6.45%	"	1,966,750
Explosives	11.95%	"	3,643,824
Electrical supplies	1.53%	"	466,531
Freight	8.21	"	2,503,414
Hardware	4.58%	"	1,396,545
Insurance fire	3.27%	"	997,097
Lumber	4.33%	"	2,320,314
Legal expenses	.57%	"	173,806
Machine drills and parts	2.27%	"	692,174
Oil	1.08%	"	329,316
Power	18.95%	"	5,778,281
Pebbles	.93%	"	283,578
Rubber goods	.48%	"	146,363
Stationery and office supplies	.63%	"	192,101
Telephone and telegraph	.43%	"	131,117
Incidental expenses	4.04%	"	1,231,887
			$30,492,249

Training of Boys in Shop and School

Class in Session at Technical School.

Practical System Developed in Grand Trunk Shops — What the Technical Schools Are Doing to Meet Requirements of Industry

Do Technical Schools Meet Industrial Demands?

How Does it Apply to the Practical Side? Passing of the Old Apprenticeship System—Developing Industrial and Technical Efficiency—Description of Industrial Courses—Results Obtained

From the Viewpoint of an Instructor

"TECHNICAL EDUCATION means that those who are engaged in Industry should have a trained intelligence and an understanding of the special industries which enter as bread winners."—Playfair.

AS A DEFINITION of technical education, the above quotation is broad but not concise. In the minds of many the terms industrial, technical and vocational training mean the same thing.

The Royal Commission appointed by the Dominion Government in 1910 to report on the "needs and present equipment of our Dominion of Canada respecting industrial training and technical education," defined in their report industrial training as "the actual teaching of skilled labor, as formerly done by the apprenticeship system,—" while technical education was defined by them as follows: "A course in the principles and appliances of the sciences for the purpose of preparing men and women for professions and occupations requiring trained intelligence, skilful manipulation, and more than the usual store of information." Vocational training on the other hand means training along the lines of any calling, whether industrial, professional or otherwise, to which one may be particularly adapted on account of special physical or mental abilities or genuine interest.

It is generally understood that the apprenticeship system of industrial training is dead. This is almost true regarding the articled apprentice, between whom and the employer there exists a contract stating the duties and obligations of each toward the other.

One of the chief causes, though there are many others, for this condition is the many opportunities for the employment of unskilled boys at relatively high wages, and the shortsightedness of parents, who are more anxious to have the boy earn as high wages as possible immediately, than to learn a trade which would insure relatively steady employment in his maturity. Due to the system under which factory production is carried on, employers are no longer able to provide apprentices with the opportunities for the mastery of all details of a trade as was done by the old time masters.

Under the old system, the apprentice, by working on all operations in connection with the product, acquired a wide and varied experience, which while developing a skill of hand, gave technical understanding. Because of the highly organized manner in which industries are now conducted, employees are generally given opportunities to develop skill and understanding in only one or two processes of the work. This does not tend to produce a thorough technical knowledge of the work as a whole, but, especially on piece work systems, has the tendency to keep a man in the same small job, which he can do rapidly and skilfully for relatively high wage, while he pays little attention to the other processes in the industry. These conditions hamper greatly the development of good all-round mechanics. The use of automatic machinery, and the consequent division of labor, are reducing the need for the all-round mechanic, but it is only from this class, and not from the handy-laborers or machine tenders, that foremen and factory superintendents can be developed.

Special Training for Foreman

Probably no educational factor in industry has been so emphasized by the war as the need of special training for the foreman. The character of his job has changed, and his importance has increased. He determines certain factors which decide whether production is on an economical or a wasteful basis. He also represents the management, or may do so, in the new relations with employees. He is no longer employed to "hire and fire," but to organize, assist the accounting department in analysing costs and reducing them, to co-ordinate more closely with other departments and to maintain good personal relations with his men as representative of the management.

From the above it can be seen that upon leaving the elementary schools boys have not the same incentive in entering a trade or industry to become masters of it as under the old apprenticeship system. What are we doing to counteract this influence? With the application of science to industry, workers, to be suitable for advancement, require a technical knowledge of the industry, but present industrial conditions do not favor the gaining of this knowledge while on the job. On the other hand, thorough instruction in the theory, apart from practice in the actual work, will not qualify the young industrial worker. The following paragraph is taken from the report of the royal commission above mentioned:

"While the interests of the employer and the employee alike require efficiency in the doing of work, it is recognized more and more that there is a difference between industrial efficiency and technical efficiency. Industrial efficiency may represent ability to do work quickly and well, while technical efficiency may represent ability to plan, to understand, and so to direct the activities and operations to advantage. There is an essential difference between industrial

technique and industrial intelligence, as there is between skill of hand and the scientific spirit in work. As far as possible the aim of industrial training and technical education should be to develop both kinds of ability. From them result power and willingness to render efficient service." What is required in our future foremen and superintendents, etc., is a combination of the two above described types of efficiency.

Technical and Industrial Schools

To assist in the production and training of the all-round mechanic for the various industries, technical and industrial schools are in operation, under government supervision in most countries. More or less assistance in this direction may also be obtained through the agency of correspondence or private trade schools. Correspondence courses are a valuable aid to those who can not attend school or college, provided that the lessons and instructions be carefully prepared, the problems practical and the supervision and examinations be by teachers thoroughly acquainted with the subject.

This plan has been commercialized and abused, but substantially it is sound, except where field or laboratory work is essential and facilities therefore are not available to the student. The cost of instruction through correspondence schools is in general high, because most of this type of school have been developed as a commercial venture which must pay dividends to the promoter as well as running expenses, and their source of revenue is from students' fees and books sold to the students.

Municipal or governmentally owned technical or industrial schools, which need be only partially, if not all, self-supporting through the pupils, will obviously be able to offer instruction at a lower cost to the student. In order that the employees who form the bulk of the students of technical schools may be educated in citizenship as well as in trade it seems important that the government should be a party to the education of wage earners.

Examine Opportunities Offered

In considering ways and means of achieving to a greater or less extent the desirable aims of technical education as outlined above, we can do no better than to examine the opportunities provided for technical training in Ontario. Under the Vocational Education Act of 1921, the department of education of Ontario has made certain regulations, among which two types of technical schools are provided for, namely ,—"industrial schools" which are defined as follows: "To give boys and girls looking forward to employment a thorough training in the essentials of a general education and at the same time to furnish a special training in the subjects and operations which are fundamental to the trades and industries in which they expect to become employed," and "technical high schools," which are planned to meet the needs of those who are looking forward to occupying junior executive and technical positions in the trades and industries or to proceeding to higher institutions for advanced training in technical and engineering lines."

Throughout this discussion we shall confine our remarks to the training offered in the type of school described above as "industrial," those schools classed as technical high schools being apparently designed to meet the needs of those entering the office end of industrial work, or the universities.

Aims and Objects of Industrial Schools

It will be noticed that the primary object of the industrial schools as described above is laid down as being "a thorough training in the essentials of a general education." This is for the purpose of developing in the pupils a high type of citizenship by broadening the vision to the point where an intelligent interest can be taken in civic and political affairs and community movements. It is in respect to such general training that the majority of the courses given by correspondence schools or private trade schools are to be found wanting; for although most of these schools will give this general training, for a further financial consideration, if desired by the pupil, it is not an enforced part of any of their courses in industrial or technical work, and for these reasons is more often neglected by the pupils.

The secondary object of the industrial type of schools in Ontario is "to furnish a special training in the subjects and operations which are fundamental to the trades and industries in which they expect to become employed." In the organization of the detailed work in such schools it is found that many of the subjects of study and some of the operations are fundamental to several of the trades and industries for which the pupils are being prepared. It is therefore possible to have a common course of instruction applicable to nearly all the trades or industries during the elementary part of the training. This is specially desirable when boys enter such schools before deciding upon a particular trade or knowing to which industry they are best adapted.

Selection of Vocations

As an industrial course of study progresses, the various trades must be segregated and the various groups given detailed instruction and practice in the actual work of the respective trades chosen. Before this segregation can take place the pupils, in the case of young boys, must choose which industry each proposes to follow. This is preferably done with the help of the instructional staff who can advise each pupil as to his adaptability to particular classes of work as a result of their observation of his progress or efficiency in the various general operations and subjects taught, having regard to the industries in the district which will be likely to absorb mechanics.

To assist in an advisory capacity in the work of choosing the most suitable vocation for each boy, the Vocational Education Act provides for the appointment of one or more coordinating officers for each school to study industrial conditions in the district and thus be in a better position to advise the students as to which industry is most likely to be suitable to each student, also to bring the work and the pupils of each school to the attention of employers, etc.

The above mentioned regulations provide that previous to the starting of an industrial school, the committee in charge and the principal make "a careful survey of the trades, industries, and pursuits of the district for the purpose of discovering the subjects in which it is desirable to offer instruction, and of determining the kind of instruction that will meet the needs of the community."

Employers on Committee

Schools of the industrial type in Ontario are under the management and control of an advisory industrial committee, consisting of eight or twelve members appointed by the high school or board of education under whose jurisdiction the school is instituted. One half of the members of the committee are elected members of the board, including one member representing the separate school board. Another twenty-five per cent. of the members of the committee, not members of the board, are to be chosen from among employees in the industries carried on in the municipality or district. The remaining members, not members of the board, are chosen from among employers of labor or directors of companies employing labor in manufacturing or other industries.

This arrangement places the control of the school in the hands of a body, one half of whose members are responsible to the electors, and whose term of membership terminates with the expiration of the period for which they were elected to the board. This is necessary in order to keep the actions of the committee within the approval of the public.

The other half of the committee, being equally divided between employees and employers, is intended to be more of an advisory nature as to types and courses of study required in the school. These industrial members of the committee may be appointed for terms up to three years. Provision is made for cases in which the committee may desire further representation within itself of some important industry in the community, by the appointment of "co-opted" members, equal numbers of which must be employers and employees.

It is seen from the above that it is intended that these schools should have available the proper kind of advice on local industrial conditions and therefore determine upon the course of study for its students in that light, although all courses of study offered must be approved of by the minister of education.

The National Association of Manufacturers of the United

States has declared in convention that: "Failure has marked every attempt at vocational education not directed by employers and employees from the vocations, thereby assuring that the instruction given shall justify the confidence and hope of students, parents and the vocational interests whose co-operation is essential."

In respect to the choice of courses of study pertaining particularly to local industries, the following abstract from a paper by Leonard P. Ayers on "Studies in Occupations" is of interest. This paper recorded the results of the study of certain facts concerning the thirteen-year-old boys in the public schols of seventy-eight American cities "This inquiry disclosed the facts that among the fathers of these boys only one in six is now living in the city where he was born, and that among the boys only a little more than one-half are living in the city of their birth. These facts seem to indicate that vocational guidance must have a broader outlook than that which relates solely to the local industries; for if present conditions maintain in the future, one thing that we can be sure of is that many of the young people of any given community will eventually find their life work in some other community."

Courses of Instruction Provided

The regulations respecting industrial schools in Ontario provide for any or all of the following courses of study:

(a) Full-time day courses covering three or four years, designed to give, as a basis of citizenship, an extension of their training of the essentials of a general education, and at the same time a specialized training in the subjects, processes, and operations which are fundamental in the fields of work to which the school concerned is most closely related. The majority of students entering these courses will be boys between the ages of thirteen and eighteen years.

(b) Special day school courses planned to meet the needs of such classes as men working on night-shifts, or those temporarily out of employment.

(c) Part-time courses to cover the requirements of (1) those adolescents who are required to attend part time classes by virtue of the Adolescent School Attendance Act, and who choose to enroll in an industrial school; and (2) those who may attend part time classes by virtue of co-operative agreements between employees, employers and the school concerned.

(d) Evening courses where training along industrial and related lines is offered to men and women at any stage of their career.

Subjects of Instruction

In considering the subjects of instruction which have been chosen to as nearly as possible satisfy the purpose of this type of school, we can do no better than examine what is being done in the premier institution of this kind in Canada, which is said to be the finest of its kind on the American continent, the Toronto Technical School. The courses of instruction offered in this school to boys and men in industrial work are here described in as few words as possible.

Full Time Day Industrial Course

Government regulations require that during the first two years of this course the time devoted to the study of general subjects, which include physical training and hygiene; English literature, composition and grammar; history, civics and elementary economics; arithmetic, geography and elementary physics, should be substantially equal to the time spent on special vocational subjects. It has been found convenient in the Toronto school to have the boys entering all the industries or trades receive the same type of instruction, including the following industrial subjects: Woodworking, sheet metal work, electric wiring, foundry and forge work, simple machine shop operations and printing.

At the beginning of the third year each boy may choose to follow a certain specialized line of study according to the class of work to which he appears best suited. Government regulations provide that during this year at least thirty per cent. of the total instructional time must be spent on general subjects, at least thirty per cent. on drawing and other practical work, while the balance must be devoted to mathematics and science and a study of materials related to the needs of the industry chosen. The special work outlined for each trade in this year overlaps to some extent with that of other trades in order that mistakes in choice of trade may be rectified without too complete change of work.

In the Toronto Technical Schools the following trades are specially provided for with a particular course of study, while others can be introduced if a demand arises: Architects, builders, machine trades and mechanical draftsmen, plumbing, heating and sanitary engineering, printers, painters and decorators, surveyors, electrical workers, steam engineers, watchmakers, industrial chemists and automobile mechanics.

The fourth year is a more specialized continuation of the work of the third year. In this year only fifteen per cent. of the total time need be spent in general subjects and the same amount of time on drawing and practical work, while the balance of the time may be spent on the study of materials, science and mathematics, bearing directly on the trade or industry chosen.

Special Courses

These courses are given in any of the subjects of regular instruction in the school, and may be of any duration depending on the amount of instruction desired by, and the capabilities of. the student. These courses are laid out to assist the student in the better understanding and execution of the work on which he is employed or for which he is preparing.

Evening Courses

Courses are offered in all subjects which will best help the industrial worker to make progress in his vocation. Most of these courses occupy two hours an evening twice a week from October to March inclusive, some of them extending over three or four years for the complete course.

Choice of Instructors

The National Association of Manufacturers of the U.S.A. declared that: "It is essential that the teachers in vocational schools shall have had extended experience in actual employment in the occupations taught to the end that the instruction be practical and meet actual conditions." It has even been emphasized recently in England that a reasonable proportion of teachers in continuation and technical high schools should have had practical training or trade experience, even though the trades are not taught there.

The majority of expert workmen are, however, unable to impart to others the knowledge which their experience gives them, and it is thus necessary that industrial instructors should have some training as teachers, that they may understand the learning process in the different types of pupils which they may have under their instruction, and in order that they may arrange the work of their subject in the best order for presentation in the class to provide for progressive work.

The Ontario regulations regarding instructors of this class are as follows: A fair general education, training and experience in the subject taught to be approved of by the Minister of Education, and training in teaching and school management approved by the minister. In order to procure a permanent certificate as an industrial teacher one must have had at least two years' teaching experience in Ontario approved by an inspector. It is thus seen that the instructors which can be chosen for this type of schools are thoroughly qualified for the work which they have to do.

Results of Technical Education

The results of technical education as applied to industry can not better be summarized than was done in the report of the Royal Commission above referred to, as follows: "All evidence which has come to the commission indicates that workers who have been trained in shop and factory, in connection with the instruction and experience of industrial and technical courses, are more efficient than those not so trained. The wages which the technically educated earn are confirmation of that."

How Apprentices Are Trained in G.T.R. Shops

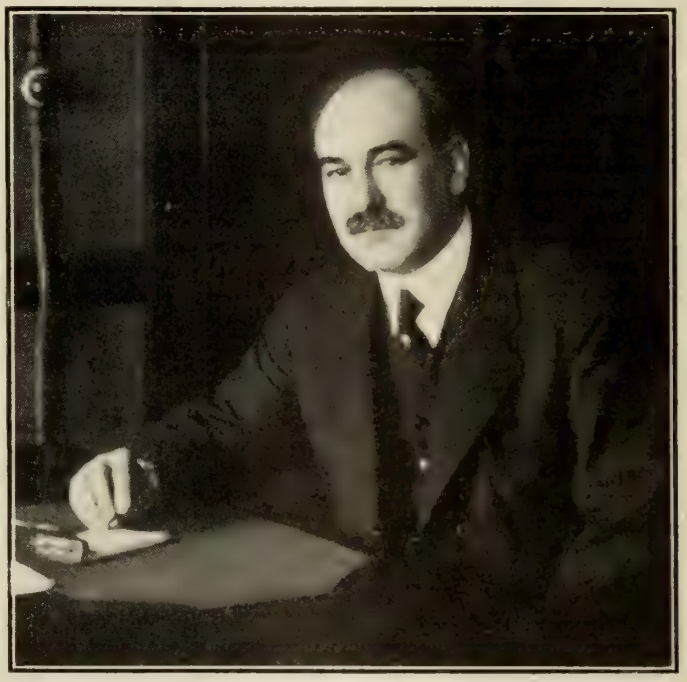
High Standard System of Education Has Been Built Up to Meet Demand for First Class Mechanics—Skilled Instructions Employed—Seldom Necessary to Go Outside to Fill Vacancies

By J. C. GARDEN,
Superintendent of Motive Power, G.T.R., Montreal.

THE GRAND Trunk Railway System is one of the pioneers in the systematic education and training of apprentices. The energizing influences of the officials of the motive power and car departments have been focused on this subject in which they have taken a keen interest. This has resulted in the apprentice system on the Grand Trunk Railway standing supreme, not only among railways, but also among the industrial establishments on this continent.

It was early recognized that the most satisfactory method of obtaining mechanics well qualified to prosecute the work of construction and maintenance of railway equipment was to train them ourselves. The demand for first-class mechanics has increased with the development of the railways, and modern railway appliances.

The systematic education and training of apprentices was first started by us in a general way about twenty years ago, and as experience in this line was gained, improvements were made and the system was gradually extended, until at the present time the boys entering the employ of the Grand Trunk Railway as apprentices are given every facility to become proficient in their respective trades.



J. C. GARDEN.
General Superintendent, Motive Power and Car Departments, Montreal.

The vice-president and general manager, W. D. Robb, who himself was an apprentice, as superintendent of motor power, inaugurated the system, and is still very active in its development, and his efforts in this direction are ably supported by the heads of the motive power and car departments.

How System is Organized

The organization for handling the apprenticeship system is as follows:

The general superintendent of motive power and car departments is the officer in general charge of the work, and he decides the policy to be followed. The mechanical and electrical engineer, who reports to the general superintendent of all the detail work, and to him the supervisor of apprentices motive power and car departments, has immediate charge of reports.

The supervisor of apprentices visits all classes regularly and deals with matters of discipline, arrangement for classes, methods of construction and revision of text books. He also attends to the organization of athletics among the apprentices. Leagues are formed among the different stations, both in baseball and hockey, which create a great deal of interest and tend to promote a good feeling among the boys. The company grants free transportation to teams for out-of-town games.

There are six main stations where permanent instructors are employed, who devote their entire time to the work, and there are also three traveling instructors, each having seven stations which are visited regularly each week to give instruction to the apprentices. An apprentice examiner, who examines all apprentices on the system semi-annually, for increases in rate, and who devotes all his time to this work, reports to the supervisor of apprentices.

The annual report of the supervisor of apprentices gives a detailed account of the work done throughout the year, including the examiner's report of examinations at each station.

These results considered as a basis of competition, showing the comparative standing of the different stations. A diploma is given to the station obtaining the highest average.

The applicant for an apprenticeship course must be between the ages of sixteen and twenty-one, and must write a letter of application, which serves as an examination in writing and spelling.

He must also pass a physical examination by the company's doctor and a mathematical examination in the simple rules of arithmetic. Knowledge of elementary mechanics is also helpful.

The following are offered to G. T. R. apprentices:

Motive Power Department	Car Department
Machinists	Freight Car Builders
Boilermakers	Coach Body Builders
Blacksmiths	Carpenters
Patternmakers	Wood Machinists
Moulders	Painters
Electricians	Blacksmiths
Tinsmiths	Machinists
Pipefitters	Cabinet Makers
Toolmakers	Tinsmiths
Air Brake Mechanics	Steam Fitters and Plumbers
Millwrights	Electricians
	Brass Finishers

Shop Instruction

If the applicant is successful in his examination, he is sent to the shop and placed on a simple machine, such as a nut facer, or centring machine, and is looked after by the shop instructor. He remains on this machine until he has mastered its operation, or until the instructor is satisfied that he is qualified to pass on to another machine.

Skilled instructors are employed in each main shop whose

duties are to move the boys from one machine or class of work to another, at the required time, and to follow each move up in order to assist him in his new work, and to keep record of all shifts for future reference.

The instruction in the shop is supplemented by a text book on shop practice, which is supplied without charge to the apprentices on entering the service. This book contains a series of questions and answers applicable to each year of apprenticeship term, and examinations include this work.

It is found that a large number of applicants choose the trade of machinist, and the following shop schedule will give the reader an idea of the opportunities afforded the average apprentice to learn this trade insofar as shop instruction is concerned:

Schedule of Shifts
Machine Shop

Nut facer, centring on screwing machine	3 months
Drills	3 months
Slotter or milling machine	3 months
Boring mills	3 months
Shaper or planer	3 months
Bolt lathes	3 months
General lathes	6 months
Rod bench	3 months
Motion bench	3 months
Air brake	3 months
Erecting Shop	
Eccentrics	2 months
Shoe and wedge and wheels	3 months
Guide bars and steam chests	3 months
Frames and cylinders	3 months
Brakes and spring gear	3 months
Motion	4 months
Trimming	3 months
Front end	3 months
Boiler mountings and superheater equipments	3 months
Total	5 years

Instructions pertaining to the different trades are given in the class rooms to all apprentices. These classes are held during working hours and the apprentices are paid for their time while attending them, receiving instruction for a period of two hours each week. All equipment is supplied by the company gratis, with the exception of drawing instruments, which are purchased in large quantities and sold to apprentices at wholesale prices.

The subjects taught are as follows: Mechanical drawing, sketching, mathematics, practical mechanics and blueprint reading.

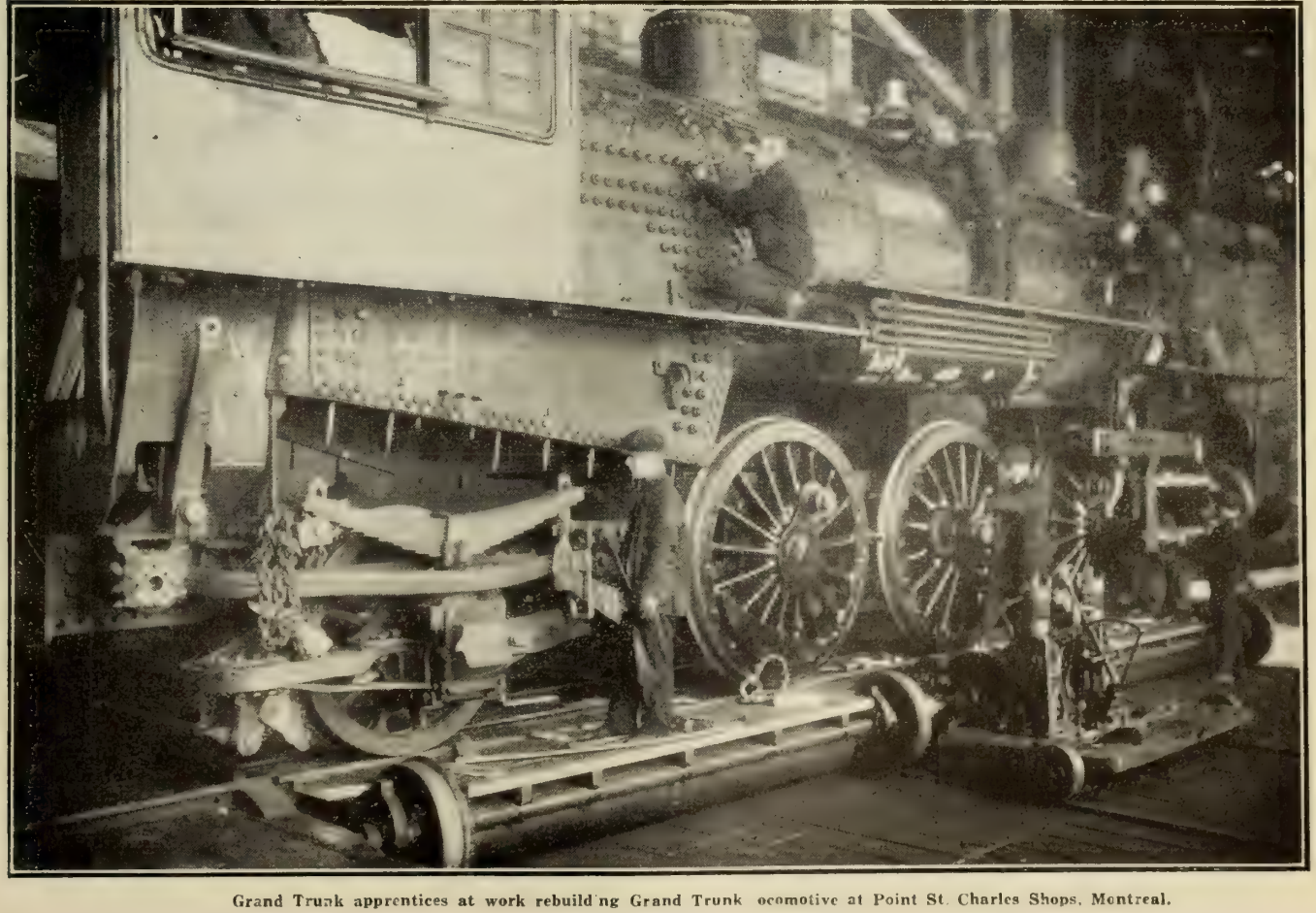
The first year apprentices take up simple mathematical problems. They only touch upon the subject of mechanical drawing, but study the essential subjects leading up to it, such as geometrical constructions, elementary, solid and descriptive geometry to such an extent as to lay a good foundation for future work and give the apprentice practice in the use of drawing instruments.

The second year apprentices take up mechanical drawing and more advanced work in mathematics, geometry and projections. They make freehand sketches of simple models and from these make drawings to scale.

The apprentices in the last three years take up more difficult work in mechanical drawing and mathematics with its allied subjects, specializing more in the details most essential to their respective trades. The making of freehand sketches and drawings to scale are continued, the proper relation of the different views to one another being particularly brought out. The more advanced work in mathematics required in machine design and applied mechanics is here introduced.

To aid the instructors and to make instruction uniform over the whole system, in addition to the text book of questions and answers on shop practice, text books have been prepared in mathematics and drawing.

The mathematical text book is divided into ten sections, each representing a six-months' period of the apprenticeship term. Each apprentice is required to at least reach the successive stages as his term progresses.



Grand Trunk apprentices at work rebuilding Grand Trunk locomotive at Point St. Charles Shops, Montreal.

The drawing book is particularly adapted to motive power and car department apprentices. The course as presented has been carefully prepared. By working out all the problems and doing the exercises in the order given, the apprentice is brought to a stage where he is able to make his own sketches and drawings, read working drawings and understand all blue prints.

Must Pass Examinations

It is necessary for all apprentices at the completion of each six-months' term to pass an examination on the subject taught, before being advanced in rate of pay. These examinations consist of questions relative to shop work, mechanical drawing and mathematics, the marks for shop efficiency being allowed by the foreman. The time allowed for this examination is eight hours and the apprentice must obtain an average of fifty per cent. in each subject, otherwise he must take the examination again in the course of a month.

A feature appreciated by the parents is the quarterly report. These reports are compiled by the instructor, and sent to the parents of the apprentices, showing them the progress the boys are making in the shop and in the class room, also the number of hours absent from work and the wages earned each period. These reports are returnd to the shop superintendent with remarks from the parents.

When the apprentice has satisfactorily completed his course of five years, he is given a certificate of apprenticeship, which shows that he is a qualified mechanic in his particular line.

Apprentices have the privilege of attending the first aid classes which have been developed on the Grand Trunk Railway System. Instructions and demonstrations are given in these classes by competent men and valuable knowledge can be gathered, which is beneficial to anyone in case of emergency.

The apprentices of the Grand Trunk Railway System have for the last number of years taken part in the Mechanical Drawing Competition at the Canadian National Exhibition, and have been very successful in capturing prizes, taking seven out of ten in 1921 and seven out of ten in 1922.

High Standards Maintained

The apprenticeship system of the Grand Trunk Railway System stands as an example of the best that can be offered in systems of its kind, and every effort is made to keep it up to a standard commensurate with the great importance of the work it is doing.

The very satisfactory results obtained by the Grand Trunk and the interest shown by the apprentices are clearly brought to evidence by the fact that the management is seldom obliged to go outside of its own shops to fill a vacancy in the mechanical department, and many of the highest positions in this department are now filled by men who started with the company as apprentices.

MONEY AVAILABLE TO FINANCE

(Continued from page 119)

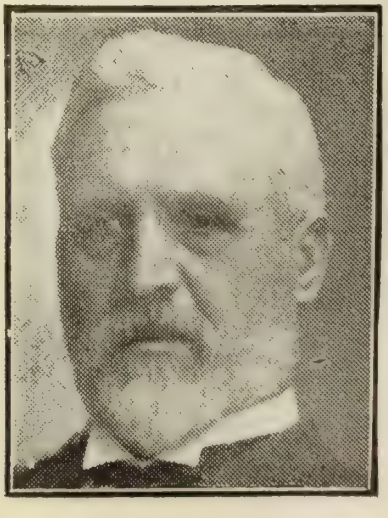
Ever since the United States Steel Corporation advanced the wages for common labor some months ago there have been increases in various trades and industries and in some trades, like building, there has been a shortage which has checked operations. The difficulty in the United States—and the same condition applies to Canada—is that through the immigration regulations the influx of Europeans has been checked to such an extent that industrial labor is at a premium.

The difficulty of this situation is not so much in the actual check to industrial operations through labor shortage but the advances in wages all along the line have a tendency to advance costs, with cumulative effect, and these are passed on to the consumer. The effect on consumption is, therefore, quickly felt and this is particularly the case in Canada because of the large agricultural population and the fact that the slump in the prices for farm products was greater in reducing the purchasing power of the agricultural class than was the decline in the prices for the manufactured products which he has to buy.

The industrial outlook then is for general improvement, the continuation of which will depend largely upon the ability of manufacturers with their labor and taxation problems to keep prices down to a basis where normal consumption on the part of the farmers can be looked for on the basis of profit on agricultural products.

In connection with the periodical revision of the Canadian Bank Act next year there is heard from the agricultural communities the old complaint that the banking system is designed for the benefits of business and industry at the expense of the farmers—in other words that the banks collect deposits in the farming districts and bring them to the cities for the benefit of manufacturers and financiers. There are agitations of a more or less radical nature based on this premise—demands for government banks, etc. Nor is the idea that the banking legislation should be amended confined entirely to the agricultural organizations. There has been a feeling since the Merchants Bank affair that an act which would permit of the conditions revealed in connection with the collapse of that institution is radically weak.

However, the indications are that changes made will be of a constructive rather than a destructive character in view of the record of the banks in their service to the whole country, and that nothing of a revolutionary character will result. One of the weaknesses of the system, however, appears to be the failure of the Canadian Bankers Association to recognize the importance of bringing home to the people what the banks are actually doing in the way of loans to the agricultural districts, in showing that their shareholders are largely people of comparatively small means and many of them farmers and in other ways emphasizing the service rendered to all classes to offset the talk of money trust and other charges that the system is designed to serve the few rather than the many.



HON. JOHN OLIVER

British Columbia's Bright Prospects

By HON. JOHN OLIVER,
Premier of British Columbia.

WITH its vast resources in lumbering, farming, mining and fishing, British Columbia has a substantial basis on which it is building for a prosperous future. Discrimination in freight rates eastward still operates against the lumber industry as against the general development of the Province. In spite of this, the logs scaled during the year exceeded the cut of the preceding year by over 390,000,000 feet. The pulp and paper business is firmly established, and two or three new mills are under consideration.

There was this year a general increase in crop areas, but lower prices are responsible for a drop in total values. Plans for the settlement of some of the best vacant lands of the Province are under consideration. Mining continues satisfactory, in spite of a fall in prices and a reduced market for several metals. In fisheries we lead all other provinces, two-fifths of the whole Canadian output being caught in our waters, and this in spite of a falling off in the salmon cannery pack. The Provincial credit stands high in the money markets, and the prospects for the coming year are altogether brighter than for some years past.

Employment Statistics Show Industrial Growth

Peak in 1922 Highest Since Middle of 1920—Great Increase in Building Permits Charts Shows Motor Industry Well Employed—Imports Down But Exports Advance—Wages Slightly Lower

By RONALD HOOPER,
Associate Editor, "Labor Gazette," Ottawa.

WHILE THE readers of Canadian Machinery are, naturally, more or less interested in certain specific industries, it is at the same time desirable that a background should first be obtained of employment conditions in all the basic and manufacturing industries of the country taken as a whole. In January, 1920, the newly-created Employment Service of Canada commenced the work of receiving and tabulating each month the employment returns of some 6,000 of the most representative industrial concerns in the country.

A reading of the index numbers, which are based on the number of employees actually at work on the last day of each month, taking the index of January, 1920, at 100, shows that the highest peak, slightly higher than 109, was reached in July, 1920. In October there developed a declining movement which by January, 1921, had reached 88. There were fluctuations up and down during 1921, until January, 1922, the lowest peak in three years was recorded at 78. The tendency, however, showed signs of improvement and in April, from a point around 81, there was a pronounced upward swing to 96 in October. Cessation of seasonal work has since brought about a slight decline.

Better Showing in Skilled Labor

It is of interest to note that returns received from trade unions show the same trends in employment as the reports from employers. A careful analysis of the trade union figures indicates, in fact, a high degree of correlation between the two employment curves, although as the trade unions are for the most part composed of skilled workers, they do not report such marked fluctuations as are indicated in the employers' returns which cover not only skilled workers but unskilled as well. Reports from 1,468 labor organizations with a total membership of 153,642 persons on October 31 last, showed 147,438 members employed, or 96 per cent. The reports from trade unions showed on October 31, 1920, an employment percentage of 93.9. According to this index, therefore, the early winter situation shows a volume of employment among organized and, for the most part, skilled workers appreciably greater than last year.

The accompanying tabulation gives for each month from January to October of the present year the index numbers of employment as reported by employers in certain basic and manufacturing industries in which readers of this journal are perhaps more intimately concerned. In order that the table shall be of greater interest, some of the industries are further divided into groups.

A column has been introduced into the table to show the average relative weight of employment in each industry, or branch of industry, in comparison with all the industries in the Dominion. For instance, the average relative weight of the manufacturing of iron and steel products industry is given as 15. This means, of course, that out of every 100 workers reported by the industries making returns as being employed in any given month, about 15 were employed in that particular group.

For the benefit of those readers who might be specially interested in the automobile manufacturing industry, it should be stated that this industry is included with railway rolling

INDEX NUMBERS OF EMPLOYMENT AS REPORTED BY EMPLOYERS MAKING RETURNS

INDUSTRY—	Average Relative Weight	Index No. Jan., 1920 = 100	1922									
			Jan. 31	Feb. 28	Mar. 31	Apr. 30	May 31	June 30	July 31	Aug. 31	Sept. 30	Oct. 31
Manufacturing iron and steel products:	15.0	100	55.4	68.5	64.9	62.5	70.5	65.6	70.8	72.3	72.1	74.3
Crude, rolled and forged products	1.6	100	53.7	50.7	49.6	49.5	51.4	57.7	64.8	60.9	60.4	56.1
Machinery other than vehicles	1.0	100	58.5	60.4	60.8	62.8	46.4	63.1	62.9	64.3	63.6	65.2
Agricultural implements	.7	100	49.3	53.3	54.2	48.6	49.0	56.0	56.2	53.1	53.3	54.2
Land vehicles (Motor Cars)	7.1	100	58.4	90.4	78.8	72.8	89.2	72.3	84.1	87.3	86.1	90.9
Steel shipbuilding and repairing	.4	100	17.3	21.5	——	——	41.6	28.2	21.9	23.8	22.1	23.2
Heating appliances	.7	100	73.7	80.0	81.1	82.8	85.1	86.8	85.4	86.5	89.0	93.9
Iron and steel fabrication (n.e.s.)	.7	100	68.9	68.2	67.0	67.4	73.4	74.0	74.4	84.6	88.1	89.2
Foundry and machine shop products	.6	100	61.7	65.0	65.8	68.8	69.7	68.6	69.2	73.0	73.4	72.0
Others	2.2	100	——	47.6	49.1	50.8	68.9	69.9	71.3	71.7	73.4	75.3
Manufacturing non-ferrous metal products:	1.4	100	60.8	62.5	64.8	65.1	67.7	71.4	72.7	78.5	74.8	77.1
Manufacturing mineral products:	1.2	100	85.9	85.0	87.3	94.9	96.7	97.4	96.7	94.4	97.3	96.0
Manufacturing lumber and its products:	6.8	100	68.6	70.8	76.2	88.9	107.0	113.3	116.6	114.8	108.3	100.5
Rough and dressed lumber	4.7	100	67.6	69.0	77.0	98.1	130.0	139.3	144.1	142.0	129.1	114.2
Lumber products	2.1	100	——	——	75.3	77.1	77.9	78.5	80.1	78.9	80.2	81.9
Logging:	2.4	100	61.5	54.8	27.2	37.0	37.5	31.4	27.9	36.5	42.1	66.0
Mining:	5.9	100	89.7	90.3	88.9	90.2	92.6	94.4	96.2	97.1	101.1	104.5
Coal	3.8	100	93.7	94.5	92.6	91.6	90.8	91.6	92.8	93.9	99.4	105.7
Metallic ores	1.2	100	87.5	88.2	89.3	92.4	99.2	99.1	101.6	102.2	103.7	104.7
Non-metallic minerals	.9	100	71.2	71.0	68.4	80.5	92.4	101.1	105.7	105.5	106.2	99.4
Construction and maintenance:	10.3	100	79.8	83.7	81.4	101.1	129.5	157.4	169.4	164.3	166.2	153.2
Building	2.6	100	59.0	59.0	60.2	86.3	102.2	112.9	121.0	123.6	128.1	128.1
Highway	2.0	100	866.5	388.4	436.4	688.5	1,448.8	3,369.9	3,440.4	3,239.7	4,233.8	2,963.8
Railway	5.7	100	83.6	87.3	82.3	102.5	129.8	145.2	156.6	149.1	137.6	133.3
All other industries:	57.0	100										
Total all industries:	100.0	100	78.9	81.9	80.6	83.3	89.2	91.1	93.1	93.7	94.6	95.8

stock, etc., in the Land Vehicles group. Separating the automobile manufacturing industry from the rest of the group its relative weight is found to be about one-sixth of the group, or about 1.2 per cent. of all the industries. Index numbers of employment in the industry for certain months of 1922 are approximately as follows:

Date	Index Number
January, 1920 (base)	100.0
January 31, 1922	81.3
September 30, 1922	63.0 (temporary shutdowns)
October 31, 1922	90.4

It is not possible at the present time to give the actual number of workers in 1922, but nevertheless a fairly close estimate can be made from the index numbers, the actual number of workers engaged in the manufacture of automobiles in January, 1920, being 7,627. Of this number 7,374 were males and 253 were females.

Building Permits a Barometer

The accompanying chart shows the values of building permits issued monthly by 35 municipalities from January, 1915, to October of the present year, as reported to the Department of Labor. The values of such permits issued in 1920 and 1921 amounted to about $100,680,000 and $94,508,000 respectively. During the present year there has been a noticeable improvement in the employment of building tradesmen as compared with 1921. This coincides with the permits issued, the value for the first ten months of the year being $105,501,000.

Import and Export Values

The following tabulation taken from a recent bulletin of the Department of Customs and Excise, which shows for the first seven months of the past and present fiscal years the values of imports and exports in certain selected industries, will be of some interest as another indication of the improvement in industrial activity:

	Imports		Exports	
	7 months ending Oct., 1921	7 months ending Oct., 1922	7 months ending Oct., 1921	7 months ending Oct., 1922
Iron and its products	$ 68,860,923	$ 79,552,197	$ 15,907,847	$ 25,778,093
Non-ferrous metals and products	16,880,141	20,755,891	15,009,795	21,860,815
Non-metallic minerals and products	84,746,795	63,796,703	14,670,461	15,076,269
Wood, wood products and paper	21,048,733	20,357,481	102,192,194	128,999,212
Chemicals & allied pr'd'cts	13,409,420	14,699,168	5,568,541	7,353,238
	$204,946,012	$199,161,390	$153,348,838	$199,067,627

The Department of Labor has issued bulletins on wages in certain industries in Canada, Bulletin No. 1 covering the period 1901 to 1920, and Bulletin No. 4, the years 1921 and 1922. The changes are analyzed in the form of index numbers for which wage rates in 1913 were taken as base and therefore made equal to 100.

In the following tabulation the wage index numbers for the years 1914 to 1919 have been omitted as wages rose steadily during those years, reaching the peak in 1920.

Index Numbers of Wage Rates

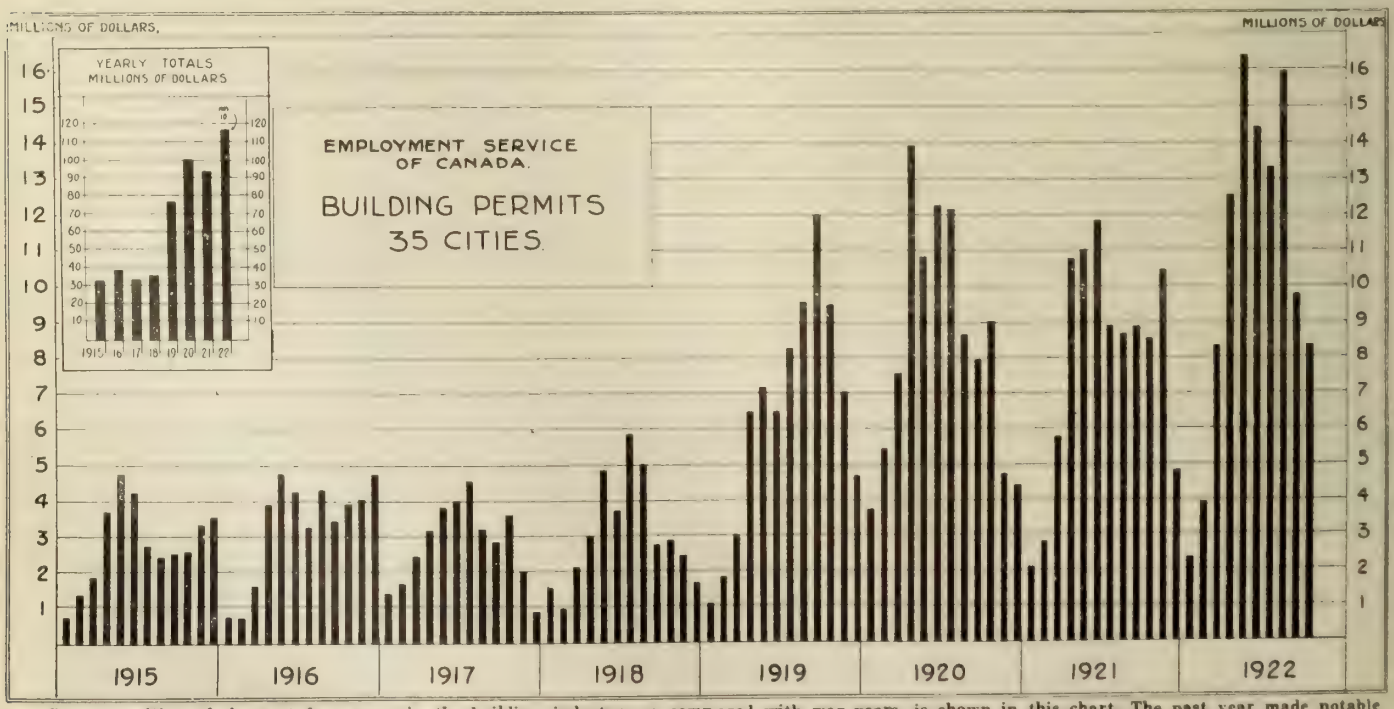
	Building Trades	Metal Trades	Steam Railways	Coal Mining	Lumbering
1913	100.0	100.0	100.0	100.0	100.0
1920	180.9	209.4	186.6	197.7	202.7
1921	170.5	186.8	165.3	208.3	152.6
1922	162.5	173.7	155.1	197.8	146.7
Decrease in 1922 from 1921	4.7%	7.0%	6.2%	5.1%	4.9%

The wage decrease on steam railways is tentative, subject to adjustment.

In the building trades the wage rate decreases in 1921 and again in 1922 averaged about 5 per cent., but in the metal trades the decreases in 1921 averaged about 10 per cent. and about 7 per cent. in 1922. In steam railways there was a general decrease averaging about 10 per cent. in 1921, but in 1922 the rates for men engaged in operating trains were not changed, but wages in the shops, maintenance of way and clerical forces were reduced approximately 10 per cent., so that in 1922 the average change in the wages of all classes of railway employees was only about 6 per cent. In coal mining, wages were reduced in Nova Scotia between 25 per cent. and 30 per cent. in January, but were later advanced to a level approximately 10 per cent. below the 1921 level, and in Vancouver Island the reduction from September, 1921, to September, 1922, was about 5 per cent. In Alberta and South-east British Columbia a wage decrease proposed in the spring was prevented by a strike. The average decrease in the three areas was, therefore, about 5 per cent. In the lumbering industry there was a considerable decrease in wage rates in 1921, particularly in British Columbia, but in 1922 the decrease averaged only about 5 per cent.

In metal mining no statistics have been published, but reports have appeared in the press on numerous decreases in wages in British Columbia as well as in Northern Ontario, the

(Continued on Page 54)



Strong position of the past four years in the building industry, as compared with war years, is shown in this chart. The past year made notable records in May and August. Summary (inset) shows the year 1922 to have been the best since 1915.

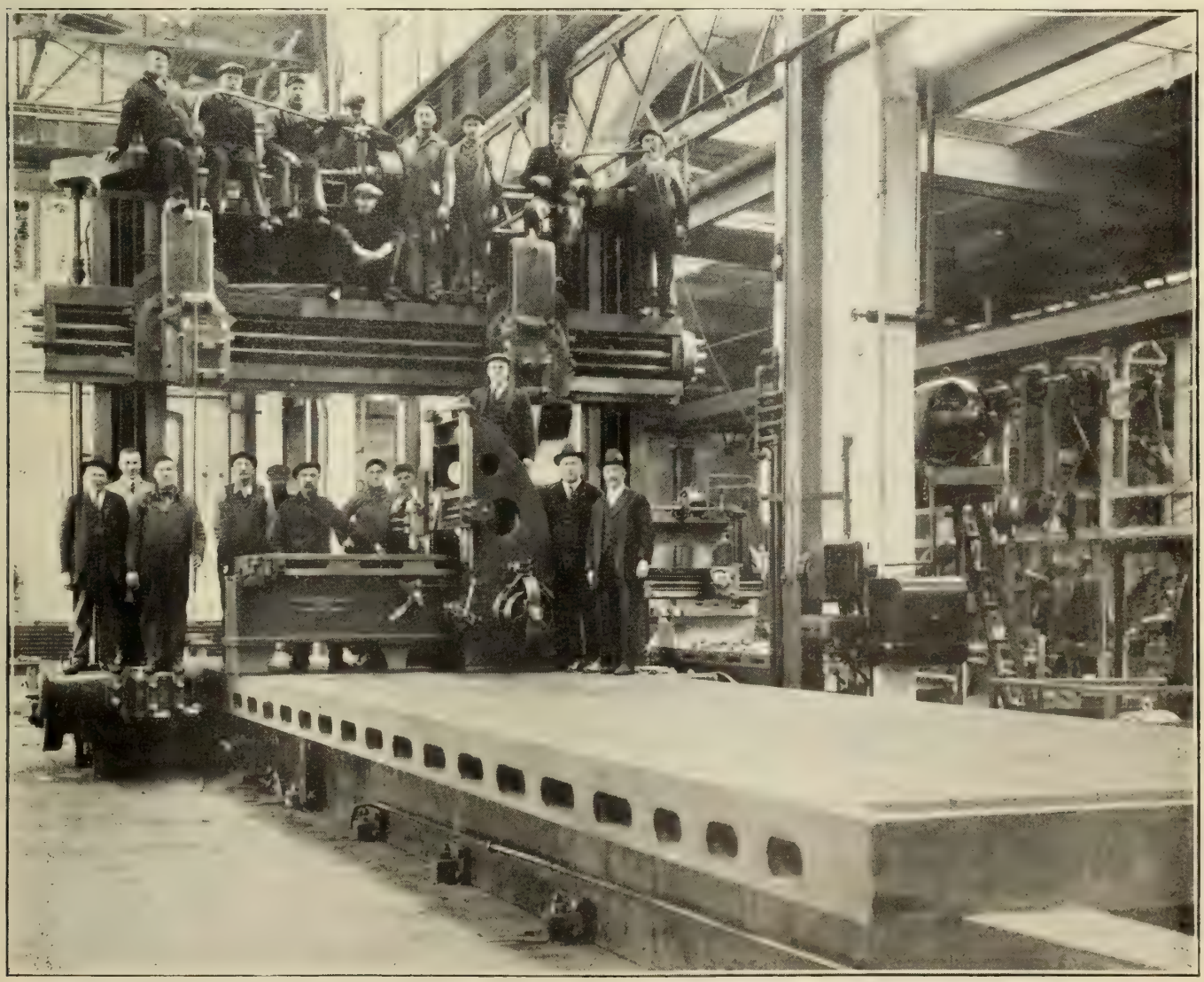
Large Planer Constructed by Canadian Firm

Design Provides Extreme Rigidity Under Heaviest Cuts—Special Lubricating System—Table Fitted With Side Guides—Drive Gears Generated on Maag System—Forged Steel Table Rack

INCREASING demand for large and heavy duty machine tools, as well as various classes of engineering equipment, has necessitated the designing and constructing of tools capable of machining the large frames and foundation castings usually associated with massive machinery. To take care of this growing tendency for heavy production work, the John Bertram and Sons Co., of Dundas, have recently completed and installed in their own plant the large planer here shown and described. The machine has a capacity for planing work 45 ft. in length at one setting. When cross rail is at its maximum height the space is 10 ft. 2 1-2 in. high and 12 ft. 2 in. between the uprights. The bed is a heavy box section with a wide body made especially deep around the gear space. There is one "V" and one flat track. The bed has a solid web across the top in addition to closely spaced cross ties, as a safe-guard against accident and to provide rigidity for heavy cuts. It is reinforced by double walls surrounding gear space and the entire centre part of bed, including double walls, extends below floor line. Gear shafts are supported by the four vertical walls, and shaft holes bored to jig. Table tracks are washed and lubricated by a continuous stream of oil under pressure from a geared motor driven pump. Oil is collected in settling tanks, strained and used again.

The table is a heavy box section with three finished T-slots and a suitable number of 1 1-2 in. reamed pin holes. Bottom of table is solid with no openings, thus preventing chips or cutting fluid from reaching the gears or tracks. Table is provided with side guides to prevent its crowding sidewise under heavy side cuts. Tracks are planed and scraped to fit tracks of bed. Controlling levers are placed on each side of machine and oscillate in a vertical plane. Table has cored holes in the side for the removal of chips and a trough cast at each end for catching chips or cutting fluid.

The driving gears are steel castings and pinions are forged steel with wide faces and heavy pitches, proportioned to safely transmit heavy working loads without undue wear. Teeth are gener-



Large 144-in. planer recently erected by and installed in the plant of the John Bertram & Sons Co., Dundas, Ont.

ated on the Maag system, producing the smoothest action. Table rack is steel forging, and each section is securely doweled and bolted to table; face is washed by continuous streams of oil, under pressure, from the same pump, which lubricated table tracks. The housings are of heavy box section having a long bearing on the bed, are securely bolted and pinned and are connected at the top by a deep arch. Housings have wide face.

The crossrail is a heavy box section carefully scraped by hand to fit the uprights and is securely clamped to both inside and outside edges of same. It has a wide face and is long enough to permit one head to plane the entire width between housings without interference from the other head. The crossrail is raised and lowered by a 15 h.p. motor. The rail heads have a long bearing and narrow guides on the crossrail are compound and provided with graduated swivels and taper gibs throughout to take up the wear. They have cross, down and angular automatic variable feed in all directions, at either end of the cut. The horizontal feed varies from 1/32 to 1 in. and the angular or down feed varies from .008 in. to ¼ in. The slides have a vertical or angular travel of 32 ins. The tool aprons are furnished with four bolts and two straps, with a tool opening 5 in. x 5½ ins. Heads are provided with automatic tool lifters without cord or pulley. The tool slide feed screws may be operated from either end of the crossrail by hand and have graduated collars.

The slide heads are compound and are provided with graduated swivels and taper gibs throughout to take up wear. They have automatic vertical feed in either direction, from below the table to the highest position of the crossrail, and are adjustable independently of the crossrail. The tool slides have a horizontal or angular travel of 24 in., are provided with hand adjustment by ratchet wrench traveling with the heads. The tool aprons have an opening for tools 5¼ in. x 5½ in., and are seated by self-releasing spring plungers. The feed screws have graduated collars.

Reversing Motor Drive

The Niles-Bement-Pond reversing drive consists of a D.C. reversing motor direct connected to the planer in the usual way, and a motor-generator which supplies current to the motor. The complex automatic controller, which forms part of every other reversing motor drive, is dispensed with except for a field rheostat and a rugged, durable master switch. This drive is not confined to a power supply of direct current, but is also furnished for alternating current, being the only equipment made on this side which can be so used. It is now possible to buy power from a central station furnishing only alternating current and use reversing motor driven planers. In shops provided with both A.C. and D.C., the D. C. supply is very apt to be overloaded. In such cases this drive may be put in without adding to the D.C. capacity. Reversal of the table is accomplished by reversing the motor by means of a patent automatic controller, actuated automatically by dogs on the side of the table or by hand from either side in the same manner as a belt driven planer.

Fourteen cutting speed from 25 ft. to 50 ft. per minute and four return speeds from 60 ft. to 100 ft. per minute may be obtained. Each is independent of the other and may be varied while the planer is running. A pendant switch is furnished by means of which the operator may take full control of the planer or stop it instantly without leaving his position on or alongside the table. The pendant switch is also used to lock the table so that it cannot be moved accidentally. An overload and no-voltage circuit breaker protects the motor, and in case of overload or failure of voltage applies a powerful emergency brake, absolutely preventing it from running away. Circuit breaker resistance and controller are contained in a ventilated metal case and wired together, nothing being left for the customer to do except reconnect the wires leading to the controller case, which we have to disconnect when shipping the machine. These wires are numbered and are connected to a convenient terminal block, having corresponding numbers and carried in conduits to the driving motor, elevating motor and pendant switch. The contacts on the controller are copper and carbon and accessible for quick cleaning if needed. Arcing is prevented by automatic relays and powerful blow-out coils. All wires and terminals in the controllers are properly marked and wiring diagrams and instructions are furnished. Total weight of machine in working order, 380,000 lbs.

15,000 TONS OF MATERIAL

(Continued from page 125)

south side, second floor of the building.

Comprising three sections, the plant, it will be seen, is nevertheless, self-contained and well served. Each department may be said to operate a separate unit, toward general production and ultimate shipment. Heavy equipment is all located on the ground floor. There is no overlapping, such as might occur on a single floor arrangement. The working force ranges from 200 to 300 men. The yearly average of manufactured output is about $2,500,000.

Combination Die for Muffler

As an example of some of the dies that are used in the Pedlar shop in the making of automobile parts the two here shown are briefly described. One of these is the combination blanking, cupping and piercing die for the cap of the hot stove on the Chevrolet muffler. The cutting ring A, which is fitted in the die bed B is made with exceptional shear on the cutting edge so as to relieve the pressure when shearing the metal. The die ring A is held firmly to its seat by means of equally spaced screws C. Concentric with the cutting ring and fitted lower down in the die bed, is the bush D, held in place by means of screws EE. This bushing carries on its upper end the piercing die F. The pressure ring G is fitted to slide freely in the space between the inner and outer dies, and restricted to an upward movement by the shoulder bearing on the base of the outer cutting ring. The pressure pins H extend through the die bed to a plate connected to springs or other means of required pressure.

The punch plate I, which is bolted to the ram of the press, carries the punch ring J, the outer edge of which is the cutting portion, while the inner circumference acts as the sizing portion for the drawn muffler. The screws K secure the punch ring to the upper bolster. The central retaining ring L carries the piercing punch M which is locked in position by the dowel shown. The knockout ring N is fitted in position before the dowell is finally inserted. The push pins O are connected to the plate P which is automatically operated when the ram rises to its upper position. The outside stripper ring Q is fitted to the ring R, the latter being connected to the blank holder ram by means of the pins S. These dies are operated on the subpress principle, the guide pins T entering into brushed holes in the upper bosses V.

Closing Nose of Fenders

An interesting die is that used for closing the nose of the front and rear fenders on the Chevrolet 49 car. On this die the block A is operated by a system of levers to move the blocks B outward to support the inner side of the stock while the forming pieces C are forced in radially by the action of the wedge blocks D, which are secured to the face of the bolster E, fitted to the ram of the press. The sliding pieces C are returned to their outward position by means of springs pressing against the lugs I. This die is also operated on the sub-press principle.

A considerable export business has always been done by the Pedlar People. Notable at the present time are the fairly large shipments to Japan and also to South America, in expanded metal lath, and other building material. The recent fire in the north country also created a heavy demand for metal culverts. It was noted that, while steel and concrete used in culverts withstood flames, wood very rapidly burnt out, and this, helping to make the roads impassable, impeded the escape of the fleeing settlers with their belongings.

Officers of the Pedlar People, Ltd., at the present time are: president and manager, W. R. Geikie; vice-president, in charge of Montreal branch, W. E. Ramsey. These with F. L. Mason and W. H. Hall, form the board of directors. W. E. Clarke is sales manager, and E. B. Northwood is in charge of the Toronto branch.

CANADIAN MACHINERY
AND MANUFACTURING NEWS

Published in the Interests of the Machinery, Manufacturing, Iron, Steel, and Metal Working Industries.

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THE MACLEAN PUBLISHING COMPANY, LIMITED

143 UNIVERSITY AVENUE
TORONTO, CANADA

Getting An Accurate Line on the Year

IN THIS number will be found an interpretation of Canadian industrial development that may be regarded as absolutely dependable. Moreover, it portrays the extent and importance of the steel and iron industry. Reports as to the year's operations are from reliable sources. Statistics are, for the most part, based upon Government returns. As reflecting the close association existing between steel and other materials used in working out the industrial destiny of the country, the articles herein contain much that will be of interest to manufacturers and business men as a whole.

Through them all is a note of confidence and optimism. Records during the past year have been excelled in recent years but much that was vague twelve months ago has been made clear and there is daylight where formerly there was discouraging doubt.

* * * * * * *

FROM manufacturers, bankers, municipalities and government authorities there comes an expression that is inspiring in its enthusiasm. Contagion of this kind is good. Industry is ready for better things. It was demonstrated during the year that much improvement came from the conviction that business favors those who expose themselves most persistently to it. Where this fact is generally observed, industry is sure to acquire strength.

* * * * * * *

PROBABLY the most noticeable index of the past year was the return of the Canadian dollar to par, and the steady approach of the pound sterling to its pre-war value. Many disadvantages attended exchange problems. While it did curb senseless buying, it also handicapped enterprising expansion. Undoubtedly, it was a factor in decisions looking to the location of branch American factories in Canada. The present status of the pound and the dollar indicates that relative inequalities are being dispelled. Greater confidence in international affairs should result.

* * * * * * *

A VERY considerable increase in export trade will surely develop during the coming year. It is notable that the past three months have made good gains over those of last year, October being more than $22,000,000 ahead, while for the seven months of the year ending October, the gain in exports was about $75,000,000. Better terms in trade treaties with Australia and France have recently been secured and no doubt the year will produce more advantageous facilities with other countries. The pulp and paper, lumbering and motor industries have shown increasing export strength during 1922 and will make higher records in 1923.

AS TO THE financial outlook, it is pointed out that the investment of capital in securities—bonds and stocks—is an important factor in the development of industry. Here, again, confidence is shown in the country's future from the manufacturing standpoint, on the part of Canadian investors and also on the part of investors in the United States who have been putting large sums into Canadian enterprises and Canadian branches of American concerns.

* * * * * * *

THERE IS one outstanding problem. All interests are agreed that it is imperative. There must be high-standard immigration. The country must have population if industry is to have adequate domestic market giving scope to production. Within easy reach of railroads with which the country is at present over-equipped, there are large areas of land which represent opportunity for the industrious agriculturalist. It is further predicted that the coming spring will open with a swing that is sure to find a shortage of labor, and of skilled mechanics in certain lines. The available supply was fairly well exhausted during the summer months of 1922. Large numbers of men also went to the United States and were absorbed in the industrial boom. There is going to be a demand for help that is willing and worth the money. Immigration must co-operate in meeting the need.

* * * * * * *

AN EXAMPLE of vision as to the industrial future of the country is given in the operations of the Canadian Steel Corporation at Ojibway. Here seven million dollars have been expended already in the preliminary work of establishing an immense industry with townsite in connection. No statement is available as to the time of active operation or at what point in the development furnaces may be blown in and wheels set in motion. It is a matter of preparedness. There are other enterprises afoot which indicate confidence in the country's future. Some have to do with the steel industry; others with pulp and paper and lumbering; but all indicate vision and confidence. These are great requisites.

* * * * * * *

THERE is an old saying that the town of Happiness is in the State of Mind. The state of mind, with high courage and cheerfulness, confronts the problems of another year. Co-operation and confidence will have much to do with the solution of the problems. The prospect is not without definite promise, and the message that Canadian Machinery and Manufacturing News gives to Canadian industry as a whole is that a full measure of prosperity and happiness may be the year's fruition. May operations "in the red," and activities "in the blue," give place to records reflecting gratifying results.

Decks Cleared for Better Year in Steel Industry

Much Liquidation in First Half of 1922—Second Half Showed Decided Improvement in Demand—Market Now on Sound Basis —Output of Foundry Iron Doubled in November

COAL STRIKE PROSPECT AS MARKET INFLUENCE

PRODUCTION of steel ingots in the United States in 1922 was about 34,000,000 gross tons, against 19,000,000 tons in 1921 and 41,000,000 tons in 1920. From 1920 to 1921, consumption of steel certainly did not decrease by 53 per cent. as did production. In 1921 there was liquidation not only of stocks of steel in the hands of buyers, but also of manufacturers of steel, including machinery, implements and hardware.

It was this process of liquidation which practically divided the past year into two distinct parts, from the viewpoint of the Canadian steel market. The first six months, dealers declare, was a distinct loss. Stocks, representing periods of higher value, were liquidated in order that business might be placed upon a sound, stable basis. The second half of the year has shown marked improvement and the outlook is free of the perplexing problems of readjustment that were held over from 1921. The decks are cleared for more definite and, it is to be hoped, more profitable operation.

Showing a decline of seven per cent., as compared with October, the output of Canadian pig iron during November was 34,289 long tons, while in October it was 36,888. November production, however, was 8.8 per cent. higher than the preceding ten-month average. The year's output declined 37.4 per cent. below 1921, or a total of 207,271. In the output of basic pig iron, for conversion into finished steel products, Canadian furnaces declined from 28,922 tons in October to 26,156 in November, while the output of foundry pig iron increased to almost double the October record, or 8,133 tons. This indicates improvement in foundry operations. Although Steel Co. of Canada are about to blow in a second furnace, there were only four Canadian furnaces in blast in November —two at Sydney, one at Hamilton, and one at Sault Ste. Marie.

In United States, as in Canada the coal strike was probably the dominant factor in iron and steel trade conditions during the year. In Canada it was responsible for an increase in price of pig iron by about $10 a ton. This has gradually declined, and the year closes with a price of $31.80 for 2.25 to 2.75 per cent. silicon. The coal strike, according to our Pittsburgh correspondent, probably helped to stimulate demand, but it left the industry with higher costs and the consumers with higher buying prices.

Prospects for 1923 would be fairly clear were it not for the chances of there being more trouble. No one, probably, is in position to assert that there is any strong balance of probability either that there will be or will not be another coal strike April 1, 1923, and uncertainties in that respect may be the chief influence upon prices and demand in the first three months of the new year.

Were it not for this coal factor, it would seem entirely safe to predict, on the basis of present well-known facts that there will be heavy production and consumption of steel during about six months of the new year, probably with a tapering off afterwards, with steel prices well maintained for several months, with softening perhaps in a few products, and then a gradual decline. There has been a secondary inflation in 1922, not enough to prevent active business, but such as to make it necessary that eventually the general post-war deflation must be resumed. There will be many ups and downs in prices, for years to come, just as there were after the Napoleonic wars and the Civil War of the United States.

Toronto

Dec. 28

IRON and steel markets approach the New Year in much better position and with greatly improved prospects than in December, 1921. At that time the movement was under way to liquidate heavy stocks that represented abnormal prices. Considerable writing-off was done, and it may be said that the dealer, during the first six months of the present year, had to do with discouraging conditions. The second half saw gradual improvement and by December had made such progress as to give the year a more normal aspect. Volume, in fact, has been larger than last year, and in spite of slightly higher prices in 1921, say one cent per pound, financial comparison is also gratifying.

Machine tools have not had the best kind of year. Demand has been noticeably shy of any large buying, and while woodworking equipment has become stronger owing to activity in various branches of the lumber business, metal working machinery has had an erratic course. However it may be said that all industry is on a more stable footing to-day than it was one year ago, and has a better grasp of conditions because the latter have become more definite. Machine shop and mill supplies have shown a fair demand. Mining, pulp and paper, and building industries have enjoyed considerable expansion, and in that connection large engineering works have called for requirements that have meant good business in the iron and steel and machinery business.

Iron and Steel.—Year-end business, while generally showing an unwillingness to increase inventories, has been fairly active or sufficiently so to encourage the hope that the year 1923 is going to get away to a fairly good start. In fact, the Toronto office of the U. S. Steel Corporation reports that not only was the year better by 100 per cent. than the year preceding, but that 1922 is closing with fair placing business for first quarter. In fact, something like 2,000 tons were placed second week in December. The basic price has been advanced to $1.90 and steel men predict that the year will not have gone very far before the market shows a decided inclination to swing upward. Labor is high, transportation is expansive as it is difficult, and it is notorious that the steel industry claims to have been operating "in red," or at a loss during the past year. Heavy liquidation marked the close of 1921 and beginning of 1922, but the year developed strength with the opening of building operations and activity in the motor car industry.

What fluctuation occurred in sheets and bars was largely due to the coal and rail strikes. Bars were quoted at $2.75 early in the year, but by June had advanced to $3.00. By September the price was $3.25 and gradually stabilized at a range of $3.25 to $3.40. Galvanized sheets also indicated an advance from $5.35 to $6.25 in eight months and prices remain quite firm with the close of the year.

Dealers are agreed that 1923 will see a great improvement in railway buying and that conditions generally should more faithfully reflect the so-called boom in the United States.

Current Toronto prices:

Iron bars	3 25	3 40
Steel bars	3 25	3 40
Reinforcing bars	3 15	3 25
Steel hoops		4 75
Tire Steel		3 50
Spring steel	7 00	14 00
Band steel, No. 10 gauge and 3-16 in base		3 90
Small shapes		3 50
Sheets, black, No. 28		4 60
Sheets, blue, ann., No. 10		4 26
Canada plates, dull, 52 sheets		4 90
Canada plates, all bright		5 40
Galvanized Sheets, No. 28		6 00

Old Materials.—While the year closes with no pronounced movement in scrap metals, conditions seem to have improved, what with greater activity in blast furnaces and better business with the foundries. Large Toronto dealers, while declaring that the market is with-

out local features, point to the improved strength in American markets as being the basic consideration. Pittsburgh reports that expectation of higher prices has caused a display of "pep" in a market that, for some time, has appeared dormant. Those who have material are inclined to hold for higher figures, and no great volumes are coming forward. Copper and brass, in sympathy with the basic market, are very firm. Lead has also firmed. Dealers' average buying prices:

Copper, light	9 00
Copper, crucible	11 25
Copper, heavy	11 00
Copper wire	11 00
No. 1 composition	9 00
New brass cuttings	7 00
Red brass turnings	7 00
Yellow brass turnings	5 25
Light brass	4 50
Medium brass	6 00
Scrap zinc	3 50
Heavy lead	4 50
Tea lead	3 00
Aluminum	11 00
Boiler plate, per gross ton.	9 00
Heavy melting steel	10 00
Axles (wrought iron)	20 00
Rails (scrap)	11 00
Malleable	10 00
No. 1 machine cast iron	18 00
Pipe, wrought	7 00

Non-ferrous Metals.—This department is closing the year with a flourish. While there is no change of note in local quotations, things are happening at the base of supply. A few weeks ago copper seemed to have reached a high at $14. Large orders for export and domestic trade, coupled with a decidedly bullish sentiment, seems likely to skyrocket copper to a point above $15. Demand has shown some spirit and producers are predicting a shortage that restricts them to delivery three months hence. Referring to the movement of lake copper, it is learned that, in spite of the close of navigation, this continues heavy. The Calumet alone moved more than 2,500,000 pounds this month, with the bulk consigned to France.

Although tin has fluctuated considerably due to speculation and exchange movements in London, it is expected that there will be higher prices after the New Year.

Lead has taken its place among the strong features. Recently the American Smelting and Refining Company advanced its price $3.00 a ton to a basis of $7.25, New York. One reason given for the somewhat unexpected advance is the improved statistical position of the metal. Stocks were estimated at 100,000 tons at the first of the year; practically all of this has been consumed. In spite of a tariff duty of 2.12½ cents a pound, as against a previous duty of 25 per cent. ad valorem, about 66 per cent. of the Mexican production is being brought into the U. S. for consumption and the balance is being shipped to Europe.

So far as finished products of copper and brass are concerned, manufacturers state that, should strength continue, an advance in prices may be looked for early in the New Year. Local prices:

Lake copper	17 25
Electrolytic copper	17 00
Castings, Copper	16 50
Tin	41 00
Lead	7 50
Spelter	9 50
Antimony	8 50
Aluminum	22 00

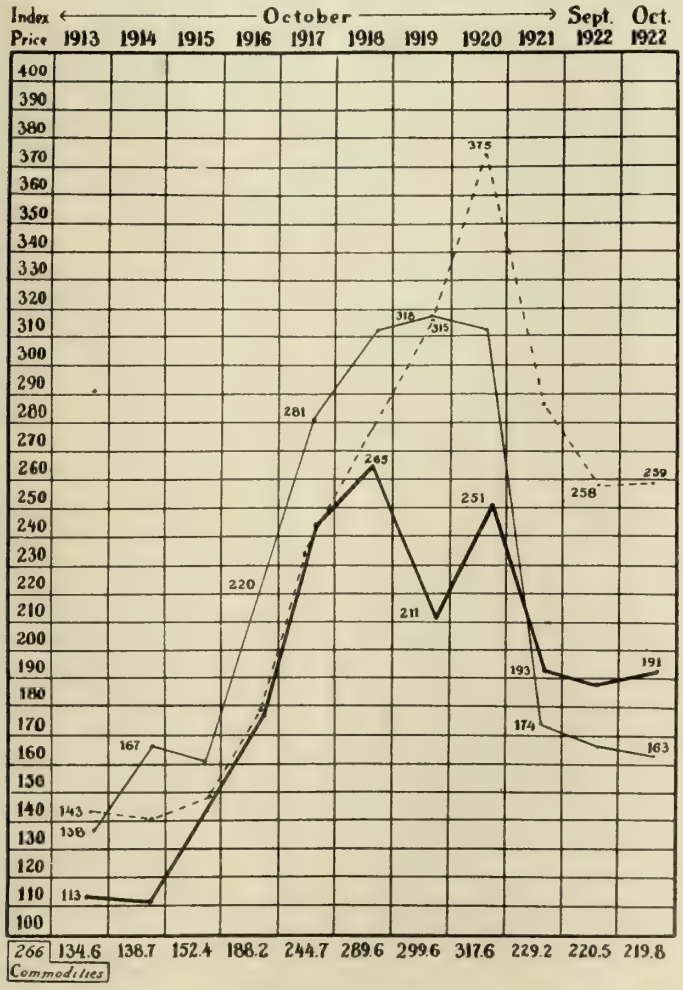
Machine Tools.—Observers report that the past year has not been marked by any conspicuous buying for or on the part of large concerns, apart from what is regarded as engineering demand. Some business has developed in connection with small shops, but this has largely called for used equipment, of which there is considerable in the market even after two years of steady absorption. Woodworking machinery improved during the year and it is an encouraging fact that machinery of all kinds will have a better opportunity now that industry generally is on a more stable basis and can view the future with greater confidence.

In his review of the machine tool industry, E. F. DuBrul, manager of the National Machine Tool Builders' Association, has this to say of demand:

"All sorts of curves in bank bulletins and economic services show an improvement in business, but the trend is quite less marked in pig iron, coal and copper, than in petroleum, cement, sugar, wheat flour, cotton, tobacco, and paper, as shown in the monthly review of the Federal Reserve Bank of New York, for December. Pig iron, coal, and copper have been very much further below their normal trend, whereas the other articles partaking more of the nature of consumer goods do not show such decided divergences. This is significant for the machine tool industry. Our demand runs with iron, and not with sugar and tobacco.

"According to our own index figures all of these industries have recovered much more than the machine tool industry has. It is true that our barometer figures for November showed some improvement over October, but neither were up to September figures.

"Pig iron production continuing below the trend shows, of course, that metal working industries on the whole are not as active as some other industries. The railway car, locomotive and automobile productions are relatively good, but the railway car, locomotive, and automobile plants are amply able to take care of the orders, and need little new equipment.



In the above chart are shown the movements of wholesale prices of commodities from 1913 to November of the present year. The heavy dark line represents 33 commodities in iron and steel and implements. The dotted line shows the steady upward trend and decline in building materials, made up of lumber, paints, oils, glass, forty-eight commodities in all. The faint line is that of grains and fodders, fifteen commodities in all, including Eastern and Western grain. The chart is interesting as showing the relative postion, at the close of the present year, of three most important groups. While there has been a decline, the levels of 1913-14 have not yet been reached, the nearest approach being farm products.

"It is the general impression that next year the selling of automobiles is going to be quite a difficult task. Reductions in prices of automobiles indicate a lack of the sort of buying pressure that the automobile builder has come to consider as normal, and the selling of automobiles will not be so easy. The Wills-St. Claire and Earls reorganizations show that there are some weak spots in spite of the largest sales in the history of automobiles.

"The automobile field ought to afford some opportunity for machine tool demand if the salesmen really sell production. The competitive condition will demand reductions in cost to as great an extent as possible and that is where the real salesmen for the machine tool industry should come in with their best work. But as all indexes continue to point to some considerable weakness among various automobile concerns credit should be watched very carefully and the machine tool builder should insist on getting a fair proportion down in cash on all special machinery that he undertakes to build.

"It looks as though the best outlet for machine tools for some time to come will be for the railroad shops. Improvement of the railroad shops is being called to the attention of the executives and no doubt will result in some improvement in that direction.

"There is a lot of optimism evident in general business circles but a great deal of this is over-optimism. Every cloud is not yet off of the business horizon. Europe has not yet gotten down to business and our own radicals in Congress are doing all they can to stop improvement, so it would be injudicious to figure any very great activity in the United States. There is going to be better business for some months to come, but if in those months the unfavorable conditions are not removed, business will hesitate. It is not safe to assume that we are in for a long period of prosperity. It would be much safer to count on a rather short period that might culminate even before the end of 1923 in the machine tool line. We must remember that the farmers' purchasing power is not yet in balance with costs of the goods he buys. The farmers' demand for goods is not yet in full swing and is not likely to be during the next year. We shall probably witness a falling off in business, some time before the excessively optimistic imagine that it can be possible. Retail trade is not very snappy right now. So it will not do for the machine tool industry to be over-enthusiastic."

Pig Iron.—It has been an eventful year in the pig iron market—more particularly by reason of the events which conspired to curtail supply and demand. Most serious of all was the coal and rail strikes, which struck the market at a time when production was low, and demand somewhat backward. Prices in the first and second quarter ranged from $27.15 to $29.15. In August and September, when the full effect of the strike manifested itself prices jumped to 39.30. With the settlement of the strike this figure gradually declined. A low of 30.80 was reached early in December, but the year closes with an advance to 31.80. The market is strengthening, foundries are buying in a much more confident way and with a feeling that pig in the yard is more useful than pig in prospect. It is likely that Canadian furnaces will show an improved output early in the New Year.

Montreal

December 27.

MONTREAL:—There have not been any price changes in current warehouse values and the demand for all products continues along fairly quiet lines. Throughout the district there is an easing off of manufacturing conditions consequent upon the approaching holiday season and stocks are being reduced as rapidly as possible without replenishment until after the inventory date. Current prices:

Lake Copper	17 50
Electrolytic Copper	17 25
Castings, Copper	17 00
Tin	45 00
Lead	8 00
Spelter	9 50
Antimony	7 50
Aluminum	22 00

Pig Iron.—The advance of $1.00 per ton announced in the price of Canadian pig iron for this locality, finds foundries so well supplied that there is no little fresh buying going on. The importation of pig iron from the Old Country finished with the close of St. Lawrence navigation and it is not anticipated that shipment will be resumed until the opening of navigation in the spring. Local prices:

Algoma, No. 1, car lots on Tracks, nominal quotation	....	34 15
Summerlee, 80-ton lots, dock	35 00	....
Carron, 30 ton lots	35 00	....
Do., 5 ton lots, ex. warehouse	40 50	....

Pittsburgh

December 27.

THE prominent feature of the manner in which the steel trade is closing the year is the way in which production and shipments keep up. Usually there is a slowing down for December, partly because some manufacturing consumers slow down in their consumption and partly because buyers, whether distributors or manufacturing consumers, like to have the January 1 inventory as light as possible. A year ago, for instance, December saw a sharp dip in steel production, the No- being regained late in January. This year there is no more than holiday dip, and little even of that. Some mills, it is reported, intended to close for this holiday week, but found delivery requirements such that they concluded to run, stopping only for the holiday. There are a few closings of departments for the week, to allow other departments to catch up with them.

The monthly report of ingot production will probably show production for the month little if any less than the rate of October and November, which was approximately 40,000,000 tons of ingots a year, the highest rate since late in 1920.

Market Seems Steadier

Concurrent with the willingness of steel buyers to receive shipments at the same rates as formerly there is a holding up of prices of bars, shapes and plates, at the 2.00c level, better than was expected in most quarters. Possibly the market in these lines is even steadier than a month ago. Yet in some quarters it had been considered almost a foregone conclusion that these lines would be down by this time, as they had advanced proportionately more, since the low point of early in the year, than other finished steel products.

Pipe is probably the strongest item on the list, mills being far in arrears in making shipments, although they are gaining a trifle, while new business continues to come in freely. The Riverside plant, in the Wheeling district, which the National Tube Company (Steel Corporation) has put in operation after a long idleness, will be making practically full shipments by about the middle of January, and this will help materially, as the plant specializes on merchant pipe, which has been in the strongest demand of the various tubular goods.

It is reported that the American Steel & Wire Company has 15 weeks of business ahead in nails, which would mean that it can accept little business in nails for first quarter. It seems to be oversold on fence. Independents are fairly well booked, and the nail and fence markets are very strong.

Advance Bookings are Fair

Sheet business is coming in quite well for the season of the year. There is a very fair volume of early delivery business, which is placed without difficulty as some of the independents have not much business ahead. Others, particularly those making special finish sheets, are very well booked ahead. The leading interest is now filled for first quarter. It is now booking business for second quarter, although its formal book opening on November 23 was really for first quarter only. The market is at 2.50c for blue annealed, 3.55c for black, 4.35c for galvanized, and 4.70c, 4.85c or 5.00c for automobile sheets, according to time of delivery and other conditions.

Tin plate production in the past year has been about 1,400 000 gross tons, the record, made in 1917, being a trifle over 1,500,000 tons. Regular domestic consumption was probably the highest, however, as there were light exports and light demand for tin plate for mak-

(Continued on page 152)

A Better Year

BEFORE us is a better year—a better year than any year since the war.

The material prosperity and purchasing power of a country are measured by its production. Production as indicated by this year's preliminary reports was never so favorable in recent years, all of which must inevitably bring about a marked stimulus in every line of commercial endeavor. Canada faces a better year.

We face a year in which we will be better able to demonstrate the ability of our national organization to serve you—a Dominion-wide organization supremely equipped in all essentials of the machinery business and with over 50 years' experience.

You will need new equipment to cope with this new era of prosperity. We can supply you. You will need advice regarding the tools best suited to your requirements. Our engineering staff is at your service.

The most advanced designs of metal and woodworking machines are included in our stock—as well as electrical equipment, small tools, and factory supplies.

Should you favor the purchase of used equipment you will find our remanufactured lines equal to all requirements. This equipment has been completely overhauled, rebuilt and tested in our own thoroughly equipped plant.

How may we serve you in 1923?

If it's Machinery—Write "Williams"

The A. R. Williams Machinery Company, Limited

TORONTO, CANADA

Halifax St. John Montreal Winnipeg Vancouver

Improved Tools and Equipment Are Essential

Modern Methods in Workshop Can Alone Reduce the Cost of Making—Cannot Blame Antiquated Practice on the Mechanic —Railways a Large Factor—Immigration Necessary

By GEN. SIR ALEX. BERTRAM

THE MACHINE tool industry in Canada, whilst not at a standstill, is what one can term poorly occupied, and I am not pessimistic when I say that the probabilities are that it will continue in its semi-dormant condition for some time to come. It is a well-known fact that the basic barometer of the machine tool trade is the purchasing power of our railroads. Their requirements in their own engine shops, and in the shops allied to the railroads, are a large factor in the machine tool trade.

While the railways may not govern the prosperity of Canada, their own financial and operating ease is the mark of our trade conditions. Their shortage of traffic and the high cost of transportation has hampered the prosperity of the Dominion. When the financial position of our railways improves they will be able to purchase the new and improved tools and equipment which will reduce labor costs. For instance, in one railroad machine shop I know of, they were able to secure one new piece of machinery to replace four obsolete machines, and that one machine did more work and better work than the four old ones. It saved the wages of eight skilled mechanics.

Industrial conditions have changed very fast in Canada during the last quarter century. Many of the important centers in Canada not long since had factories for making steam engines and boilers. Electricity has replaced the steam engine, and has restricted this important industry. The result of this restriction is that large factories have had to be adapted to the production of other manufactures. Much of their equipment has gone to the junk shops. Other have been closed up altogether, because the men were trained to the making of engines and boilers, and the owners could not or would not take up anything to replace the work.

Capital Inclined to be Shy

Practically the same elimination process has taken place in the making of agricultural implements. Towns in Ontario and Quebec had their implement factories as a basic industry. This has all been changed. A few large organizations control this industry in a few cities, and their efficient equipment produces as much of the finished article as did twice the number of men a quarter century ago. The refusal of the farmer to bear his share of taxes and the consequent granted demand for a free entry of American farm machinery has made capital shy of further investment in farm machinery plants. The American response to this abolition of customs duty was the usual one—the Canadian farmer was shut out of their markets entirely.

Yet it is the trained engineer who has been chiefly responsible for the changing conditions, insofar as it tends to cheaper production through the lower costs of more speedy and efficient construction. The engineer, the mechanical engineer, is the greatest revolutionizer in the world to-day.

Industry is Stabilized

Our water power, our water sites that were given away for a song some thirty years ago, are now recognized as one of our greatest national assets. The electrical engineer has utilized electricity for developing our water powers, and he has generated untold electrical power therefrom. This has made wonderful changes in our manufacturing conditions. It has steadied and stabilized our everyday industries.

We have power equipment and railway lines for ten million of a new population. We have land to keep busy an agricultural addition to our population of twenty millions. We require more people to cultivate our land, and we are all glad to see that there are men in Parliament who are alive to this fact, and that some effort will be made at once to induce real farmers to settle in Canada.

I know that the high cost of production hinders capital from venturing in new enterprises. It is difficult to reduce wages. The high cost of living and the low purchasing power of the dollar precludes any present reduction in the living wage. Capital is timid. It is easily scared. The noise of the agitation and the disturbance of a rough-house strike makes a man who has saved money lay it by in a safe hole. Money can make a quicker disappearance than quicksilver when it is threatened by demagogues in the legislative halls of any country.

New Methods of Production

The only means of overcoming the high cost of production, and the only way to attract capital is to secure and to show improved methods of production in factories now established. I have referred to one instance where a new machine in a railway shop cut the labor cost to one third on one important operation. This can be done in many industries.

The engineer is calling for improved tools and equipment. The machinist resents the fact that he is compelled to work with poor tools and obsolete equipment. The official in charge finds it difficult, yet, impossible, to induce the owners to buy the new equipment, even though they may know that improved methods in the workshop can alone reduce the cost of making. The owners control the financial end, and no doubt they have their worries in financing. Yet, new, modern, efficient and money-saving equipment is the only speedway to prosperity.

During the war period our Canadian manufacturers proved their methods when they had the proper financial backing. They spent vast sums in purchasing up-to-date tools and machines for the production of munitions, and when the last chapter of the munition work was on, then it was found that Canada had outstripped the world in quantity and in man-for-man production. And 'twas all done in a careful and studied reduction in the time for each operation, in a smooth and systematic run from the raw material to the finished article.

Antiquated Methods Inexcusable

I am an optimist, a cheerful one. When we know what one must do and proceed to do it, then conditions are bound to improve. They will improve. Antiquated methods cannot be blamed on the mechanic. The high cost of wages must continue so long as the three essentials of life and the pursuit of happiness cost so much more—rent, food and clothes.

Today it is up to the man who has saved the fruit of his labor—the thrifty man—the real man who holds the purse strings. Will he invest his money in the promotion of industry? Has he faith in the growth and prosperity of Canada? I vow he has, and that he will. I was going to term the man who holds the purse a capitalist. Every man who saves, every man who is not shiftless, thriftless and inert, is an asset to Canada and a capitalist.

REGINA, Sask.—Industrially the year has been quiet in Regina, with very little expansion.

The Steele Briggs Seed Co. have established their western headquarters in the city, coming from Winnipeg where they had been located for many years. The Canadian Chemical Products Co. have recently put in a very good plant for the manufacture of household requisites. From a distribution standpoint, which is, of course, Regina's strong suit, there has been very little development owing to conditions that have obtained throughout the year. On the strength of the excellent crop we look forward to a more active season next year.

350 to 400 Per Hour

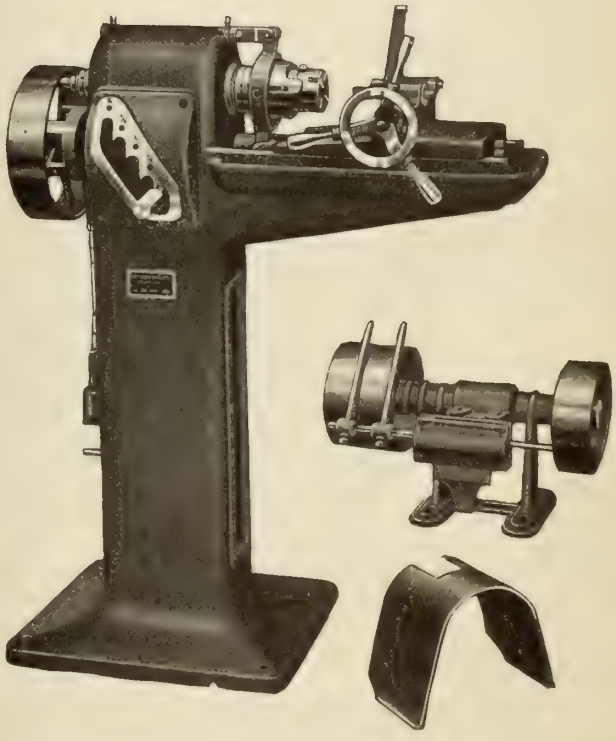
of These Aluminum Wireless 'Phone Receiver Caps Are Threaded on a Geometric Threading Machine

The Thread is 2.180″—24 U.S.

The Connecticut Shop where the work is done gives the Production Figures, and the New York concern for whom the Caps are made, confirms them.

The Self-Opening Die Heads with which the Geometric Threading Machines are equipped are also used for rotating on other types of machines, such as Drill Presses, Bolt Cutters, and machines of similar operation.

Various types of Geometric Die Heads and Collapsing Taps give a correct finish to Screw Machine and Turret Lathe.



¾ Inch Size Geometric Threading Machine—Complete with Countershaft and Oil Hood.

Submit your Screw Thread Cutting Specifications to

The Geometric Tool Company

New Haven, Connecticut, U.S.A.

Canadian Agents:

Williams & Wilson, Ltd., Montreal. The A. R. Williams Machinery Co., Ltd., Toronto. St. John, N.B.; Halifax, N.S.; Vancouver, B.C.

News From the Industrial Field

Sarnia.—Fire caused $25,000 loss at the Imperial Oil Co.'s plant when one of the agitators exploded.

Oshawa.—According to assessment figures, Oshawa's total population is now over 14,000. The village of Cedardale, with 1,300, was recently annexed.

Vancouver, B. C.—Plans have been prepared for the erection of a building designed especially for transportation company offices. The estimated cost will be about $100,000.

United States Steel Corporation are now operating at 83 per cent. of capacity, the highest production rate this year. Buying from the oil and motor car companies is particularly strong.

Peterboro.—A college that will take care of the first two years of university work is proposed for this city. It would be a means toward relieving overcrowded classrooms in many Canadian colleges.

Two hundred Danish families, all farmers, from the north of Jutland, intend emigrating to Canada. The Government, it is reported, has promised to place land and facilities for farming at their disposal.

To connect with the Imperial Oil tank farm at Coutts, Alberta, a pipe line is to be run from the Sunburst-Kevins oilfields in Montana, and it is proposed to build a 1000-barrel refinery in Southern Alberta.

Employment officials sizing up the prospects for next Spring, predict that unemployment will reach zero, and that there is likelihood of a labor shortage. Much engineering work is in process or being planned which will absorb hundreds of men.

According to grain export statistics, the Canadian farmer has not been seriously affected by the American tariff. During October and November farm products exported amounted to $15,601,954 as against $17,633,141 in the same period last year.

For manufacturing and assembling motor cars, Henry Ford will build a $6,000,000 factory in Chicago. It is expected that this in time will rival the Detroit works. First of the proposed four units costing $1,500,000 it is expected will be employing 4,000 men by next May.

Mount Royal Hotel, which has just been opened, is the largest in the British Empire. It has employed 1,500 men in its construction for the past year. The site is 306 ft. x 227 ft. Electric wiring in the building is 150 miles in length, requiring 60 miles of conduit and the phone system is of 2,000 station capacity.

Two garages and several stores were destroyed by fire in Sturgeon Falls, Ont. Several motor cars, and considerable hardware stock were in the loss which is estimated at $175,000.

A Napier-Cub Aero engine, weighing 2,200 pounds, without fuel or water, and capable of developing 1,000 horse power, was recently given a successful test at Southampton. It is the largest aero engine of its kind in the world.

Locomotives which generate their own motive power, and able to maintain an average speed of 120 kilometers an hour, with 12 coaches weighing 45 tons each, are proposed for the French railroads. Naptha is used for fuel. The locomotive is the invention of a Russian.

Car ferries operating on the cross-the-lake route between Cobourg and Charlotte, N. Y., have been very busy up to the present time this season with practically no interruptions on account of weather. Considerable coal has been moved.

At a meeting of building trades and builders' representatives in Toronto, the rate of wages for union bricklayers and stonemasons was fixed at $1 an hour for 1923. The rate and agreement are practically the same as in 1922, and so far as building trades are concerned, are not likely to be changed.

E. Long Manufacturing Co., Orillia, manufacturers of sawmill equipment, are employing 60 men at present. Business is said to be exceptionally good. The plant has sufficient orders to run until next June. Part time and part staff were run up to November 1st, but at present men are being daily added to the force.

Metal Shingle and Siding Co., Preston, and Montreal, and the Western Steel Products Co., Winnipeg, have made an arrangement whereby the offices of the former in Manitoba, Alberta and Saskatchewan, will be closed Jan. 1, and the latter company will take charge of the business of the two companies in the four provinces

Welland:—Announcement is made of the incorporation of the Eastern Steamships Company, Limited, with head office at Port Colborne, and a capitalization of $1,000,000. Buffalo steamship interests are behind the organization, and a Dominion Charter has been secured.

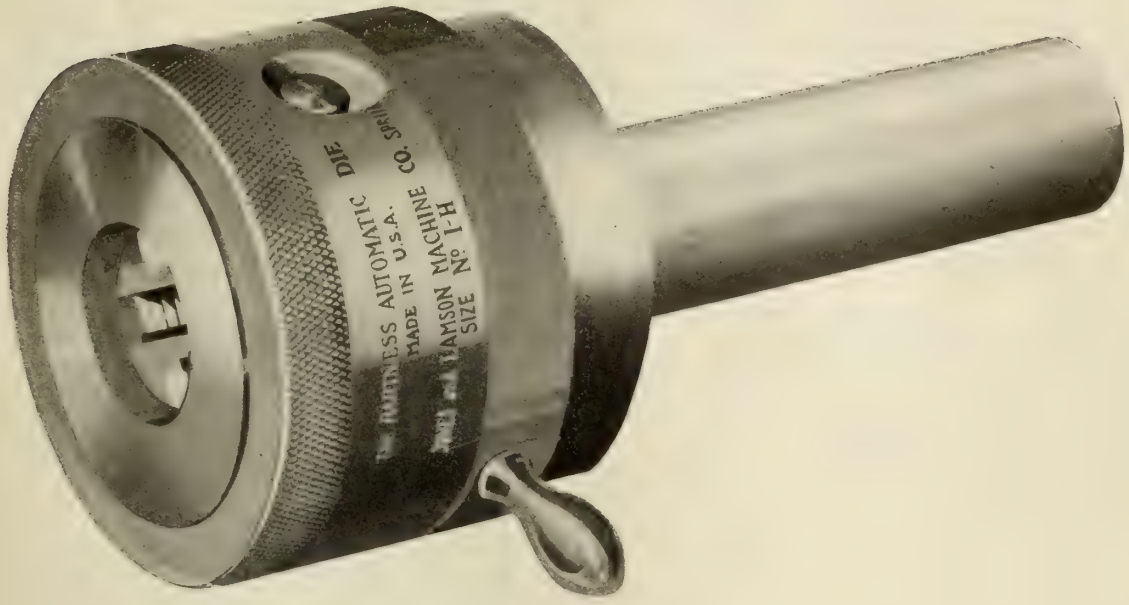
It is stated the company will put a fleet of ten steel steamers on the route between Buffalo and Montreal. The project is an alluring one. Grain rates from Port Colborne to Montreal run about 7½ cents while the Buffalo-Montreal rate is 17 to 20 cents. Shortage of storage at Port Colborne is an additional factor in the calculation.

A. J. T. Taylor, Vancouver, has been appointed vice-president and managing-director of the Combustion Engineering Corporation, Toronto, in the organization of which he took a prominent part. The company has two large contracts on hand in the erection of a power plant for the Imperial Oil Co., at Calgary, and the installation of a large pulverized coal power unit at Walkerville, Ont.

Swedish locomotive builders are to promote business among the South American republics by sending a deputation of salesmen in a sailing yacht to the more important cities. They will be armed with suitable literature, and the president and several of his technical experts will direct the expedition. Swedish builders have just delivered the two hundredth locomotive on an order to the Russian Soviet.

According to information received from Mr. Knowles of the Harmer-Knowles Motor Truck Co., Toronto, they have appointed Major L. H. Ingram, (late Canadian manager of Republic Truck Sales Corporation) to take charge of their sales department. At the present time this firm have in course of erection a new factory 100 x 125 ft. of brick construction. The design is such that there will be only two pillars in the entire building. It is being built to their special requirements and will be occupied about February 1st, 1923.

Canada this year has a wheat crop of 340,000,000 bushels. A C. P. R. statistician estimates that to move this crop it would take 257,250 (40-ton) grain cars loaded to capacity, or 7,350 trains, running at intervals of five minutes, 252 days to pass a given point. Placed end to end these cars would make a train 1,946 miles long, or one extending from Montreal to a point 26 miles west of Swift Current, Sask., or from New York to Denver, Colorado. Allowing thirty-five cars to a locomotive, it would require 7,350 to haul 257,250 cars, which would make a total length of cars and locomotives combined of 2,060 miles. The largest trans-Atlantic C. P. R. freight carrier is the S. S. Bosworth, with a capacity of 352,000 bushels of wheat. It would take 974 steamships of the Bosworth's capacity to carry the wheat crop of the Prairie Provinces across the ocean. Taking the Bosworth's gross tonnage at about 6,000, this would mean a fleet of 5,844,000 gross tons, or the largest mercantile fleet in the world with the exception of the United States and the United Kingdom.



Announcement—

We present a new design of threading tool known as

THE HARTNESS *High Speed* AUTOMATIC DIE

One size is now in stock and ready for distribution. Made in two styles:

No. 1-R, Revolving type, for threads 3/32″ to ⅝″ diameter.
No. 1-H, Stationary or hand operated type, for threads 3/32″ to ⅝″ diameter.

Hardened and ground throughout, including cam surfaces and chaser pockets.

High speed chasers carried to full high speed hardening heat. Thread form of chasers ground and lapped—the logical counter-part of the ground tap.

High Speed Chasers only supplied.

JONES & LAMSON MACHINE COMPANY

Springfield, Vermont, U.S.A.

INDUSTRIAL NEWS

(Continued from page 150)

Canadian Oil Co., whose plant at Petrolia was recently destroyed by fire, will rebuild at once.

D. H. Howden Co., London, wholesale hardware dealers, propose the erection of a warehouse to cost $50,000.

Metal Stampings, Ltd., Toronto, report improved demand for stamped domestic goods. Orders well into the new year represent a fair volume. The plant employs thirty men.

Precision & Thread Grinder Mfg. Company, Philadelphia, wish to announce that F. Rodger Imhoff, formerly sales manager and consulting engineer of the company, is no longer connected with the present organization.

That the law respecting inspection of steam boilers be extended to include those used for agricultural purposes, was the recommendation of a jury that enquired into a fatality caused by a boiler explosion on a farm near Delhi, Ont.

Sarnia.—Because it is alleged that he failed to report arrears of money due the local Hydro, J. E. B. Phelps was recently dismissed as manager. He was, however, recently elected to Sarnia Hydro Commission over his opponent Jas. E. Crawford, who is said to have been primarily responsible for Phelps' dismissal.

In connection with the erection of their new machine shop, on which an expenditure of $1,500,000 is proposed, the following contracts have been placed: Steel: Canadian Bridge Co. Ltd., Walkerville; grooved wood block flooring, F. B. Goodman, Toronto; reinforcing and steel sash, Trussed Concrete Steel Co. of Canada Ltd., Walkerville.

EXTENSIVE POSTAL SERVICE

Ten Thousand Persons Are Employed By the Canadian Post Office Department

Over half a billion letters and post cards were carried by the Department in the fiscal year ended March 31st, 1922. In addition, the Department handled 350,000,000 newspapers, 50,000,000 parcels, and 250,000,000 circulars, making in all well over a billion missives carried for the Canadian public during the past fiscal year. The Department issued postal notes, and money orders to the value of $295,000,000, of which sum money orders represent $270,000,000 and postal notes the balance. Money orders issued and handled by the Department totalled 10,000,000; postal notes 6,000,000; Canadian orders issued on Great Britain 520,000; British orders issued on Canada 55,000; Canadian orders issued on the United States 680,000; and United States orders issued on Canada 340,000. In all 15,595,000 money orders and postal notes were issued and handled in the year ended March 31st, 1922.

Pittsburgh

(Continued from page 146)

ing containers for exported oil. The market is firm at $4.75 for 100-pound cokes.

Foundry Iron Prices Up

The demand from the east for Connellsville coke for domestic use has continued and has sent the price up farther, as high as $9.00 being paid on a lot of 25 carloads for eastern distribution, while a fortnight ago the market was easy at $6.50 for good grades of furnace coke. The eastern demand has cleaned up all coke, including some that was of doubtful value for metallurgical purposes. This outside demand has put the blast furnaces in awkward position, as they expected cheaper, not dearer, coke, when they sold foundry pig iron at $25 valley, for first quarter.

Partly on account of demand, partly on account of the bulge in coke prices, foundry iron is now up to $27 valley. One furnace interest succeeded in contracting for first quarter coke at not over $7.00, before the advance occurred, but others are left uncovered and faced with what is obviously a fancy price. Basic iron, which is offered by steel interests as well as merchant furnaces, is held at $24.50 valley, against some recent sales at $24.25. Bessemer remains at $27.50 at which price a few stray carloads have been sold.

Foundry coke is held at $8.50 to $9.00. Thus far foundries have not been buying to any extent, objecting to the sudden advance.

DELEGATES DISCUSS RECENT CONFERENCES

That much good must accrue to international trade from the recent Pan-Pacific Conference held recently at Honolulu, is the conviction of Thomas Roden, delegate of the Canadian Manufacturers' Association, who reported to a special meeting of the Ontario division. The session brought together a large number of manufacturers, and great additional interest centred in the report of W. C. Coulter, chairman of Industrial Relations Committee, who represented Canadian employers at the International Labor Conference at Geneva, Switzerland.

Mr. Roden pointed out that the object of the Pan-Pacific conferences, of which this was the fourth, was to bring the peoples of the Pacific ocean together to see in what way they might benefit by exchange of views. Countries represented were: Canada, Australia, United States, China, Japan, Corea, Salvador, Mexico, Fiji, Phillipines, Peru and New Zealand. Discussions were largely in the nature of reviews of important matters pertaining to the different countries, such as natural resources, railway facilities, hydro-electric development and education.

Proper regulation and development of natural wealth and resources of the different countries were considered, and also the means of co-operation, looking to proper use of facilities such as wireless for broadcasting information.

The lack of such information explained much of the antipathy evident in these nations toward western countries.

Discussed Labor Problems

W. C. Coulter, as the representative of Canadian employers at the the Geneva Labor Conference, said that, as part of the League of Nations, the functions of the conference had to do with the consideration of factors making for industrial peace. Resolutions were brought forward which, while not compulsory, were submitted for the serious consideration of member nations. Employers, employees and governments were represented.

The sessions this year had to do largely with a review of the work of former conferences, but certain changes were proposed that would have deprived Canada of her place on the executive body as a state of industrial importance, had it not been for the fight put up by Canadian delegates. Referring to the resolution endorsing the eight-hour day and 48-hour week, it was pointed out that only five nations out of 55 had so far ratified this basis of work.

European Conditions

As an observer of European conditions, Mr. Coulter stated that Canadian industry had few problems as compared with some of the countries overseas. A German delegate had told him that wages in his plant were, as a rule, adjusted upward every fortnight, and that the greatest increase had been 95 per cent. These increases were due largely to advances in living costs. When customers took from 30 to 60 days to make payment, it was evident that original values would increase from 25 to 50 per cent. between the time of production and time of payment. Yet German industry seemed to be making headway under these precarious conditions.

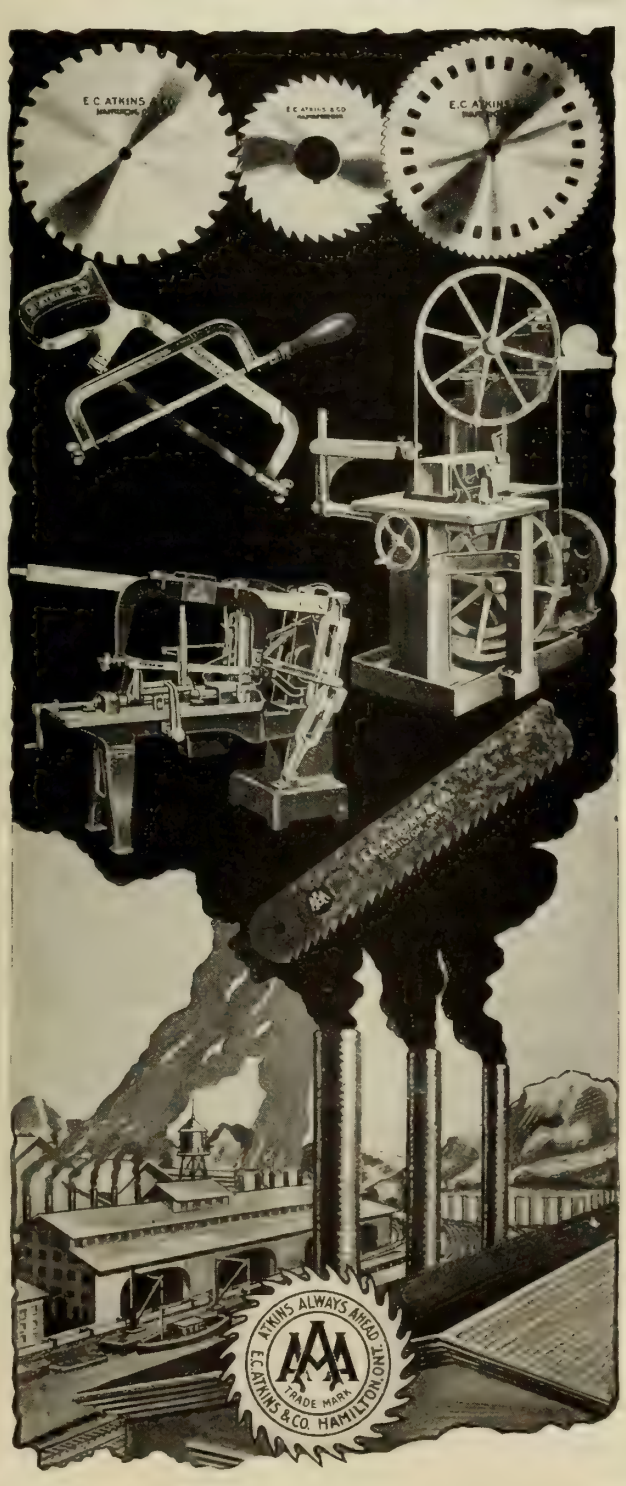
In Switzerland, conditions were not much better. Exchange was high and export business beset with difficulty. There was considerable unemployment. In Holland also, exchange was high. Domestic trade was very bad. The market was flooded with German goods. Because of this the cost of living was very low, but exports were booming.

In France there was no unemployment. Exchange was about one-third normal. Industrial conditions were good and people from other countries are being brought in to relieve labor shortage. Two-thirds of the French people are on farms.

As to deductions from these conditions, Mr. Coulter said he preferred not to express himself. He described them for what they were worth.

ATKINS

METAL CUTTING SAWS



METAL SAW ECONOMY

To successfully cut iron, steel, brass, copper, pipe and tubing, meansthatsaws should be selected which have been designed specially for the work.

When buying Atkins Metal Cutting Saws, Hack Saw Machines, Hack Saw Blades and Metal Bands, you will make no mistake if you use as your guide our new book.

The Saw In The Shop

Sent free on request to Purchasing Agents, Millwrights, Master Mechanics, Superintendents, and Shop Foremen.

It contains valuable and useful information not only pertaining to saws, but covering short cuts and hints. Write for your copy today.

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Established 1857. The Sterling Quality Saw People

Factory **HAMILTON, ONT.**

Branch House **VANCOUVER, B.C**

"A Better Saw For Every Use"

Necessity of First Aid in Industrial Plants

IN THE early days, before Canadian industry became as highly-organized as it is today, accidents of both minor and major importance were of frequent occurrence. The unfortunate victims of these accidents did not receive prompt attention. Often a workman who received a small scratch contracted blood-poisoning as the result of the scratch being infected before medical attention was received. The result of such accident was that the workman was off for weeks without pay, and the employer was deprived of his services for that lengthy time. As time went on both employers and employees recognized the necessity of prompt attention to workmen's injuries, and saw that legislation should be provided which would be beneficial to both parties.

In the year 1915 the Workmen's Compensation Act was passed by the Ontario Legislature. This Act provides that a workman who receives injury while at work that necessitates his absence from business for a period of 7 days or more shall receive compensation from the Workmen's Compensation Board. The board receives its monetary requirements from a tax levied upon the employers in the industries in which the accidents happen. This Act in itself is enough to show the necessity for first aid, as the fewer the number of accidents and the less serious are results of them, the less money employers and board alike require to pay.

Herewith are a few figures regarding accidents, taken from a report issued by the chairman of the board in April of this year. In an industrial army of about 450,000 workmen, 45,191 accidents were reported in 1921—386 of them fatal. There were 272,000 accidents—2,784 of them fatal—during the 7 years' operation of the Act, which is a total equal to the population of Hamilton, Ottawa and Windsor.

Might Have Minimized Trouble

Many of these accidents might have been prevented, and a large majority of those attended by fatal results might have been minimized had the victims received first aid promptly. A large number of minor injuries, such as cuts, wounds, scratches, skin abrasions and burns become dangerous through infection. Were these slight accidents promptly reported to a first aid officer for attention, they could be properly sterilized and disinfected, and the dread blood-poisoning averted. The figures respecting blood-poisoning cases are startling. From six to nine per cent. of all industrial accident cases have infection at some stage. In 1920 the nine per cent. of blood-poisoning cases included 56 cases of joints immoblized by infection, and no less than 24 deaths due to infection. This is a terrible toll and surely calls for drastic measures.

We have spoken of promptly reporting accidents, even of slight nature, to a first aid officer, who should be an employee trained in the first aid course. His duties should be to keep the first aid kit up to standard; to give prompt and efficient application of first aid, should an accident occur. The best first aid man, of course, is the surgeon himself, and first aid work by the layman should be restricted to immediate stopping of hemorrhage and transportation. After that he should be taken care of promptly by some man who can follow through the courses. The experience of industries who have a man on the staff who can follow the patient in the hospital is that results are better, the man is back to work to work earlier, and he is also happier. Experience also shows that long convalescence means a loss of morale, the idleness in long convalescence produces all sorts of neurotic conditions. In this respect the patient's own activity is often more beneficial for actual recovery than other method of treatment. To bring this about there should be co-operation among employer, surgeon and employee to secure for the man favorable tasks for each period of convalescence.

It is well known that a small percentage of industrial plants have the necessary first aid equipment. To those employers who have not yet supplied their plants with first aid kits or first aid rooms, the Act requires that all plants having 15 workmen and less than 300 shall provide suitable first aid kits, and where more than 300 are employed a suitable first aid room must be maintained in charge of a clerk, workman or nurse, who has taken a recognized course in first aid to the injured.

The Industrial Accident Prevention Association, Toronto, has done much to make information available with reference to standard equipment and the operation of first aid rooms.

EMPLOYMENT STATISTICS FOR INDUSTRIAL GROWTH

(Continued from page 140)

two principal metal mining districts in Canada. The decreases so reported have been about 5 cents per hour in most cases, averaging about 5 per cent.

Time Lost On Strikes

The following table shows the number of strikes reported as having occurred in certain selected industries during the first ten months of 1922, together with the number of workers involved and the approximate time loss in working days. Owing to strikes in the coal mining areas of Nova Scotia and Alberta the time loss in these selected industries was much greater this year so far than during the whole year of 1921, when less than 8,000 workers were involved in strikes with a time loss of only 210,000 working days.

The table also gives the total strikes, etc., for all industries, from which it will be seen that nearly two-thirds of the total time loss occurred in the coal mining industry.

Strikes in First Ten Months of 1922

Industry	No. of Disputes	No. of employees	Time loss in working days
Manufacturing iron and steel products:			
Crude, rolled and forged products	1	16	4,080
Steel, shipbuilding and repairing	2	1,370	8,690
Others	4	53	153
Lumber and its products:			
Rough and dressed lumber	1	8	112
Logging	1	150	1,350
Mining:			
Coal	9	23,577	1,199,579
Construction and Maintenance:			
Building	21	1,831	39,667
Railway	3	99	873
Canal	1	40	240
	43	27,144	1,254,744
All other industries	39	12,339	610,308
Total all industries	82	39,483	1,865,052

An analysis of the principal causes of the strikes in the industries selected and the manner in which they were settled will be of interest:

Cause	Employees	Time loss (days)
For increased wages	**15,306**	**267,277**
In favor of workpeople	236	1,488
In favor of employers	717	7,435
Settled by compromise	14,353	258,354
Against reduction in wages:	**9,605**	**976,082**
In favor of workpeople	7,904	938,968
In favor of employers	760	26,743
Settled by compromise	326	8,646
Indefinite, unsettled	615	1,725
Other causes	**2,233**	**11,385**
	27,144	**1,254,744**

Are You Prepared for Accidents?

NO MANUFACTURING plant is free from accidents. Accidents happen in the best of regulated plants despite any number of safety devices. Take whatever precautions you may there comes from time to time the necessity for treating persons in your employ who have suffered from accident—or sickness—and who require immediate attention.

Have you the facilities for giving relief to the injured or sick workman? For your own protection and the protection of your employees a "first aid" department should be installed in your plant.

Our experience in the fitting out of plant hospitals and smaller "first aid" rooms is extensive, and we know exactly what to suggest for the nature and size of plant. Nothing is too large or small for us to handle.

Take for example the photograph shown. Here is a very neat, inexpensive hospital installation, which we can place in your factory at a very low cost.

Write us for full particulars.

The J. F. HARTZ CO.
LIMITED
24-26 Hayter Street, TORONTO, ONT.

Classified Opportunities

Two cents a word, including "Canadian Machinery" box numbers; minimum charge is $1.00 per insertion for 50 words or less, set in 6-pt. type. Each figure counts as a word. Display ads., or ads. set in border, are at the card rates.

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TORONTO PATTERN WORKS, 65 JARVIS Street, Toronto. Patterns in wood and metal for all kinds of machinery. (ctfm)

BRANTFORD PATTERN WORKS ARE PREpared to make up patterns of any kind—including marine works—to sketches, blue prints or sample castings. Prompt, efficient service. Bell 'Phone 631; Machine 'Phone 733. Brantford Pattern Works, 49 George St., Brantford, Ont. (ctfm)

POSITION WANTED

PRACTICAL AND VIGOROUS FACTORY EXecutive desires a change. Is now employed as manager in charge of office and mechanical ends. Highest references, character and ability. Apply Box 820, Canadian Machinery. (C.22M).

WANTED

WANTED — THE FOLLOWING TOOLS IN good condition: 5 H.P. Motor; 26 in. Disc Grinder; 18 in. Lathe, Hollow Spindle; 20 in. Upright Drill Press; Small Sensitive Drill; Small Milling Machine; Pedestal Grinder. Box 823.

WANTED—ONE SECOND-HAND ELECTRIC blue printing outfit. John T. Hepburn, Ltd., 18 Van Horne St., Toronto, Ont.

WANTED—200 to 300 H.P. 3 phase, 25 cycle, 550 volt, belt driven Generator set, used equipment preferred; must be in good working order. Box 821, Canadian Machinery.

WANTED

SCRAP ENDS

STEEL PLATES 9, 10, 11 Gauge

Carloads or less. Suitable for making Iron Washers.

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Toronto

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Japanning Oven Electrically Heated

Size Over All: Height, 60" Width, 36" Depth, 57"

500 lbs. dead weight, will reach temperature 370 deg. F. in 1 hour.

Core Ovens—Swing door type, 5 shelves or sectional wall construction.

24" Kernchen Siphonage Ventilators—Special price, made of Toncan galvanized iron.

Double ball bearing casters with 4" single wheels. The best truck caster made and with an easy swivel.

Fully illustrated catalog on application.

Industrial Ovens of all kinds—Heated by Gas, Electricity, or Fuel Oil.

The Brantford Oven & Rack Co., Limited

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THE OLD ESTABLISHED FIRM. PATENTS everywhere. Head Office, Royal Bank Bldg., Toronto. Ottawa Office, 5 Elgin St. Offices throughout Canada.—Booklet free.

FETHERSTONHAUGH & CO.

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WELL-RATED AND LIVELY MANUFACTURing company is desirous of locating in a prosperous Ontario city or town, where private or municipal financial assistance could be obtained. Have plenty of plant and collateral assets, good market and plenty of orders. Rigid investigation invited. Box 822, Can. Mach.

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Light and Medium-Bench and Floor Repetition Castings; Capacity 15 tons per day.
Expert Metal and Wood Pattern Work. Our advice and estimates will save you money.
Semi-finishing operations on Lathe or Grill on Castings supplied if required.

ASK US.

THE KATIE FOUNDRY, GALT, ONT.

GRINDERS and SPECIAL MACHINERY

We make a complete line of Bench and Floor Grinding Machines, equipped with Patented Adjustable Guards and Tool Rests, and Special Mounting Means. We also design and manufacture special machinery for any purpose. Let us have your enquiries.

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7 St. Mary St. - Toronto, Ont.

ELMES HYDRAULIC

Presses, Pumps, Accumulators, Valves, Fittings.

CHARLES F. ELMES
Engineering Works,
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We have just taken over the Smith Invention's complete line of Welding and Cutting apparatus with a full line of miscellaneous welding supplies.

Write us for full particulars.
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RUBBER MILL MACHINERY

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Air Pressure Tanks, Air Receivers, Steel Plate Tanks, Pneumatic Tanks, Tote Boxes, Shop Barrels, Steel Factory Equipment, Smoke Stacks, Gasoline Tanks.
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FOR SALE

RICARDO PETROL ENGINES 100 h.p 4 cyl. 150 h.p. and 225 h.p. 6 cyl. 300 h.p. 12-cyl. complete and brand new. Suitable for marine stationary or tractor work or anywhere where hard use is required. Price 30 - per horse power, London. Full particulars, SYKES, PATCHING, SUSSEX, ENGLAND.

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We have a complete Belknap Equipment for sale. This equipment is still in use in our Subscription Department and is in excellent working order. We have placed an attractive price on this outfit, and would advise manufacturers or merchants having a mailing list to let us tell you how it will save you money. We will give a guarantee as to the proper working condition of this equipment.

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TAYLOR SAFES FOR SALE—RARE OPPORtunity to secure a safe at small cost. They are in splendid condition. Inside dimensions and prices are as follows: 15" deep, 2 ft. 6" wide, 3 ft. 11½" high, fitted with built-in compartment. Price $250.00. 18" deep, 2 ft. 8" wide, 4 ft. 5" high, fitted with steel compartment. Price $200.00. Apply Box No. 817. Canadian Machinery.

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COSTS LESS AND GOES FARTHER

Oil Tempered Steel Springs

for every purpose and the best for each use.

Special styles of all kinds to order.

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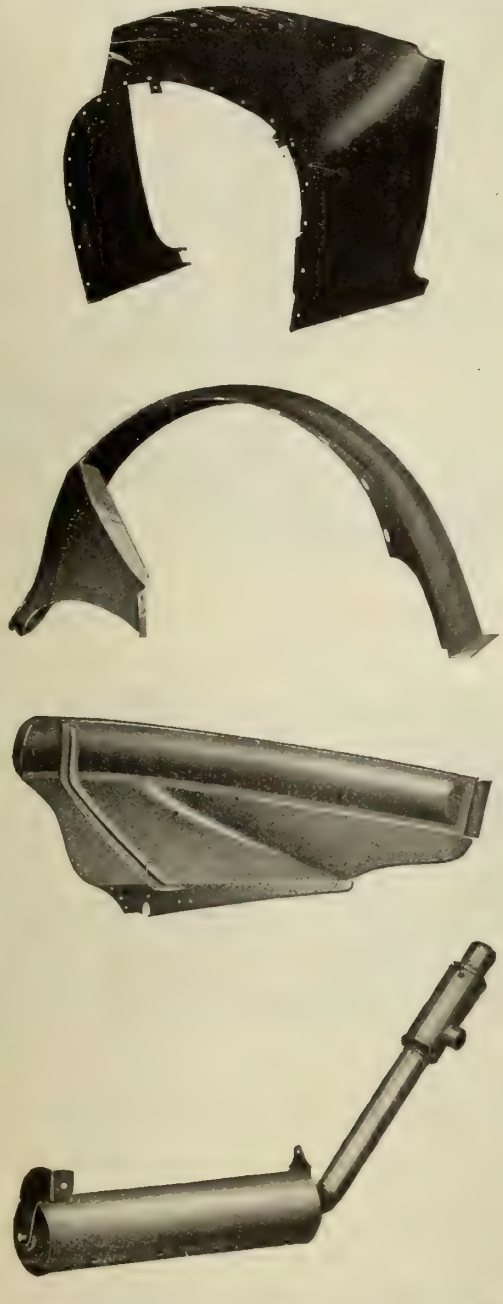
For Everything in
STEEL STAMPINGS



There is no stamping operation too large or complicated for Pedlar Stamping Service. In equipment and personnel our stamping plant is equal to everything.

We have a special department for automobile body stampings in which the sheet steel bodies of many of the best-known cars are manufactured.

Our success in this difficult work is an indication of our ability to handle any conceivable problem in sheet steel stamping.

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Stationary Head Drilling Machine

24"-26"-28" Swing

Power! Speed! Easy Running!

THREE step cones, generous ratios of driving gears provide plenty of power for the various classes of work you may require to do on this sturdily built Sibley.

Speeds and feeds are selective and cover the range of machine thoroughly. Die cast bushings of high quality antifriction metal on main drive bearings with improved oiling devices insure easy running and low maintenance cost.

Canadian manufacturers are advised to investigate this Sibley tool in the interests of economy and efficiency.

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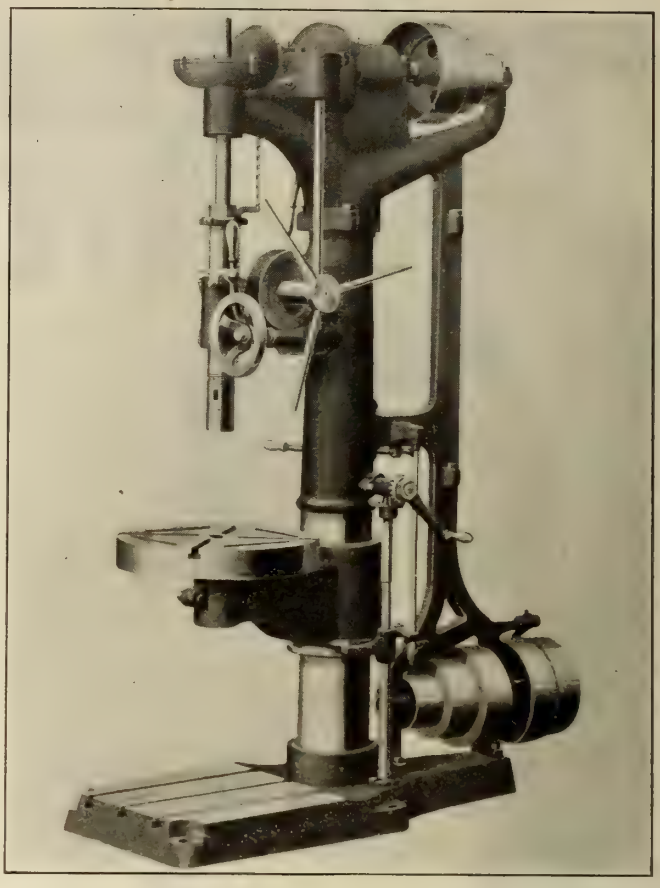

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Combination Bench Lathe, Milling and Drilling Machine.

The most universal machine for small work. Occupies less space and costs 1/3 as much.
The many interesting features of the Triplex are described in our Circular M. Send for it.

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Many interesting applications of the continuous method to the field of industrial heating are shown in **Bulletin 234-T.** Write for copy.

BETTER HEATING
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INDUSTRIAL FURNACES
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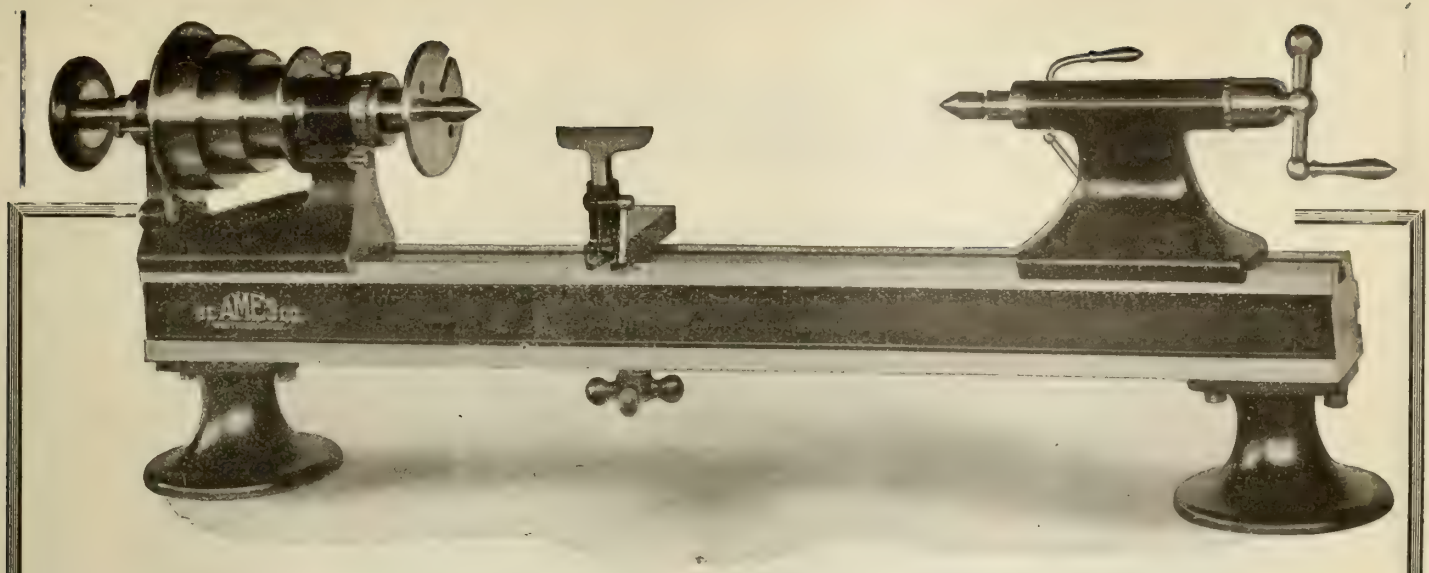

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A PRECISION TOOL *for* PRECISION WORK

In this Lathe the maximum of utility is obtained with the highest degree of accuracy

CONSTRUCTION—Only the best quality of workmanship and materials enters into the construction of this Lathe. Everything is made to standards, thereby insuring absolute interchangeability of parts.

FIXTURES—Through our line of special interchangeable fixtures, this Lathe is a production tool capable of doing speedily and accurately turning, drilling, grinding, milling, and thread cutting, either straight or at any angle. We carry a good supply of fixtures in stock on which we can make immediate delivery. Each lathe and all fixtures are carefully tested before they leave the factory and their accuracy is guaranteed.

AMES LATHES are daily turning out work in factories all over the world. Wherever they are used they give universal satisfaction.

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Bench Lathes, Bench Milling, Drilling, Tapping, Filing Machines and Dial Gauges

B.C. AMES CO.
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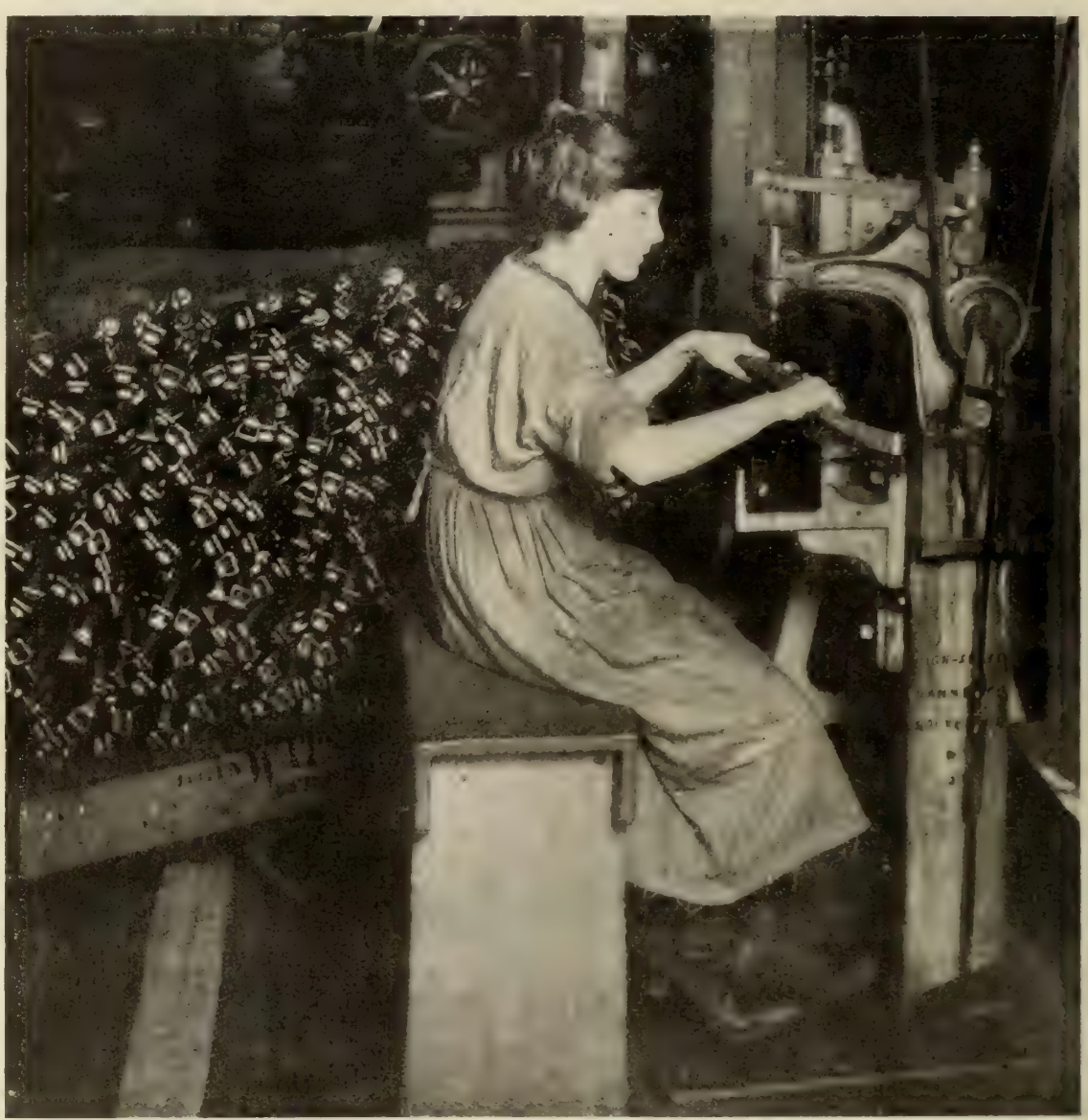
Lower Production Costs with



ANOTHER example of High Speed Hammer production in a Canadian plant is shown in the illustration above. The operator is shown rivetting harness parts (hames) in the plant of the McKinnon Industries, of St. Catharines, Ont. Note the pile of work this operator has completed. Realize how long it would take to do this work by hand. Not speed in production alone, but the almost complete elimination of spoiled work resulted when this plant installed High Speed Rivetting Hammers—twelve of them in use here.

THE HIGH SPEED HAM

ROCHESTER,

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High Speed Riveting Hammers

HERE are two illustrations of High Speed Hammers at their cost-cutting work in Canadian plants. These tools are demonstrating every work-day of the year that the High-Speed-Hammer way of rivetting long run jobs is the only way to keep production costs down to the irreducible minimum.

A remarkable feature of High Speed Hammer Rivetting lies in the fact that it gives production speed as well as first quality finish.

The illustration on this page shows a High Speed Hammer in the plant of the International Business Machines Company, of Toronto. The operator is "whistling" through parts of a recording machine. The quality of the rivetting must be of first quality--and the High Speed Hammer can always be depended upon to deliver the quality desired.

Have us advise you on the adaptability of High Speed Rivetting Hammers to your class of work

MER COMPANY, Inc.

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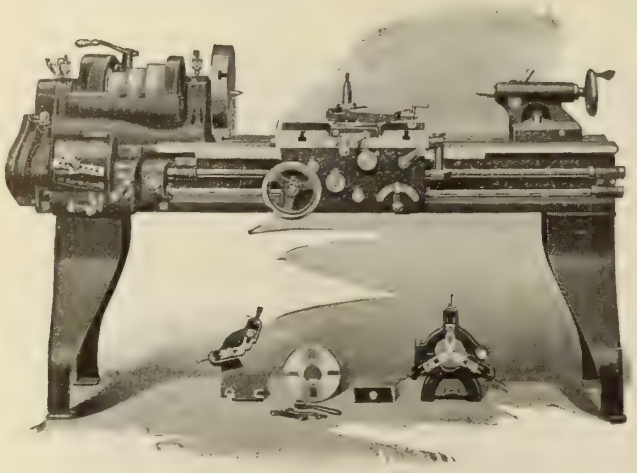
Small in Size but Big in Capacity



All Rockford machines are built in multiple lots, on the jig system, and all parts are completely interchangeable.

The
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has many features that make it an ideal lathe for the tool room, general repair work, etc., where rapid production and accuracy are essential. Though small in size it also is of sufficient weight and power to meet the demands of the up-to-date manufacturing plant.

It has 32 changes of threads and speeds through sliding steel gears and hardened steel clutches. Extra gears may be substituted on the quadrant, giving an almost unlimited range.

The Rockford "Economy" is built in 12, 14, 18 and 22-inch sizes. **Write for complete description.**

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These firms know it pays to use "Stellite"
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"THE MASTER METAL"

GALT

Malleable Iron Castings

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There's no doubt about the strength of Galt Malleable Iron Castings. Thorough tests are made to prove their quality.

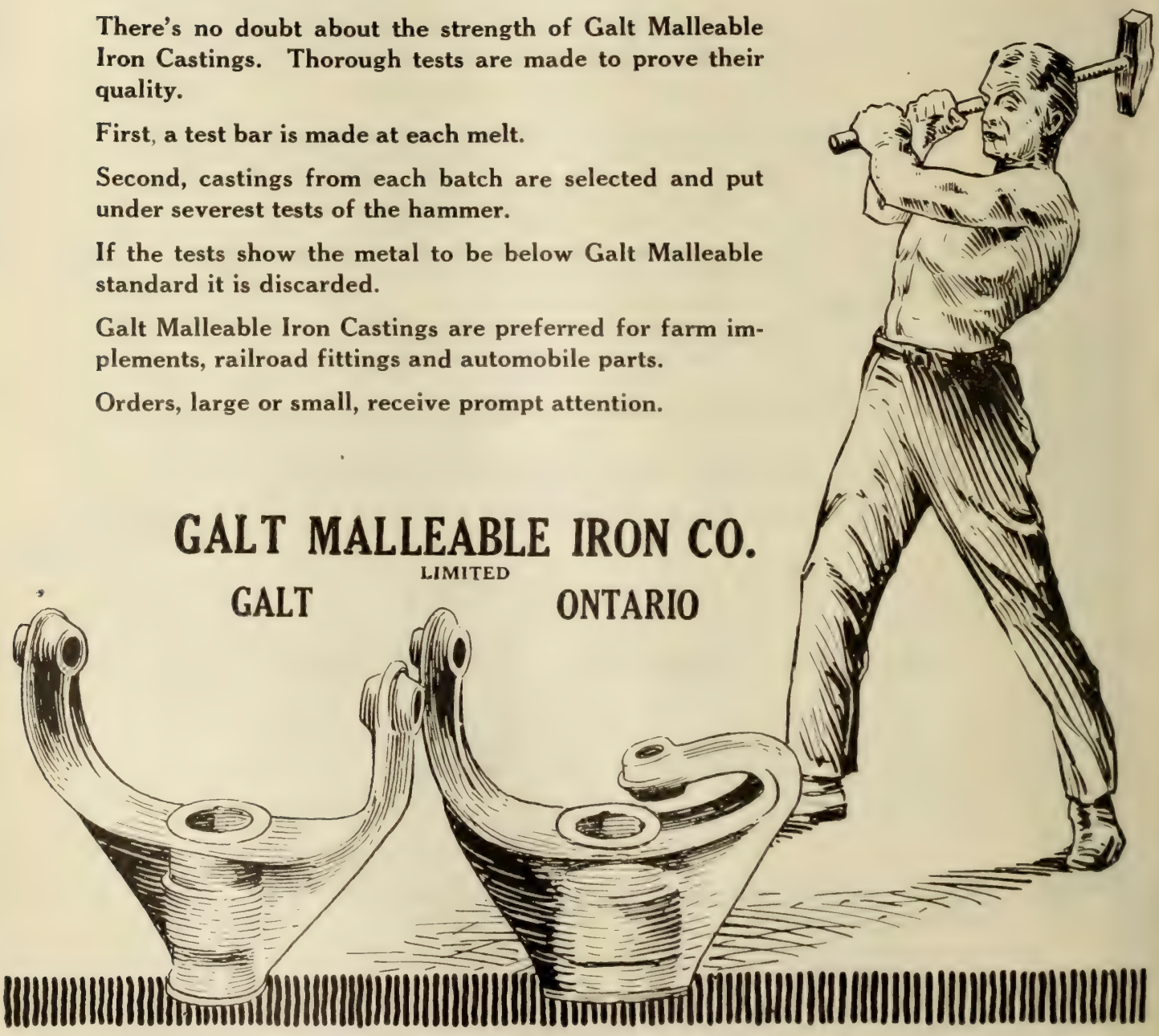
First, a test bar is made at each melt.

Second, castings from each batch are selected and put under severest tests of the hammer.

If the tests show the metal to be below Galt Malleable standard it is discarded.

Galt Malleable Iron Castings are preferred for farm implements, railroad fittings and automobile parts.

Orders, large or small, receive prompt attention.



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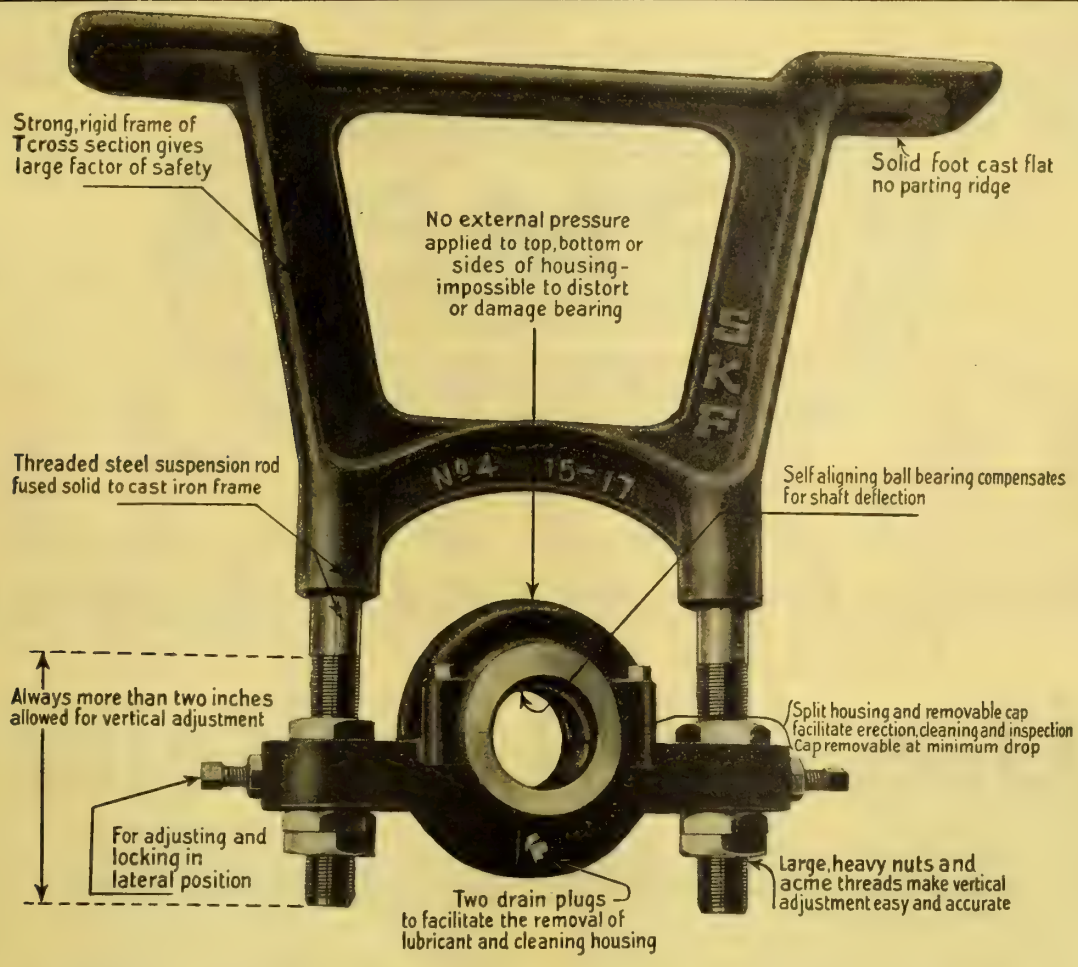
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THE "RED RIBBON" BELT
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Minimize Breakdowns and Readjustments

Use "PMS" Belts

THE "RED RIBBON" BELTING

Practically eliminating "breakdowns" and adjustments means continuous production with all the benefits of increased sales and revenue.

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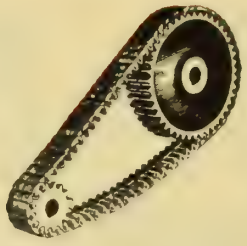

A Fact which means Minimum Power Losses and Maximum Production

RENOLD
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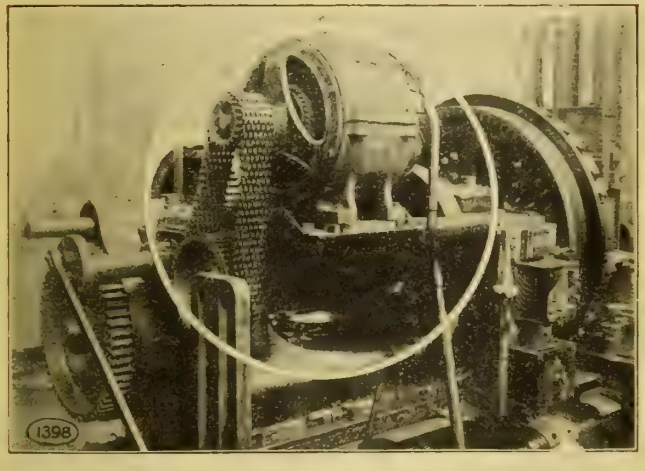

20 H.P. "Renold" Silent Chain Operating 36 in. Lathe.

Positively
the most
COMPACT
EFFICIENT and
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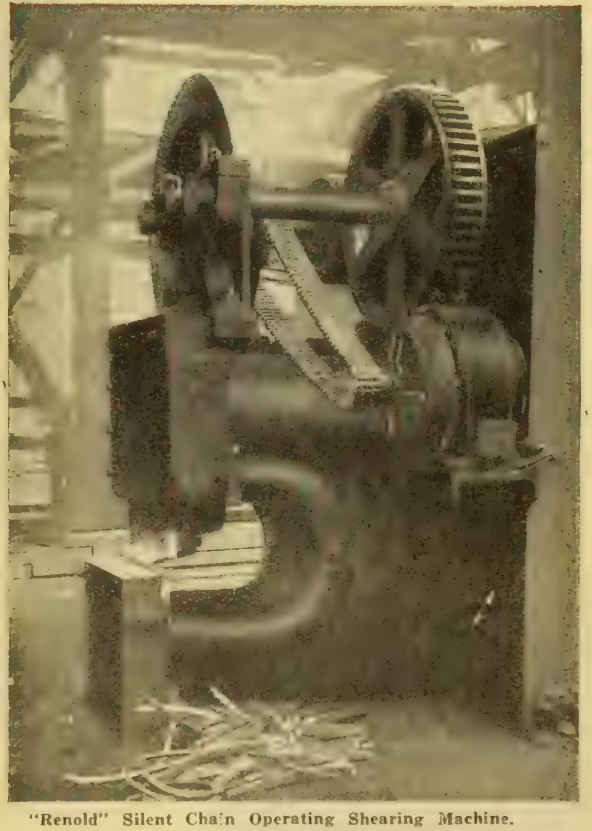
means of transmitting power to Machine Tools and Lineshafts.

Write for our Booklet Ref. No. 0008, "Chains and the Machine Tool."



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Our Engineering Service is at your Immediate Disposal

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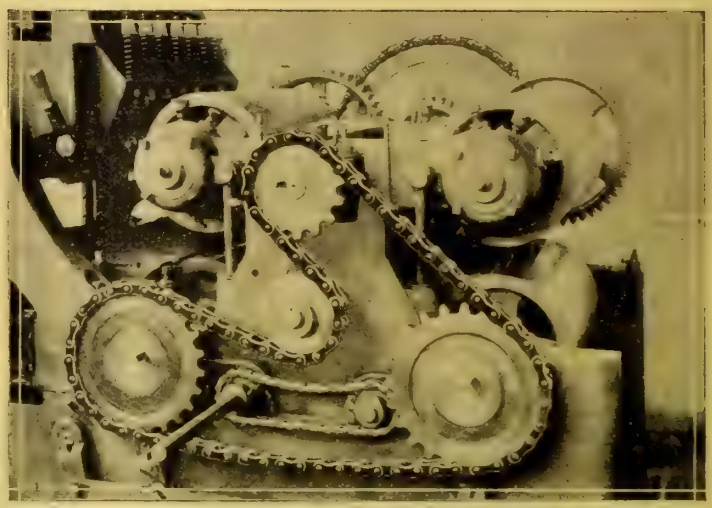
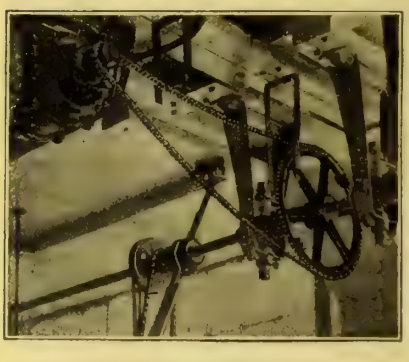
DIAMOND
Chains and Sprockets

Photo at right shows section of a P. B. Yates Wood-Working Machine, with DIAMOND Chain Drives.

Below are listed a few of many other applications in which these drives are used:

Baking Machinery
Canning Machinery
Mining Machinery
Dairy Machines
Agricultural Machines
Machine Tools
Paper Making Machines
Textile Machines
Wood-Working Machinery





More and more factories are using overhead chain drives from motor-to-line shaft.

On Taylor Automatic Stokers, Diamond Chain Drives run in oil-tight cases.

Drive It With Diamond Chains and Sprockets

For practically every place where power-transmission units are used—whether for light, high-speed electric motors, or for slow, heavy-duty machines—DIAMOND Chains and Sprockets make dependable drives that give efficient service at low yearly cost.

They save power and speed up production, because slippage is eliminated and friction reduced. They avoid shutdowns and costly repairs, by giving steady, trouble-free service. They are used extensively for power transmission and conveying purposes by mills, mines, factories, canneries, power plants, railroads, etc.

DIAMOND Chains are made from strong, durable steels, accurately machined and heat-treated by correct methods. There are fifty standard chain models in the DIAMOND line—ranging from ⅛ to 1¼ inches in width, and from ⅜ to 2 inches in pitch. This variety of sizes will meet practically all requirements. DIAMOND Sprockets are made in types and sizes to suit individual drives. Our sprocket department is in position to give to you unusually attractive prices on your sprocket specifications.

Let our engineers aid you in solving power-transmission problems, and in selecting suitable chains and sprockets for your drives.

"Useful Data on Diamond Chain Drives"

This handy, loose-leaf book is valuable to every engineer and designer. It gives simple rules for choosing the correct chain and sprockets for each drive. You'll find it of real help. Your free copy is ready—write for it NOW.

DIAMOND CHAIN & MFG. COMPANY, Indianapolis, Indiana, U.S.A.

Makers of High Grade Chains and Sprockets Since 1890

If interested tear out this page and place with letters to be answered.

12½ Machine Hours Lost

Each Time This Belt Was Laced By Hand

In a Michigan factory (send for the name) where 25 machines are driven from a single shaft, a broken belt means 25 idle machines. Lacing the belt by hand took 30 minutes and wasted 12½ hours. Now the Clipper method saves 10 of these 12½ hours.

Today one man and a thirty-six dollar Clipper machine instead of four millwrights, take care of the 1600 belts in this plant—light and heavy duty and high speed belts of leather and composition from 2" to 12" wide. Due to the speed the Clipper method and the superior strength and longer life of the Clipper joint, the company's books show a ***clear saving of $2500 a year over*** the obsolete way of hand lacing.

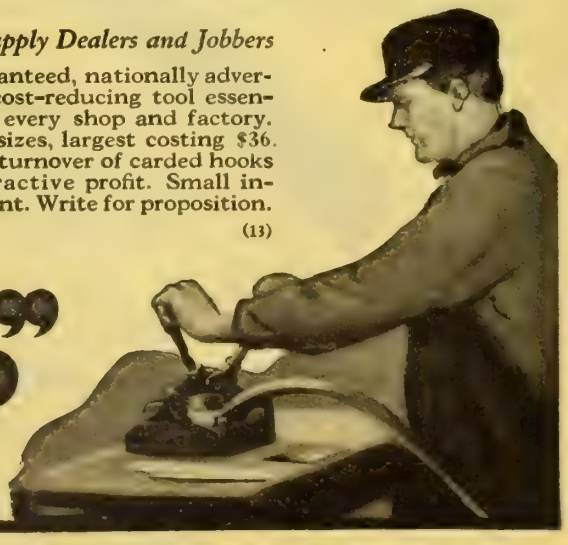
Based on a large number of belts, this total figure is exceptional. Yet our files contain equally convincing reports on the experience of hundreds of Clipper users, large and small. Authentic data has been gathered from busy officials to convince executives that maintenance costs ***will come down*** wherever the Clipper is used. A letter or postcard will bring it to you without cost.

CLIPPER BELT LACER COMPANY
Grand Rapids, Michigan, U. S. A.

Mill Supply Dealers and Jobbers

A guaranteed, nationally advertised, cost-reducing tool essential to every shop and factory. Three sizes, largest costing $36. Rapid turnover of carded hooks at attractive profit. Small investment. Write for proposition.

(13)



Anyone can lace a belt with the

"Clipper"

If what you need is not advertised, consult our Buyers' Directory and write advertisers, listed under proper heading

YOU MUST HAVE-- BABBITT METAL

that can be depended on.

Because—

our products bear this reputation they are being used extensively from coast to coast.

HARRIS HEAVY PRESSURE

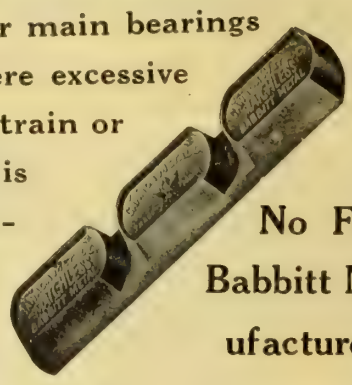
The BABBITT METAL—

unequalled for all General Service and of such high quality that it can be employed in many cases where a Genuine Babbitt has been used

without a fault

IMPERIAL GENUINE

For your main bearings and where excessive shock, strain or friction is encountered.



No Finer Babbitt Manufactured

CANADA METAL CO. LIMITED

Winnipeg Hamilton — TORONTO — Montreal Vancouver

Steel—and Light

STEEL gives strength—*greater strength.* But scientifically fabricated steel is *light.* This combination in the "American" Pulley insures the delivery of *all* the available power with the *minimum* of bearing friction or other waste.

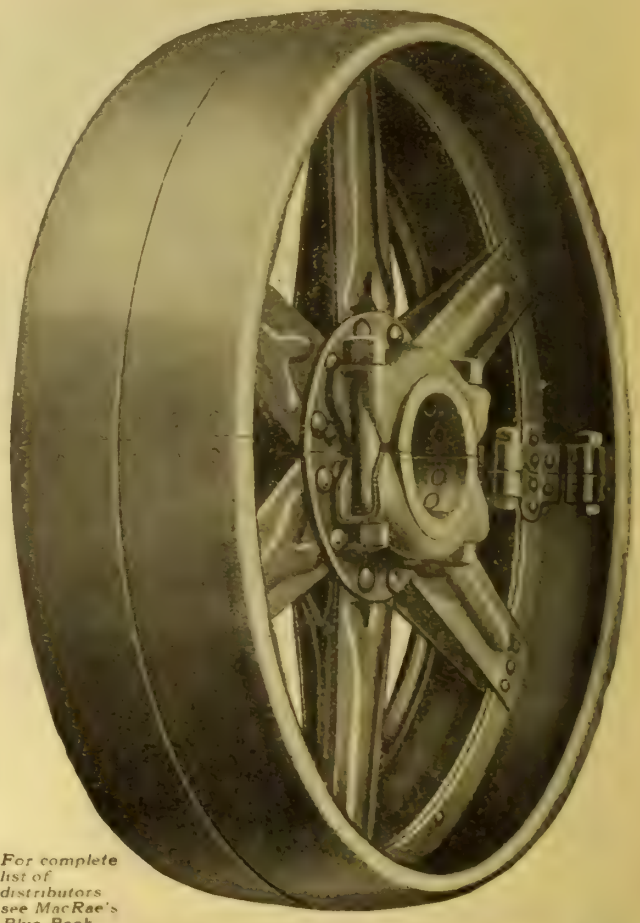
"American" Pulleys are *split*—which means quickest installation with least interference.

These two principal characteristics combined mean maximum pulley efficiency. Write for free book giving all details.

The American Pulley Co.

Manufacturers of Steel Split Transmission Pulleys, Steel Sash Pulleys and Pressed Steel Shapes

Philadelphia, Pa.



For complete list of distributors see MacRae's Blue Book

AMERICAN STEEL SPLIT PULLEYS

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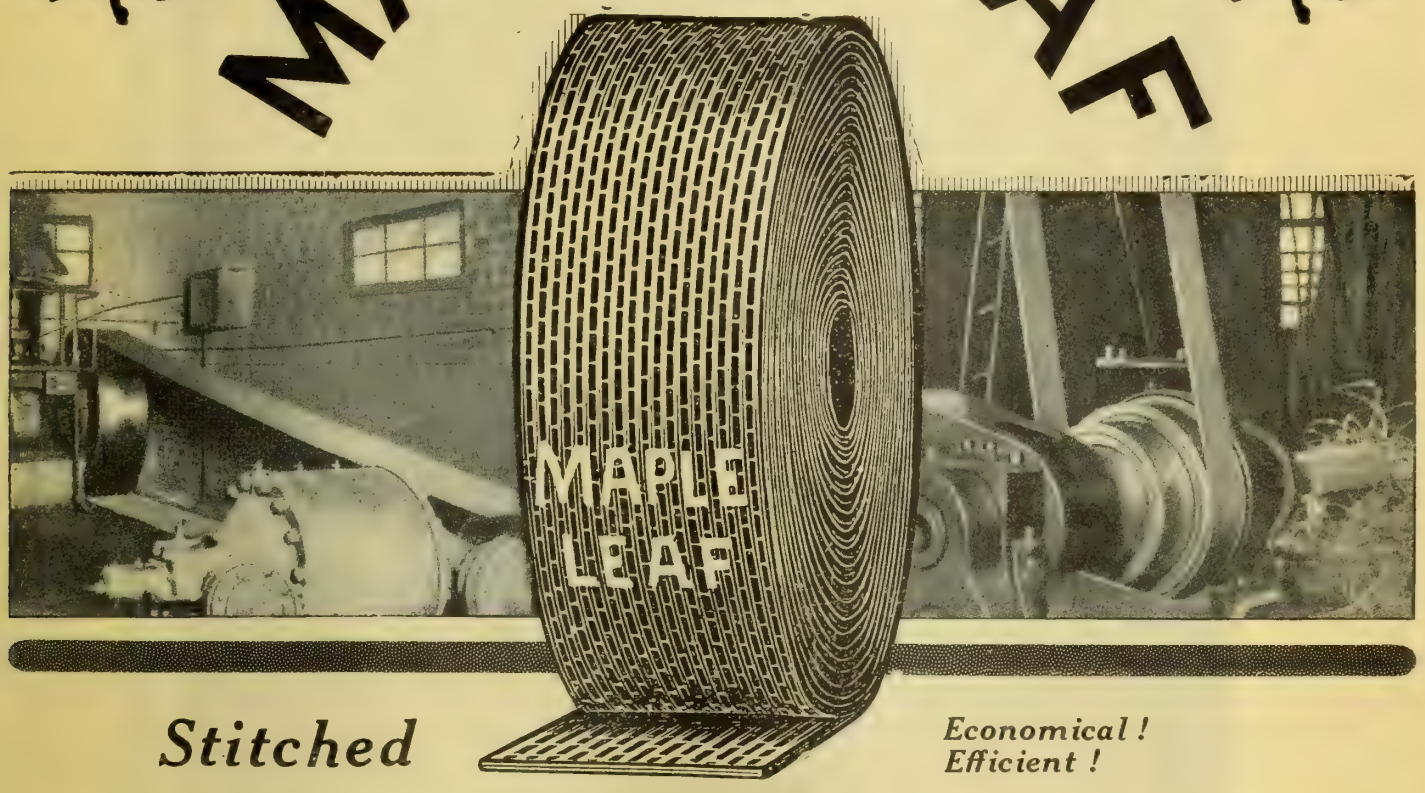
MAPLE LEAF BRAND



Stitched

Economical !
Efficient !

Cotton Duck Belting

Costs Less Than Leather, Rubber or Balata

FOR transmission of power or conveying purposes, Maple Leaf Brand Belting is as efficient as any belting you can buy. It costs less than leather, rubber or balata. Figured on a basis of "service per dollar," it is the best belting buy on the market. It is strong, durable, economical, efficient and true running. Satisfied users throughout Canada will verify these statements. We will gladly send samples and prices on request.

MAPLE LEAF DRESSING—BEST FOR ALL BELTS

Maple Leaf Belt Dressing does not contain resin, mineral or animal oils or other ingredients harmful to belts. All belts should have an occasional application of a reliable dressing in order that the best results be obtained. We recommend Maple Leaf Belt Dressing as the safe and sane treatment.

Dominion Belting Co., Limited

HAMILTON, - CANADA

Quebec Branch--51 Duluth Building, Montreal

CHAIN YOUR MOTOR TO YOUR MACHINE

Flexible as a Belt—
Positive as a Gear—
More Efficient Than Either.

PERFORMANCE proves Link-Belt Silent Chain to be the ideal method of transmitting power. With it you can transmit practically the full power of the motor – without slip. 98.2% efficient on actual test, is its record. It is compact, positive, permitting the location of the machine where maximum efficiency dictates. It saves space by permitting motors to be closely coupled to machines, with drive at short centers. Because of its positive, uniform application of power, production is increased, and the product is often bettered.

1065

LINK-BELT
SILENT CHAIN DRIVES

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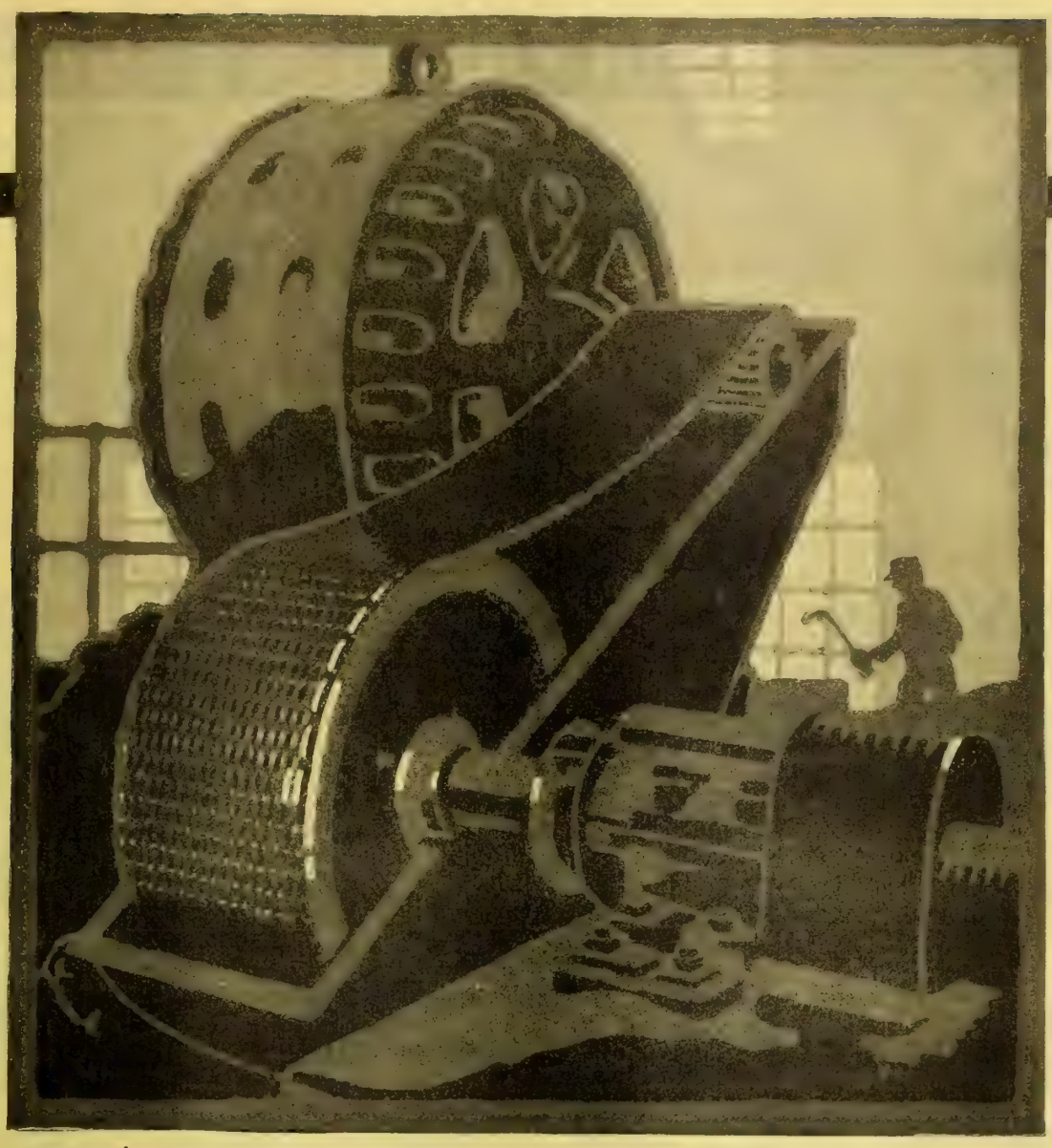


TRANSMIT POWER AT HIGHEST EFFICIENCY

In short, Link-Belt Silent Chain has the advantages of both flat belts and gear drives; without their disadvantages. It is "Flexible as a Belt—Positive as a Gear—More Efficient than Either". Get in touch with our experienced power transmission engineers, or send for our Price-List Data-Book No. 125—giving prices and full particulars.

Look for the Name on the Washers,

Look for the Li[illegible]ers in the Joints.

CANADIAN LINK-BELT COMPANY, LIMITED

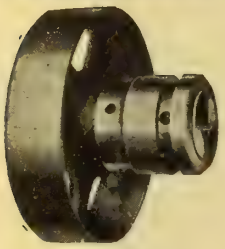
TORONTO—Wellington and Peter Streets MONTREAL—10 Gauvin Lane

1065-A

LINK-BELT
SILENT CHAIN DRIVES

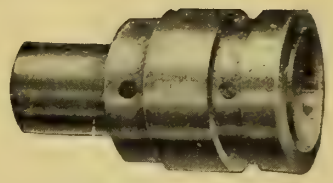
If what you need is not advertised, consult our Buyers' Directory and write advertisers, listed under proper heading.

THE JOHNSON FRICTION CLUTCH



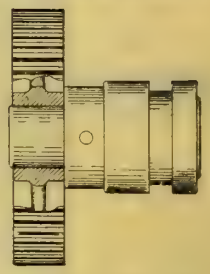
Single Clutch with Fulley

A SMALL COMPACT CLUTCH



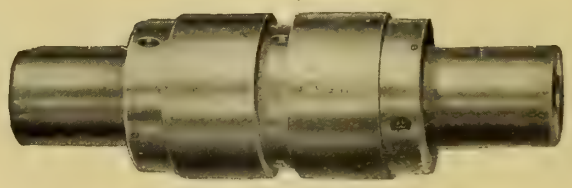
Single Clutch Exterior

BUILT FOR MEDIUM AND LIGHT POWER ONLY



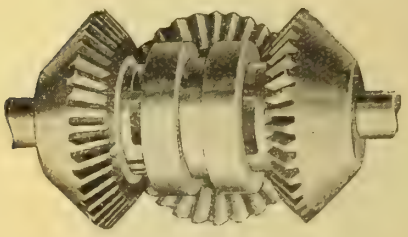
Single Clutch with Spur Gear

A RELIABLE CLUTCH



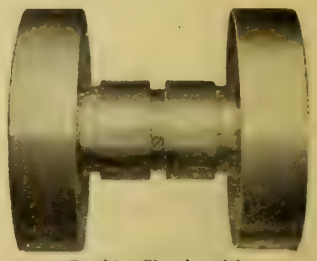
Double Clutch Exterior

A DURABLE CLUTCH



Double Clutch in nest of Bevel Gears

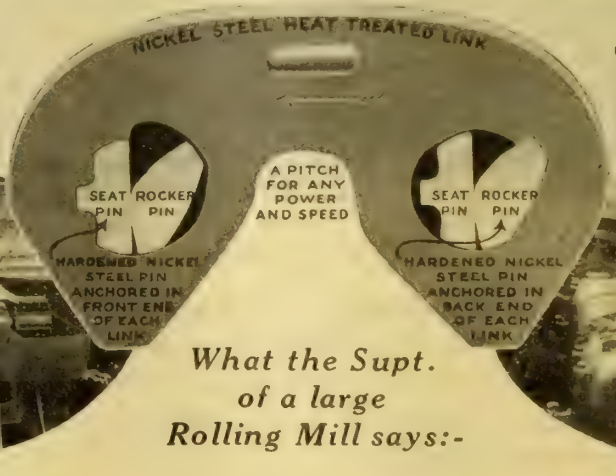
WRITE FOR YELLOW CATALOG

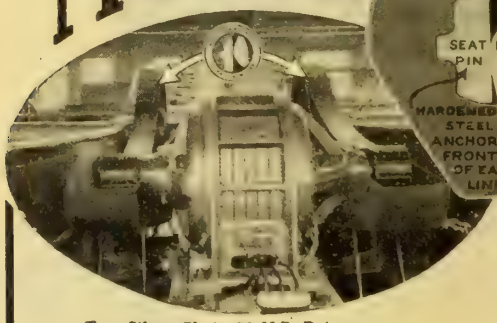


Double Clutch with Pulleys

THE CARLYLE JOHNSON MACHINE CO. MANCHESTER CONN

MORSE DRIVES


NICKEL STEEL HEAT TREATED LINK
SEAT PIN
ROCKER PIN
A PITCH FOR ANY POWER AND SPEED
SEAT PIN
ROCKER PIN
HARDENED NICKEL STEEL PIN ANCHORED IN FRONT END OF EACH LINK
HARDENED NICKEL STEEL PIN ANCHORED IN BACK END OF EACH LINK



Two Silent Chain 80 H.P. Drives

300 H.P. Drive From Motor To Beater Line Shaft

What the Supt. of a large Rolling Mill says:-

"When we erected our rolling mill in 1914 the question of what we should use for driving the mills came up and it was either chain drives or gears. Our decision rested with Morse Silent Chain Drives because first, of their reputation, second, because they were more economical than gears, third, because there was less chance of breakage with Morse Chains. Two 600 H.P. Morse Chain Drives are driving our rolling mills and practically all our motors about the Plant are also now equipped with Morse Chains.

"Our first which was one of the 600 H.P. was purchased eight years ago and today it hasn't cost us anything for repairs and has given us absolutely no trouble. This is merely typical of our experience with this equipment. Our Morse Drives have had unusually hard usage for easily 50 per cent of the time they have been in operation practically 24 hours out of each day on work that is a severe test because the load is not constant."

Canadian Agents:

JONES & GLASSCO, REG'D.

Bank of Hamilton Bldg., Toronto St. Nicholas Bldg., Montreal

If interested tear out this page and place with letters to be considered.

CUT GEARS

Accurate Cut Gears of all Kinds

Use Positive Gear Drives

No Slippage Losses

Economical - Safe - Efficient

Write us for quotations on any
Gear Drives you may have in mind

Hamilton Gear & Machine Co.

76 Van Horne St. TORONTO

UNION DRAWN

BRIGHT COLD FINISHED STEEL

SHAFTING

We manufacture Bright, Cold-Finished Steel in Rounds, Flats, Squares, Hexagons and Special Shapes for Pump Rods, Piston Rods, Roller-bearing Rods, etc.
Cold Drawn or Turned and Polished Alloy Steel.

3½% Nickel Steel.
1% Nickel Steel.
Chromium Steel.
Chrome Nickel Steel.
Chrome Vanadium Steel.

For use in manufacturing parts where greater strength and toughness are required than ordinary Cold Drawn Steel.

Besides maximum strength and accurate size you get absolute straightness and highly polished surface in UNION DRAWN, BRIGHT, COLD-FINISHED STEEL PRODUCTS.
Large stock constantly on hand to meet demands for prompt delivery.

Union Drawn Steel Company, Limited

Hamilton Ontario Canada

SOLID WOVEN
HAIR BELTINGS
"TWINTEX" and "MULTIPLAR"

NO PLIES TO OPEN UP
PROTECTED EDGES
Can be used with any shifter
SUPER-GRIP DRIVING SURFACE
MAXIMUM FLEXIBILITY
CONSTRUCTION THAT LASTS

Belts are thoroughly waterproof and not affected by atmospheric changes.
Have proven themselves the best belts under most trying conditions of moisture and heat. On the larger widths a friction-heat-absorber-face is woven on the Driving Side. This absorbs the heat generated by the friction of driving and keeps the wear and tear off the body of the belt.

SUMNER & CO.
108 WORTH ST.
NEW YORK

Representative for Eastern Canada
GEORGE F. SHEPPARD
128 Bleury St., Montreal

"THISTLE" BRAND RUBBER BELTING

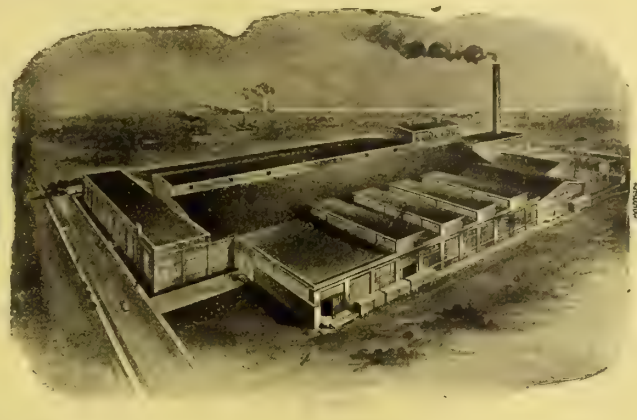
"Maintenance of Quality"
is our motto, and our experience in the manufacture of belting since the year 1856 should be invaluable to you. Let us tell you all about this friction faced belting. The price will appeal to you.
Write to-day.

J. C. McLAREN BELTING CO., LTD.
TORONTO, MONTREAL, WINNIPEG

Why Don't You Write?

HARDLY a week passes that Canadian Machinery does not receive copies of this paper returned by the postal authorities because of the change in firm names or the address of some whose names are on the mailing list. Sometimes complaints reach us of the non-delivery of mail matter. It is not till the receipt of such complaints or the return of the paper, as the case may be, that we obtain any knowledge of the changes or removals of persons or firms. The adoption of the co-operative spirit on your part by notifying changes would make things a good deal more pleasant for both parties. The MacLean Publishing Co. want their mailing list to be in such shape that they will be able to render the perfect service to their subscribers. There is a lot of valuable trade matter mailed by this company and if you don't receive it—well, the fault is entirely yours.

SHAFTING



Cold Drawn, Turned and Polished Steel Shafting

Rounds Squares Hexagons and Flats

Finished Machine Keys Ready to Drive.
Free Cutting Screw Stock and Piston Rods.

The Canadian Drawn Steel Co., Limited

Hamilton
Canada

Reasonable Prices

Quick Service

If what you need is not advertised, consult our Buyers' Directory and write advertisers, listed under proper heading

Bond

POWER TRANSMISSION

BOND PRODUCTS have stood the test for over forty years, and is a complete line of Power Transmitting Appliances.

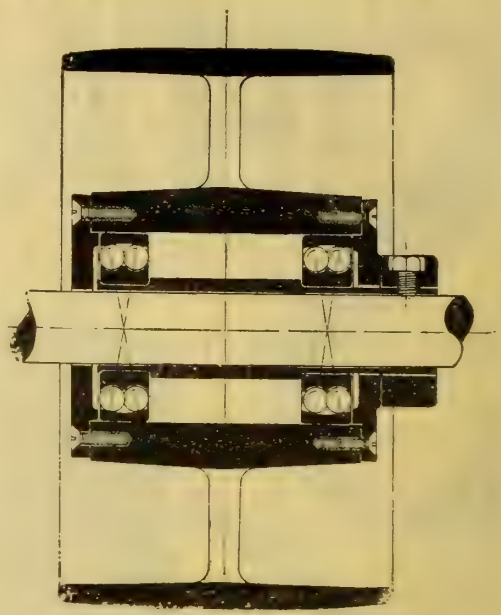
To meet the demand for Ball Bearing Transmission Appliances we have secured the manufacturing rights for, and now offer, a BOND BALL BEARING HANGER BOX (fitted with SKF Ball Bearings), which can be used in any standard lineshaft hanger.

This feature enables you to change to Ball Bearing equipment with a minimum of expense as the hanger frames you have installed can be fitted with Bond Ball-Bearing Boxes.

Why not make the change to-day?

We also manufacture Bond Ball Bearing Loose Pulleys (illustrated above). These are guaranteed to operate at any speed and are easily installed.

Write for literature to-day using coupon below.



Bond Ball Bearing Loose Pulley

Bond Universal Hanger

Cut this out and mark item on which information is desired:

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[ ] Truck Casters
[ ] Grundy Flexible Couplings
[ ] Ball Bearing Hangers
[ ] Ball Bearing Loose Pulleys
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Name .....

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Bond Ball Bearing Truck Caster

BOND ENGINEERING WORKS, Limited

TORONTO, ONT. - - CANADA

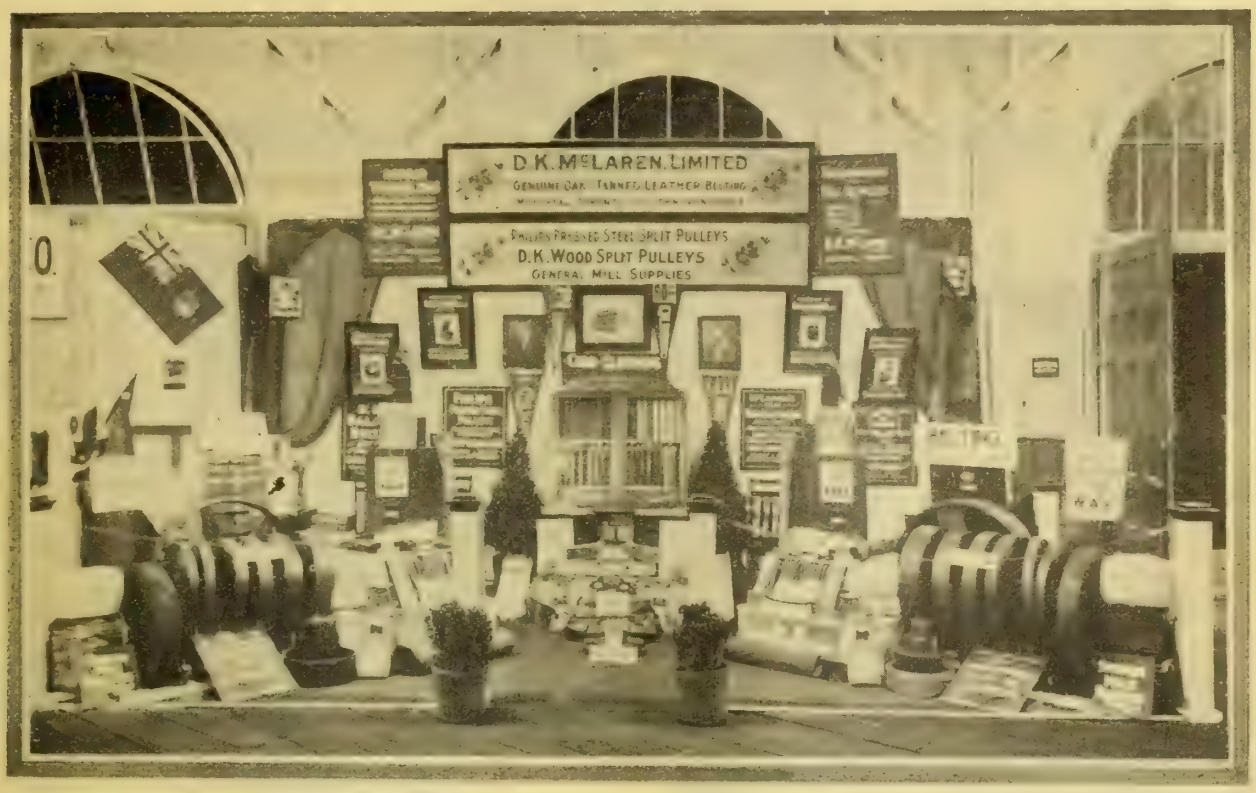
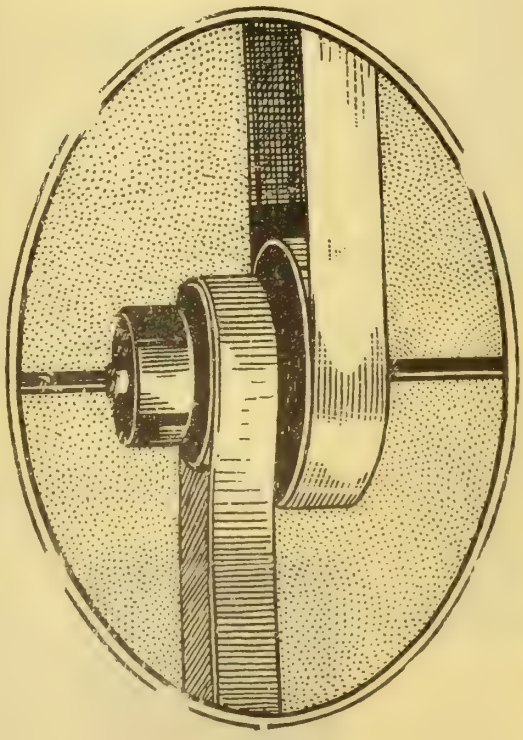


Exhibit of D. K. McLaren's Belting, Belt Accessories, Mill Supplies, etc., at Canadian National Exhibition, Toronto, 1922.

Headquarters for Belting and Supplies

We carry the largest stock of Belting, Belt Accessories, Steel and Wood Split Pulleys, Card Clothing and Mill Supplies in the Dominion—in fact, many of Canada's largest and best equipped industrial and power plants look upon D. K. McLaren's as Headquarters that can be depended upon at all times. **How can we serve you?**

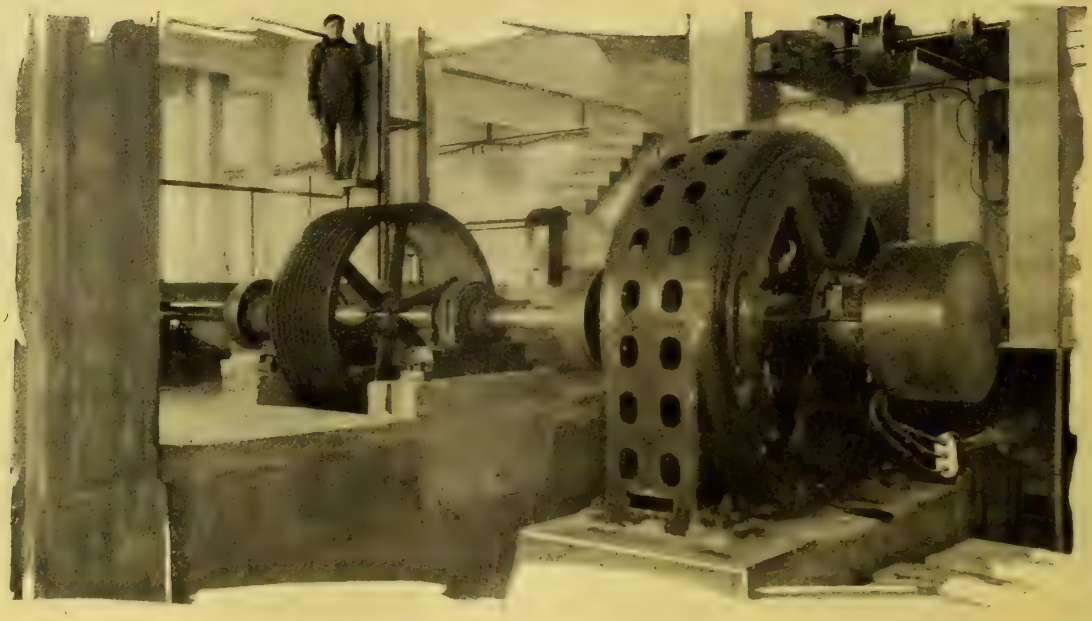


D·K·McLAREN LIMITED

Head Office and Factory:
351 St. James St., Montreal, P.Q.

TORONTO, ONT.	ST. JOHN, N.B.	CALGARY, ALTA.	EDMONTON, ALTA.	VANCOUVER, B.C.
194 King St. West	90 Germain St.	Gormans, Limited	Gormans, Limited	Gormans, Limited, 1158 Homer St.

SKF



15 Per Cent Upwards—Power Saved
by Ball Bearing Pillow Blocks and Hangers

MOST vital of all losses in grain mills is the waste in power caused by the frictional resistance in plain bearings in power distribution systems. More than fifteen per cent of the power generated is wasted in overcoming this useless load.

Of this power absorbed by plain bearing equipped shafting, approximately 60 per cent can be saved by using SKF improved self-aligning ball bearing pillow blocks and hangers.

Shafts thus supported are carried by two rows of hardened steel balls that roll between polished steel races and without appreciable friction or wear. Even shaft deflections cannot cause heating and binding for the inner race tilts with the shaft like a ball and socket joint.

Furthermore, there is no worn shafting, no need for bearing adjustments and replacements, no vibrations and no oil leakage. Engineering details on request.

CANADIAN SKF COMPANY, LIMITED
TORONTO - MONTREAL

Normal View *Deflected View*

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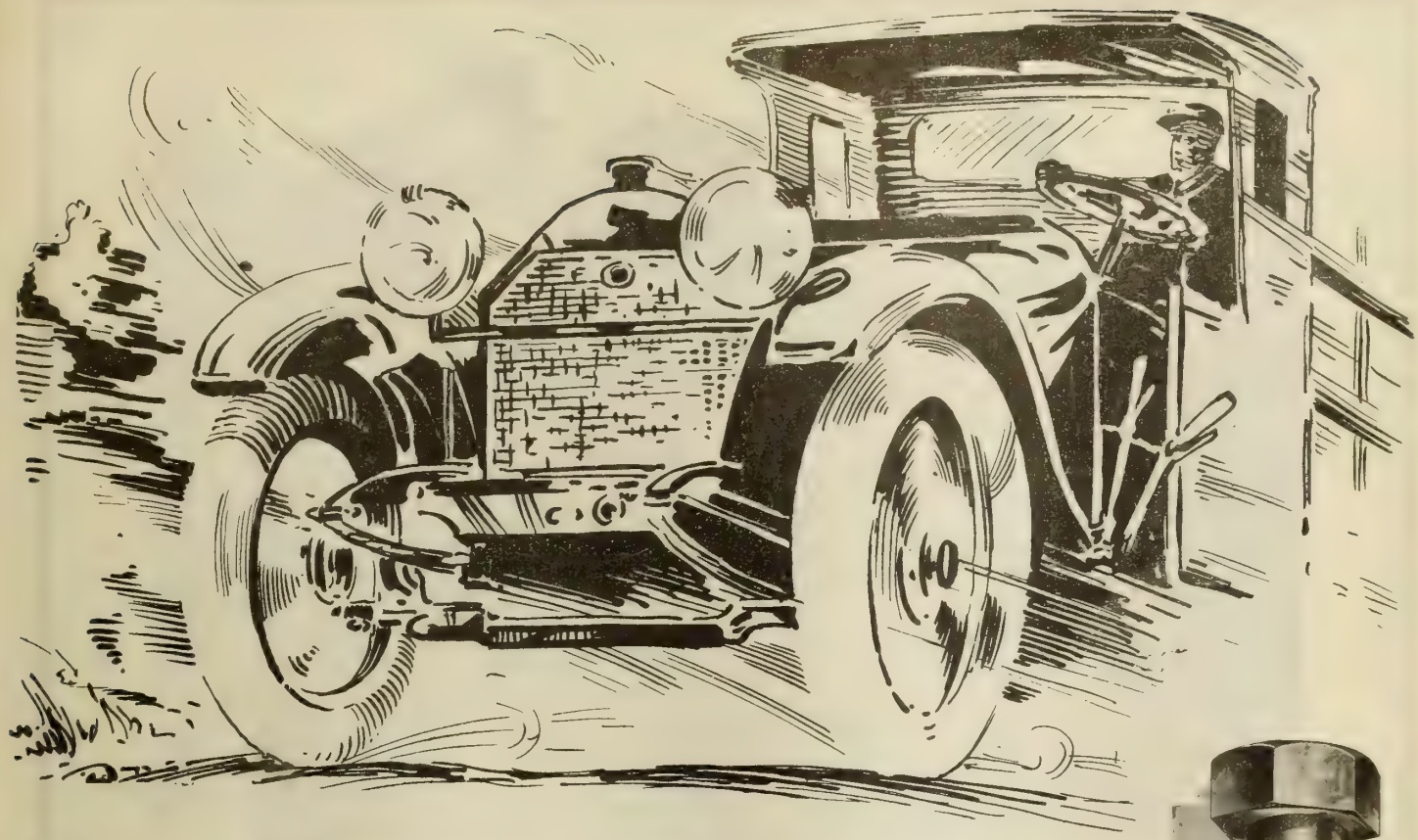


To Forge Ahead-

Canadian Industry Must Make Dependable Products

Canada is immensely rich in mine, forest and field products, and water power potentialities. Her natural resources form the basis of her future prosperity. If Canada is to forge ahead, her manufacturers, however, must establish a name for dependable products.

If you are a builder of motor trucks, pleasure or service cars, machine tools or other manufactured lines, use only dependable parts and fit them together with

"GALT" Screws and Nuts

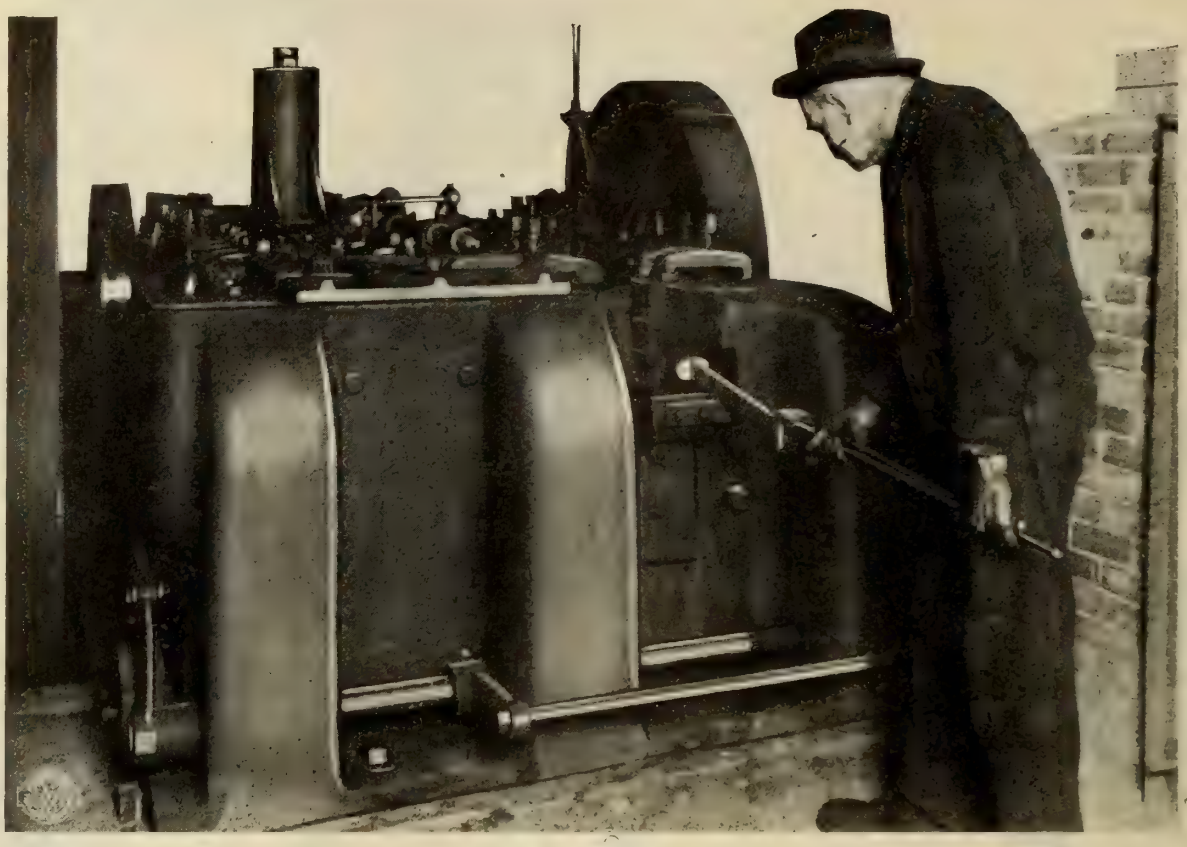
"GALT" products are always accurate and made of the best material for the purpose. "GALT" Screws and Nuts, because they have established a reputation for accuracy, have become the preferred lines for the building of all classes of Canadian-built trucks and automobiles. Specify "GALT" and get accuracy and service on your next order for Cap and Set Screws and Nuts.

Send your blueprints for Estimates. We specialize on immediate shipments of all standard products.

THE GALT MACHINE SCREW COMPANY, LIMITED

GALT, ONTARIO, CANADA

Eastern Representatives: **F. Bacon & Co., 131 St Paul St., Montreal, Quebec**
Western Representative: **D. Philip, Winnipeg, Man.**



Saved $398 in a Day-and-a-Half

A Western Pennsylvania Manufacturing Company installed an Acme Forging Machine. The machine immediately demonstrated its productive qualities. Cost records were consulted. It was shown that a saving of $398 was made the first day-and-a-half the machine was in operation. The work consisted of spokes for tractor wheel, besides miscellaneous contract work. **You, too, can save a lot of expense by installing the**

ACME

All-Steel Heading, Upsetting and Forging Machine

Powerful, efficient in construction, "ACME" Forging Machines ensure maximum output at a minimum of cost. They are capable practically of constant operation and have a range that is exceptional.

The Acme Machinery Company

4530 St. Clair Avenue, Cleveland, Ohio

Canadian Agents: **The John Bertram & Sons Company, Limited, Dundas, Ontario**

If Interested tear out this page and place with letters to be answered

MANUFACTURERS OF HIGH GRADE GRINDING WHEELS

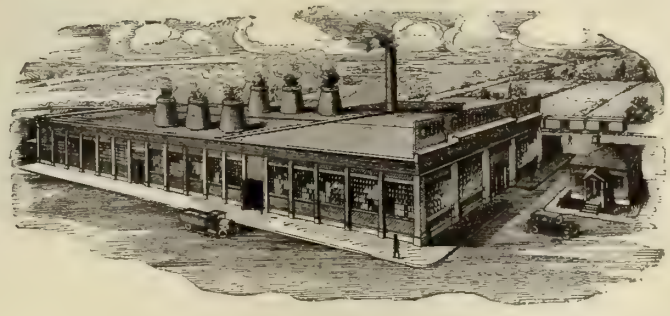
"LION" GRINDING WHEELS

Fast Cutting and Durable

—CANADIAN WHEELS OF QUALITY—

ALU-LION

For Grinding High Tensile Material



CARBO-LION

For Grinding Low Tensile Material

VITRIFIED **SILICATE** **ELASTIC**

We make grinding wheels for all purposes, using only the best quality of materials. If you have any grinding problems we will be pleased to assist you to solve them.

LION GRINDING WHEELS Ltd.

BROCKVILLE, ONTARIO, CANADA

Agents for Quebec Prov.
J. R. Baxter & Co., Ltd.
Montreal

Riveting Costs Slashed by the New "KOBERT" Method *of Production Riveting!*

IN THE FISHER BODY PLANT, Detroit, Mich., top body irons are now riveted on the KOBERT ELECTRIC RIVETER at only two-fifths the cost of former methods! At the same time Fisher's well-known quality standards are maintained.

Six men, six gas furnaces and multiple riveters are replaced by one "KOBERT," a man and a boy! As against four rivets per minute by former methods, an output of six perfectly formed rivets, 7/16 in. square is now possible. A single 40-ton blow fills the hole completely.

Best of all "KOBERT" has eliminated the costly straightening and the heavy rejection item due to the inevitable warping and shrinking of the metal in the furnaces. The ability of "KOBERT" to concentrate the heat on the exact spot where needed, revolutionizes riveting practice, not only in work like the above, but especially where temper drawing has been a problem (roller chain, ring gears, roller bearings, etc.).

This "KOBERT" reduces floor space required from 1000 sq.ft. to about 100 sq.ft. Hot weather labor trouble, due formerly to the excessive heat, is no longer a disturbing factor. Fire hazard also eliminated, and energy cost reduced to one-fifth.

"KOBERT" has opened the way to lower costs of production riveting. It will pay you to let "KOBERT" engineers co-operate in analyzing your particular problem without obligation.

Get This New Riveting Story— FREE

Kobert Machine Company, Inc.,

Manufacturers of Automatic Electric Riveting Machinery

50 Church St., New York City, N. Y.

"HOW ELECTRIC RIVETING WAS MADE COMMERCIAL," just coming from the press, throws new light on modern riveting. Interesting—practical. Write for it at once.

If interested, tear out this page and place with letters to be answered

TRADE NORTON MARK

Alundum

Crystolon

The grinding wheel is being used more generally to-day than it was a year ago. It is replacing other tools because work can be ground faster, cheaper and more accurately to dimension limits and with a superior finish.

The properly selected NORTON ALUNDUM or NORTON CRYSTOLON wheel will insure you of these features and when we say economy we mean lower grinding costs ultimately—computed from wheel, labor, and burden cost figures.

Some one of the following subjects would undoubtedly interest you :—

Grinding High Speed Steel
Saw Sharpening
Tool Grinding
Grinding Wheel Dressers and Their Use
Diamonds for Truing Grinding Wheels
Metal Polishing
Storage, Handling and Supervision of Grinding Wheels
Principles of Cylindrical Grinding
Safety As Applied to Grinding Wheels

We have special treatises in pamphlet form on these subjects, a postal request for which is all that is necessary.

REMEMBER

To specify NORTON ALUNDUM wheels for grinding steel and soft malleable iron and NORTON CRYSTOLON wheels for cast iron, brass and aluminum.

Norton Company of Canada Limited

Hamilton, Canada

Electric Furnace Plant—Chippawa, Ontario

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The Canadian Fairbanks-Morse Co., Ltd., Montreal, Toronto, Ottawa, St. John, N.B.: Winnipeg, Calgary, Saskatoon, Vancouver, Victoria. F. H. Andrews & Son, Quebec, Que. Simonds Canada Saw Co., Vancouver, B.C.

Save Your Tools

Poor grinding wheels will spoil your tools. You will get more service out of them and do better work by keeping your tools in shape with

PRESCOTT EMERY WHEELS

Prescott Wheels are built to meet modern requirements. They are unsurpassed for all iron and steel grinding. They are made of the very best abrasives, carefully graded, require very little dressing, and give absolutely uniform service.

There is a Prescott Wheel to meet every grinding requirement. They have a well-merited reputation for efficiency and economy.

Write for catalogue and interesting particulars.

Prescott Abrasive Wheels and Grinding Machinery are Made in Canada by

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How to know
the Best Brush for each Generator or Motor

COLUMBIA Data Sheet Service brings Nation-wide experience to bear on your brush problems. It goes far beyond the experience of any individual or of several individuals.

Columbia Data Sheet Service assures the correct Columbia Pyramid Brushes for each machine.

The specialists who secure the facts show on the Data Sheet the condition of each unit. The Board of Engineers carefully analyzes the Data Sheet for each machine. The brushes selected are guaranteed to be satisfactory.

Avail yourself of this service of specialists. It is yours for the asking, whether you have one machine or a thousand.

C N C

CANADIAN NATIONAL CARBON CO.
LIMITED
TORONTO - CANADA

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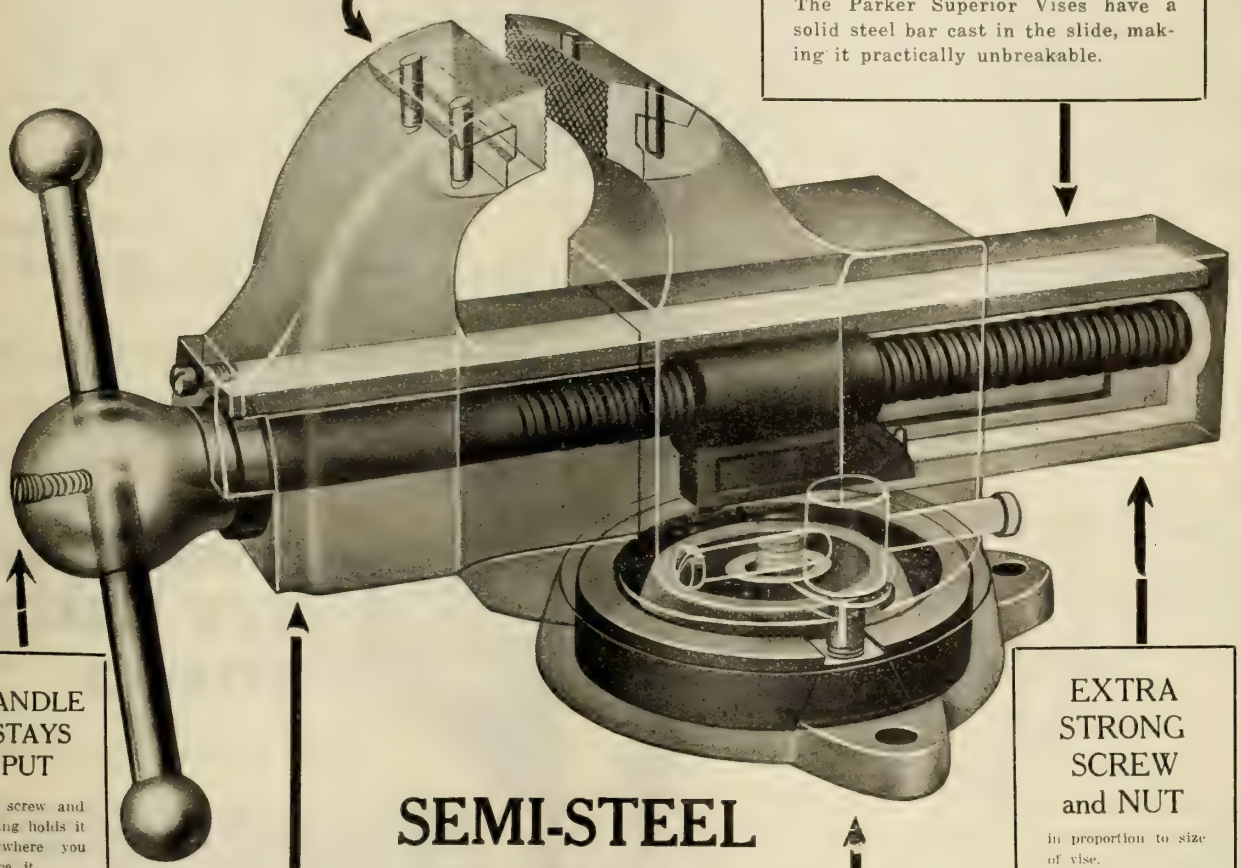
PARKER VISES

Grip Like a Grizzly

RENEWABLE TOOL STEEL JAWS
Milled to fit; pinned on, not cast or screwed on. Cover entire top of vise with steel.

SOLID STEEL BAR SLIDE STRENGTHENER
The Parker Superior Vises have a solid steel bar cast in the slide, making it practically unbreakable.



HANDLE STAYS PUT
Set screw and spring holds it anywhere you place it.

EXTRA STRONG SCREW and NUT
in proportion to size of vise.

SEMI-STEEL CASTINGS

IMPROVED SADDLE and SOLID UNDERPORTION
The slide is further strengthened by an outside collar or saddle. This makes possible a solid underportion in place of the usual hollow casting. The screw can be removed easily.

Send for Catalog No. 57-C.

A SWIVEL THAT GRIPS LIKE A GRIZZLY
A swivel base with the strength of a solid back jaw. Not a mere clamping device, but a form of construction that gives a gripping power 360 degrees of the base by the expansion of a ring.

The* CHARLES PARKER CO, *Master Vise Makers

MERIDEN, CONN., U.S.A.

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The "bite" of a file is the measure of its efficiency.

A file the least bit dull cannot bite like a perfectly sharp file. And more effort is required to make it bite at all.

This means economic waste —of effort, time and money. True economy lies in replacing a file the least bit dull with a new, sharp file.

These standard brands retain their sharpness till they have given maximum service:

KEARNEY & FOOT
GREAT WESTERN
AMERICAN
ARCADE
GLOBE

Standard for over Fifty Years

Made in Canada by

Nicholson File Company

PORT HOPE - ONTARIO

STEEL TUBING

cold WELDED and BRAZED rolled

Going—Going Fast

At Bargain Prices

We are under the urgent necessity to clear out our stock, quickly, — material as listed below offered subject to prior sale. You will realize this is an exceptional opportunity.

MATERIAL IN STOCK — TORONTO

1,000 ft. 3 16 O D. x 20 Ga.	W	10,000 ft. ⅞" O.D. x 20 Ga.
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1 x 20 Ga.—1¼" x 18 and 16 Ga.—1½" and ⅝" x 16 Ga—
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Special Price **5c** Per lb. F.O.B. Whse. Toronto

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Phone Main 5594 84 Victoria St., Toronto, Can.

Wood Screw Making Machinery

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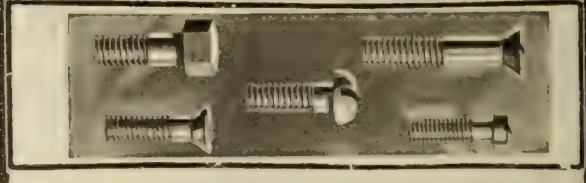

For sixty years we have constantly manufactured machinery for making screws, always studying to improve and refine our product.

Write or Wire us.

Cable address: "Cook."
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Codes: Liebers
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FORGED SHAFTINGS up to 30,000 Lbs.

Smooth Forged
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1 lb to 50 tons

FOR ALL PURPOSES

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A Better Furnace
for general tool work

Bellevue No. 106

Small tool annealing and tempering costs are reduced to the lowest possible point when this highly efficient scientifically built **Bellevue Furnace** is employed.

Reverberatory flame action—no direct flame on the work.

Our engineers will gladly assist in solving your furnace problems. Write us.

Bellevue Industrial Furnace Co.

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Representatives in Canada:

CHAS. A. STRELINGER COMPANY, WINDSOR

GARLOCK MACHINERY LTD., Toronto, Montreal, Winnipeg

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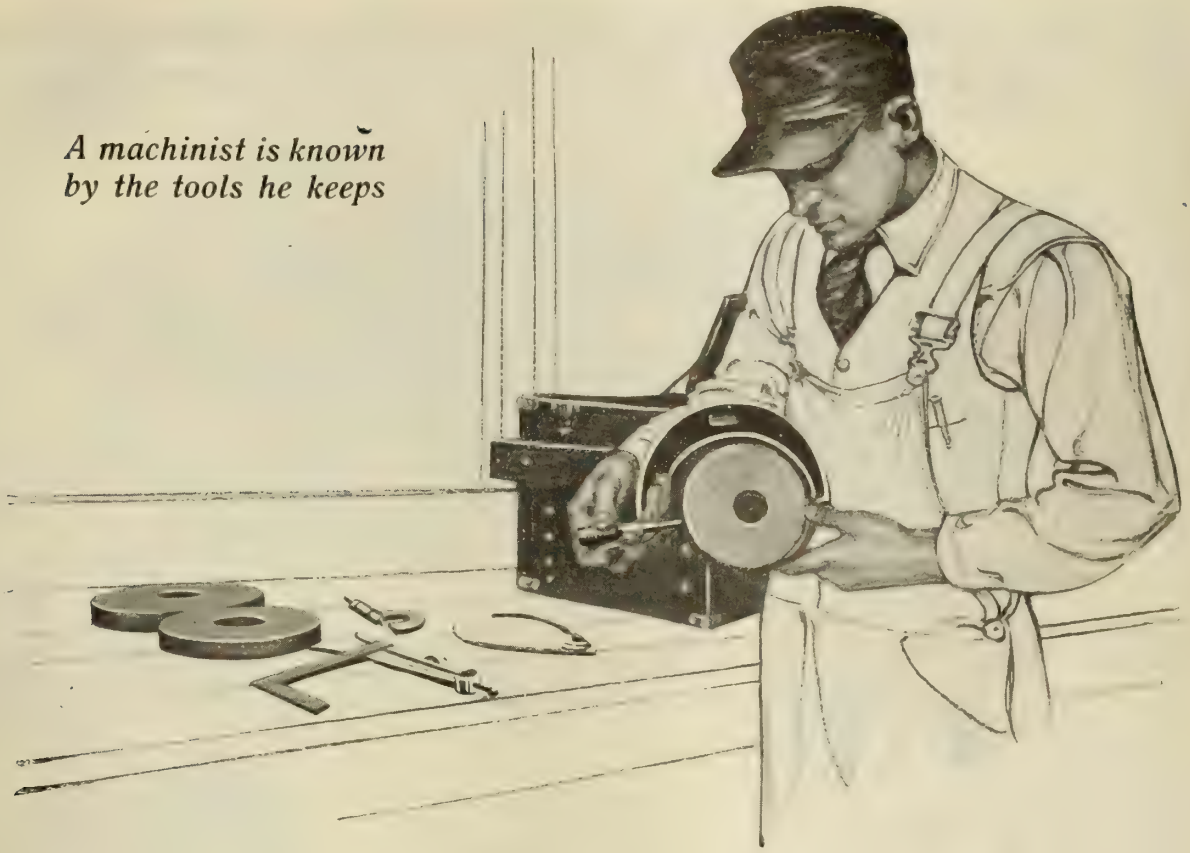
A machinist is known by the tools he keeps



TO have a well supplied kit of Starrett Tools doesn't mean necessarily that the owner is an expert machinist. But it's pretty good evidence that he's on the right track. Look about you in the shop and see if it isn't so.

Have you the Supplement to the Starrett Catalog where you can put your hand on it? Just ask us for Catalog No. 22" 3" and Supplement. They're free.

THE L. S. STARRETT CO.

The World's Greatest Toolmakers
Manufacturers of Hacksaws Unexcelled
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STARRETT TOOLS — STARRETT HACK SAWS CUT QUICKER LAST LONGER

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When you order "Liquid Air" Oxygen or Dissolved Acetylene it is delivered to you at the very time you want it delivered, with no exorbitant costs added for freight or long distance haulage. This is only made possible by "Liquid Air" chain of factories situated at convenient centres all over Canada, operating in conjunction with service stations situated at a point in your own immediate neighborhood.
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The Canadian Industrial Alcohol Co., Corbyville, ordered this immense storage tank for molasses on June 7th. On July 15th it was completed—a record for an erection of this size. The diameter was 65 feet. Height 42 feet.

T.I.W. STEEL PLATE PRODUCTS

TANKS—Steel Plate Work, Electric and Acetylene Welding

Canada's leading engineers and manufacturers buy T. I. W. Tanks. They know our products will stand every test and that we give the kind of service they want.

You can make no mistake in following their example. Our prices are right. The workmanship and materials are guaranteed, our service exceptional, and our facilities enable us to produce anything—from the largest commercial tank to the smaller Hydro Pneumatic and Hot Water Storage Tanks.

Here Are a Few of Our Lines :

Oil Storage Tanks, Gasoline Tanks, Air Receivers, Pneumatic and Water Supply Tanks, Smoke Stacks, Boiler Breechings, Riveted and Electric Welded Steel Pipe, Bins and Hoppers

Heavy and Light Steel Plate Construction erected anywhere.

THE
TORONTO IRON WORKS
LIMITED

HEAD OFFICE: ROYAL BANK BLDG. TORONTO WORKS: CHERRY STREET

A recent installation—a battery of 4 oil storage tanks erected in Toronto.

CUT GEARS

Theoretically Correct

PROMPT SERVICE

ROBERT GARDNER & SON
LIMITED
52 NAZARETH ST., MONTREAL, P.Q.

RAWHIDE CONDENSITE CELORON OR METAL

STANDARD GAUGE STEEL CO.

Incorporated 1892

Manufacturers of

COLD DRAWN STEEL:—
Rounds, Squares, Hexagons,
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When in Need of Small Tools—*See Us*

We have made definite arrangements to act as special representative for the following companies:

Greenfield Tap and Die Corp. of Canada Limited
Taps, Dies, Screw Plates, Pipe Vises and Pipe Wrenches

Canadian Detroit Twist Drill Co., Ltd.
All sizes of Carbon and High Speed Drills.

Canada Illinois Tool Co., Ltd.
Cutters and Hobs. All Styles and Sizes.

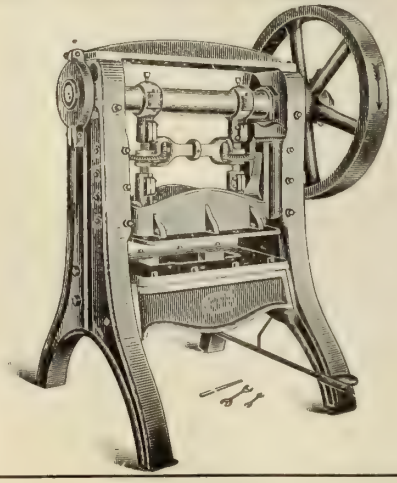
As heretofore, we give typical TAYLOR SERVICE, Which means,

Prompt Delivery at Reasonable Price

Give us your trial order and we know we can hold you as a regular customer.

J. A. M. Taylor Tool Company
Limited

77 Adelaide St. W., Toronto.
Phone: Adelaide 6240



EXCELSIOR TOOL & MACHINE CO.

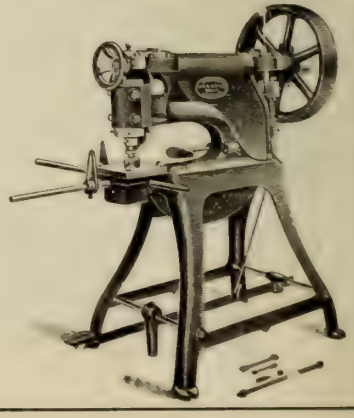
Ridge and Jefferson Aves.,
EAST ST. LOUIS ILLINOIS

Manufacturers of

PRESSES, SHEARS,
BRAKES, GRINDERS,
ANGLE IRON BENDERS,
and POLISHING MACHINES

Write and get our prices

Machine No. 37 and No. 20



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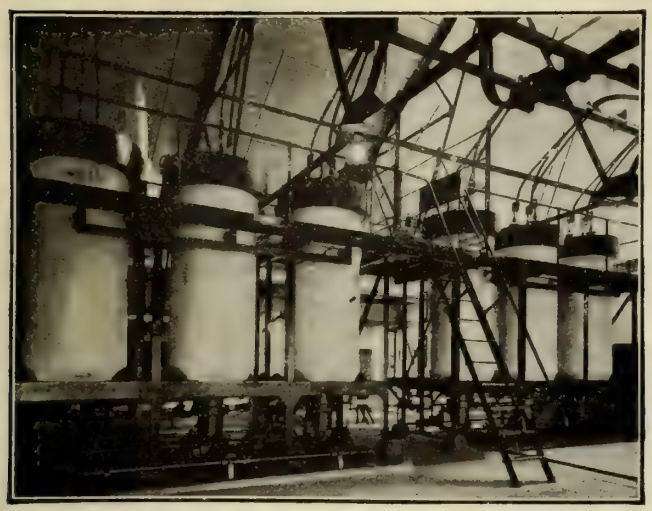


Two 3 phase Kaelin Electric Steam Generator Units for 6600 volts, designed and built by us for the Laurentide Co., Limited. Capacity of units shown, 7000 boiler horsepower, all controlled by a single operator on each shift.

The generator shown at the left is typical of sizes from 75 to 400 boiler horsepower for 3-phase power. Note its compactness and convenience.

"Can our idle power be made to conserve our coal pile?"

If you will Tell us your Conditions we will give you the Answer.

A number of plants producing or purchasing power but not using it fully at week-ends or other periods are turning this surplus energy into heat by means of

The Kaelin Electric Steam Generator

(Patents applied for)

thus securing remarkable reductions in their bills for coal or other fuel.

The saving in labor is also quite important. Altogether, the generator often pays for itself within a short time.

We build these generators in sizes from 5 to 3,500 boiler horsepower, for pressures up to 200 lbs.; also in sizes from 5 to 75 boiler horsepower for low pressure steam heating.

When desired, any of these generators may be equipped with automatic pressure or surplus power control.

WRITE FOR QUOTATIONS

HYDRAULIC DEPARTMENT:

I. P. Morris Hydraulic Turbines and Centrifugal Pumps. The Larner-Johnson Hydraulic Valve in sizes up to 20 ft. diameter. Large Gate and Pivot Valves.

PAPER MACHINERY DEPARTMENT:

Fourdrinier Machines for Fine Papers, High-Speed Machines for Newsprint or Kraft, Cylinder and Wet Machines, Millspaugh Suction Rolls, etc.

Dominion Engineering Works, Limited

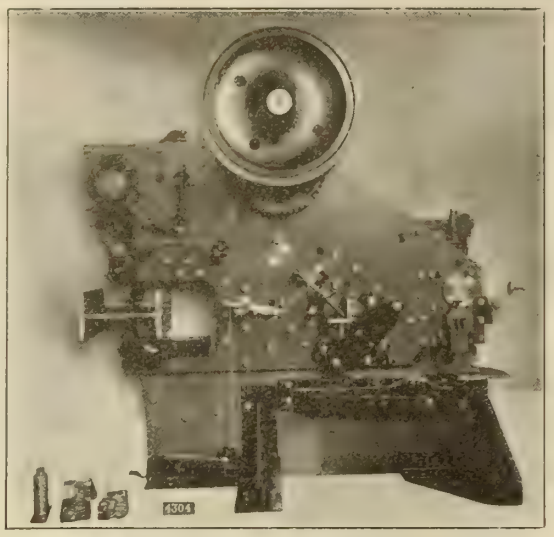
Telephone: Melrose 700

Montreal, Canada

Cable Address: "Domworks, Montreal"

Western Representative: R. F. MATHER, London Building, Vancouver, B.C.

(M-74)



Type BLUEFG—Triple Combination Punch, Plate Splitting Shear and Bar, Angle and Tee Cutter

Punches 1″ holes in 1″ plate; splits ¾″ plate of any length or width; cuts angles up to 6″ x 6″ x ½″; angles on bevel at 45 degrees up to 3½″; rounds up to 2″; squares up to 1¾″.

Made with punch throat of any depth and with height sufficient to take care of standard or broad flanged sections.

No change of tools. Controls entirely independent. Can be operated by three men at the highest capacities simultaneously.

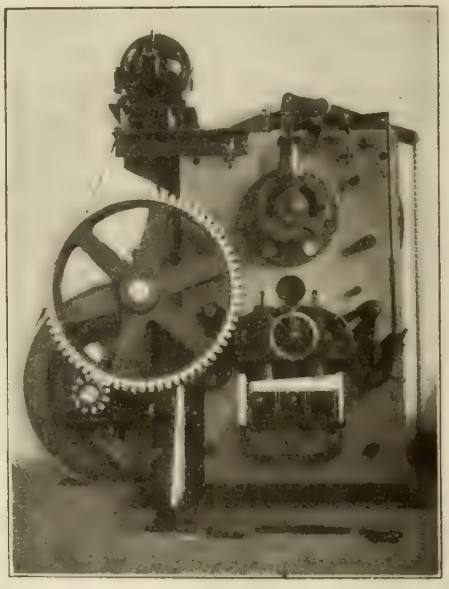
Send for special circular.

PELS

Super Punches *and* Shears Cost Less

Less per punched hole.
Less per cut.
Less per year.

Thousands of fabricators of steel in all industrial centres of the North American Continent have proved this.



SLAB SHEAR, TYPE FV—Cuts slabs up to 20″ x 2″. This type is made in all sizes from 1″ rounds to 10″ squares cold. Send for special circular.

All PELS machines are built with frames of heavy open hearth steel plate, of special analysis and tensile strength. These frames are guaranteed without any reservation to be absolutely unbreakable. All gears are steel with cut teeth; pinions, shafts and working parts are forgings. These machines are built by engineers whose thirty years' experience can be made profitable to you.

Send for bulletin describing such types of tools as will take care of your particular class of work.

Our line covers a complete range of Single and Double Vertical Punches, Universal Shears, Gate Shears, Rod, Bar and Billet Cutters, Angle Shears, Coping Machines, Beam and Channel Shears and Bending Machines, in all sizes to fit all conditions.

HENRY PELS & COMPANY, INC.

86 WEST ST. NEW YORK

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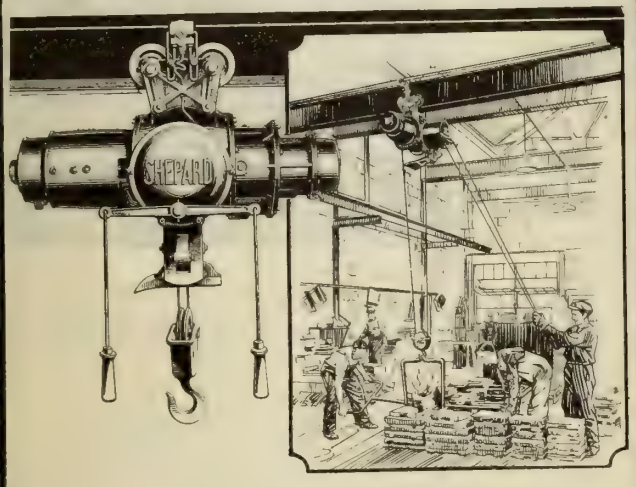
To help you take care of more business

The "Aerial Railway of Industry," of which this Shepard cage control hoist and Transfer crane are a part, affords rapid transit between departments without rehandling load. Ask about it.

THE SHEPARD ELECTRIC LIFT ABOUT



A powerful little hoist that is now used in practically every industry.

½ and 1 ton capacities. Remarkably low in price, due to standardized manufacture and quantity production. Has same "time tried and true" features as found in other Shepard equipment.

Electric hoisting and rehandling equipment that lasts

The Shepard Balanced Drive, which is used in all Shepard equipment, thorough, automatic oil bath lubrication: enclosed unit construction; and "endurance" built into every part—all combine to give you what you seek in crane and hoist service—strength and permanence.

Shepard builds electric traveling cranes; transfer cranes; jib cranes; floor and cage control hoists; and electric winches. Competent engineers are always at your service. Call upon them.

SHEPARD ELECTRIC CRANE & HOIST COMPANY

426 Schuyler Ave., Montour Falls, N.Y.

Branches in Principal Cities

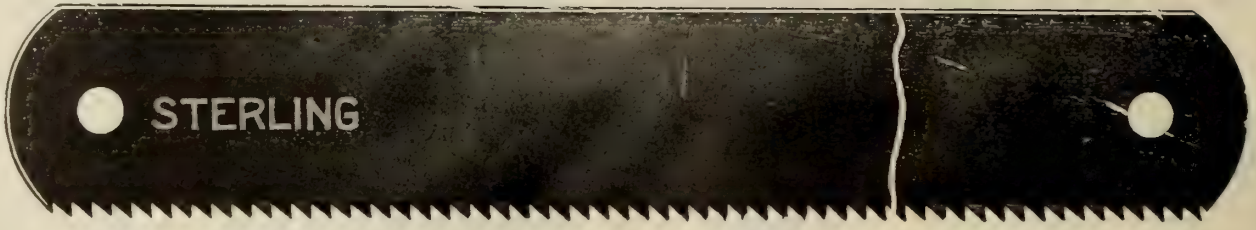
Member Electric Hoist Manufacturers' Association.

REG US PATOFF

SHEPARD

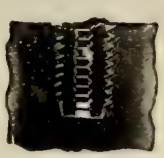
ELECTRIC CRANES & HOISTS

HACK "STERLING" SAWS



DIAMOND SAW & STAMPING WORKS -:- BUFFALO, N.Y., U.S.A.

Buried in the Work and Broke!



Next time a tap breaks below the surface of a large casting, don't let some make-shift method of removing it injure the thread and waste half an hour of valuable production time. Instead—

Walton it Out in a Jiffy

And save the casting.

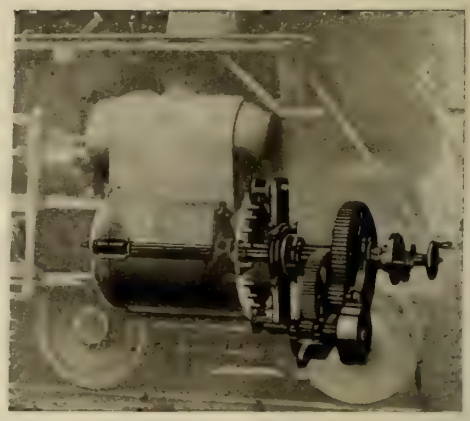
Special analysis steel fingers of the Walton Extractor drop into the flutes of the broken tap—and grip. Then a few turns of a wrench applied to the squared end of the Extractor backs out the buried tap.

Sixty-day trial offer proves the Walton Extractor pays for itself. Write.

The Walton Co.
Hartford, Conn.

UNDERWOOD PORTABLE TOOLS

Figure What You'll Save On One Job Alone

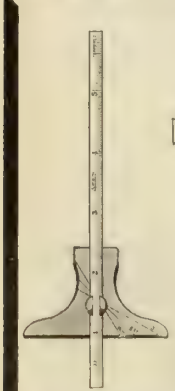


THERE'S no sense in taking down your engine every time it needs boring when all that is necessary is to remove the cylinder covers and piston and take the

Underwood Portable Boring Bar for *Stationary Engines or Locomotives*

right to the job. You can appreciate what a saving of time and labor this is—just figure what it will save you on one job alone and then write for catalogue.

H. B. Underwood Corporation
1025 Hamilton St., - Philadelphia, Pa., U.S.A.

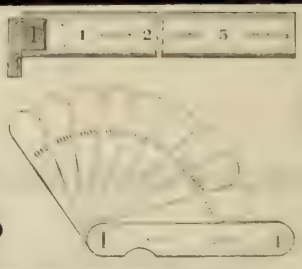


LUFKIN RELIABLE MECHANICS' TOOLS

APPEAL TO EVERY PROGRESSIVE MECHANIC

Accurate, and having all the other essential qualities of precision tools; also many improvements which mean better work, easier done.

Their nicety of design and finish appeal to the eye. Their performance day in and day out will hold your approval.



Ask your dealer to show you a LUFKIN Send for Catalogue of Mechanics' Tools.

THE LUFKIN RULE CO. OF CANADA, LTD. WINDSOR, ONT.

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PACKAGE-HANDLING HEADQUARTERS

for

EQUIPMENT and SERVICE!

What is Your Conveying Problem?

Is it—

Boxes,
Crates,
Cartons,
Cans,
Trays,
Tote Boxes,
Brick,
Lumber,
Shingles,
Pig Iron,
Castings,
Forgings?

The Made in Canada *Line of*

Conveying Equipment:

Roller Conveyors,
Roller Spirals,
Spiral Chutes,
Automatic Lifts,
Belt Conveyors,
Apron Conveyors,
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Etc.

We'll Handle Anything

outside of bulk materials. We hook gravity and power together into complete package handling systems, and have done this work and nothing else for eighteen years.

What is Your Problem?
Let a Mathews Engineer Work on it.
No Solution, No Cost.

Mathews Gravity Carrier Co., Limited

130 Tenth Street - - - - Port Hope, Ontario

BAWDEN

CENTRIFUGAL

PUMPS

Centrifugal pumps for Fire and Municipal installations, Pulp and Paper Mills, Mining, Irrigating, and General Service.

Agents for Alley-McLellan Air Compressors, Steam Engines, Crude Oil Engines.

General Machinery, Rubber Mill Machinery, Tin Moulds, Mechanical Rubber Moulds of all Descriptions, Grey Iron, White Metal, Bronze Castings of all sizes.

Bawden Duplex Automatic Condensation Unit.

Are built to efficient designs; of high grade, carefully selected materials; by skilled men who are satisfied with their surroundings and proud of their product.

Consequently **BAWDEN PUMPS** are efficient, reliable, long-service machines in which pump users are safe in placing their confidence.

Agents for

ALLEY-McLELLAN AIR COMPRESSORS

Bawden Machine Co., Limited

STERLING ROAD, TORONTO, ONTARIO

Represented in

Montreal Winnipeg Vancouver Calgary Edmonton.

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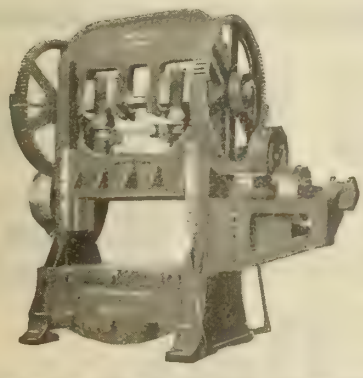
The "TOLEDO"

Presses, Dies, Shears, Drop Hammers, Cam Drawing Presses, Circle Cutting Shears, Double Seaming Machines, Forging Presses, Horning Presses, Knuckle Joint Presses, Shovel Making Machinery, Spinning Lathes, Sprue Cutters, etc.

THE "TOLEDO" OPEN BACK PRESSES:

Series Nos. 1 and 70. Built in 30 sizes, weighing from 500 to 60,000 lbs. They are adapted for a great variety of work, including nearly every kind of blank cutting, forming, perforating, drawing, shaping and combination die work. Illustrated in the "Toledo" Catalog, Section No. 2-A.

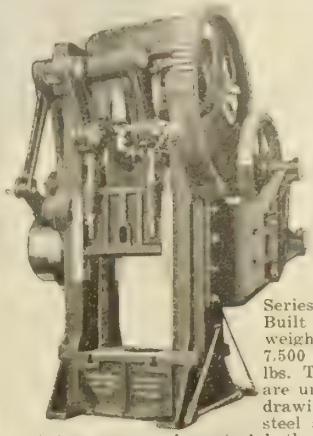
THE "TOLEDO" DOUBLE CRANK PRESSES:



Series Nos. 90 and 200. Built in over 200 sizes with either Straight Column or Overhanging Frames, weighing from 1,500 to 500,000 lbs. For cutting out and forming large articles in tin, brass, copper, sheet steel, cardboard, paper, cloth, etc. Among these may be mentioned automobile parts, armature discs and segments, large pieced tinware, coal hod bodies, shingles, tanks, tin and paper signs, shovels, circular saws, steel stoves and ranges, steel car parts, metal furniture, metallic caskets and burial vaults, wash boilers and tubs, etc.; also for hot and cold forging and trimming drop forgings. Also used for multiple gang punching or perforating, and for operating several different kinds of dies, where special work requires a series of operations one after the other, or for operating duplicate dies in gangs.

Illustrated in The "Toledo" Catalog, Section No. 7-A.

THE "TOLEDO" TOGGLE DRAWING PRESSES:

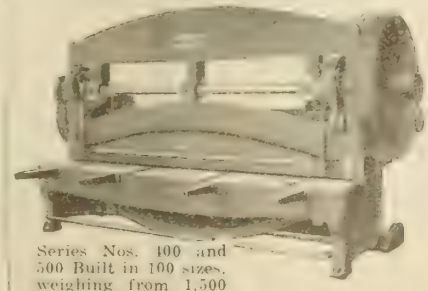


Series No. 160. Built in 50 sizes, weighing from 7,500 to 650,000 lbs. These presses are unexcelled for drawing stamped steel and enamelled ware, seamless steel bath tubs, metallic caskets, automobile bodies, radiators, steel stove parts, elevator buckets and innumerable other articles made from brass, copper, aluminum, steel or tinplate. Illustrated in the "Toledo" Catalog, Section No. 8-A.

THE "TOLEDO" PUNCHING PRESSES:

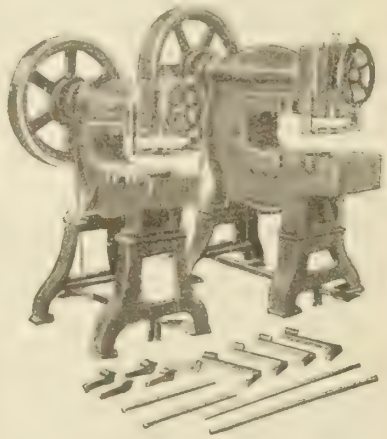
Series No. 30P. Built in 15 sizes, weighing from 700 to 15,000 lbs. These presses are extensively used for a large variety of work, being especially suited for punching, shearing and cutting out blanks of heavy metal steel, iron, brass, etc.; for operating trimming and forming dies, using bar and sheet metal stock. Illustrated in the "Toledo" Catalog, Section No. 4-A

THE "TOLEDO" SHEARS:



Series Nos. 400 and 500 Built in 100 sizes, weighing from 1,500 to 100,000 lbs. These shears are noted for the ease, rapidity and accuracy with which they perform their work. Illustrated in The "Toledo" Catalog, Section No. 11-A.

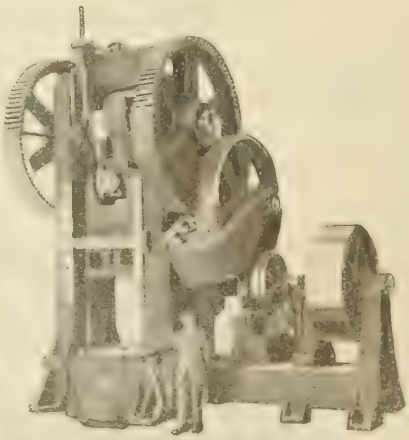
THE "TOLEDO" DEEP GAP PUNCHING PRESSES:



Series No. 15. Built in 3 sizes, weighing from 1,500 to 7,500 lbs. These "Toledo" Presses are particularly adapted for range boiler, steel range, automobile and various other classes of work where it is required to punch holes at a distance from the edges of wide sheets.

They are intended for operating the "horseshoe" gauge system for multiple perforating with single dies; also for cutting the cleanout and other small openings; for punching, perforating, etc. Illustrated in The "Toledo" Catalog, Section No. 4-A.

THE "TOLEDO" STRAIGHT COLUMN PRESSES:



Series No. 50. Built in 70 sizes weighing from 3,000 to 150,000 lbs. Largely used for working the heavier gauges of metal, such as for operating embossing, cutting and drawing and reducing dies, for punching, piercing, shaping and stamping heavy blanks, etc., as well as for a general line of deep drawing, reducing and forming operations, also for cold forging. Illustrated in The "Toledo" Catalog, Section No. 6-A.

The TOLEDO MACHINE & TOOL CO., Toledo, Ohio, U. S. A.

"CANADIAN"
HAND POWER PUNCHES AND SHEARS

All Canadian hand power punches and Shears are made with "Armor Plate" frames.

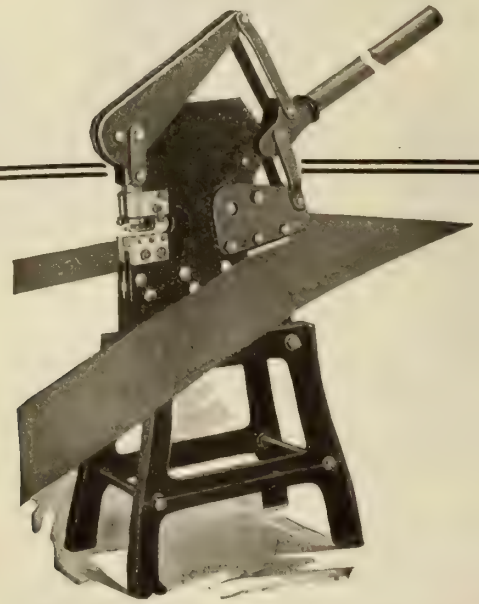
This frame construction consists of a rolled steel plate having a tensile strength 7½ times that of cast iron. This strength permits of a machine much lighter and more compact than is possible with either cast iron or cast steel.

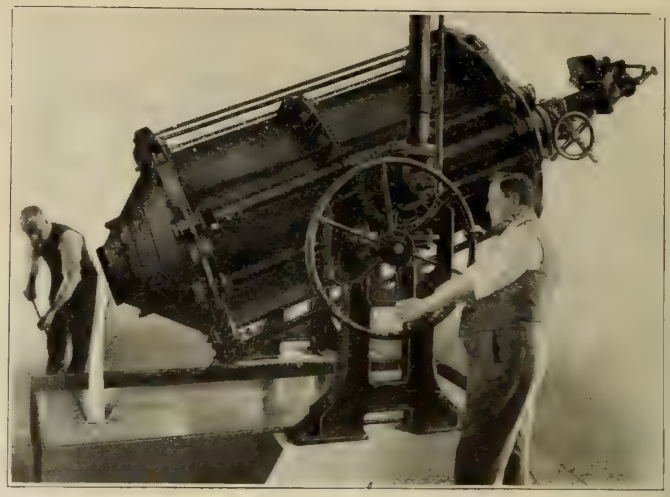
Let us know your punching and shearing requirements. We have an "Armor Plate" machine for the service. Remember our Armor Plate line comprises power operated machines as well as hand power.

CANADIAN BLOWER AND FORGE COMPANY LTD.

KITCHENER, ONT.

Toronto Montreal Calgary
Vancouver St. John Winnipeg





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for
Ceramic and Metallurgical Industries

Send for our list of Canadian, Foreign or United States users

The U. S. Smelting Furnace Co.
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CANADIAN
ATLAS CRUCIBLE STEEL Co.
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Canada's Only Manufacturer
OF
Specialty Steels

HIGHEST QUALITY

High Speed Tool Steels
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Special Analysis Steels
Magnet Steels

Highest Quality Die Blocks

All Manufacturing Operations from Ingots to Finished Material are carried out in Canada by Canadians

Canadian Atlas Crucible Steel Company, Limited

Executive Offices and Mills,
WELLAND, ONT.

Sales Offices and Warehouses,
TORONTO, ONT. MONTREAL, QUE., and WINNIPEG, MAN.

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Announcing to the Canadian Industries

the "BOX" *Electric* LOAD LIFTER

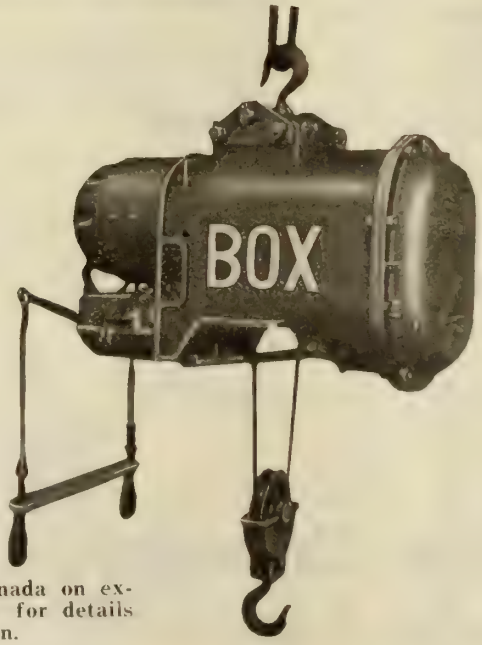
A New, Smaller and Better Electric Hoist

Built for everyone who has a load to lift or move.

A powerful electric hoist that may be easily and quickly hung up any place, indoors or outside; or installed on an I-Beam track hung from the ceiling.

This small "LOAD LIFTER" will let you lift up and move more loads of any kind, so much faster, and with less help, that you cannot now afford to use even the most efficient "man power" devices.

Send right now for complete information on this unique "LOAD LIFTER" and let us tell you what it could do for you in your business.



The "Load Lifter" is built for the man who must lift loads of 1000-lbs. or 500-lbs. or less, and needs to do it in the most economical manner. Its cost is surprisingly low—the operating expense negligible.

Distributors wanted for Canada on exclusive agency basis—Write for details of this attractive proposition.

ESTABLISHED 1878

BOX CRANES

ALFRED BOX & COMPANY, INC. PHILA. PA.

LOAD LIFTER DEPARTMENT, 824 NORTH FRONT STREET

Manufacturers of Electric Traveling Cranes—Hand Power Traveling Cranes—Jib Cranes—Electric Hoists—Chain Hoists—I-Beam Trolleys—Monorail Cranes—Overhead Track Systems.

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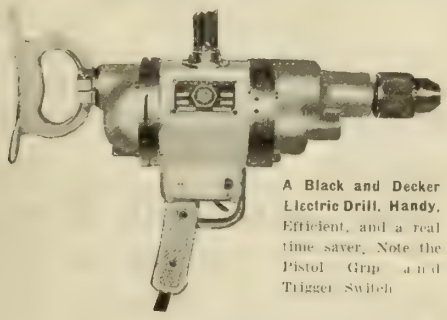
'RICE LEWIS' NEWS

Machine Shop Supplies

In addition to the tools shown, we carry a full line of machine shop supplies, including Set Screws, Cap Screws, Machine Screws, High Speed and Carbon Drills, Files, etc. Our assortment of machinists' tools is varied and well worth looking over.

When it comes to Micrometers, we carry only the best lines. Take for example the set shown above. It comes in a neat case, and is not expensive when the quality of product is considered. We have a wide range of these tools in different sizes and invite you to come in and look them over, or write for prices and particulars.

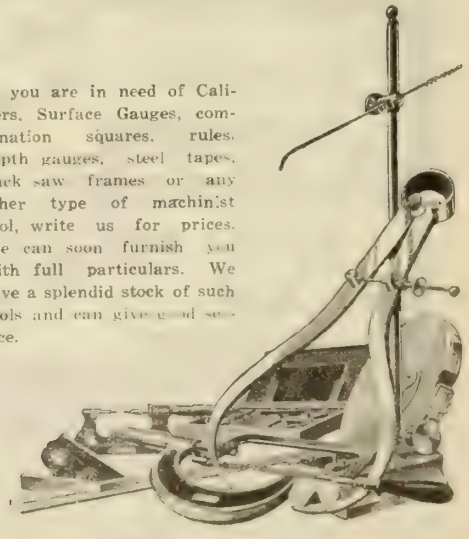


A Black and Decker Electric Drill. Handy, Efficient, and a real time saver. Note the Pistol Grip and Trigger Switch

Attention is called to the new Special Price on Black and Decker ¼ in. Electric Drills. The price is now only **$36 net.** We carry a good assortment of these drills in the following sizes: ¼ in., 5/16 in., ⅜ in., ½ in. Special for repair work, ½ in. Heavy for general construction work, ⅝ in. and ⅞ in. capacity. We also have a good assortment of "Thor" Electric Drills in stock.

We stock Electric Drills from 1-4 in. to 7-8 in. sizes.

If you are in need of Calipers, Surface Gauges, combination squares, rules, depth gauges, steel tapes, hack saw frames or any other type of machinist tool, write us for prices. We can soon furnish you with full particulars. We have a splendid stock of such tools and can give good service.

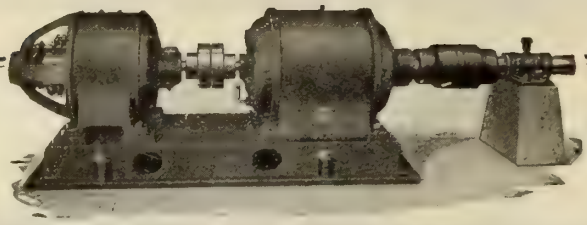


Hack Saw trouble is often due to the operator using the wrong type of blade. Victor hack saw blades are made in Flexible and All Hard grades. There is a blade for every purpose. They are guaranteed, and are made from a high grade alloy steel. Get a box today and try them. We can ship them to you from stock.

RICE LEWIS & SON, LIMITED

Established 1847 **TORONTO, ONT.** **19 Victoria Street**

HINTS TO BUYERS



JONES SPUR GEAR SPEED REDUCERS

for use between electric motors and driven machines.

Compact: occupy very little space, even for large reductions. **Safe:** all moving parts entirely closed. **Economical:** no upkeep except occasional oiling; gears run in a bath of oil.

W. A. Jones Foundry & Machine Company.
Main Office and Works: **4439 West Roosevelt Road, CHICAGO.**

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Diamonds and Diamond Tools for Accuracy and High Production

Sample lot of Rough Diamonds for Emery Wheel Dressing

We stock diamonds and dressing tools for all services and sizes of abrasive wheels.

Write for Catalogue and Prices.

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RAPID *Slip Drill CHUCK*

Drives Straight and True
Cannot Injure the Collet

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Blowers ***Exhausters***

The Connersville Blower Co.

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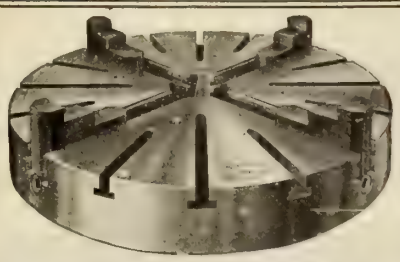

IRON BODY INDEPENDENT CHUCKS

They represent strength and economy with high-speed cutting tools. Accurate and dependable always.

Our All-Steel Independent Chucks have established records for accurate, long-wearing qualities. We also make Geared Scroll Chucks and the Geared Scroll Combination. Ask for particulars.

UNION MANUFACTURING COMPANY

New Britain, Conn. **New York Office: 26 Cortland Street**

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IMPORTERS OF
INDUSTRIAL DIAMONDS
Goods Submitted on Memorandum if Desired
JOHN W. GORDON, Manager
James Street, ST. CATHARINES, ONTARIO

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MANUFACTURERS OF
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All Mountings Fully Guaranteed
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FOR ALL KINDS OF HEAVY LIFTING
Send for complete catalogue showing 50 styles 10 to 100 tons capacity.
Made only by A. O. NORTON, Limited
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Strand Flexible Shafts and Equipments
Flexible shaft equipments for grinding, polishing, drilling, reaming, scraping, scratch brushing, power screw driving and nut setting.
Write for circulars and prices.
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THE D. H. STOLL CO., INC.
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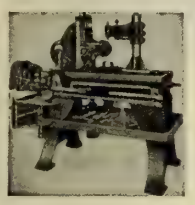

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Hand Feed
Semi-Automatic, Fully Automatic
Also Lathe Chucks and Centering Machines
THE D. E. WHITON MACHINE CO.
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DESIGNS PATTERNS
CASTINGS FORGINGS
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Building for the Future
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The "Incomparable"
That New Steel Chuck
Style 214
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THE SKINNER CHUCK COMPANY
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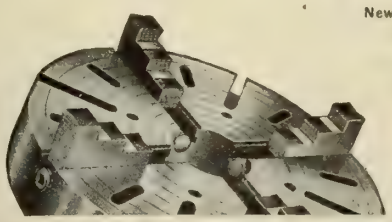

LATHE-DRILL PLANER CHUCKS

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OF QUALITY SINCE 1878.
SMITH'S FALLS MALLEABLE CASTINGS LTD
SMITH'S FALLS, ONTARIO.

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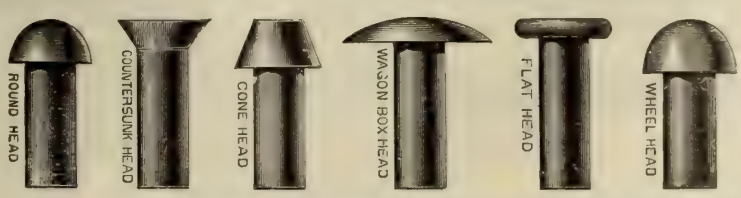
UNIVERSAL GRINDING MACHINES
THE THOMPSON GRINDER CO.
SEND FOR BULLETIN NO. U.13. SPRINGFIELD, OHIO



WE MANUFACTURE RIVETS of every description, 5/8 inch dia. and smaller
PARMENTER & BULLOCH CO., LTD.
GANANOQUE, ONTARIO

If what you need is not advertised, consult our Buyers' Directory and write advertisers, listed under proper heading

OIL CUPS

For every Purpose

An exceptionally strong and well-made hinge lid oil cup. Cap can be operated with oil can spout; closes automatically; cannot jar open or loose. Dust-proof. Made in three sizes.

Write for catalog and prices covering our complete line of grease cups, oil cups and spring shackle bolts.

Canadian Winkley Co., Ltd.
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HANNA RIVETERS

For
Tank, Boiler, structural and car fabrication

Hanna Engineering Works
1758 Elston Ave.,
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Manufacturer and Distributor
for
MUMFORD MOLDING MACHINE CO.

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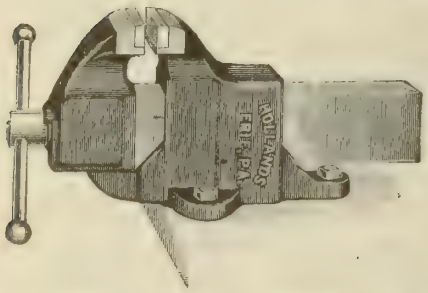
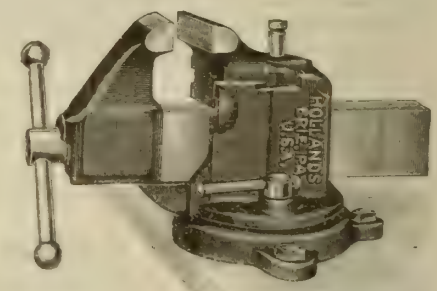


Have a record of thirty-five years of satisfactory service.

If your dealer cannot supply you, write direct for circular No. 25.



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Established 1887 Erie, Pa., U. S. A.

When answering advertisements kindly mention Canadian Machinery

STEEL TUBING

CLOSE Joints and Welded Steel Tubing for Bedsteads, Trolley Arms, Agricultural Implements, and all other manufacturing purposes, reliable quality, uniform in size, 14 to 20 gauge, 3-8 inch to 2 inch outside diameter.

STANDARD TUBE COMPANY, LIMITED
WOODSTOCK, ONT.

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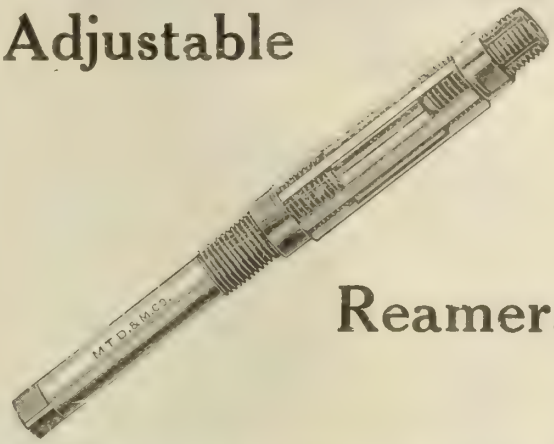
Adjustable



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THE GENUINE MORSE DRILLS ENCIRCLE THE GLOBE

Have a Wide Range of Expansion

From 1/16" in the smallest to 3/16" in the largest. With a set of eleven reamers (A to K) you can ream a hole of any desired size from 15/32" to 1-17/32". Strength, accuracy and ease of adjustment are features of these adjustable reamers. In them, the best materials obtainable and the experience of over half a century of reamer manufacture are combined for your benefit.

Send for descriptive circular.

"MORSE"
Twist Drill & Mch. Co.
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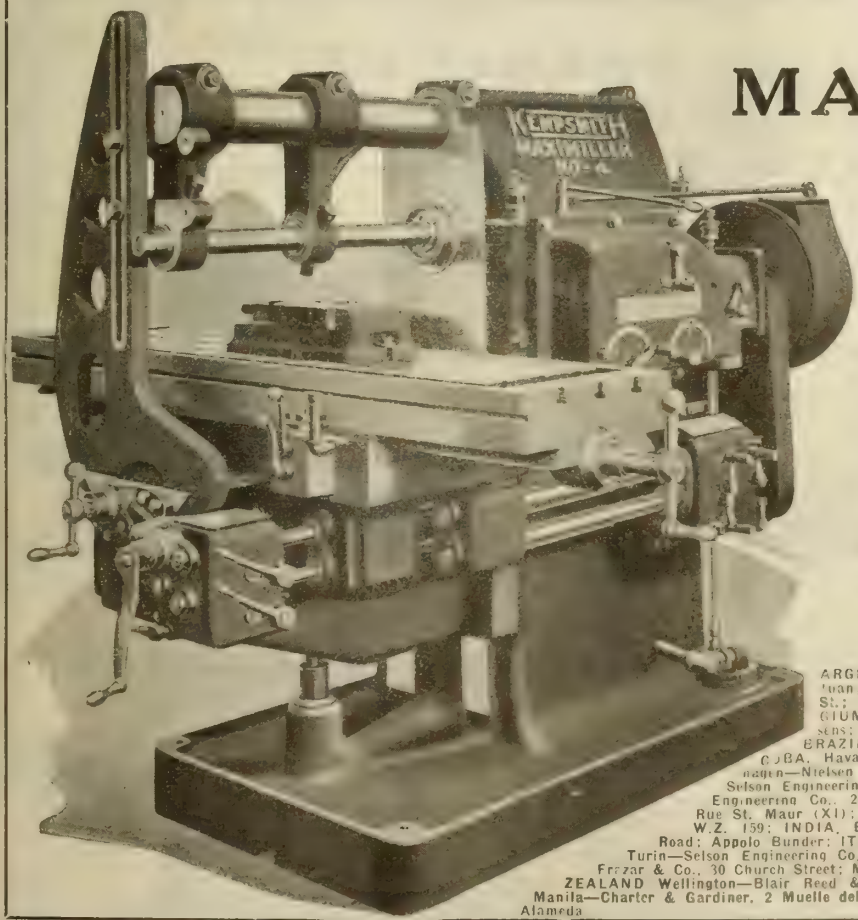
THE GENUINE MORSE DRILLS ENCIRCLE THE GLOBE



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FOR

PERMANENT PRODUCTION PROFITS

BECAUSE:—

RIGID CONSTRUCTION, AMPLE POWER! POWER RAPID TRAVERSE! (In all directions)
CENTRALIZED CONTROL! GEARS RUN IN OIL!

Built By

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Builders of Cone Type, Constant Speed and Production Milling Machines.

Send for Circular.

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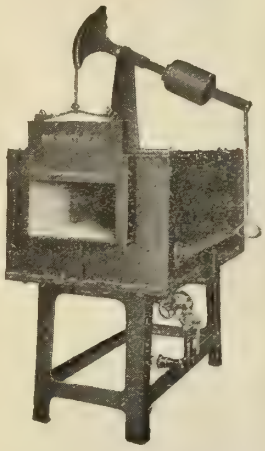
STEWART

Industrial Furnaces



No. 10—Oven for Annealing, Carbonizing, Hardening, Carbon Steel Heat Treating, Preheating or Reheating. Opening 12 in. by 20 in. Depth 48 in.

The knowledge gained by over 25 years' actual experience of manufacturing conditions is reflected in the designing and building of Stewart Furnaces. There's a Stewart Industrial furnace for

Annealing
Billet Heating
Brass Melting
Carbonizing
Cyanide Hardening
Drop Forging
Galvanizing
High Speed Steel Hardening
Lead Hardening
Oil Tempering
Pre-Heating
Rivet Heating
Rod End Heating
Soft Metal Melting
Spring Hardening
Tinning. Etc.

The benefit of expert counsel freely given for the solution of your heat treating problems.

Double Deck High Speed Steel Furnace. Upper or preheatng chamber heated by waste gases from lower chamber. Made in 5 standard sizes.

Stewart Industrial Furnaces
Are Made in Canada by

Flexible Shaft Company
LIMITED
353 Carlaw Ave., Toronto

CLECO PRESSURE SEATED AIR VALVES

Style PO

Style PO: Parallel Valve has "waste port" to bleed the air from hose after valve is shut off, sizes ¼" ⅜" ½" ¾" 1" 1¼" 1½" and 2" Standard Pipe Thread Outlets.

Style A

Style A: 30-degree Angle Valve, sizes: ½" and ¾". Standard Pipe Thread Outlets.

Style RA: 90 degree Angle Valve sizes ¼" ⅜" ½" and ¾". OUTLETS Standard Pipe Thread.

Style RA

Styles A, RA and SL also have waste-ports to bleed air from hose.

Style SL

Style SL: The Inlets and Outlets are the same size and in alignment. Sizes ¼" ⅜" ½" ¾" 1" 1¼", 1½" and 2" standard pipe threads.

The Valve That Improves With Use
Requires no attention after installation.

IN STOCK

Riveting Hammers, Chipping Hammers, Sand Rammers, Air Drills, Grinders, Corner Drills, Bowes Hose Couplings, Cleco Air Valves, etc.

Style FWL

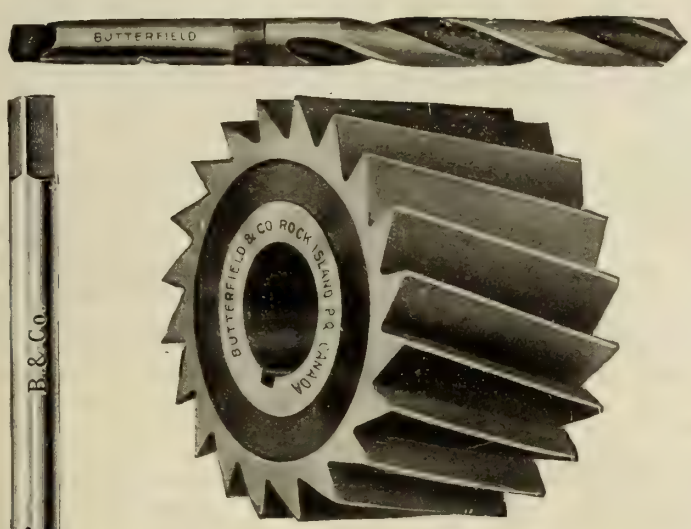
Style F.W.L.: Four-way valve controls the supply and exhaust from both ends of a double acting piston. Sizes: ⅜" ½" ¾" and 1" Outlets.

Style LW: Three way valve sizes ½" ¾" and 1." Standard pipe thread Outlets.

Write for Illustrated Bulletin No. 50

CLEVELAND PNEUMATIC TOOL CO., of Canada Ltd.
84 Chestnut Street, Toronto **337 Craig Street, Montreal**

If interested, tear out this page and place with letters to be answered



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Butterfield

Taps, Dies, Drills, Reamers and Cutters

For Better Service

YOUR mechanics appreciate tools of QUALITY in their milling, drilling and reaming operations, and when provided with such tools they turn out a bigger and better day's work. Furnish your mechanics with Butterfield tools. Compared with any ordinary drills, reamers or milling cutters, the Butterfield line cuts faster, more accurately and require less regrinding. They cost no more than ordinary tools. Try them—they are "the tools you buy again."

BUTTERFIELD & CO. DIVISION

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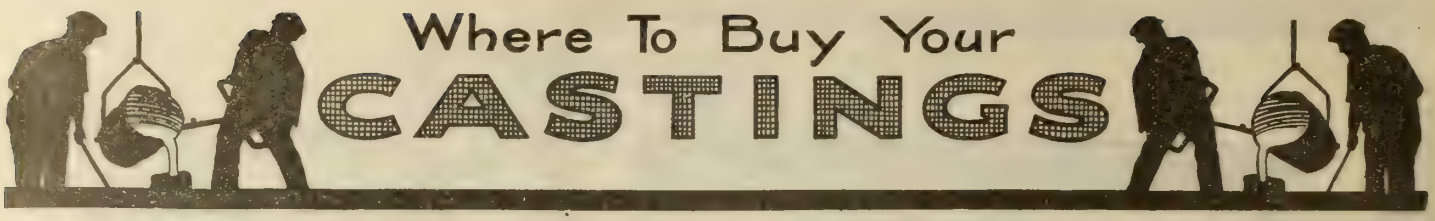

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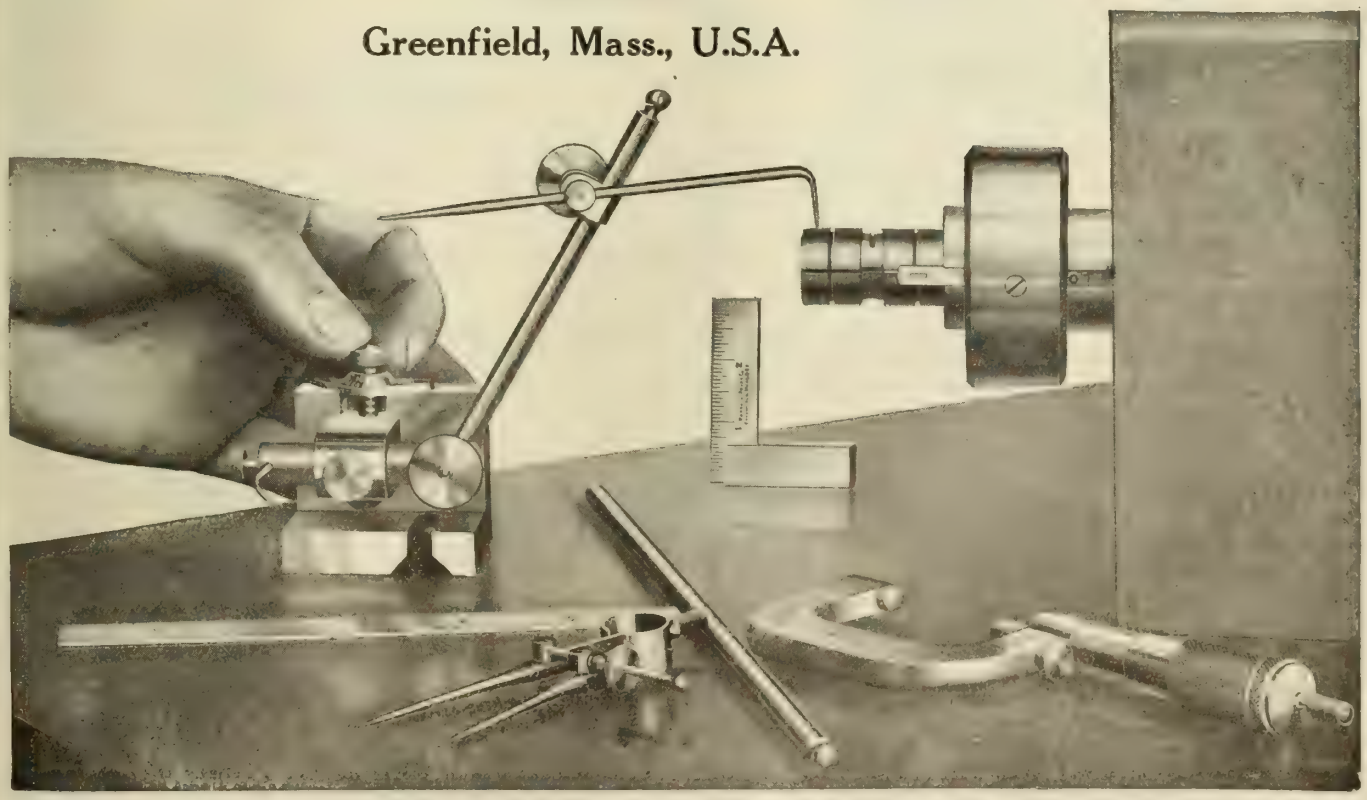

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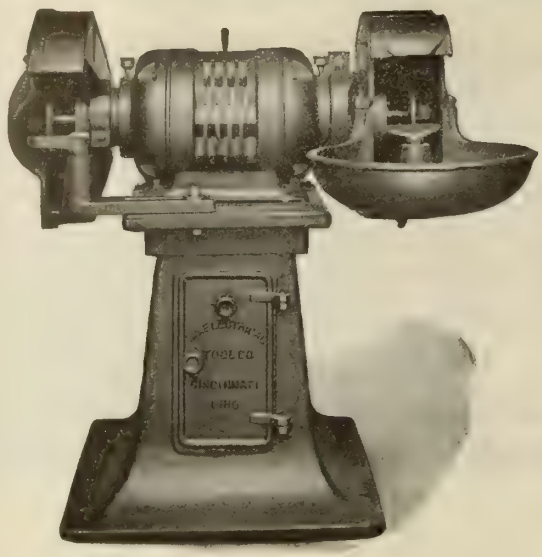

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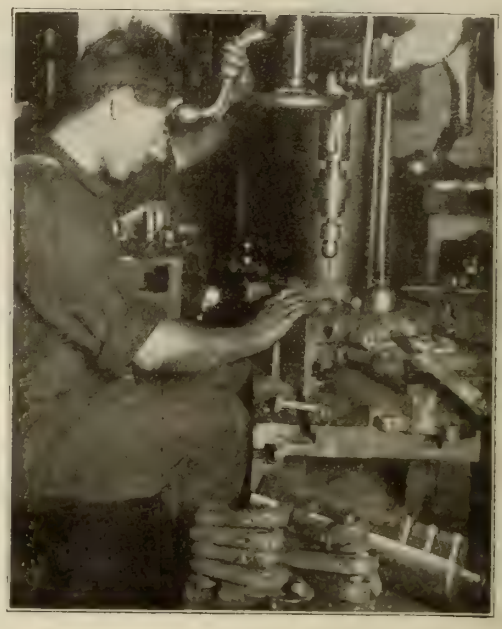

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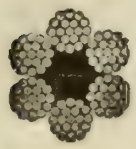
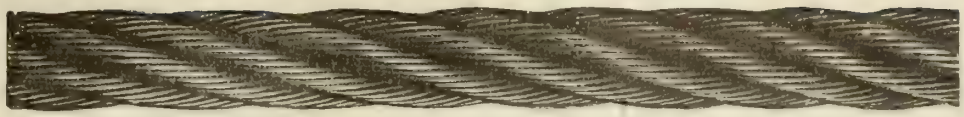
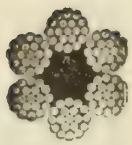

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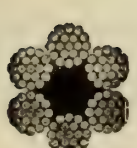
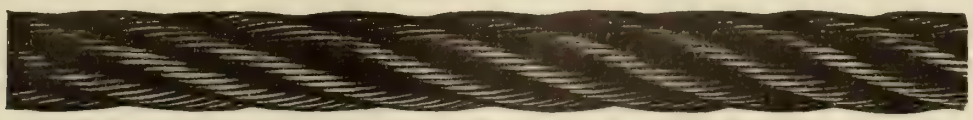
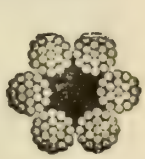

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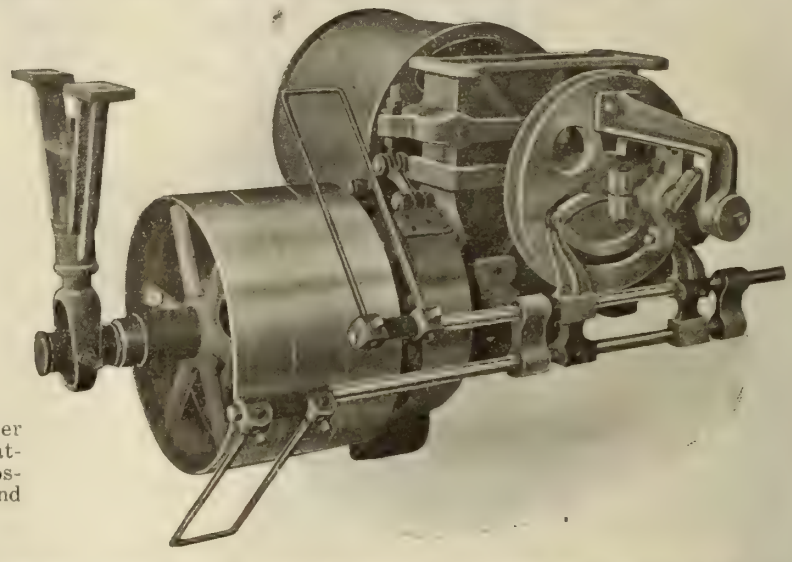

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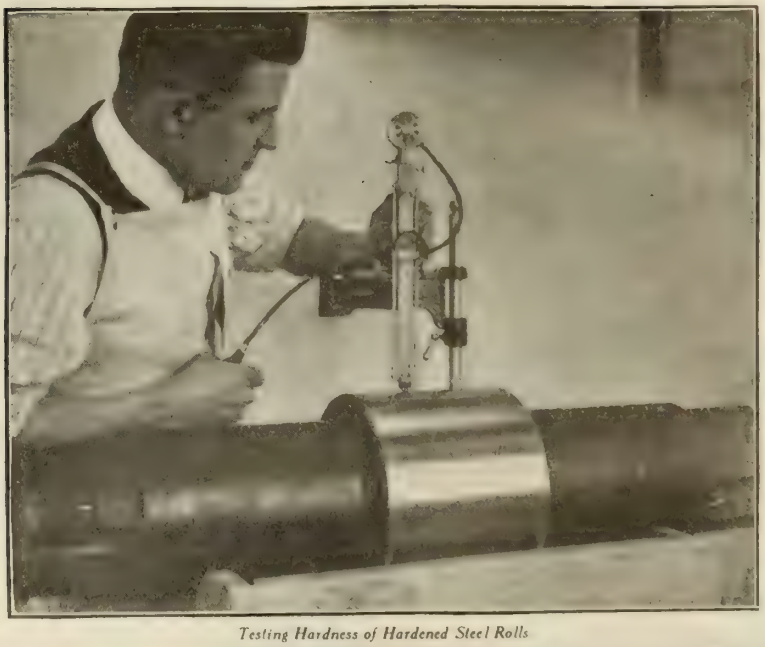

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CATARACT PRECISION TOOLS

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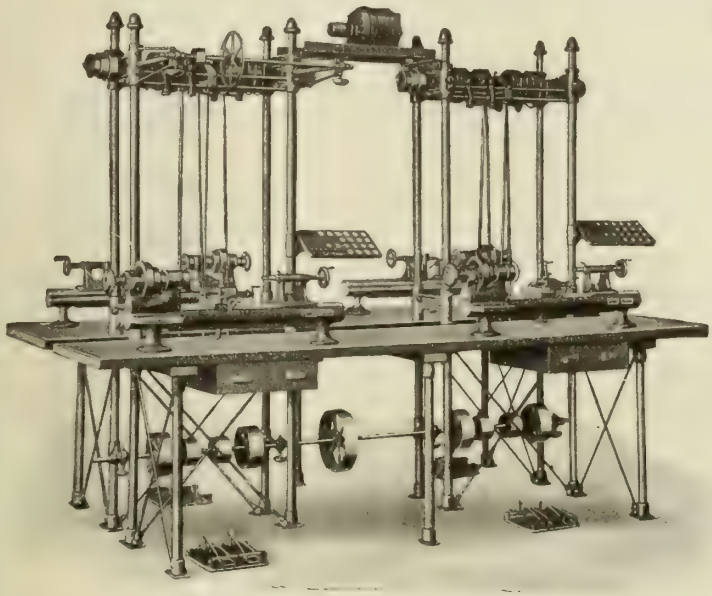
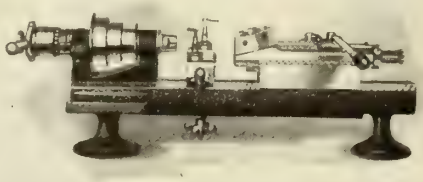


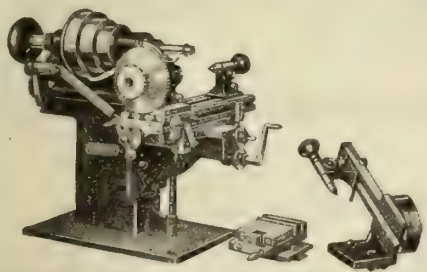
Cataract R-4 Double Bench Unit with Under-Drive.
(Details in No. 15 Catalogue.)

IF THIRTY MINUTES PER DAY IS LOST IN YOUR SHOP BECAUSE A MACHINE IS UNHANDY—or takes that much more time to keep clean and exchange fixtures and chucks—the price of the tool is lost many times during its life. Consider the small amount of time necessary to exchange fixtures on the CATARACT TOOLS. CATARACT TOOLS and Attachments have gained a worth while reputation in Canadian shops. There are many more where they would be appreciated and prove that our claims on their behalf are warranted. Best quality material, first-class workmanship, unexcelled finish, interchangeability of fixtures—are among some of the outstanding features of CATARACT MACHINES.

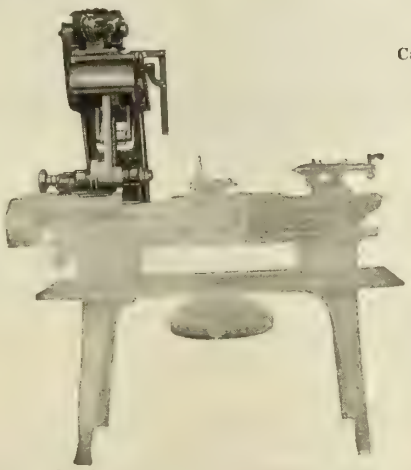
Below find illustrated several CATARACT TOOLS:



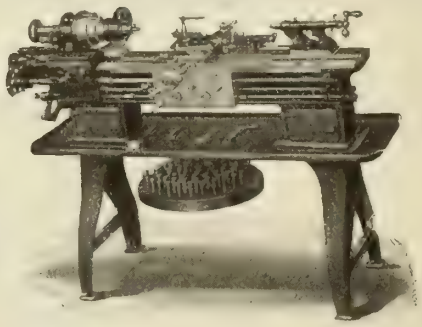
Cataract Bench Lathe with Turret Double Tool Cross Slide and Chuck Closer for the Manufacture of Duplicate Parts.



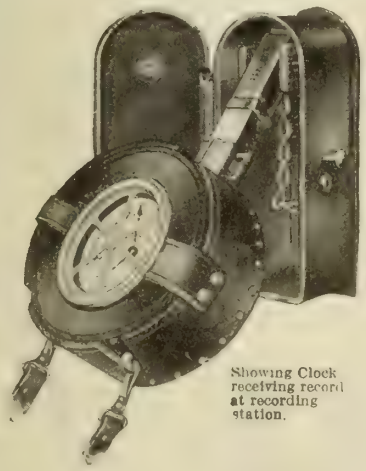
Cataract Bench Miller, with Horizontal Head.
(Details in No. 15 Catalogue).



Cataract Quick Change Swing Precision Lathe, with Motor Drive. (Special Catalogue for Details).



Cataract Quick Change Swing Precision Lathe, with Cone Drive.
(Details in Special Catalogue).



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LET US ADVISE YOU ON YOUR SPRING PROBLEMS

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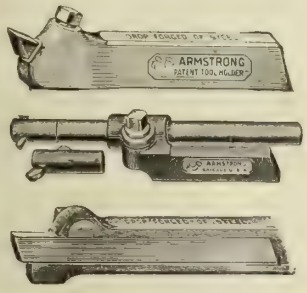
ARMSTRONG

TOOL HOLDERS



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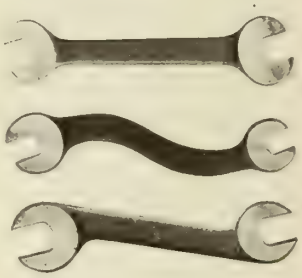

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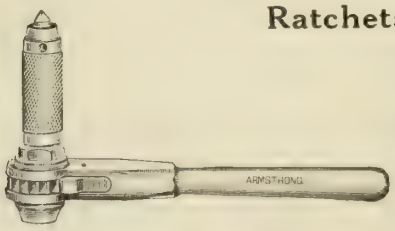

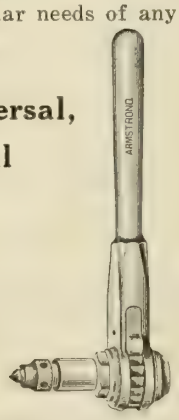

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D. K McLaren, Limited, Montreal,
McLaren Belting Co., J. C., Montreal, Que.

BELT CONVEYORS
Matthews Gravity Carrier Co., Ltd., Port Hope, Ont.

BELT DRESSINGS AND FILLERS
Dom. Belting Co., Ltd., Hamilton, Ont.
D. K McLaren, Limited, Montreal,

BELT FASTENERS
Bristol Company, Waterbury, Conn.
Clipper Belt Lacer Co., Grand Rapids, Mich.
D. K. McLaren, **Limited, Montreal,**
McLaren Belting Co., J.C., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

BELT HOOKS
Bristol Co., **Waterbury, Conn.**
Clipper Belt Lacer Co., Grand Rapids, Mich
D. K McLaren, Limited, Montreal,

BELT LACING
Bristol Company, Waterbury, Conn.
Clipper Belt Lacer Co., Grand Rapids, Mich.
D. K. McLaren, Limited, Montreal,
McLaren Belting Co., J. C., Montreal,

BELT LACING, STEEL
Bristol Company, Waterbury, Conn.
Clipper Belt Lacer Co., Grand Rapids, Mich.

BELT LACING MACHINES
D. K. McLaren, **Limited, Montreal,**
McLaren Belting Co., J. C., Montreal, Que.

BELTING, CHAIN
Can. Link-Belt Co., Toronto, Ont.
Fittings, Limited, Oshawa, Ont.
Jones & Glassco, Montreal, Que.
real, Que.
Renold (Hans) of Canada, Ltd., Mont-

BELTING, FABRIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Dom. Belting Co., Ltd., Hamilton, Ont.
D. K. McLaren, Limited, Montreal,
McLaren Belting Co., J. C., Montreal, Que.
Sheppard, George F., Montreal, Que
Sumner & Co., New York City, N. Y

BELTING, LEATHER
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Can. Fairbanks-Morse Ltd., Montreal, Q.
D. K. McLaren, Limited, Montreal,
McLaren Belting Co., J. C., Montreal, **Que.**

BELTS, ABRASIVE
Oakey & Sons, Ltd., John, London, S.E., Eng.

BENDING MACHINES, POWER
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bertrams Ltd., Edinburgh, Scotland.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Excelsior Tool & Machine Co., East St. Louis, Ill.
Pels, Henry & Co., Inc., New York City, N. Y.

BILLETS, BLOOMS and SLABS
Jessop & Sons, Ltd., Wm., Toronto, Ont.
Steel Co., of Can. Ltd., Hamilton, Ont.

BLAST GATES
Rockwell Co. W. S., New York, N. Y.

BLOCKS
Wright Mfg. Co., Lisbon, Ohio.

BLOCKS, CHAIN (See Hoists, Hand)
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

BLOCKS, DIE
Canada Foundries & Forgings Co., Welland, Ont.

BLOCKS, PILLOW
Can. Link-Belt Co., Toronto, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

BLOWERS
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Connersville Blower Co., Connersville, Ind.
Flexible Shaft Co., Ltd., Toronto, Ont.

BOLT AND NUT MACHINERY
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Montreal, Que.

BOLT AND NUT MACHINERY, Automatic
National Acme Co., Cleveland, Ohio.

BOLTS AND NUTS
British Empire Steel Corporation, Montreal, Que.
National Acme Co., Montreal, Que.

BOLT THREADING DIE HEADS
Landis Machine Co., Inc., Waynesboro, Pa.

BOLTS, TRACK
Steel Co. of Canada, Ltd., Hamilton, Ont.

BOOSTERS, GAS
Connersville Blower Co., Connersville, Ind.

BORING BARS
Hannifin Mfg Co., Chicago, Ill.

BORING and TURNING MILLS, Vertical
Bertram & Sons Co., Ltd., The John Dundas, Ont.
Buckton & Co., Joshua, Leeds, England.
Gisholt Machine Co., Madison, Wis.

BORING, DRILLING and MILLING MACHINES, Horizontal.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
Herbert, Limited, Alfred, Toronto, Ont
Landis Tool Co., Waynesboro, Pa
Vertical
Can Fairbanks-Morse Co., Ltd Montreal, Que.

FOR LIST OF DEALERS SEE THE LAST PAGE OF THIS BUYERS DIRECTORY.

BORING TOOLS
Armstrong Bros. Tool Co., Chicago, Ill
Gisholt Machine Co., Madison, Wis

BORING TOOLS, ADJUSTABLE
Hannifin Mfg Co., Chicago, Ill

BUCKET CARRIERS, Pivoted
Can. Link-Belt Co., Toronto, Ont.

BUFFERS
Pryibil Machine Co., New York, N.Y.
Wadack Electric Tool Corpn. Chicago Ill

BUFFING OR POLISHING MACHINES (See Polishing and Buffing Machines)
Blount Co., J. G., Everett, Mass.
Excelsior Tool & Machine Co., East St. Louis, Ill
Herbert, Limited, Alfred, Toronto, Ont
Pryibil Machine Co., New York, N.Y.
U. S. Electrical Tool Co., Cincinnati, O.

BUILDING MATERIALS
Bertram & Son Co., Ltd., The John Dundas, Ont.

BURNERS, OIL AND GAS
Rockwell Co., W.S., New York City.

BUSHES
Steel Co. of Can Ltd., Hamilton Ont

CABINETS, OIL
S. F. Bowser & Co., Ltd., Toronto, Ont

CALIPERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Starrett Co., L. S., Athol, Mass.

CAMS
Canada Foundries & Forgings Co., Welland, Ont.

CAN-MAKING MACHINERY
(See Sheet Metal Working Machinery)
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Bliss Co., E. W., Brooklyn, N. Y.
Smooth Mfg. Co., Jersey City, N. J.

CARBONIZING AND HARDENING
Corman Engineering Co., Toronto, Ont.

CEMENTS, IRON CENTERING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.

CHAINS (See Sprockets and Chains)
Diamond Chain & Mfg. Co., Indianapolis, Ind.
Reynold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

CARD CLOTHING
D. K. McLaren, Limited, Montreal.

CAR WHEEL BORING BARS
Hannifin Mfg. Co., Chicago, Ill

CASTINGS, ALUMINUM, BRASS, BRONZE, COPPER, DIE-MOLDED, FERRO-ALLOY, IRON, SEMI-STEEL, STEEL.
See "Where to buy your castings" Section. Page number may be found by turning to Advertisers' Index.

CHAINS, DRIVING
Can. Link-Belt Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont
Jones & Glassco, Montreal, Que.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

CHASERS
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CHUCKING MACHINES
Acme Machine Tool Co., Cincinnati, O
Brown & Sharpe Mfg. Co., Providence, R. I.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Stainle Turret Machine Co., Madison, Wisconsin.

CHUCKS, DRILL AND TAP
American Equipment Co., Detroit, Mich
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canadian SKF Co., Toronto, Ont.
Cushman Chuck Co., Hartford, Conn
Geometric Tool Co., New Haven, Conn.
Hannifin Mfg. Co., Chicago Ill
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg., New Britain, Conn

CHUCKS, LATHE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can Fairbanks-Morse Co., Ltd., Mon
Collis Co Clinton, Iowa
treal, Que.
Cushman Chuck Co., Hartford, Conn
Eastern Tube & Tool Co., Inc., Brooklyn N Y
Geometric Tool Co., New Haven, Conn
Gisholt Machine Co., Madison, Wis
Herbert, Limited, Alfred, Toronto, Ont
Ker & Goodwin Machine Co., Brantford Ont.
Pryibil Machine Co., New York, N Y
Skinner Chuck Co., New Britain, Conn
Union Mfg. Co., New Britain, Conn

CHUCKS, MAGNETIC
Pratt & Whitney Co., of Canada Ltd., Dundas, Ont.

BUYERS' DIRECTORY

CHUCKS, PLANER
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cushman Chuck Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

CHUCKS, PNEUMATIC
Hannifin Mfg. Co., Chicago, Ill.

CHUCKS, QUICK CHANGE DRILL
Collis Co, Clinton, Iowa.

CHUCKS, TAPPING
William L. Procunier, Chicago, Ill.

CHUCKS, VERTICAL BORING MILL
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Skinner Chuck Co., New Britain, Conn
Union Mfg. Co., New Britain, Conn.

CLAMPS, MACHINISTS'
Brown & Sharpe Mfg. Co., Providence,
Starrett Co., L. S., Athol, Mass.

CLEANERS, METAL, WASTE, GENERAL
Oakley Chemical Co., New York, N. Y.

CLOCKS
Chicago Watchman's Clock Co., Chicago,
Hardinge Bros., Limited, Toronto, Ont.

CLOCKS, TIME
Gisholt Machine Co., Madison, Wis.

CLOCKS, WATCHMEN'S
Chicago Watchman's Clock Co., Chicago, Ill.
Hardinge Bros., Limited, Toronto, Ont.

CLUTCHES, FRICTION
Bond Engineering Wks. Ltd., Toronto.
Can.-Link-Belt Co., Toronto, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Jones, W A., Foundry and Machine Co., Chicago, Ill.

COAL AND ASH HANDLING MACHINERY
Can.-Link Belt Co., Toronto, Ont.
Roelofson Elevator Works, Galt, Ont.

COAL-STORAGE SYSTEMS
Can. Link-Belt Co., Toronto, Ont.

COLLARS, SHAFT OR SET
Canada Foundries & Forgings Co., Welland, Ont.
Can. Link-Belt Co., Toronto, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

COLLETS
Butterfield & Co., Inc., Rock Island, Que.
Geometric Tool Co., New Haven Conn.
Hardinge Bros., Inc., Chicago, Ill.
Hendley Machine Co., Torrington Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

COMPOUNDS, CLEANING
Oakley Chemical Co., New York, N.Y

COMPOUNDS—CUTTING, DRILLING, GRINDING, SCREW CUTTING
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Oakley Chemical Co., New York, N.Y.

COMPRESSORS, AIR AND GAS
Bawden Machine Co., Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.

COMPRESSORS, ELECTRIC
Can. Westinghouse Co., Ltd., Hamilton, Ont.

CONES, FRICTION
Norton Co., of Can. Ltd., Hamilton, Ont.

CONNECTING RODS AND STRAPS
Canada Foundries & Forgings Co., Welland, Ont.

CONTRACT WORK
Dominion Engineering Works, Limited Montreal, Que.
Victoria Foundry Co., Ltd., Ottawa, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

CONVEYORS AND ELEVATORS (SEE ELEVATORS)
Jones & Glassco, Montreal, Que.
Matthews Gravity Carrier Co., Ltd., Port Hope, Ont.

COPING MACHINES
Pels, Henry & Co., Inc., New York City, N. Y.
Pels, Henry & Co., Inc., New York City, N. Y.

COTTERS
Steel Co. of Canada, Ltd., Hamilton, Ont.

COUNTERBORES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

COUNTERS, REVOLUTION
Starrett Co., L. S., Athol, Mass.

COUNTERSHAFTS
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Johnson Machine Co., Carlyle, Man-
Kempsmith Mfg. Co., Milwaukee, Wis.

COUNTERSHAFTS, PNEUMATIC
Hannifin Mfg. Co., Chicago, Ill.

COUNTERSINKS
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

COUPLERS, CAR AND LOCOMOTIVE
Can. Steel Foundries, Montreal, Que.

COUPLINGS
Steel Co. of Canada, Ltd., Hamilton, Ont.

COUPLINGS, SHAFT
Bond Engineering Wks. Ltd., Toronto.
Can. Link-Belt Co., Toronto, Ont.
Jones, W A., Foundry and Machine Co., Chicago, Ill.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

CRANES, ELECTRIC
Berry & Co., Ltd., Henry, Leeds, England.
Box & Co., Inc., Alfred Philadelphia, Pa.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can.-Link-Belt Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Northern Crane Works, Walkerville, Ont.
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.

CRANES, LOCOMOTIVE
Can. Link-Belt Co., Toronto, Ont.

Bertram & Son Co., td., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Northern Crane Works, Walkerville, Ont.

CRANK PIN TURNING MACHINE
Underwood Corp., H.B., Philadelphia, Pa.

CUTTERS, BILLET
Pels, Henry & Co., Inc., New York City, N. Y.

CUTTERS, BILLET
Pels, Henry & Co., Inc., New York City, N. Y.

CUTTERS, GEAR
Brown & Sharpe Mfg. Co., Providence, R. I.
Butterfield & Co., Inc., Rock Island, Que.
Can. Illinois Tools, Ltd., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Taylor, J A. M. Tool Co., Ltd., Toronto, Ont.

CUTTERS, HIGH SPEED
Atkins & Co., Inc., E. C., Indianapolis.
Butterfield & Co., Inc., Rock Island, Que.
Can. Illinois Tools, Ltd., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Taylor, J A. M. Tool Co., Ltd., Toronto, Ont.

CUTTERS, MILLING
Brown & Sharpe Mfg. Co., Providence, R. I.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Can. Illinois Tools, Ltd., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Taylor, J A. M. Tool Co., Ltd., Toronto, Ont.

CUTTERS, STAY BOLT
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.

CUTTING-OFF MACHINE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Preston Woodworking Machinery Co., Preston, Ont.
Starrett Co., L. S., Athol, Mass.

CUTTING STEEL
Deloro Smelting & Refining Co., Ltd., Toronto

CUTTING OFF MACHINES, PIPE (SEE PIPE-CUTTING AND THREADING MACHINES)
Landis Machine Co., Inc., Waynesboro, Pa.

CUTTING-OFF TOOLS
Armstrong Bros. Tool Co., Chicago, Ill.

CUTTING OIL FILTERS (SEE OIL FILTERING SYSTEMS
Bowser, S. F. & Co., Ltd., Toronto.

CUTTING, OXY-HYDROGEN
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

CYLINDER BORING AND REAMING
Hannifin Mfg. Co., Chicago, Ill

DETACHABLE CHAIN
International Malleable Iron Co., Guelph, Ont.

DIAMONDS, BLACK AND ROUGH
Can. Desmond-Stephan Mfg Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont

DIAMOND TOOLS
Can. Desmond-Stephan Co., Hamilton,
Wheel Trueing Tool Co., Windsor, Ont.

DIAMOND CROSSINGS
Can. Steel Foundries, Montreal, Que.

DIAMONDS, IMPORTERS
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Co., Windsor, Ont.

DIE-CUSHIONS, PNUEMATIC
Marquette Tool & Mfg Co. Chicago, Ill

DIES, SCREW AND THREAD CUTTING
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.

DIES, SHEET-METAL AND SUB-PRESS (See Tool Work)
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Ford-Smith Machine Co., Ltd., Hamilton, Ont.
Homer & Wilson, Hamilton, Ont.
Leffler & Co., Chas., Brooklyn, N.Y.
Triplex Machine Tool Corpn., New York

DIES, FORGING
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

DIES, SCREW AND THREAD CUTTING
Morse Twist Drill & Machine Co., New Bedford, Mass.

DIES, SELF-OPENING, ADJUSTABLE
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Jones & Lamson Machine Co., Providence, R.I.
Landis Machine Co., Inc., Waynesboro,
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DIES, THREADING-OPENING
Jardine & Co., A. B., Hespeler, Ont.
Jones & Lamson Machine Co., Providence, R.I.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DIVIDING HEADS
Burke Machine Tool Co., Conneaut, Ohio.
Hendey Machine Co., Torrington, Conn
Kearney & Treacker Co., Milwaukee, Wis.

DOGS, LATHE AND MILLING MACHINE
Armstrong Bros. Tool Co., Chicago, Ill.

DRAFTING MATERIALS
American Lead Pencil Co., New York City, N.Y.

DRESSERS, GRINDING WHEEL
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ont.
Norton Co., of Can., Ltd., Hamilton
Wheel Trueing Co., Windsor, Ont.

DRESSING TOOLS
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Co., Windsor, Ont.

DRILL HOLDERS
Armstrong Bros. Tool Co., Chicago, Ill

DRILLING MACHINES, BENCH
Ames Co., B. C., Waltham, Mass.
Burke Machine Tool Co., Conneaut, Ohio.
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Hardinge Bros., Inc., Chicago, Ill.
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont.
Wisconsin Electric Co., Racine, Wis

DRILLING MACHINES, ELECTRIC AND HAND
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Independent Pneumatic Tool Co., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis

DRILLING MACHINES, GANG
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

DRILLING MACHINES, HEAVY DUTY
Barber Machy. Co., Ltd., Toronto, Ont
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
Herbert, Limited, Alfred, Toronto, Ont.
Petrie Ltd, H W., Toronto, Ont.

BORING, DRILLING AND MILLING MACHINES, (HORIZONTAL.)
Barber Machy. Co., Ltd., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Herbert, Limited, Alfred, Toronto, Ont.
Petrie Ltd, H W., Toronto, Ont.

DRILLING MACHINES, Multiple Spindle
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
National Acme Co., Cleveland, Ohio.

DRILLING MACHINES, Pneumatic
Cleveland Pneumatic Tool Co., Toronto, Ont.
Independent Pneumatic Tool Co., Montreal, Que.

DRILLING MACHINES, PORTABLE
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, RADIAL
Barber Machy. Co., Ltd. Toronto Ont.
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Canada Machinery Corpn., Ltd Galt, Ont.
Herbert, Limited, Alfred, Toronto, Ont.
Independent Pneumatic Tool Co., Montreal, Que.
Petrie Ltd, H. W., Toronto, Ont.
Williams Machinery Co., A R., Toronto.

DRILLING MACHINES, SENSITIVE
Barber Machy. Co., Ltd., Toronto, Ont
Burke Machine Tool Co., Conneaut O.
Herbert, Limited, Alfred, Toronto, Ont.
Petrie Ltd, H. W., Toronto, Ont
Pratt & Whitney Co., of Canada Ltd. Dundas Ont
Sibley Mach. Co., South Bend, Ind
Triplex Machine Tool Corpn., New York City, N. Y.
Williams Machinery Co., A. R., Toronto.
Wisconsin Electric Co., Racine Wis

DRILLING MACHINES, TURRET
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wisconsin.
Williams Machinery Co., A. R., Toronto.

DRILLING MACHINES, VERTICAL
Barber Machy. Co., Ltd., Toronto, Ont
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Consolidated Machine Tool Corp., New York City, N. Y.
Herbert, Limited, Alfred, Toronto Ont
Sibley Mach. Co., South Bend, Ind

DRILLS, CENTRE
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DRILLS, CLOSE CORNER
Independent Pneumatic Tool Co., Montreal, Que.

DRILLS, ELECTRIC
Independent Pneumatic Tool Co., Montreal, Que.
Petrie Ltd, H. W., Toronto, Ont.
U. S. Electrical Tool Co., Cincinnati, Ohio
Black & Decker Mfg. Co., Ltd., Montreal, Que.
Wadack Electric Tool Corpn., Chicago, Ill.

DRILLS, HIGH SPEED TWIST
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Cleveland Twist Drill Co., Cleveland, O.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Taylor, J A. M. Tool Co., Ltd., Toronto, Ont.

DRILLS, PORTABLE
Independent Pneumatic Tool Co., Montreal, Que.

DRILLS, PNEUMATIC
Independent Pneumatic Tool Co., Montreal, Que.

BUYERS' DIRECTORY

DRILLS, RATCHET
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

DRILLS, TWIST AND FLAT
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont

DRILL SLEEVES AND SOCKETS
Collis Co. Clinton, Iowa

DROP FORGINGS
Steel Co of Canada, Ltd., Hamilton

DUMB WAITERS
Roelofson Elevator Works, Galt, Ont.

DUST HANDLING EQUIPMENT
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

ELECTRIC DRILLS AND GRINDERS
Black & Decker Mfg. Co., Ltd., Montreal, Que.
U. S. Electrical Tool Co., Cincinnati, Ohio

ELECTRIC STEAM GENERATORS
Dominion Engineering Works, Limited, Montreal, Que.

ELECTRICAL INSTRUMENTS
Bristol Co., Waterbury, Conn.

ELECTRICAL SUPPLIES
Atkins & Co., Inc., E. C., Indianapolis
Diamond State Fibre Co., Toronto, Ont.

ELECTRIC TOOLS
U. S. Electrical Tool Co., Cincinnati, Ohio.

ELEVATORS AND CONVEYORS
Can. Link-Belt C., Toronto, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q
Matthews Gravity Carrier Co., Ltd., Port Hope, Ont

ELEVATORS, FREIGHT AND PASSENGER
Roelofson Elevator Works, Galt, Ont.
EQUIPMENT, ELEVATOR SAFETY
Jones & Glassco, Montreal, Que

EMERY WHEELS (See Grinding Wheels)
Lion Grinding Wheels, Limited, Montreal, Que.
Atkins & Co., E. C., Indianapolis, I
Norton Co., of Canada., Ltd., Hamilton
Prescott Emery Wheel Co., Prescott, Ont

ENGINES, CAPSTAN
Kennedy & Sons, Wm., Owen Sound, Ont.

ENGINEERS, CONSULTING
Chase Inc., Frank D., Chicago, Ill

ENGINEERS, FOUNDRY
Chase Inc., Frank D., Chicago, Ill.

ENGINEERS, FACTORY
Chase Inc., Frank D., Chicago, Ill.

ENGINEERS, MECHANICAL
Dominion Engineering Works, Limited, Montreal, Que.
Excelsior Tool & Machine Co., East St Louis, Ill.
Gisholt Machine Co., Madison, Wis.
Hamilton Gear & Machine Co., Toronto.

EXPANDERS, TUBE
Jardine & Co., A. B., Hespeler, Ont.

FANS, ELECTRIC
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

FANS, EXHAUST
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

FANS, VENTILATING
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

FIBRE
Diamond State Fibre Co., of Can. Ltd., Toronto, Ont.

FILES AND RASPS
Nicholson File Co., Port Hope, Ont.
Simmons Canada Saw Co., Montreal, Que.

FILLER, IRON (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J.

FIRE ESCAPES
Roelofson Elevator Co., Galt, Ont.

FITTINGS, PIPE
Elmes, Charles F. Engineering Works, Chicago, Ill.
International Malleable Iron Co., Guelph
Fittings, Limited, Oshawa, Ont.

FLEXIBLE SHAFTS
Flexible Shaft Co., Ltd., Toronto, Ont
Strand & Co., N. A., Chicago, Ill

FLUE LATHES
Marshalltown Mfg Co., Marshalltown, Iowa.

FLUE WELDERS
Marshalltown Mfg Co., Marshalltown, Iowa.

FLUXES, WELDING
Dominion Oxygen Co., Ltd, Toronto
Liquide Air Company, Toronto, Ont.

FORGES
Flexible Shaft Co., Ltd., Toronto, Ont.

FORGING MACHINERY
Acme Machinery Co., Cleveland, Ohio
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown Boggs & Co., Ltd., Montreal.
National Machinery Co., Tiffin, Ohio.
Steel Co of Canada, Ltd., Hamilton

FORGINGS, DROP
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Ltd., Toronto, Ont.
Jessop & Sons, Ltd., Wm., Toronto, Ont

FORGINGS, HAMMER
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Jessop & Sons, Ltd., Wm., Toronto, Ont.

FORMING AND BENDING MACHINES
Quickwork Co., St. Mary's, Ohio

FOUNDRY EQUIPMENT
Rice Lewis & Son, Ltd., Toronto, Ont.

FOUNDRY SUPPLIES
Rice Lewis & Son, Ltd., Toronto, Ont.

FROGS, SPRING OR RIGID
Can. Steel Foundries, Montreal, Que.

FURNACES, ELECTRIC
Flexible Shaft Co., Toronto, Ont
Rockwell Co., W. S. New York City.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

FURNACES, ENAMEL
U. S. Smelting Furnace Co., Belleville Ill.

FURNACES, HEAT TREATING COAL
Rockwell Co., W. S., New York City.

FURNACES, HEAT TREATING OIL AND GAS
Bellevue Industrial Furnace Co., Detroit, Michigan.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Flexible Shaft Co., Ltd., Toronto, Ont
Rockwell Co. W. S., New York, N. Y.

FURNACES, METAL MELTING
U. S. Smelting Furnace Co., Belleville Ill

FURNACES, SMELTING
U. S. Smelting Furnace Co., Belleville, Ill

FURNACES, NON-CRUCIBLE
U. S. Smelting Furnace Co., Belleville, Ill

FURNACES TEMPERING AND ANNEALING
Bellevue Industrial Furnace Co., Detriot, Mich.
Brown & Sharpe Mfg., Co., Providence R. I.
Flexible Shaft Co., Ltd., Toronto, Ont.
Rockwell Co., W. S., New York City.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

FURNACES AND OVENS, ELECTRIC
Flexible Shaft Co., Toronto Ont
Rockwell Co. W. S., New York, N. Y.
Starrett Co., L. S., Athol, Mass.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

GAGES, MEASURING (See Tool Work)
Brown & Sharpe Mfg. Co., Providence, R. I.
Greenfield Tap & Die Corp., Galt, Ont
Lufkin Rule Co., Windsor, Ont.
Starrett Co., L. S., Athol, Mass.

GAGES, PLUG AND RING
Precision & Thread Grinder Mfg. Co., Philadelphia, Pa.

GAGES, RECORDING
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GAGES, SNAP
Precision & Thread Grinder Mfg. Co., Philadelphia, Pa.

GAGES, SPECIAL MEASURING (See Tool Work)
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GAGES, THREAD
Brown & Sharpe Mfg. Co., Providence R. I.
Herbert, Limited, Alfred, Toronto, Ont.
Precision & Thread Grinder Mfg. Co., Philadelphia, Pa.
Starrett Co., L. S., Athol, Mass.

GALVANIZING
Fittings, Limited, Oshawa, Ont.
Pedlar People, Ltd., Oshawa, Ont.

GAS, COAL COMPRESSED
L'Air Liquid Society, Toronto, Ont.

GAS, COMPRESSED
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

GASKETS
Diamond State Fibre Co. of Ca., Ltd., Toronto, Ont.
Smooth Mfg. Co., Jersey City, N. J

GAUGES VACUUM AND PRESSURE
Taylor Instrument Co. Toronto, Ont.

GEAR BLANKS
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.
Dominion Engineering Works, Limited, Montreal, Que.

GEAR COUNTERS
Hart Mfg. Co., R. A., Battle Creek, Michigan.

GEAR CUTTING MACHINES
Bertram & Sons Co., Ltd., The John, Dundas, Ont.

Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Fellows Gear Shaper Co., Springfield, Vt.
Whiton Machine Co., D. E., New London, Conn.

GEAR TESTING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Davenport Machine Tool Co., Rochester N.Y.

GEARS, CAST
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Hull Iron & Steel Foundries, Hull, Que.
Dominion Engineering Works, Limited, Montreal, Que.
Jones, W. A., Foundry and Machine Co Chicago, Ill
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

GEARS, CUT
Brown & Sharpe Mfg. Co., Providence, R. I.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Gardner & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
Jones, W. A., Foundry and Machine Co Chicago, Ill
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

GEARS, DRESSED
Kennedy & Sons, Wm., Owen Sound, Ontario

GEARS, FORGED
Canada Foundries & Forgings Co., Welland, Ont.

GEARS, HERRINGBONE
Hamilton Gear & Machine Co., Toronto, Ont.

GEARS, RAWHIDE (See Gears, Cut)
Hamilton Gear & Machine Co., Toronto.

GEAR, SILENT CHAIN
Gardner & Son, Robt., Montreal, Que.
Can. Link-Belt Co., Ltd., Toronto, Can
Hans Renold of Canada, Ltd., Montreal, Quebec.

GEARS, WORM
Hamilton Gear & Machine Co., Toronto

GENERAL ENGINEERING SERVICE
Corman Engineering Co., Toronto, Ont

GENERATORS ACETYLENE
L'Air Liquide Society, Toronto, Ont.

GOGGLES, SAFETY
Dominion Oxygen Co., Ltd., Toronto
Liquide Air Company, Toronto.

GRAB BUCKETS
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Cleveland Twist Drill Co., Cleveland, O.

GREASE CUPS, PRESSED STEEL AND BRASS
Can. Winkley Co., Ltd., Windsor, Ont.

GREASES, LUBRICATING
Canadian SKF Co., Toronto, Ont.

GRINDERS, ELECTRIC
Black & Decker Mfg. Co., Ltd., Montreal, Que.
U. S. Electrical Tool Co., Cincinnati, Ohio.
Wadack Electric Tool Corpn., Chicago, Ill.

GRINDERS TOOL POST
U. S. Electrical Tool Co., Cincinnati, Ohio.

GRINDING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Excelsior Tool & Machine Co., East St Louis, Ill.
Norton Co., of Canada, Ltd., Hamilton

GRINDING MACHINES, ABRASIVE BELT
Norton Co. of Can. Ltd., Hamilton, Ont.

GRINDING MACHINES, AUTOMATIC
Excelsior Tool & Machine Co., East St. Louis, Ill.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, BENCH
Blount Co., J. G., Everett, Mass
Ford-Smith Machine Co., Ltd., Hamilton, Ont.
Geometric Tool Co., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co. of Canada, Ltd., Hamilton, Ont.
Pratt & Whitney Co. of Canada, Ltd.,

GRINDING MACHINES, CENTER
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES, CUTTER AND REAMER
Barber Machy. Co., Ltd., Toronto, Ont
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Garvin Mach. Co., New York City, N.Y.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Precision & Thread Grinder Mfg. Co Philadelphia, Pa

GRINDING MACHINES, CYLINDRICAL
Barber Machy Co., Ltd., Toronto, Ont
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Petrie Ltd. H. W., Toronto, Ont.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.
Norton Co., of Canada, Ltd., Hamilton.
Precision & Thread Grinder Mfg. Co., Philadelphia, Pa.

GRINDING MACHINES, DIE
Geometric Tool Co., New Haven, Conn.
National Acme Co., Cleveland, O.
National Machinery Co., Tiffin, Ohio.

GRINDING MACHINES, DRILL
Bellevue Industrial Furnace Co., Detroit, Mich
Bertram & Son Co., Ltd., The John, Dundas, Ont
Precision & Thread Grinder Mfg. Co Philadelphia, Pa

GRINDING MACHINES, ELECTRIC
Independent, Pneumatic Tool Co., Montreal, Que
Precision & Thread Grinder Mfg. Co., Philadelphia, Pa
Strand & Co., N. A., Chicago, Ill.

GRINDING MACHINES, FLOOR AND TOOL
Barber Machy. Co., Ltd., Toronto, Ont
Blount Co., J. G., Everett, Mass
Ford-Smith Machine Co., Ltd., Hamilton, Ont.
Herbert, Limited, Alfred, Toronto, Ont.
National Acme Co., Cleveland, Ohio.
Norton Co. of Canada, Ltd., Hamilton, Ontario.
Greenfield Tap & Die Corp., Galt, Ont.
Petrie Ltd. H. W., Toronto, Ont
U. S. Electrical Tool Co., Cincinnati, Ohio.

GRINDING MACHINES, GAGE
Precision & Thread Grinder Mfg. Co., Philadelphia, Pa

GRINDING MACHINES, HOB
Precision & Thread Grinder Mfg. Co., Philadelphia, Pa

GRINDING MACHINES, INTERNAL
Barber Machy. Co., Ltd., Toronto, Ont
Garlock Machinery Ltd., Toronto, Ont
Greenfield Tap & Die Corp., Galt, Ont
Cleveland Pneumatic Tool Co., Toronto
Precision & Thread Grinder Mfg. Co Philadelphia, Pa
Ont.
Wisconsin Electric Co., Racine, Wis

BUYERS' DIRECTORY

GRINDING MACHINES, PIPE THREADING DIE
Precision & Thread Grinder Mfg. Co., Philadelphia, Pa.

GRINDING MACHINES PORTABLE
Independent Pneumatic Tool Co., Montreal, Que.
Precision & Thread Grinder Mfg. Co., Philadelphia, Pa.
Strand & Co., N. A., Chicago, Ill.

GRINDING MACHINES, SNAGGING
Blount Co., J. G., Everett, Mass.
Norton Co., of Can. Ltd., Hamilton, Ont.
U. S. Electrical Tool Co., Cincinnati, Ohio.

GRINDING MACHINES, SURFACE
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Garvin Mach. Co., New York City, N.Y.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, THREAD
Pratt & Whitney Co., of Canada, Ltd., Sound, Ont.
Precision & Thread Grinder Mfg. Co., Philadelphia, Pa.

GRINDING MACHINERY, TOOL POST
Gisholt Machine Co., Madison, Wis.
Grenfield Tap & Die Corp., Galt, Ont.
Precision & Thread Grinder Mfg. Co., Philadelphia, Pa.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES, UNIVERSAL
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Herbert, Limited, Alfred, Toronto, Ont.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co., of Canada, Ltd., Hamilton, Ontario.

GRINDING WHEELS
Lion Grinding Wheels, Limited, Montreal, Que.
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Norton Co. of Can., Ltd., Hamilton, Ont.
Precision & Thread Grinder Mfg. Co., Philadelphia, Pa.
Prescott Emery Wheel Co., Prescott, Ont

GUARDS, WIRE
Canada Wire & Iron Goods Co., Hamilton, Ont.
Frost Steel & Wire Co., Ltd., Hamilton, Ont.

GRINDING WHEEL TRUEING HEADS
Precision & Thread Grinder Mfg. Co., Philadelphia, Pa.

GUN-BARREL MACHINERY
Steinle Turret Machine Co., Madison, Wisconsin.

HACK SAWS, POWER
Atkins & Co., Inc., E.C., Indianapolis, Indiana.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.

-RS, CHIPPING
Cleveland Pneumatic Tool Co., Toronto, Ont.
High Speed Hammer Co., Rochester,
Independent Pneumatic Tool Co., Montreal, Que.

HAMMERS, DROP
Bertram & Son Co., Ltd., The John Dundas, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Chambersburg Engineering Co. Chambersburg, Pa.
Quickwork Co., St. Mary's, Ohio

HAMMERS, ELECTRIC
Brown, Boggs & Co., Ltd., Hamilton, Ont.

HAMMERS, PNEUMATIC
Can. Steel Foundries, Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto Ont.
Independent Pneumatic Tool Co., Montreal, Que.

HAMMERS, SEALING
Independent Pneumatic Tool Co., Montreal, Que.

HANGERS, SHAFTING
Bond Engineering Wks. Ltd., Toronto.
Canadian SKF Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Hamilton Gear & Machine Co., Toronto,
Jones, W A., Foundry and Machine Co., Chicago, Ill.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

HOBBING MACHINES
Shore Instrument Co., Jamaica, N.Y.

HARDENING, CASE-HARDENING AND TEMPERING
Barnes Company, Wallace, Hamilton.
Gisholt Machine Co., Madison, Wis.
Cleveland Pneumatic Tool Co., Toronto Ont.

HAMMERS, POWER
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Chambersburg Engineering Co. Chambersburg, Pa.
Jardine & Co., A. E., Hespeler, Ont.

HOBS
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Illinois Tools, Ltd., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Taylor, J A. M. Tool Co., Ltd., Toronto, Ont.
Precision & Thread Grinder Mfg. Co., Philadelphia, Pa.

HOISTS, AUTOMATIC
Matthews Gravity Carrier Co., Ltd., Port Hope, Ont.

HOISTS, ELECTRIC
Box & Co., Inc., Alfred, Philadelphia, Pa.
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Northern Crane Works, Walkerville, Ont.
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.

HOISTS, HAND
Box & Co., Inc., Alfred, Philadelphia, Pa.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

HOISTS, PNEUMATIC
Independent Pneumatic Tool Co., Montreal, Que.
Hanna Engineering Works, Chicago, Ill.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

HOLDERS-ON, PNEUMATIC
Cleveland Pneumatic Tool Co., Toronto Ont.
Independent Pneumatic Tool Co., Montreal, Que.

HOSPITAL SUPPLIES & EQUIPMENT
Hartz Co., Ltd., J.F., Toronto, Ont.

HYDRAULIC MACHINERY
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Berry & Co., Ltd., Henry, Leeds, England.
Elmes, Charles F. Engineering Works, Chicago, Ill.
Dominion Engineering Works, Limited, Montreal, Que.
Excelsior Tool & Machine Co., East St. Louis, Ill.
Kennedy & Sons, Ltd., Wm., Owen

IGNITERS, GAS ENGINE
Canada Foundries & Forgings Co., Welland, Ont.
Burke Machine Tool Co., Conneaut, O

INDEX CENTERS
Dickow Machinery Co., Fred C., Chicago, Ill.

INDICATORS, SPEED AND TEST
Brown & Sharpe Mfg. Co., Providence, R.I.

INSULATION
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.

IRON BARS
Steel Co. of Canada, Ltd., Hamilton, Ont.

JACKS, HYDRAULIC
Berry & Co., Ltd., Henry, Leeds, England.
Norton, A. O., Boston, Mass.

JACKS, PLANER
Armstrong Bros. Tool Co., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

JAPANNING AND VARNISHING OVENS
Brantford Oven & Rack Co., Brantford, Ont.

JIGS AND FIXTURES (SEE TOOL WORK)
Fisher Motor Co., Ltd., Orillia, Ont.
Gisholt Machine Co., Madison, Wis.

JOB MACHINE AND GRINDING
Corman Engineering Co., Toronto, Ont.

KEYSEATING MACHINES
Morton Mfg. Co., Muskegon, Mich
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

KEYS, MACHINE
Can. Drawn Steel Co., Hamilton, Ont.
Morton Mfg. Co., Muskegon, Mich.

KNIVES, MACHINE
Atkins & Co., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

KNURL HOLDERS
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

LATHE CENTRES
Orillis Co., Clinton, Iowa.

LATHE ATTACHMENTS
Hendey Machine Co., Torrington, Conn.

LATHE TOOLS
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

LATHES, AUTOMATIC AND SEMI-AUTOMATIC
Barber Machy. Co., Ltd., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Herbert, Limited, Alfred, Toronto, Ont.
National Acme Co., Cleveland, Ohio.
Petrie Ltd, H. W., Toronto, Ont
Rockford Machine & Tool Co., Rockford, Ill.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, BENCH
Ames Co., B. C., Waltham, Mass
Hardinge Bros., Inc., Chicago, Ill.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Triplex Machine Tool Corpn., New York City, N. Y.

LATHES, BORING
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, CHUCKING (SEE LATHES, HORIZONTAL TURRET, AND LATHES, VERTICAL TURRET)
Acme Machine Tool Co., Cincinnati, O.
Barber Machy. Co., Ltd., Toronto, Ont.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
Herbert, Limited, Alfred, Toronto, Ont.
Petrie Ltd, H. W., Toronto, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, ENGINE
Barber Machy. Co., Ltd., Toronto, Ont.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Buckton & Co., Joshua, Leeds, Engl'nd.
Canada Machinery Corpn., Ltd., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hendey Machine Co., Torrington, Conn
Herbert, Limited, Alfred, Toronto, Ont
Petrie Ltd, H. W., Toronto, Ont.

LATHES, EXTENSION AND GAP
Barber Machy. Co., Ltd., Toronto, Ont
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corpn., Ltd., Galt, Ont.
Gisholt Machine Co., Madison Wis.
Herbert, Limited, Alfred, Toronto, Ont
Petrie Ltd, H. W., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont
National Acme Co., Cleveland, O
Steinle Turret Machine Co., Madison, Wis.

LATHES, MOTOR DRIVEN
Wood Turret Machine Co, Brazil, Ind

LATHES, PRECISION
Ames Co., B. C., Waltham, Mass.
Hardinge Bros., Chicago.
Wood Turret Machine Co, Brazil, Ind.

LATHES, RELIEVING
Hendey Machine Co., Torrington, Conn.

LATHE, UNIVERSAL HAND
Brown & Sharpe Mfg. Co., Providence, Rhode Island.

LATHE, SPEED AND HAND
Blount Co., J. G., Everett, Mass.

LATHES, SPINNING
Pryibil Machine Co., Torrington, Conn.
Triplex Machine Tool Corpn., New York City, N. Y.

LATHES, VERTICAL TURRET
Barber Machy. Co., Ltd., Toronto, Ont.
Bertram & Son, Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio
Wood Turret Machine Co, Brazil, Ind.

LATHES, WOOD TURNING
Blount, Co., J. G., Everett, Mass.
Can. Fairbanks-Morse Co., Ltd., Montreal.

LEAD PIPE
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

LEAD VARIATORS, THREAD
Precision & Thread Grinder Mfg. Co., Philadelphia, Pa.

LEATHER FILLET
D. K. McLaren, Limited, Montreal.

LINE BORING AND REAMING BARS
Hamnfin Mfg. Co., Chicago, Ill

LINOLEUM MILL MACHINERY
Berry & Co., Ltd., Henry, Leeds, England.
Bertrams, Ltd., Edinburgh, Scotland.

LIQUID AIR PLANTS
L'Air Liquide Society, Toronto, Ont.

LOCKERS, CLOTHES
Dennis Wire and Iron Works, London, Ont.

LUBRICANTS
Oakley Chemical Co., New York, N.Y.

LUBRICATING SYSTEMS
Bowser, S. F., & Co., Ltd., Toronto, Canada.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Ltd., Welland, Ont.
Ker & Goodwin Machine Co., Brantford, Ont
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R. Toronto Ont.

MANGANESE STEEL
Can. Steel Foundries, Montreal, Que.

MANDRELS, EXPANDING
Eastern Tube & Tool Co., Inc., Brooklyn, N.Y.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MANDRELS, SOLID
Eastern Tube & Tool Co., Inc., Brooklyn, N.Y.
Greenfield Tap & Die Corp., Galt, Ont.
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Pratt & Whitney Co of Canada, Ltd., Dundas, Ont.

MANDRELS, PNEUMATIC
Hamnfin Mfg. Co., Chicago, Ill.

MEASURING MACHINES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MECHANICS' FINE TOOLS
Lufkin Rule Co., Windsor, Ont.

METAL EXPANDING
Pedlar People, Ltd., Oshawa, Ont.

METALS, ALLOY
Canada Metal Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que

METAL WORKERS
Parker Co., Charles, Meriden, Conn

METERS, GAS AND AIR
Connersville Blower Co., Connersville, Ind.

MICROMETER CALIPERS
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Rice Lewis & Son, Ltd., Toronto, Ont

MILLING ATTACHMENTS
Burke Machine Tool Co., Conneaut, O.
Hendey Machine Co., Torrington, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.

MILLING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Burke Machine Tool Co., Conneaut, O.
Ford-Smith Machine Co., Ltd., Hamilton, Ont.
Garvin Mach. Co., New York City, N.Y.

MILLING MACHINES, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence, R. I.
Hardinge Bros., Inc., Chicago, Ill.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

MILLING MACHINES, BENCH
Ames Co., B. C., Waltham, Mass
Burke Machine Tool Co., Conneaut, O
Hardinge Bros., Inc., Chicago, Ill
Triplex Machine Tool Corpn., New York City, N. Y.

MILLING MACHINES, HAND
Brown & Sharpe Mfg. Co., Providence
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Triplex Machine Tool Corpn., New York City, N. Y.

MILLING MACHINES, HORIZONTAL PLANER TYPE.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie Ltd, H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto.

BUYERS' DIRECTORY

MILLING MACHINES, PLAIN
Barber Machy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R. I.
Burke Machine Tool Co., Conneaut, O.
Garvin Mach. Co., New York City, N.Y.
Hendey Machine Co., Torrington, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie Ltd. H. W., Toronto, Ont

MILLING MACHINES, THREAD
Barber Machy. Co., Ltd., Toronto, Ont
Petrie Ltd. H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MILLING MACHINES, UNIVERSAL
Barber Machy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R. I.
Garvin Mach. Co., New York City, N.Y.
Hendey Machine Co., Torrington, Conn.
Herbert, Limited, Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie Ltd. H. W., Toronto, Ont.

MILLING MACHINES, VERTICAL
Barber Machy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R. I.
Burke Machine Tool Co., Conneaut, O.
Garvin Mach. Co., New York City, N.Y.
Herbert, Limited, Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie Ltd. H. W., Toronto, Ont.
Triplex Machine Tool Corpn., New York City, N. Y.
Williams Machinery Co., A. R., Toronto.

MILLING TOOLS, ADJUSTABLE HOLLOW
Geometric Tool Co., New Haven, Conn.

MINING STEEL
Jessop & Sons, Ltd., Wm., Toronto, Ont.

MOLDING MACHINES
Hanna Engineering Works, Chicago, Ill.

MOTORS, ELECTRIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Can. Westinghouse Co., Ltd., Hamilton, Ont.
New Way Motor Co., Lansing, Mich.
Roelofson Elevator Co., Galt, Ont.
Williams Machinery Co., A. R., Toronto.
Wisconsin Electric Co., Racine Wis.

MULTIPLE BORING AND REAMING TOOLS
Hannifin Mfg. Co., Chicago, Ill.

NAILS AND STAPLES
Canada Metal Co., Ltd., Toronto, Ont.

NIPPLES
Canada Metal Co., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton.

NITROGEN
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

NUT TAPPERS
(See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
National Acme Co., Cleveland, Ohio.

NUTS, FINISHED and SEMI-FINISHED
Galt Macine Screw Co., Galt, Ont.
National Acme Co., Montreal, ue.

NUTS (Up to 4-in.)
Steel Co. of Canada, Ltd., Hamilton.

NUTS, S.A.E., PLAIN AND CASTELLATED
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

OIL FILTERING AND STORAGE SYSTEMS
Bowser, S. F., & Co., Ltd., Toronto,

OIL STORAGE ENGINEERS
Bowser, S. F., & Co., Ltd., Toronto,

OIL HOLE COVERS
Can. Whitney Co., Ltd., Windsor, Ont.

OILS, SOLUABLE
Brantford Oven & Rack Co., Brantford, Ontario

ORNAMENTAL IRON AND WIRE WORKS
Roelofson Elevator Works, Galt, Ont.

OXYGEN
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

OXY-ACETYLENE APPARATUS
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Atlas Press Co., Kalamazoo, Mich.

PACKING, SHEET AND ROD
Quaker City Rubber Co., Philadelphia, Pa.

PACKING, HYDRAULIC
Berry & Co., Ltd., Henry, Leeds, Eng.

PAINTS, INDUSTRIAL
Flint Varnish & Color Works of Canada, Ltd., Montreal, Que.

PAPER MILL CONVEYORS
Dominion Engineering Works, Ltd., Montreal, Que.

PAPER MILL MACHINERY
Bertram Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Limited, Montreal, Que.

PATENTS AND INVENTION WORK
Corman Engineering Co., Toronto, Ont.

PATTERNS, WOOD AND METAL
Fittings, Limited, Oshawa, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.
Victoria Foundry Co., Ltd., Ottawa.

PHOSPHOR TIN
Canada Metal Co., Ltd., Toronto, Ont.

PHOTOGRAPHIC DUPLICATING MACHINES
Photostat Corp., Providence, R. I.

PIPE BENDING MACHINES
Berry & Co., Ltd., Henry, Leeds, Eng.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Underwood Corp., H. R., Philadelphia, Pa.
Williams Machinery Co., A. R., Toronto.

PIPE CUTTING AND THREADING MACHINES
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.

PIPE
Canada Metal Co., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Toronto Iron Works, Ltd., Toronto, Ont.

PIPE FITTINGS
Canada Metal Co., Toronto, Ont.
International Malleable Iron Co., Guelph Ont.

PIPE AND NIPPLE THREADING MACHINES
Landis Machine Co., Inc., Waynesboro, Pa.

PIPE FITTERS' TOOLS
Rice Lewis & Son, Ltd., Toronto, Ont.

PIPE THREADING DIE HEADS
Landis Machine Co., Inc., Waynesboro, Pa.

PISTON-RING MACHINES
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

PLANING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Buckton & Co., Joshua, Leeds, England
Canada Machinery Corpn., Ltd., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont
Morton Mfg. Co., Muskegon, Mich.
Petrie Ltd. H. W., Toronto, Ont.
Preston Woodworking Machinery Co., Preston, Ont.
Rockford Machine & Tool Co., Rockford, Ill.
Williams Machinery Co., A. R., Toronto

PLANING MACHINES, ROTARY
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Herbert, Limited, Alfred, Toronto, Ont.

PLATE MILLERS
Marshalltown Mfg. Co., Marshalltown, Iowa.

PLATE ROLLS
Berry & Co., Ltd., Henry, Leeds, Eng.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Jessop & Sons, Ltd., Wm., Toronto, Ont

PNEUMATIC TOOLS
Cleveland Pneumatic Tool Co., Toronto.

POLISHING AND BUFFING MACHINES
Lion Grinding Wheels, Limited, Montreal, Que
Blount Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Excelsior Tool & Machine Co., East St. Louis, Ill.
Ford-Smith Machine Co., Ltd., Hamilton, Ont.
Prybil Machine Co., New York, N.Y.

PRESSED STEEL PARTS
American Pulley Co., Philadelphia, Pa.

PRESSES, ARBOR
Atlas Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que

PRESSES, ARBOR PNUEMATIC
Hanscomb Mfg. Co., Chicago, Ill

PRESSES, DOUBLE CRANK
Niagara Machine & Tool Works, Buffalo, N. Y.

PRESSES, DROP AND FORGING
Brown, Boggs & Co., Ltd., Hamilton.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Chambersburg Engineering Co. Chambersburg, Pa
Leffler & Co., Chas., Brooklyn, N.Y.
Toledo Machine & Tool Co., Toledo, Ohio.

PRESSES, FOOT AND HAND
Brown, Boggs & Co., Ltd., Hamilton
Excelsior Tool & Machine Co., East St. Louis, Ill.

PRESSES, HYDRAULIC
Berry & Co., Ltd., Henry, Leeds, Eng.
Bertram & Son Co., Ltd., The John Dundas, Ont.
Chambersburg Engineering Co. Chambersburg, Pa.
Cleveland Twist Drill Co., Cleveland, O
Excelsior Tool & Machine Co., East St. Louis, Ill.
Elmes, Charles F. Engineering Works, Chicago, Ill.
Perrin Ltd., W. R., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

PRESSES, POWER
Bliss Co., E. W., Brooklyn, N. Y.
Brown, Boggs, & Co., Ltd., Hamilton
Excelsior Tool & Machine Co., East St Louis, Ill.
Elmes, Charles F. Engineering Works, Chicago, Ill.
Hepburn Ltd., John T., Toronto, Ont.
Niagara Machine & Tool Works, Buffalo, N. Y.
Steli Co., Inc., D. H., Buffalo, N.Y
Toledo Machine & Tool Co., Toledo, Ohio

PRESSES, PUNCHING
Niagara Machine & Tool Works, Buffalo, N. Y.

PRESSES, SCREW
Brown, Boggs & Co., Ltd., Hamilton
Toledo Machine & Tool Co., Toledo, Ohio.

PRESSES, TOGGLE
Niagara Machine & Tool Works, Buffalo, N. Y.

PROFILING MACHINES
Pritt & Whitney Co., of Canada, Ltd Dundas, Ont.

PROTRACTORS
Brown & Sharpe Mfg. Co., Providence
Lufkin Rule Co., Windsor, Ont.

PROPELLERS
Kennedy & Sons, Wm., Owen Sound Ontario.

PULLEYS, CAST IRON
Jones, W. A., Foundry and Machine Co Chicago, Ill.

PULLEYS, CORK INSERT
American Pulley Co., Philadelphia, Pa

PULLEYS, METAL AND FIBRE
American Pulley Co., Philadelphia, Pa
Bond Engineering Wks. Ltd., Toronto
Can. Fairbanks-Morse Ltd., Montreal, Q
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co., of Can., Ltd Toronto, Ont.
Dominion Engineering Works, Limited Montreal, Que.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound Ont.
D. K. McLaren Co., Limited Montreal, Que

PULP AND PAPER MILL EQUIPMENT
Dominion Engineering Works, Ltd., Montreal, Que.

PUMPS, CENTRIFUGAL AND VACUUM
Bawden Machine Co., Ltd., Toronto, Ont

PUMPS, HYDRAULIC
Bawden Machine Co., Ltd., Toronto, Ont
Berry & Co., Ltd., Henry, Leeds, England.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que
Dominion Engineering Works, Ltd Montreal, Que.
Elmes, Charles F. Engineering Works Chicago, Ill.
Hepburn Ltd., John T., Toronto, Ont

PUMPS, LUBRICANT AND OIL
Bowser, S. F., & Co., Ltd., Toronto.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Hepburn Ltd., John T., Toronto, Ont.

PUMPS, POWER
Bowser, S. F., & Co., Ltd., Toronto.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hepburn Ltd., John T., Toronto, Ont.
Petrie Ltd. H. W., Toronto, Ont.

PUNCHES, CENTER
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

PUNCHES, HAND
Brown Boggs & Co., Ltd., Hamilton.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Jardine & Co., A. B., Hespeler, Ont.

PUNCHES, POWER
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corpn., Ltd., Galt, Ont.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Petrie Ltd. H. W., Toronto, Ont.
Excelsior Tool & Machine Co., East St. Louis, Ill.
Chambersburg Engineering Co. Chambersburg, Pa.

PUNCHES, VERTICAL
Pels, Henry & Co., Inc., New York City, N. Y.

PUNCHING MACHINES, HORIZONTAL
Berry & Co., Ltd., Henry, Leeds, England.
Bertram Ltd., Edinburgh, Scotland.

PYROMETERS, ELECTRIC
Bristol Co., Waterbury, Conn.
Flexible Shaft Co., Ltd., Toronto, Ont.
Taylor Instrument Co., Toronto, Ont.
Hiram Walker & Sons Metal Products Co., Walkerville, Ont.

RACKS, CUT
Hamilton Gear & Machine Co., Toronto.

RACKS, STORAGE
(See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ontario.

REAMER HOLDERS
Simonds Canada Saw Co., Montreal, Q.

REAMERS, ADJUSTABLE
Hamilton Mfg. Co., Chicago, Ill

REAMERS, ELECTRIC
U. S. Electrical Tool Co., Cincinnati, Ohio.

REAMERS, EXPANDING
Can. Illinois Tools Ltd., Toronto, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

REAMERS, SOLID
Butterfield & Co., Inc., Rock Island, Q.
Morse Twist Drill & Machine Co., New Bedford, Mass.

REAMERS, TAPER
Brown & Sharpe Mfg. Co., Providence, R. I.
Butterfield & Co., Inc., Rock Island, Q.
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canad, Ltd., Dundas, Ont.

RECORDERS, TEMPERATURE
Taylor Instrument Co., Rochester, N. Y.

RECORDERS, TIME
Gisholt Machine Co., Rochester, N. Y.
International Business Machines Co. Ltd., Toronto, Ont
Taylor Instrument Co., Toronto, Ont.

REGULATORS, TEMPERATURE
Taylor Instrument Co., Toronto, Ont.

RIVETS AND BURRS
Parmenter & Bulloch Co., Gananoque, Ont.
Steel Co., of Canada, Ltd., Hamilton.

RIVET-MAKING MACHINERY
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

RIVETING MACHINES
Berry & Co., Ltd., Henry, Leeds, England
Can. Fairbanks-Morse Ltd., Montreal Q
Excelsior Tool & Machine Co., East St Louis, Ill
High Speed Hammer Co., Rochester, N.Y.
Parmenter & Bulloch Co., Gananoque Ont.

RIVETING MACHINES, ELECTRIC
Kebert Machine Co., Inc., New York City, N. Y.

BUYERS' DIRECTORY

RIVETING MACHINES, PINCH BUG
Hanna Engineering Works, Chicago, Ill

RIVETING MACHINES, HYDRAULIC
Hanna Engineering Works, Chicago, Ill
Chambersburg Engineering Co. Chambersburg, Pa.

RIVETING MACHINES, PNUEMATIC
Hanna Engineering Works, Chicago, Ill

RIVETING MACHINES, STEAM
Hanna Engineering Works, Chicago, Ill

ROLLER SPECIALTIES
Matthews Gravity Carrier Co., Ltd., Port Hope, Ont.

RUDDER FRAMES, STEEL
Can. Steel Foundries, Montreal, Que.

RUBBER MILL MACHINERY
Berry & Co., Ltd., Henry, Leeds, England.
Bawden Machine Co., Ltd., Toronto, Ont
Bertram Ltd., Edinburgh, Scotland.

RUBBER MOULDS
Corman Engineering Co., Toronto, Ont.

RULES, STEEL AND WOOD
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Windsor, Ont.

RUST PREVENTATIVES
Oakley Chemical Co., New York, N. Y.

SAND BLASTING EQUIPMENT
United States Silica Co., Chicago, Ill.

SAND EQUIPMENT
Can. Link-Belt Co., Toronto, Ont.
United States Silica Co., Chicago, Ill

SAND RAMMERS, PNEUMATIC
[illegible] Pneumatic Tool Co., Toronto.
Independent Pneumatic Tool Co., Montreal, Que.

SAW FRAMES AND BLADES, HACK
Atkins & Co., Inc., E. C., Indianapolis,
Diamond Saw & Stamping Works, Buffalo, N. Y.
Rice Lewis & Sons, Ltd., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWING MACHINES, POWER HACK
Atkins & Co., Inc., E. C., Indianapolis,
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Hanna Engineering Works, Chicago, Ill.
Preston Woodworking Machinery Co., Preston, Ont.

SAW SHARPENING MACHINES
Atkins & Co., Inc., E. C., Indianapolis,
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Hanna Engineering Works, Chicago, Ill.

SAWS, CIRCULAR METAL
Atkins & Co., Inc., E. C., Indianapolis.
Pryibil Machine Co., New York, N. Y.
Gisholt Machine Co., Madison, Wis.

SAWS, HAND
Atkins & Co., Inc., E. C., Indianapolis
Simonds Canada Saw Co., Montreal, Q.

SAWS, HOT AND COLD
Atkins & Co., E. C., Indianapolis, I.
Berry & Co., Ltd., Henry, Leeds, England.
Simonds Canada Saw Co., Montreal, Q.

SAWS, HIGH SPEED STEEL
Atkins & Co., Inc., E.C., Indianapolis, I.
Butterfield & Co. Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWS, METAL BAND
Atkins & Co., E. C., Indianapolis, I.
Preston Woodworking Machinery Co., Preston, Ont.

SAWS, METAL CUTTING
Brown & Sharpe Mfg. Co., Providence,
Butterfield & Co., Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.
Starrett Co., L. S., Athol, Mass.

SAWS, SCREW SLOTTING
Atkins & Co., Inc., E., C., Indianapolis.
Butterfield & Co., Inc., Rock Island, Q.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canda, Ltd., Dundas, Ont.

SAWS, SCREW SLOTTING
Atkins & Co., Inc., E. C., Indianapolis.
Butterfield & Co., Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWS, WOOD
E. C. Atkins & Co., Indianapolis, Ind.
Preston Woodworking Machinery Co., Preston, Ont.

SCALES
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Lufkin Rule Co., Windsor, Ont.

SCREENS
Dominion Engineering Works, Ltd., Montreal, Que.

SCREW DRIVERS, OPTICAL, JEWELRY AND NOVELTY
Strand & Co., N. A., Chicago, Ill.

SCREW MACHINE WORK
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Montreal, Que.

SCREW MACHINERY, WOOD AND LAG
Cook Co., Asa S., Hartford, Conn.

SCREW MACHINES
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Davenport Machine Tool Co., Rochester, N.Y.
Garvin Mach. Co., New York City, N.Y.

SCREW MACHINES, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Davenport Machine Tool Co., Rochester, N.Y.
Garvin Mach. Co., New York City, N.Y.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.

SCREW MACHINE PRODUCTS
National Acme Co., Montreal, Que.

SCREW PLATES
Butterfield & Co., Inc., Rock Island. Que.
Jardine & Co., A. B., Hespeler, Ont.

SCREWS, CAP AND SET
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

SCREWS, SAFETY, SET
Galt Machine Screw Co., Galt, Ont.

SECOND-HAND MACHINERY
See last page of directory.

SEPARATORS, MOISTURE AND OIL
Bowser, S. F., & Co., Ltd., Toronto, Canada.

SEPARATORS, OIL AND WASTE
Bowser, S. F., & Co., Ltd., Toronto.

SHAFTS, FLEXIBLE
Flexible Shaft Co., Toronto, Ont.
Strand & Co., N. A., Chicago, Ill.

SHAFTING
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
Williams Machinery Co., A. R., Toronto.

SHAPES, COLD-DRAWN SPECIAL STEEL
Union Drawn Steel Co., Hamilton, Ont.

SHAPING MACHINES
Barber Macby Co., Ltd., Toronto, Ont.
Canada Machinery Corpn., Ltd., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.
Morton Mfg. Co., Muskegon, Mich.
Petrie Ltd, H. W., Toronto, Ont.
Rockford Machine & Tool Co., Rockford, Ill
Williams Machinery Co., A. R. Toronto.

SHEARS HAND
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Niagara Machine & Tool Works, Buffalo, N. Y.

SHEARS, POWER
Bliss Co., E. W., Brooklyn, N. Y.
Brown, Boggs & Co., Ltd., **Hamilton, Ont.**
Canada Machinery Corpn., Ltd., Galt, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie Ltd. H. W., Toronto, Ont
Chambersburg Engineering Co. Chambersburg, Pa.
Niagara Machine & Tool Works, Buffalo, N. Y.
Pels, Henry & Co., Inc., New York City, N. Y.
Quickwork Co., St. Mary's, Ohio.
Excelsior Tool & Machine Co., East St. Louis, Ill
Stoll Co., Inc., D. H., Buffalo, N. Y.
Toledo Machine & Tool Co., Toledo, Ohio.
Williams Machinery Co., A. R., Toronto, Ont.

SHEARS, THROATLESS, BEVEL AND SPLITTING
Marshalltown Mfg. Co., Marshalltown, Iowa.

SHEARING MACHINES, ANGLE, IRON BAR AND GATE
Berry & Co., Ltd., Henry, Leeds, England.
Buckton & Co., Joshua, Leeds, Engl'nd.
Bertrams Ltd., Edinburgh, Scotland.
Excelsior Tool & Machine Co., East St. Louis, Ill.

SHEET LEAD
Canada Metal Co., Ltd., Toronto, Ont.

SHEET METAL WORKING MACHINERY
Bliss Co., E. W., Brooklyn, N. Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Excelsior Tool & Machine Co., East St. Louis, Ill.
Leffler & Co., Chas., Brooklyn, N.Y.
Quickwork Co., St. Mary's, Ohio
Stoll Co., Inc., D. H, Buffalo, N.Y.

SHEETS, HOT ROLLED
Jessop & Sons, Ltd., Wm., Toronto, Ont

SHEETS, NICKEL, MONEL AND FIBRE
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.

SHEETS, GALVANIZED IRON
Dominion Sheet Metal Corpn., Hamilton, Ont.

SHEETS, O.P.C.R. & B. A. AND BLUE ANNEALED
Steel Co., of Canada, Ltd., Hamilton, Ont.

SIDE FRAMES, LOCOMOTIVE
Can. Steel Foundries, Montreal, Que.

SLOTTING ATTACHMENTS
Brown & Sharpe Mfg. Co., Providence, R.I.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

SLOTTING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corpn., Ltd., Galt, Ont.
Buckton & Co., Joshua, Leeds, Engl'nd
Garvin Mach. Co., New York City, N.Y.

SOLDERS
Canada Metal Co., Ltd., Toronto, Ont.

SOLDERINB MACHINES
Leffler & Co., Chas., Brooklyn, N.Y.

SPECIAL MACHINERY AND TOOLS
Berry & Co., Ltd., Henry, Leeds, England.
Brown Engineering Corp., Ltd., Toronto.
Gisholt Machine Co., Madison, Wis.
Hanna Engineering Works, Chicago, Ill.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.
National Acme Co., Cleveland, O.

SPEED REDUCERS, SPUR AND WORM GEARS
Jones, W. A., Foundry and Machine Co., Chicago, Ill.

SPIKES, RAILWAY AND PRESSED
Steel Co of Canada, Ltd., Hamilton, Ont.

SPINNING LATHES
Prybil Machine Co., P., New York City.

SPIRAL CHUTES
Matthews Gravity Carrier Co., Ltd., Port Hope, Ont.

SPRING, MILLED
Barnes & Co., Wallace, Hamilton, Ont.

SPRINGS, SMALL SPIRAL HELICAL, COMPRESSION, EXTENSION, TORSION AND SPECIAL
Barnes Company, Wallace, Hamilton.
Steele, Ltd., James, Guelph, Ont.

SPRINGS
Barnes Company, Wallace, Hamilton.
Cleveland Wire Spring Co., Cleveland, O.
Steele Ltd., James, Guelph, Ont.

SPRINGS, FLAT STEEL, BRUSH HOLDER, CLOCK, SMALL FLAT SPRINGS
Barnes Company, Wallace, Hamilton.

SPROCKETS AND CHAINS
Can. Link-Belt Co., Toronto, Ont.
Diamond Chain & Mfg. Co., Indianapolis, Ind.
Jones & Glassco, Montreal, Que.
Renold Hanson of Canada, Ltd., Montreal, Que.

SPROCKET WHEELS
Jones, W. A., Foundry and Machine Co., Chicago, Ill.

SQUARES
Brown & Sharpe Mfg. Co., Providence, R.I.
Lufkin Rule Co., Windsor, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

STAMPING, METAL
American Pulley Co., Philadelphia, Pa.
Barnes Company, Wallace, Hamilton.
Diamond Saw & Stamping Works, Buffalo, N. Y.
Homer & Wilson, Hamilton, Ont.
Parmenter & Bulloch Co., Gananoque, Ont.
Pedlar People, Ltd., Oshawa, Ont

STAMPS, STEEL
Diamond Saw & Stamping Works, Buffalo, N. Y.

STEEL BRIDGES
Hamilton Bridge Co., Hamilton, Ont.

STEEL CONCRETE REINFORCEMENT
Steel Co. of Canada, Ltd., Hamilton.

STEEL PLATE
British Empire Steel Co., Montreal, Que.
Jessop & Sons, Ltd., Wm., Toronto, Ont

STEEL AND IRON BARS
Toronto, Ont.
Canadian Atlas Crucible Steel Co., Ltd.,
Steel Co. of Canada, Ltd., Hamilton.

STEELS, CUTTING
Deloro Smelting & Refining Co., Ltd., Toronto

STEELS TOOL
British Empire Steel Co. Montreal Q.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont
Jessop & Sons, Ltd., Wm., Toronto, Ont.

STEEL, COLD DRAWN
Can. Drawn Steel Co., Ltd., Hamilton, Ont.
Standard Gauge Steel Co., Beaver Falls, Pa.

STEEL, COLD-ROLLED STRIP
British Empire Steel Co., Montreal, Q.
Barnes Company, Wallace, Hamilton.
Jessop & Sons, Ltd., Wm., Toronto, Ont

STEEL, CHROME NICKEL
Union Drawn Steel Co., Ltd., Hamilton, Ont.

STEEL, CHROME VANADIUM
Union Drawn Steel Co., Ltd., Hamilton, Ont.

STEEL, CHROMIUM
Union Drawn Steel Co. Ltd., Hamilton, Ont

STEEL, CRUCIBLE, SPRING
Barnes, Company, Wallace, Hamilton.
British Empire Steel Co., Montreal, Q.

SHEETS, OPEN HEARTH STEEL
Dominion Sheet Metal Corpn., Hamilton, Ont
Steel Co., of Canada, Ltd., Hamilton.

STEEL, SHAFTING AND FREE CUTTING SCREW
Union Drawn Steel Co., Hamilton, Ont.

STEEL, SHEET
British Empire Steel Co., Montreal, Q.
Jessop & Sons, Ltd., Wm., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

STEEL, STAINLESS
Steel Co., of Can. Ltd., Hamilton, Ont.

STEEL STAIRS
Roelofson Elevator Works, Galt, Ont.

STEEL TANKS, STORAGE AND PRESSURE
Toronto Iron Works, Ltd., Toronto, Ont.

STEELS, ALLOY AND CARBON
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Jessop & Sons, Ltd., Wm., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton. Ont.
Union Drawn Steel Co, Ltd., Hamilton, Ont.

STEELS, HIGH-SPEED
Armstrong Bros. Tool Co., Chicago, Ill.
Atkins & Co., Ltd., Wm., Sheffield, England.
British Empire Steel Co., Montreal, Q.
Canadian Atlas Crucible Steel Co., Ltd., **Toronto, Ont.**
Jessop & Sons, Ltd., Wm., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton.

STEELS, MAGNET
Jessop & Sons, Ltd., Wm., Toronto, Ont.

STEEL TUBING, CLOSE JOINT AND WELDED
Standard Tube & Fence Co., Ltd., Woodstock, Ont.

STEEL WIRE
Frost Steel & Wire Co., Ltd., Hamilton, Ont.

STERN FRAMES, CAST STEEL
Can. Steel Foundries, Montreal, Que.

STRAIGHTENING MACHINERY
Berry & Co., Ltd., Henry, Leeds, England.
Bertram Ltd., Edinburgh, Scotland.
Williams & Co., Ltd., J. H., Brooklyn, N.Y.

STRUCTURAL STEEL
Hamilton Bridge Co., Hamilton, Ont.

STUDS
Galt Machine Screw Co., Galt, Ont.

STUD SETTERS, SELF OPENING
Geometric Tool Co., New Haven, Conn.

SWAGING MACHINES
Atkins & Co., Inc., E. C., Indianapolis, Indiana.

SWITCHES, RAILWAY
Can. Steel Foundries, Montreal, Que.

TACHOMETERS
Bristol Co., Waterbury, Conn.

TANKS AND PUMPS, OIL
Bowser, S. F., & Co., Ltd., Toronto.

TANKS, STEEL
Toronto Iron Works, Ltd., Toronto, Ont.

TAP HOLDERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
William L. Procunier, Chicago, Ill.

BUYERS' DIRECTORY

TAPER PINS
Galt Machine Screw Co., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

TAPES, MEASURING
Starrett Co., L. S., Athol, Mass.
Lufkin, Rule Co., Windsor, Ont.

TAPPERS
Eastern Tube & Tool Co., Inc., Brooklyn, N.Y.

TAPPING MACHINES AND ATTACHMENTS
Acme Co., B. C., Waltham, Mass.
Burke Machine Tool Co., Conneaut, O.
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.
Wm. L. Procunier, Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

TAPS AND DIES
Butterfield & Co., Inc., Rock Island, Q.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Eastern Machine Screw Corpn., New Haven, Conn.
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
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Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

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WIRE SPRINGS
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WIRE, WELDING
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Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Preston Woodworking Machinery Co., Preston, Ont
Williams Machinery Co., A. R., Toronto, Ontario.

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Taylor, J. A. M. Tool Co. Toronto, Ont.

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THE Buyers' Directory of CANADIAN MACHINERY was originally intended to contain information regarding lines actually manufactured by our advertisers. We now carry the advertising of leading machinery dealers, some of whom represent scores of manufacturers in addition to being manufacturers themselves in some cases. We recommend therefore, if our subscribers cannot find what they want in our Directory that they communicate with the dealers whose names appear herewith.

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A. R. Williams Machinery Co., Toronto, Ont.

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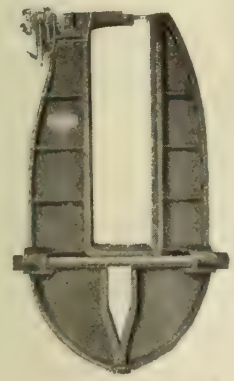

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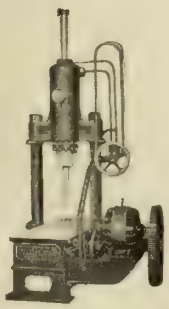

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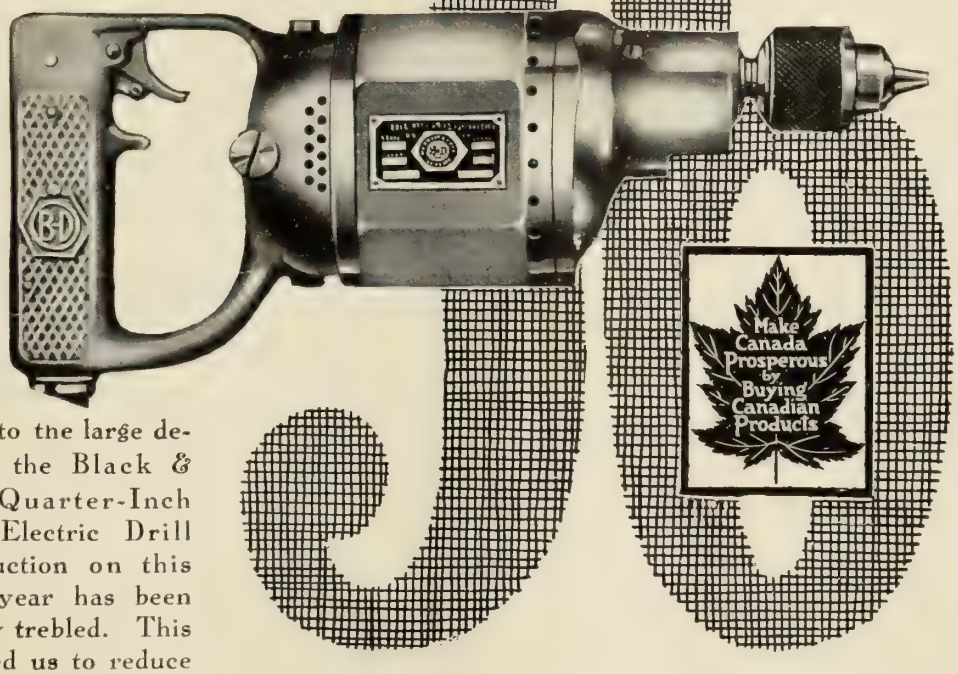

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